DETERMINANTS OF SUCCESS IN CLINICAL DECISION SUPPORT

WHAT MAKES AN EFFECTIVE COMPUTERIZED CLINICAL DECISION SUPPORT SYSTEM? A SYSTEMATIC REVIEW AND LOGISTIC REGRESSION ANALYSIS OF RANDOMIZED CONTROLLED TRIALS.

By

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Abstract

Context: Computerized clinical decision support systems (CCDSSs) give practitioners patient-specific care advice and are considered an important increment to electronic clinical documentation and order entry systems. Despite decades of research on CCDSS, results from rigorous clinical evaluations remain mixed and systems vary greatly in design and implementation.

Objective: To identify factors differentiating CCDSSs that improve the process of care or patient outcomes from those that do not.

Data Sources: We searched major bibliographic databases and scanned reference lists for eligible articles up to January 2010.

Study selection: 162 eligible comparisons from randomized controlled trials of CCDSS to non-CCDSS care. We deemed successful those systems that improved either 50% of reported process of care outcomes or 50% of patient outcomes. We extracted system characteristics hypothesized to impact patient care and tested them for association with system effectiveness in logistic models.

Results: Our primary analysis showed that CCDSSs presented in electronic health records or order entry systems were less likely to be effective than their counterparts (OR, 0.37; 95% CI, 0.17 to 0.80). Systems more likely to succeed than their counterparts provided advice for patients in addition to practitioners (OR, 2.77; 95% CI, 1.07 to 7.17), required from practitioners a reason to override advice (OR, 11.23; 95% CI, 1.98 to 63.72), or were evaluated by their developers (OR, 4.35; 95% CI, 1.66 to 11.44). These findings remained consistent across different statistical methods, sensitivity analyses, and adjustment for other potentially important factors.

Conclusions: We identified several factors that may partially explain why some systems succeed and others fail. Primary studies should investigate the impact and optimal implementation of advice provided to patients and practitioners and advice that requires reasons to be overridden. Researchers should also address the reasons for failure of advice presented within charting and order entry systems.

Acknowledgements

This project on determinants of success in computerized clinical decision support represents the second phase of a large systematic review of computerized clinical decision support systems (CCDSSs). It borrows much from the first phase of the review, including the search strategy, initial screening of studies for inclusion, the first round of data extraction, and tables describing the interventions and study outcomes.

The following people were involved in collection or organization of data in the first phase of the CCDSS review: Jeanette Prorok, Nathan Souza, Brian Hemens, Robby Nieuwlaat, Shikha Misra, Jasmine Dhaliwal, Navdeep Sahota, Anita Ramakrishna, Tahany Awad, Nancy Wilczynski, Tamara Navarro, Lorraine Weise-Kelly, and Jean Mackay. Nicholas Hobson, Chris Cotoi, and Rick Parrish provided programming and information technology support. Brian Haynes (the PI) obtained funding for the original study, provided frequent guidance for all aspects of the project. I worked on the first phase by extracting data, creating tables, and authoring 2 publications. Special thanks go to Jean Mackay for working closely with me when I was writing my first manuscripts. She answered my countless questions and helped me understand this complex project.

I was primarily responsible for this extension on determinants of success. I prespecified the hypotheses with help from Jeff Wilczynski, Natasha Fernandes, and a team of clinicians and researchers who we consulted through a modified Delphi study. I designed the data collection process, including extraction forms, extraction confirmation

process, and the electronic survey of corresponding authors. I extracted data from all 166 studies; Jeff and Natasha split the duplicate extraction. I selected all statistical methods and conducted the analyses. All three of us double-checked and adjudicated the response forms. Jeff also kept us on track ("Hi Pavel, just wondering how the extraction's going….") and calculated agreement statistics after extraction was complete. Natasha was involved in all iterations of the study design (there were many) and wrote our very first study plan. I would not have graduated without Jeff and Natasha's help! Special thanks also to Nicholas Hobson for his patience and quick response to my many programming requests.

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Prologue

The evidence-base of knowledge translation (KT) science is increasing along with the need for systematic reviews to summarize it. Some examples include reviews of strategies to improve patients' adherence to prescribed treatment (Haynes, Ackloo, Sahota, McDonald, & Yao, 2008), health information technologies to improve medication management (McKibbon et al., 2011), and computerized clinical decision support systems to improve the process of care and patient outcomes (Hemens et al., 2011; Nieuwlaat et al., 2011; Roshanov, Misra, et al., 2011; Roshanov, You, et al., 2011; Sahota et al., 2011; Souza et al., 2011). The complex interventions in these reviews are very heterogeneous; they address a variety of problems, were designed and implemented in a variety of ways, deployed in a variety of settings, and had their performance assessed with a variety of outcome measures, all of which render conventional meta-analysis inappropriate or impossible.

As a result, the reviewers resorted to outcomes that summarize study results in a dichotomous way: each study either showed benefit or did not show benefit. Results took the form "60% of trials (30 of 50) demonstrated benefits." This *vote counting* comes with its own set of methodological problems(Hedges & Olkin, 1985), but it is often the only estimate of effectiveness than we can present without calling apples oranges. The message is that approximately half of the interventions work, but readers are left to guess which half. Those designing, implementing, or selling one of these

interventions may think that theirs are in the "good" half. Dangerous territory for decision-makers looking to make the most of our healthcare dollars!

The review on clinical decision support systems represents the latest update in a series running one quarter of a century. Much time, effort, and money was spent conducting this study. It concluded that just over half of the identified trials showed improvements in the process of care and some showed improved patient outcomes.

The literature is rich in hypotheses about what it is that differentiates successful clinical decision support systems from their ineffective counterparts. Investigating heterogeneity between systems can uncover determinants of CCDSS success. The nature of the dichotomous study-level outcome limits reviewers to using 2 x 2 tables and multiple logistic regression models to investigate heterogeneity. Small sample sizes, sparse data, and missing data can impact the accuracy, efficiency, and reliability of standard procedures. In primary studies, study design can avoid the poor small-sample performance of common binary association estimators by recruiting more participants or by choosing different effect measures. The size of systematic reviews, however, is limited by the size of the literature addressing the research question and because the literature grows slowly, a review with invalid inferences may exert influence for years until enough primary studies are available to refute it. Therefore, reviewers must carefully select statistical techniques that provide unbiased estimates. This may mean departing from the most common statistical methods and employing strategies better suited to the available data.

The purpose of this thesis was to identify what makes an effective computerized clinical decision support system and, in the process, to devise a sound way of investigating heterogeneity in systematic reviews of complex interventions.

1.0 Introduction

Practitioners of medicine face countless decisions about diagnosis, treatment, and monitoring of disease under great uncertainty and an oath to do no harm. In landmark reports at the turn of the century, the Institute of Medicine identified significant deficiencies in the quality of medical care in the United States (Corrigan, Donaldson, Kohn, Maguire, & Pike, 2001; Corrigan, Kohn, & Donaldson, 1999). The Canadian Adverse Events Study (Baker et al., 2004) showed that Canadian hospital-based medical care resulted in approximately 187,500 patients experiencing an adverse event out of the approximately 2.5 million admitted to hospitals annually, and anywhere between 9,000 and 24,000 of these patients died as a result. The authors judged 37% of the events to be preventable. To reduce errors and improve the effectiveness of the healthcare enterprise, the Institute of Medicine suggested key roles for electronic health records (EHRs) that longitudinally store patient characteristics in a shareable electronic format, and computerized practitioner order entry (CPOE) systems that allow practitioners to place orders for procedures and medications in a way that reduces handwriting and transcription errors (Corrigan et al., 2001; Corrigan et al., 1999). Particularly, they suggested that we could achieve the potential health benefits of these technologies by enhancing them with computerized clinical decision support systems (CCDSSs) that give patient-specific suggestions for care and help correct mistakes as they happen.

1.1 What do we mean by CCDSS?

Our conceptualization of a CCDSS includes four main parts: 1) a knowledge base; 2) patient-specific data; 3) a matching mechanism to apply 1) to 2); and 3) a communication pathway to deliver advice to a user.

The knowledge base embodies the medical knowledge that the system is meant to deliver to its user. Some knowledge bases include simple if-then rules; others include probabilistic associations of diagnoses with signs and symptoms, refer to a repository of past patient cases, or use mathematical equations that model the pharmacokinetic and pharmacodynamic properties of medications.

A matching mechanism determines whether specific pieces of knowledge are relevant for particular patients given patient characteristics. Patient characteristics include basic demographic information, findings of recent laboratory tests, clinical symptoms, and patient history, among others. Once the matching mechanism selects knowledge relevant for a particular patient or situation, this knowledge, or advice, is delivered to the human decision-maker by some communication pathway.

A great number of possible pathways can be conceived. The advice generated by some systems is printed on paper and delivered to a practitioner by other clinical or nonclinical staff. Alternatively, staff can deliver the advice over the telephone or in person. If the practitioner is interacting with the computer program directly, the advice may simply be printed on the screen. Further, the program can be a stand-alone product

that the user must actively initiate to receive the advice, or it can be integrated with other routinely used software. A common conceptualization of ideal decision-support software is that of an assistive tool tightly integrated with an electronic health record or computerized order entry system that displays evidence-based advice as the practitioner interacts with the host software.

Given the few and basic elements of our description, it becomes easy to conceive innumerable configurations of computerized decision support serving a wide range of purposes for a wide variety of users in every kind of environment. Some decision-support systems were developed to provide a list of suggested diagnoses to their users. Other systems inform medication therapy by suggesting correct dose forms, dosages, laboratory monitoring, and potential contraindications or interactions with other medications. Essentially every medical decision that requires theory or empirical knowledge to be applied to patients with different characteristics, and the appropriateness of its application depends on those characteristics, is a potential target for computerized clinical decision support. The ultimate purpose of such systems is to make recommendations that alter medical management in a way that optimizes patient health.

1.2 Why test CCDSSs?

The promise of CCDSS is alluring and has captured the interest and imagination of scientists and healthcare professionals since the late 1960s as they have grappled with

the overwhelming demands of the medical domain. Recent recognition from policymakers that quality of medical care is widely variable and at times sub-optimal has turned attention to interventions for preventing medical error and promoting the consistent application of best medical knowledge to daily patient care (Corrigan et al., 2001; Corrigan et al., 1999). Health information technology and computerized clinical decision support have been identified as key enablers of better care.

Under the Health Information Technology for Economic and Clinical Health (HITECH) act, for example, the United States government will spend $27 billion on incentives to accelerate the adoption of EHRs and care providers will qualify for remuneration if their systems meet 'meaningful use' criteria, including implementation of decision rules relevant to a specialty or clinical priority, drug-allergy alerts, and later, provision of decision support at the point-of-care (Blumenthal & Tavenner, 2010). Providers began to receive financial rewards for meeting these requirements starting in 2011 and continuing until 2015, when failing to meet the requirements will result in financial penalties. Canadian investment varies by province – Ontario will spend $386 million to help physicians adopt EHRs with the goal of improving patient care(Webster, 2010).

Claims of benefit should be subject to rigorous testing with any health intervention. Much of health information technology supports the process of care by enhancing communication, portability of health information, legibility of health information, and completeness of clinical records. While such technology could

ultimately improve patient health, the magnitude of health benefits may be muted because most technology does not aim to directly improve patient outcomes.CCDSSs often aim to change practitioners' clinical actions and to ultimately improve patient health. They must be tested rigorously, as only measurable health benefits can justify their costly creation, implementation, and maintenance.

1.3 Do CCDSSs work?

Despite decades of research, results from rigorous CCDSS evaluations in clinical settings remain mixed, and we know little about what makes an effective system. Several systematic reviews have summarized the evidence base regarding computerized clinical decision support (Balas et al., 2000; Durieux et al., 2008; Garg et al., 2005; Hemens et al., 2011; Hunt, Haynes, Hanna, & Smith, 1998; Kawamoto, Houlihan, Balas, & Lobach, 2005; Mollon et al., 2009; Nieuwlaat et al., 2011; Roshanov, Misra, et al., 2011; Roshanov, You, et al., 2011; Sahota et al., 2011; Shojania et al., 2010; Souza et al., 2011). Most recently, the Health Information Research Unit published a comprehensive series of six reviews covering a total of 166 randomized controlled trials of CCDSS (Hemens et al., 2011; Nieuwlaat et al., 2011; Roshanov, Misra, et al., 2011; Roshanov, You, et al., 2011; Sahota et al., 2011; Souza et al., 2011). These reviews show that CCDSSs improve the process of medical care in a small majority of studies across all six clinical application areas (primary prevention, diagnostic test ordering, acute care, chronic disease management, drug prescribing and management, toxic drug monitoring

and dosing) but demonstrate little impact on (typically surrogate) markers of patient health. Expert opinion in the literature suggests many characteristics that may differentiate effective CCDSSs from their unsuccessful counterparts (Shiffman, Brandt, Liaw, & Corb, 1999; Sim et al., 2001; Solberg et al., 2000; Trivedi et al., 2002; Wetter, 2002). Systematic reviews of randomized controlled trials (RCTs) (Balas et al., 2000; Garg et al., 2005; Kawamoto et al., 2005; Mollon et al., 2009; Shojania et al., 2010) have found associations between success and providing decision support automatically (Kawamoto et al., 2005), giving recommendations and not just assessments (Kawamoto et al., 2005), integrating CCDSS with electronic clinical documentation or order entry systems (Kawamoto et al., 2005) (although only in unadjusted analyses), and providing support at the time and location of decision making (Kawamoto et al., 2005). Finally, trials conducted by the developers of the system are more likely to show benefit than trials conducted by another party (Garg et al., 2005).

1.4 Research question

We asked, "What characteristics of CCDSSs, tested in RCTs, influence the success of these systems as measured by improvement in the process or outcome of clinical care?"

2.0 Methods

We based our analysis on the dataset of 166 critically appraised RCTs included in our recent CCDSS review. Our methods for creating this dataset (i.e. identifying, retrieving, and assessing CCDSS trials) have been described previously (Haynes, Wilczynski, & the Computerized Clinical Decision Support System (CCDSS) Systematic Review Team, 2010) and are openly accessible at http://www.implementationscience.com/content/5/1/12. Here we summarize those methods and outline the steps we used to identify determinants of CCDSS effectiveness.

2.1 Building the CCDSS dataset

We defined CCDSSs as information systems designed to improve clinical decision making by presenting patient-specific, actionable recommendations or management options. This definition excluded systems that presented potentially important information (e.g. costs of diagnostic tests (Tierney, Miller, & McDonald, 1990) or past test results (Tierney, McDonald, Martin, & Rogers, 1987)), without giving patient-specific recommendations or management options.

Our previously published review protocol (Haynes et al., 2010) contains our detailed search strategy. In summary, we searched MEDLINE, EMBASE and other bibliographic databases until January 6th, 2010, and reviewed the reference lists of

included RCTs and relevant systematic reviews. We screened articles for eligibility through a duplicate, independent review of titles and abstracts followed by a duplicate, independent, full-text review of potentially eligible articles. Cohen's κ for reviewer agreement on study eligibility was 0.93 (95% confidence interval [CI], 0.91 to 0.94). A third reviewer resolved disagreements.

2.1.1 Partnering with decision-makers

We met periodically with decision makers, including clinicians and senior hospital managers, to plan the overall direction and specific details of our data extraction, analysis, and presentation and interpretation of results. To meet their information needs, we extracted, in duplicate, study characteristics (e.g., study design, size, setting, authorship, funding, and year of publication) and system characteristics of interest for local implementation (e.g., integration with other systems; user interface elements; methods of data entry and delivery of recommendations; target users) and some implementation details including pilot testing and user training. We contacted the corresponding authors of primary studies to confirm the accuracy of the extract and provide missing data. We received feedback from trial investigators on 81% (135/166) of studies and a research assistant re-assessed the remaining reports to confirm extraction accuracy.

2.1.2 Assessing study quality

CCDSS trials can be judged according to the same basic criteria relevant to trials of other healthcare interventions, including random allocation to intervention and control groups, concealment of allocation to intervention or control groups, adequate follow-up of the unit of analysis, appropriate adjustment for any baseline differences between the control and intervention groups, and blinding or use of an objective outcome (Haynes et al., 2010). In addition, information interventions are best evaluated in trials which minimize the potential for contamination (via learning effects within the same practitioner or communication between practitioners in the same practice) by allocating not individual patients, but rather practitioners, hospital wards, clinics, entire hospitals, and even geographical regions to receive or not to receive CCDSS advice (Liu & Wyatt, 2011). Allocation of such *clusters* improves the ability of the trial to minimize contamination between the groups and to detect the true impact of the intervention. Trials that do not employ the cluster randomization methodology run the risk of finding attenuated effects of the intervention under study, which they may not have adequate statistical power to detect, or no effects at all. Cluster allocation, however, has implications at the analysis stage of the RCT, where the analysis ought to be conducted using the unit of allocation or adjusted for clustering effects to protect the resultant effect estimates from spurious precision (Donner, 1998).

Pairs of reviewers independently evaluated the selected trials on 5 quality dimensions: concealment of allocation to intervention and control groups, appropriate

unit of allocation, appropriate adjustment for baseline differences, blinding or outcome objectivity, and adequate follow-up. For the purpose of this study on determinants of success, we modified the scale used when building the original CCDSS dataset, converting the 3 step (0, 1, 2) scale to 2 steps (0, 1) for use in our analyses. Briefly, we coded concealment of allocation (concealed, score = 1, versus unclear or not concealed, 0), unit of allocation (a cluster such as a practice or physician 1, versus patient, 0), the presence of baseline differences between the groups that were potentially linked to study outcomes (no baseline differences present or appropriate statistical adjustments made for differences, 1, versus baseline differences present and no statistical adjustments made or baseline characteristics not reported, 0), the objectivity of the outcome (objective outcomes or subjective outcomes with blinded assessment, 1, versus subjective outcomes with no blinding, 0), and the completeness of follow-up for the appropriate unit of analysis (>80%, 1, versus <80% or not described, 0).

2.1.3 Assessing effectiveness

We defined effectiveness as impact in the intended (by the authors) direction on the process of medical care or on patient outcomes. Process outcomes were defined as changes in care activities including diagnosis, treatment, and monitoring of disease; patient outcomes reflected effects on a patient's state, including changes in blood pressure, clinical events and health-related quality of life. We assessed these two

categories separately and considered a system *effective*/*successful* if it showed improvement in **either category** and *ineffective*/*unsuccessful* if it did not.

We judged a CCDSS effective in a given category if it produced a statistically significant ($p \leq .05$) improvement in ≥50% of the study's pre-specified primary outcomes in that category or in ≥50% of multiple relevant pre-specified outcomes if a primary outcome could not be identified. We considered primary any outcome that trial reports described as "primary" or "main". If authors did not designate a primary outcome, we considered the outcome used to calculate the trial's sample size to be primary, if reported. When none of the reported outcomes were clearly prespecified, we considered a system effective if it improved ≥50% of all reported outcomes.

Most trials used parallel designs comparing a CCDSS directly to usual care. Some studies, however, involved more than 2 study arms and we chose 1 comparison so as to isolate the effect of the CCDSS. Where 2 versions of the CCDSS were tested against a control, we assessed the comparison involving the most feature-enhanced CCDSS intervention. Where co-interventions supplemented a CCDSS arm (e.g. audit and feedback or educational rounds), we selected the CCDSS arm with the least co-intervention. Where multiple control groups existed, we considered comparisons involving the most intervention-free usual care group. If the CCDSS + another intervention were compared to just that intervention alone and to usual care, we considered the first comparison as a means of isolating the effect of the CCDSS.

We used the comparison deemed primary by the study authors to determine CCDSS effect, but this comparison was only acceptable if it involved a usual care or other non-CCDSS group. If a primary outcome was not specified or if it did not involve a usual care or non-CCDSS control, we chose comparisons according to Table 1 in the appendix.

In studies that used analysis of variance (ANOVA) to compare outcomes across 3 or more arms and found no difference, we considered this a sufficient demonstration of CCDSS failure. If post-hoc analyses were used to investigate specific contrasts, we chose comparisons according to Table 1 in the appendix.

Each of two studies (Flottorp, Havelsrud, & Oxman, 2003; Flottorp, Oxman, Havelsrud, Treweek, & Herrin, 2002; Martens et al., 2006, 2007) tested two different CCDSS reminders, each in a different study group, with one reminder group acting as control for the other. These studies presented separate outcomes for the reminders and we split them into two separate comparisons, forming a total of 4 eligible comparisons in our dataset.

2.1.4 Looking for determinants of success

There are many plausible hypotheses about factors that distinguish effective CCDSSs from their ineffective counterparts. Here we describe our methods of selecting factors for extraction from RCT reports (and supplemental publications) and for including these in statistical analyses appropriately. Figure 1 in the appendix summarizes this process. Briefly, we relied on past systematic reviews and a panel of clinicians and

researchers to select factors for extraction. We designated factors to be of primary, secondary, or exploratory interest. We contacted the authors of study reports to confirm the accuracy of our extraction, to comment on our primary factors, and to rank the remaining ones (secondary and exploratory) in order of importance to CCDSS success. We used this ranking to guide our analyses.

2.1.4.1 Determinants of success or determinants of failure?

Although our methods were limited to finding associations, we pursued factors that we hypothesized to cause success. Such factors may be 1) necessary but not sufficient to achieve success or 2) neither necessary nor sufficient to achieve success. It is difficult to conceive of a single factor that is independently sufficient to cause success.

Alternatively, one may look for factors that cause failure. These may be distinguished by being sufficient but not necessary. In other words, a given factor may guarantee the failure of a system but is not necessary for failure to occur. Significant downtime may be an example. A system that is unusable for large periods of time would certainly fail because users cannot access it, regardless of its many useful features (sufficient), but systems may fail for reasons other than high downtime (not necessary).

We chose not to pursue determinants of failure. Such factors are rarely investigated or reported in this literature. Further, authors may be more likely to discuss factors that they implicate in failure if the system failed to show benefit, but not mention these same factors (even if they were present) if the system succeeded. In

other words, the *reporting* of the feature is likely to be associated with success or failure, leading to erroneous conclusions about associations.

2.1.5 Selecting new factors for extraction

To direct the study toward characteristics most likely to affect system success, we assembled the 'ad-hoc working group on determinants of success in computerized decision support', a panel of clinicians and researchers. Details on the membership of this group can be found in Table 2.

We used a modified Delphi method (Sicotte, Jaana, & Girouard, 2008) to reach consensus regarding the explanatory variables for inclusion in our review. We first presented the 13 clinicians and researchers from our working group with an opportunity to independently assess the importance of each characteristic and to suggest additional characteristics using a web-based survey. The survey allowed members to rate each characteristic's potential for association with effectiveness on a 10-point scale, (1=very likely to be negatively associated with effectiveness; 10=very likely to be positively associated with effectiveness). 10 of the 13 completed the survey; only the facilitator knew their identity. The working group later met to discuss the anonymous survey results and to select characteristics for extraction.

2.1.6 Extraction methods and definitions

Having previously authored CCDSS reviews, 5 members* of the team were familiar with the reporting practices in this literature and led the group in creating operational definitions amenable to extraction. Five extractors working in parallel pilot-tested and refined these definitions in a targeted sample consisting of the 3 oldest and 3 newest studies in our dataset. We chose this configuration expecting that studies would range significantly in the types of systems they described and in their reporting practices.

Figure 3 shows a screenshot from the interface of our in-house, web-based system for duplicate data extraction and third-party or consensus-based adjudication of disagreements. Forcing extractors to consider their confidence in each answer choice, the extraction form asked them to rate their answers on a scale of 1 (not confident) to 7 (very confident). Extractors were also required to provide a reason for their answer choice, preferably in the form of a direct excerpt from the text. These reasons were meant to improve our accuracy and efficiency during the adjudication stage.

2.1.7 Inter-rater agreement

We assessed inter-rater agreement using the intraclass correlation coefficient (ICC). Three reviewers extracted data from primary studies. The ICC has a real advantage over the kappa statistic with multiple, variable reviewer teams because it can be

* Brian Haynes, Brian Hemens, Nathan Souza, Robby Nieulaat, Pavel Roshanov

calculated and reported as an average kappa instead of calculating multiple kappas for observers 1 and 2, 1 and 3 and 2 and 3 and is mathematically equivalent to Cohen's weighted kappa (Norman & Streiner, 2000). The extraction form response options were Yes, No and Unstated/Cannot Tell.

2.1.8 Contacting study authors

2.1.8.1 Data confirmation

After completing our extraction in duplicate and adjudicating responses, we emailed the corresponding authors of all primary studies to verify the accuracy of our extract using a web-based form developed in-house (Figure 4).

2.1.8.2 Analysis survey

We split our search for determinants of success into 3 sets of candidate factors: primary, secondary, and exploratory. This decision was based on limitations arising from our analytic methods and our sample of RCTs. We provide detailed rationale in the "Model specification procedures" section of the statistical appendix.

We presented authors with a chance to comment on the factors specified for our primary analysis but did not plan to modify this factor set. We also presented authors with the 20 factors that were not in our primary factor set and asked them to choose the top 10 items of interest to them that are most likely to cause CCDSS success, ranking them from 1 (most important) to 10 (Figure 5). We recognized that the order of

presentation may influence the ranking and addressed this problem by presenting every author with a different randomly-generated order.

We sent an email reminder to authors who had not replied within 1 week, with follow-up reminders every week for the next 4 weeks. We received responses regarding our extraction for 57% of the comparisons in our dataset (92/162) and 36% (50 of the 140 eligible authors) responded to the factor ranking survey. The denominators here differ because authors were eligible to reply to the ranking request only once but some acted as the corresponding author for multiple publications.

We analyzed the analysis survey results by using simple logistic regression to detect associations between each factor and being ranked in the top 10 by authors. We then considered the direction of significant associations ($p \leq 0.05$): positive association with a top 10 ranking meant that a factor should be in the secondary factor set; negative association meant that it should be in the exploratory factor set. We modified factor set membership if the resulting classifications differed from our prespecified order. If no significant association was found for a factor, we simply used its prespecified secondary or exploratory classification.

Table 3 summarizes the findings of the author survey. In response to the survey results, we modified the prespecified factor set membership of 4 factors: *users trained to use the system* and *local users consulted during development* moved from exploratory to secondary; *periodic performance feedback* and *major informatics research institution*

moved from secondary to exploratory. We either found no statistical association between top 10 ranking and any of the remaining factors, or the associations agreed with our prespecified factor set classifications.

2.1.9 Three factor sets

This section provides details on the factors in each set as ordered after the ranking survey. We also provide brief rationale behind each factor, as presented in the survey to corresponding authors.

2.1.9.1 Primary factor set

1. Some of the study's authors are also the system's developers.

Garg and colleagues (Garg et al., 2005) found a positive relationship between developer involvement in authorship of the study and that study's chances of finding the system effective. This could be due to a variety of reasons, such as a more diligently planned study, more carefully designed software, and bias in selection or publication of outcomes.

2. System provides decision support automatically within the practitioner's workflow.

Providing decision support within practitioner workflow saves the effort of initiating a separate process or program to retrieve the advice and should make decision support more appealing to practitioners. Kawamoto and colleagues (Kawamoto et al.,

2005) found an association between this characteristic and system effectiveness. We planned to test the importance of this characteristic using the increased statistical power of our analysis.

3. System provides feedback at the time of care.

The review by Kawamoto and colleagues (Kawamoto et al., 2005) suggested that this characteristic might be important. Its association with effectiveness closely approached statistical significance in adjusted and unadjusted analyses. We planned to test the importance of this characteristic using the increased statistical power of our analysis.

4. Integration with computerized charting (EMR-type) or order entry systems.

As electronic medical records and computerized practitioner order entry systems become more commonplace, provision of decision support integrated within these systems promises to improve care delivery. In the United States, the HITECH act's criteria for meaningful use of electronic health records include integration of decision support rules. Such integration may simplify the delivery of timely decision support at the point of care. However, the multitude of alerts afforded by integration with electronic records may overwhelm practitioners.

5. Engagement of patients and practitioners.

As personally controlled health records and software supporting self-management become more common, one attractive solution includes providing decision support that

engages both practitioners and patients to maximize compliance. Our definition involved direct delivery of recommendations or reminders to patients, as well as indirect delivery through the practitioner. We assessed these two methods separately in our secondary analysis.

6. System demands reason from the user for ignoring its recommendations.

Recommendations cannot change practice if ignored. Some systems demand that users provide a reason for not carrying out the recommended actions. The review by Kawamoto and colleagues (Kawamoto et al., 2005) found that this characteristic was associated with success in a univariable analysis but the association disappeared upon adjustment for other factors. We planned to test the importance of this characteristic using the increased statistical power of our analysis.

2.1.9.2 Secondary factor set

1. The system facilitates or automates the recommended actions.

For example, if the system recommends peak and trough drug concentrations in response to an order for an aminoglycoside, the clinician simply clicks “Okay” to order the recommended tests. Alternatively, the system may facilitate ordering by including an order button within the prompt or, if the advice is delivered on paper, a field or check box to make the order. Practitioners may be more likely to adhere to advice if it is easy for them to do so.

2. Advice is evidence-based.

Clinicians may be more likely to act on scientifically sound advice based on a study or clinical practice guideline and such advice is more likely to improve patient outcomes.

3. Critiquing function.

The system critiques orders for treatments/tests/procedures by suggesting that they be cancelled or changed. This kind of advice targets a specific action and appears after the clinician begins to act. By being well integrated into cognitive workflow, it may be better welcomed than a more general reminder.

4. The practitioner does not enter data into the system.

Some data items, such as the results of recent blood tests, may not be available to the system automatically; if so, it requires the clinician to manually enter that data to receive support. Busy clinicians may be more likely to use a system if they do not need to enter data.

5. Modern system (study published after year 2000).

User interfaces, system responsiveness, and practitioners' general comfort with computers may have improved, making current systems more acceptable to their users. In addition, systems often need rich data streams to live up to their potential and this is less likely to have been available in older studies.

6. Advice or reminders provided directly to patients.

Engaging patients in self-management and decision-making may help to improve the process of care or patient outcomes. Providing advice directly to patients (independent of their practitioner) may mean that the advice is more likely to reach to patient than by expecting practitioners to pass the advice on. Some examples of direct advice include a postcard reminder for influenza vaccination or direct access to a web-based diabetes management system.

7. Trained users.

Users of the system received training to use it. Given the complexity of system interfaces and the busy nature of clinical practice, practitioners who receive training to navigate a system efficiently may be more likely to use it.

8. Local users were consulted when creating the recommendations.

Practitioners may find recommendations inappropriate for their setting or their patient population. They may be more likely to adhere to recommendations that they helped develop.

9. System presents its reasoning.

The system justifies its advice by explaining its reasoning. Clinicians may be more likely to accept advice when explained in the context of the clinical situation.

10. System cites research evidence.

The system justifies its advice by citing research evidence. Clinicians may be more likely to act on scientifically sound advice and such advice is more likely to improve patient outcomes.

2.1.9.3 Exploratory factor set

1. Major clinical informatics research institution.

System was tested in an institution with a well-known track record in clinical informatics, such as the Brigham and Women's Hospital, Massachusetts General Hospital, Intermountain Healthcare, Kaiser Northwest, Vanderbilt University Medical Centre, and Wishard Memorial Hospital. Such environments may have uniquely sophisticated information systems and cultures of quality improvement that facilitate more successful CCDSS implementations.

2. The system has been evaluated previously.

A previous evaluation or pilot test of the system was discussed or cited. Systems that have been tested previously may be more mature and better able to meet the needs of clinicians.

3. The system was a commercial product.

Some systems are provided by private vendors while others are developed at research institutions and are not for sale. Homegrown systems may be better integrated into the information systems of the institution and may have been carefully customized

to match the needs of local clinicians. We did not consider homegrown reminders built into commercial systems to be a commercial intervention.

4. Practitioners received advice through an electronic interface.

While computers generated all advice, some studies had the advice printed on paper and stapled to the front of patient charts, while others displayed it on a computer screen. Advice presented electronically may be easier to find and act on.

5. System targets healthcare providers other than physicians.

The system gives advice to a healthcare provider other than a physician, such as a nurse, physician assistant, or dietician. This can be in addition to a physician. Directly targeting other healthcare professionals may prevent the system from overwhelming busy physicians with alerts and reminders.

6. Periodic performance feedback in addition to patient-specific CCDSS advice.

Practitioners receive a summary of their performance on one or more aspects of clinical care. This could be delivered in the form of a monthly report, for example.

7. There was some co-intervention in the CCDSS group.

Targeting practitioners with multiple interventions may better catch their attention improve adherence to guidelines. Some examples include practitioner

education or audit and feedback. We did not consider printed guideline materials a co-intervention.

8. Community-based primary care setting.

The CCDSS is used in a primary care clinic based in the community instead of a hospital. This factor was eventually excluded for any analyses because we deemed the quality of extracted data too low. It was extracted during the initial phase of the CCDSS review and not during the determinants extension.

9. Hospital inpatient setting.

Recommendations were intended for the care of patients admitted to hospital, such as in intensive care units or maternity wards. This factor was eventually excluded for any analyses because we deemed the quality of extracted data too low. It was extracted during the initial phase of the CCDSS review and not during the determinants extension.

10. Academic setting.

The system was deployed in an academic medical centre, such as a research or teaching hospital. This factor was eventually excluded for any analyses because we deemed the quality of extracted data too low. It was extracted during the initial phase of the CCDSS review and not during the determinants extension.

2.3 Analyzing the CCDSS dataset

Studies of complex interventions are not reported in a standardized manner and many factors that we suspect are important for realizing the potential benefits of computerized systems were rarely discussed in study reports.

As a result, our dataset exhibited a number of challenging characteristics. The heterogeneity of systems, indications, and measures in studies found in our systematic review forced us to use a binary *effective-ineffective* summary outcome measure for each study. We were faced with a small sample size, a large number of potential determinants of success, missing data on known important factors, relationships among the studies in the dataset (violating the assumption of independence fundamental to most analytic procedures), and an unbalanced data structure where some factors were highly prevalent while others were rarely encountered.

We needed an analysis plan that could address these challenges and could allow us to make unbiased estimates of the degree to which certain factors determine CCDSS success. Here we describe our analysis methods for identifying factors associated with CCDSS success (summarized in Figure 2) and provide brief rationale for each of the methods selected. We also describe the methods of a simulation study that examines the performance of testing a set number of hypotheses in CCDSS datasets of progressively smaller sizes. Detailed background information on our analysis choices is presented in the statistical appendix.

2.3.1 Descriptive statistics

We presented each factor's overall prevalence in the dataset, in comparisons demonstrating CCDSS success, and in comparisons demonstrating CCDSS failure. We also presented the number of comparisons in which we had data for that factor (i.e. not missing) and a measure of association (odds ratio) between that factor and system success, unadjusted for any other factors, estimated using simple logistic regression based on maximum likelihood estimation (MLE). We calculated 95% confidence intervals (CIs) around factor prevalence estimates using Wilson's method and around estimates of association with success using the likelihood ratio. We also used likelihood ratios to calculate *p*-values for the unadjusted associations. Empirical work suggests that the likelihood ratio and Wilson's methods perform equally well to each other and both produce intervals with more accurate and reliable coverage than the common Wald method, regardless of *p* value and sample size (Brown, Cai, and DasGupta 2002; Brown, Cai, and DasGupta 2001). Numerous other methods exist and while all of them outperform Wald, none are superior to Wilson and the likelihood ratio. Please refer to the section titled "Confidence intervals and tests of significance" in the statistical appendix for more background information on these methods.

2.3.2 Model specification

To avoid finding spurious associations, while still exploring many reasonable hypotheses, we split our search for determinants of success into three sets of candidate factors: 6 primary, 10 secondary, and 7 exploratory[†].

We prespecified all primary factors and classified all remaining factors as secondary or exploratory. We subsequently modified secondary/exploratory classification based on the opinions of CCDSS study authors, collected by our web-based survey. This process was preplanned.

We initially entered all primary factors into a multiple logistic model together. We then removed those clearly showing no association with success and included the remainder in our *final primary model*. We then used simple logistic regression based on maximum likelihood estimation to screen secondary factors for inclusion, adding those that crossed p=0.20 to those from the final primary model. The *final secondary model* retained just those factors significant (or approaching significance) after this procedure. We followed the same steps with the exploratory factor set, adding exploratory factors that passed the screening stage to those from the final secondary model and retaining the significant (or close to significant) factors in a *final exploratory model*.

We placed emphasis on the primary models because they were prespecified to obey an empirically derived 10:1 event per variable (EPV) ratio (Peduzzi, Concato,

[†] down from the originally planned 10; we removed 3 due to poor data quality

Kemper, Holford, & Feinstein, 1996) and most factors had demonstrated significant association in previous reviews. We strongly caution readers regarding the potential for spurious findings in the secondary and exploratory models. Detailed statistical rationale is presented in the "Sample size and events per variable" and "Model specification procedures" sections of the statistical appendix.

We only modeled main effects. While this allowed us to control for confounding factors, we could not appropriately model effect modifiers—those factors whose interaction with other factors affects probability of CCDSS success— because our dataset was too small to support the multiple necessary interaction terms necessary without overfitting the data. Thus, we simply assumed that all factors were acting independently to affect success.

2.3.3 Four modeling methods

We used logistic regression models to estimate the associations between CCDSS success and its potential determinants. This chapter describes the four different methods we used to estimate parameters in our logistic models.

Maximum likelihood estimation (MLE) is the standard method for estimating parameters in logistic regression analyses involving binary covariates. This is the method used by Garg and colleagues (Garg et al., 2005) and what we expect most reviewers would use when investigating heterogeneity in reviews with binary study-level summary outcome measures. It has significant limitations in small samples with sparse data structures and we anticipated that it may not produce reliable estimates of some parameters. The section titled “Maximum likelihood estimation” in the statistical appendix provides a detailed discussion of MLE.

Exact logistic regression overcomes the problems of separation encountered in MLE. However, it is very computationally intensive and does not lend itself to regression diagnostics in current statistical packages. It also produces biased estimates where conditions of separation would normally produce no estimates in MLE. Kawamoto and colleagues used exact logistic regression (Kawamoto et al., 2005) and we used it to allow for comparison of our results to that review. The section titled “Exact logistic regression” in the statistical appendix discusses exact logistic regression in more detail.

Firth's Profile Penalized Likelihood Estimation has not been used in previous CCDSS reviews. It overcomes problems of separation and corrects for bias in small estimation samples with sparse data structures. It is also easier to compute and understand than exact logistic regression, and produces more accurate parameter estimates in conditions of separation. We based our primary inferences on this method and provide further details in the "Firth's bias-corrected logistic regression" section of the statistical appendix.

These three methods assume that observations are independent of each other. Nearly half of our studies, however, were conducted at the same institution as another study in the dataset, that is, they potentially shared some unobserved factors and their probabilities of demonstrating success were not independent. We used random effects logistic regression to account for this interdependence and to quantify the degree to which the probability of success is correlated among studies from the same institution. We provide in-depth discussion of our rationale behind this method of handling correlated data in the "Handling correlated data" section in the statistical appendix.

We tested each model specification using all four modeling methods and compared the results to detect parameter estimates sensitive to the choice of modeling technique.

2.3.4 Diagnostics

2.3.4.1 Collinearity

We anticipated that some of the factors in our models would be correlated with each other. This situation is termed collinearity if two factors are associated, or multicollinearity if a linear combination of several factors predicts another factor. Such correlations typically exist but, when small, pose no problem for logistic regression. If large, however, they would make it very difficult to estimate the unique impact of each factor on systems' probability of success. We looked for variance inflation factor (VIF) values of 5 to identify problematic multicollinearity in our models. The "Checking for collinearity" section in the statistical appendix provides more information about this measure.

2.3.4.2 Goodness-of-fit

We examined goodness-of-fit using Pearson's Chi-square test, comparing the predicted probability of success in subgroups defined by covariate patterns with the observed probability.

The accuracy of Adaptive Gaussian Quadrature for fitting random-effects logistic models is partially dependent on the number of integration points used (Pinheiro and Bates 1995). A larger number may produce more accurate results but is less efficient computationally. To check the quality of the random effects model fit, we varied the

number of quadrature points and compared the model coefficients with the original model. Large differences between the coefficients of models fit with a different number of quadrature points indicate a misspecified model and that the random-effect does not fit the data well. In such a case, we would consider the coefficients invalid.

We provide detailed rational behind goodness-of-fit statistics in the "Goodness-of-fit statistics" section of the statistical appendix.

2.3.4.3 Influential observations

We looked for studies or groups of studies that exert more influence on the logistic model than others by creating scatter plots of standardized Pearson residuals, deviance residuals, Pregibon's leverage, DF betas, and delta statistics plotted against study ID. Outliers may signify errors in data extraction or systems not representative of decision support systems in general. They may distort our parameter estimates and lead us to miss important associations or to identify spurious ones. The "Influential observations" section of the statistical appendix defines these measures. We conducted sensitivity analyses by removing any influential studies.

2.3.4.4 Internal validation

We developed a simulation program that draws with replacement from our original estimation sample 10,000 simulated samples of a size identical to our original sample. We conducted our analyses in each simulated sample and calculated the proportion of samples in which Wald tests were significant ($p \leq 0.05$) for each parameter

in our models. We then plotted empirical distributions of each parameter point estimate.

We used these metrics to assess the robustness of the parameter estimates and to ensure that ours were not merely lucky findings caused by the peculiarities of this particular sample of RCTs. If a factor was found significant in our original sample, it should be found statistically significant a high proportion of simulated samples. A low proportion suggests that the original finding is sensitive to idiosyncrasies in our estimation sample and we should avoid being overly-optimistic when we interpret its importance. If the factor's adjusted association with effectiveness was found to be statistically insignificant in our original sample, it should be found significant in a low proportion of bootstrap samples to be considered stable. The "Validation procedures" section in the statistical appendix provides further discussion on internal and external validation methods.

2.3.5 Predictive performance

The primary purpose of our models was to investigate causal relationships between CCDSS effectiveness and potential determinants and we have selected only factors that may reasonably have such a relationship. Causal factors, however, are often incorrectly used to predict outcomes (Wald, Hackshaw, & Frost, 1999). When possible, we assessed our models' predictive performance using sensitivity, specificity, and area under the Receiver Operating Characteristics curve (AUROC), along with corresponding

95% confidence intervals. We provide a detailed discussion of etiologic and prognostic models in the "Etiologic and prognostic models, and assessing predictive performance" section of the statistical appendix.

2.3.6 Handling missing data

To our knowledge, this data set is the largest ever used in a search for determinants of success in randomized trials of computerized clinical decision-support. However, our sample size was small in relation to what most statistical methods require to reliably identify associations between binary outcomes and binary predictors in a multivariable model.

Reporting in the CCDSS literature with respect to potentially important factors has been described as a major problem in previous systematic reviews. Missing data on the covariates of interest can greatly impact effective sample sizes and statistical efficiency. We took several steps to reduce missing data in our study.

1. During the planning phase, we worked with our expert group to define variables of interest for extraction. We considered factors examined in previous reviews, and together with authors of our own 6 CCDSS reviews, judged the feasibility of operationalizing and extracting each characteristic from RCT reports. This ensured that we pursue characteristics we can reliably extract from this literature.

2. Study reports rarely discussed features that were not present in their system. We judged it appropriate to infer absence of some characteristics. For example, if a

study made no mention of its system asking users for a reason for overriding the CCDSS advice, we inferred that this was not a feature of the system. Certainly, this method may not be perfect but it would be unreasonable to simply count this as missing data.

3. We ignored variables missing or not reasonably inferred in 30% or more of studies. We recognize that this is an arbitrary cutoff, but it was reassuring to see that only *system was a commercial product* approached the cutoff. The remaining factors were either very commonly reported or reasonably inferred, or reported in fewer than 20% of studies. Therefore, choosing a different reasonable threshold would not have affected our results.

4. We conducted extraction in duplicate with adjudication. This allowed us to minimize extraction error when one extractor noticed information another extractor may have missed, particularly when reading such complex and inconsistently structured reports. Because each pair of extraction forms was adjudicated, every study report was read at least twice and many were read three or more times.

5. We contacted the authors of each study report with our detailed extraction forms, attaching copies of the primary report and any supporting studies or descriptions we found in the literature. Thus, authors saw not only our adjudicated responses, but also our extractors' rationale for their answer, along with page and paragraph citations or direct quotes from the text. If we had missed important information in previous steps, the study's author now had a chance to correct our mistake.

6. Finally, we used *multiple imputation* to impute missing data and conducted two sets of analyses. The first was the complete-case set, on which we based our primary inferences; the second was a set of 20 imputed versions of the data created by multiple imputation using the method of chained equations. We included all factors from our 3 sets as well as study outcomes in imputation models to predict missing data. The imputed analyses were meant to assess our inferences' sensitivity to missing data. Our discussion on "Missing data" in the statistical appendix provides a review of missingness and imputation. Please refer to Figure 2 in the appendix for a graphical representation of our data analyses.

2.3.6 Impact of EPV and sample size on CCDSS analyses

Our primary analysis differs significantly from past reviews in that it maintained a 10:1 EPV (events per variable) ratio, the rationale for which we have provided in the section on “Sample size and events per variable” in the statistical appendix.

Kawamoto and colleagues (Kawamoto et al., 2005) screened 15 features for inclusion in a multiple logistic regression model and ultimately included six. Their sample contained 71 comparisons. Systems in 48 comparisons showed benefit; therefore, 23 failure “events” and 6 features—15 features for the most conservative of analysts (Babyak, 2004)—determined the EPV ratio. Considering the less restrictive option (6 features), this analysis had an EPV ratio of 3.8:1.

Empirical studies suggest that analyses with such low EPV will produce highly unreliable results (Peduzzi et al., 1996). However, we wanted to assess the reliability of parameter estimates and statistical tests with EPV ratios lower than ours specifically in CCDSS data. We did this by testing our primary model in progressively smaller random samples of studies, effectively decreasing the EPV ratio.

We created a simulation program that ran our primary analysis on 1000 simulated samples drawn with replacement from our original sample. The first round of simulations was performed using samples with 162 observations—identical in size to the original. We performed the second round of simulations using samples with 120 observations, or 25% smaller than the original. Subsequent rounds drew smaller samples

that reflected the sample size of previous reviews: 97 (Garg et al., 2005), 71 (Kawamoto et al., 2005), and 32 (Shojania et al., 2010).

We performed the entire procedure once using MLE and again using Firth's PPLE, qualitatively comparing results between the methods. For each round of simulations, we calculated the proportion of samples in which Wald tests were significant ($p \leq 0.05$) for each parameter in our models. We then plotted empirical distributions of each parameter point estimate.

Wald tests have been shown to be less reliable than likelihood ratio tests and we expected the proportion of samples showing significant results of each factor to be slightly different than if we had used the likelihood ratio method. It was not possible to use this method because sample sizes varied between log-likelihood estimates when MLE encountered conditions of separation and deleted all observations containing the problematic factor. However, the Wald test is perfectly valid for our purposes, as we were simply interested in substantial differences between the results.

3.0 Results

Figure 6 summarizes the flow of studies into the dataset. We included 162 comparisons from 166 studies. Six of our 166 studies (Ageno, 1998; Christakis & Wright, 2004; Fitzmaurice, Hobbs, Murray, Bradley, & Holder, 1996; Reeve, Tenni, & Peterson, 2008; Ryff-de Leche, Engler, Nutzi, Berger, & Berger, 1992; Wyatt, 1989) did not present evaluable data on process of care or patient outcomes and two studies (Flottorp et al., 2002; Martens et al., 2007) accounted for 4 unique comparisons. Table 4 presents descriptive statistics and results of simple logistic models for selecting factors for the secondary and exploratory complete-case analyses; tables 5-20 summarize all logistic regression analyses; table 21 summarizes the results of our decreasing sample size simulation; table 22 presents a comparison between this review and previous CCDSS reviews; table 23 presents system characteristics; table 24 provides intervention descriptions; and table 25 provides all outcomes used to assess CCDSS effectiveness.

For the items included in our analysis and extracted specifically for this extension on determinants of CCDSS success, reviewer agreement was generally good, with ICCs ranging from poor 0.43 (95%CI, 0.22 to 0.58) to excellent 0.89 (95% CI, 0.85 to 0.92). We did not have sufficient information to calculate ICC for items extracted during the previous phase of the review.

3.1 Primary models

Tables 5-13 summarize the results of all complete-case analyses. Here we summarize the findings, providing only Firth's bias-corrected parameter estimates for the logistic models, unless stated otherwise. 95% confidence intervals were calculated using the Wald method and are expected to be wider than their nominal coverage, but p-values were calculated using profile-penalized likelihood ratios.

The primary prespecified logistic regression models discovered positive associations between CCDSS success and *authors are the developers, system provides advice to patient,* and *system requires reason for ignoring advice*. *Automatic provision in workflow* (OR, 1.48; 95% CI, 0.62 to 3.52; p=0.378) and *feedback at the time of care* (OR, 0.61; 95% CI, 0.21 to 1.77; p=0.354) were not associated with success. *Integration with EMR or CPOE* showed a strong negative association with success. We removed *automatic provision in workflow* and *feedback at the time of care* to form the final primary model. All associations remained for *authors are the developers* (OR, 4.35; 95% CI, 1.66 to 11.44; p=0.002)*, system provides advice to patients* (OR, 2.77; 95% CI, 1.07 to 7.17; p=0.029)*, system requires reason for ignoring advice* (OR, 11.23, 95% CI, 1.98 to 63.72; p<0.001), and *integration with EMR or CPOE* (OR, 0.37; 95% CI, 0.17 to 0.80; p=0.010). Figure 7 presents forest plots of the prespecified and final primary factor associations.

3.1.1 Primary model diagnostics

Pearson's Chi-square test of model fit confirmed that our primary prespecified and final models fit the data well. We created index plots of influence statistics (Figure 8), residuals (Figure 9), and DF betas (Figure 10). The DF beta plots identified the comparisons in two studies (Gilutz et al. 2009 and Cobos et al. 2005) as having strong influence on the association between success and *system requires reason for ignoring advice*. The data extracted from these studies had been confirmed accurate by their authors. We removed the studies from the dataset and conducted all analyses again to assess differences. Regular logistic regression by MLE and random effects logistic regression failed to converge and omitted *system requires reason for ignoring advice*. Firth's bias corrected method converged and exact logistic regression resorted to MUE; both produced parameter estimates consistent with our original findings. Tables 12 and 13 include the details of the primary analyses conducted after removing the two studies from the dataset.

We saw extremely small changes in parameter estimates when varying the number of quadrature points used for fitting the random effects model. Ideally, the relative difference in parameter estimates would be smaller than 0.01% between the different models and this was true in our case. Only the coefficient on the *require reason* factor varied by a slightly larger amount but this was expected, given that we faced

difficulties with separation when estimating this parameter using MLE. Overall, our primary random-effects model was correctly specified and fit our data well.

3.1.2 Results of internal validation

We estimated the primary logistic model parameters using MLE and Firth's methods in 10,000 simulated samples drawn with replacement from the original. Table 11 shows the proportion of samples in which the association for each factor, adjusted for the other factors in the model, is significantly associated with CCDSS success (Wald-based $p \leq 0.05$). Figures 11-14 show distributions of Odds Ratio point estimates for each parameter across the samples. Plots of parameters based on MLE show that *system requires reason for ignoring advice* causes convergence problems in many of the samples and, as a result, its OR estimate has two distinct probability distributions -- one suggesting no association and the other suggesting strong positive association. Plots based on Firth's estimation demonstrate this method's advantage – all models converge, even in conditions that would normally result in separation. Overall, the validation results show that our findings on *integration with EMR or CPOE (significant in* 88.7% of samples), *authors are the developers (significant in* 80.4% of samples*, automatic provision in workflow (significant in 14.7% of samples), feedback at the time of care (significant in 9.5% of samples),* and *system requires reason for ignoring advice (significant in 75.6% of samples)* were not sensitive to the sample peculiarities and can be trusted to replicate. The parameter point estimates of association between success

and *system provides advice to patients* were also positive more often than not, but were statistically significant based on the Wald test in only 46% of the simulated samples. This was expected, given that its *p* value in the original sample straddled statistical significance from one model to another.

3.2 Secondary models

Using a *p* value threshold of 0.20, univariable logistic regression in the secondary factor set revealed that systems that present to clinicians the reasoning behind their recommendations (*system presents reasoning*) were more likely to succeed than systems that did not (OR, 1.84; 95% CI, 0.98 to 3.47; p=0.057).

However, this association was lost when we adjusted *system presents reasoning* for the factors found significant in our primary model (p>0.25 across all modeling methods). It had no impact on previously identified associations: *authors are the developers, integration with EMR or CPOE, system provides advice to patients, and system requires reason for ignoring advice* remained statistically significant across all modeling methods (although *system provides advice to patients* was only marginally significant in exact [p=0.057] and random effects logistic models [p=0.066]). The strength of association also remained stable for each factor. Therefore, we did not find any important factors in the secondary factor set.

3.3 Exploratory models

Using a *p* value threshold of 0.20, univariable logistic regression in the exploratory factor set revealed that systems tested in an institution with a recognized track-record in computerized decision support (*major institution*) were more likely to succeed than systems that were not (OR, 1.59; 95% CI, 0.82 to 3.06; p=0.169). Systems that were supplemented with some co-intervention were less likely to succeed than systems that were not (OR, 0.43; 95% CI, 0.17 to 1.13; p=0.087).

Adding these factors to the significant findings from our secondary model did not impact our previously identified associations. *Major institution* lost any indication of statistical significance, with its *p* value exceeding 0.25 across all modeling methods. *Co-intervention in the CCDSS group*, however, maintained a *p* value of approximately 0.1 across the modeling techniques and we could not rule out its importance. In the final exploratory model, we removed *major institution* and saw *co-intervention in the CCDSS group* approach statistically significant negative association with success across all methods, with *p* ranging from 0.06 to 0.1. All previously identified factors maintained their significance levels across the modeling methods.

3.4 Methodological factors

Stratifying our analyses on cluster randomization, adequate follow-up, allocation concealment, and baseline balance or adjustment removed statistical significance in most cases and retained the same trends as our main analyses. We found no new

associations or changes in direction of association. All studies used blinding or an objective outcome, precluding any stratification on this factor. The results of these stratified analyses are not likely to be robust due to the small size of the estimation samples.

3.5 Predictive performance

We calculated Area Under the ROC curve (AUROC) to assess the predictive performance of our models. All models—primary, secondary, and exploratory—showed fair performance (AUROC ranging from 0.77 to 0.79) at discriminating between successful and unsuccessful systems. Sensitivity at a predicted probability threshold of 0.5 ranged from 0.74 to 0.80 and specificity from 0.64 to 0.70. The point estimates and their 95% confidence intervals are shown in all results tables.

3.6 Imputed results

Tables 14-20 show the results of our multiple imputation analyses. While slightly different numerically, the findings are universally consistent with our complete-case analyses.

3.7 Effect of EPV and sample size on parameter estimates

We estimated the primary logistic model using MLE and Firth's methods in 1000 simulated samples with 162 observations, 120 observations, 97 observations, 71 observations, and 32 observations, effectively decreasing the event per variable (EPV) ratio for each analysis.

Table 21 and Figure 15 show the proportion of samples in which the association for each factor, adjusted for the other factors in the model, is significantly associated with CCDSS success. The procedure clearly demonstrates that analyses conducted using smaller samples with the same data structure are prone to missing associations discovered in large samples. When using MLE for parameter estimation, the prevalence of separation problems increased rapidly with decreases in sample size, precluding inference about the affected factors. Firth's method did not suffer from this problem, but both MLE and Firth-based procedures became less statistically efficient as sample size decreased.

4.0 Discussion

4.1 Summary of findings

CCDSSs presenting advice within electronic health records or order entry systems were much less likely to improve care or outcomes than standalone programs. Providing advice to patients and requiring practitioners to give explanations when overriding CCDSS advice may be effective ways of improving chances of success in computerized clinical decision support. Studies conducted by the computer system's developers were more likely to demonstrate benefit than those conducted by a third party. Providing support automatically in practitioner workflow or at the time of care were characteristics found important in previous reviews but showed no association with success in our study.

4.2 Interpretation

We tested *integration with electronic charting or order entry systems* with an underlying hypothesis that it makes a positive difference, acknowledging that it may make no difference in practice if practitioners are overwhelmed by many alerts. We found a strong negative association with success. This effect was very robust, maintaining magnitude and statistical significance across all models and all modeling methodologies. In our simulated internal validation procedure, it was the most reliable

finding in terms of significance testing and its parameter point estimates. Contacting study authors confirmed that our extraction of this factor was extremely accurate.

There are several potential explanations for this finding. Integrating CCDSS well with a hospital-wide EMR requires that the informatics leads have control of the EMR system but this is not true outside of the major informatics research institutions. Another possibility is that the phenomenon of 'alert fatigue' prevents CCDSS advice from changing behavior. Once an EMR or CPOE system is made capable of delivering alerts triggered by patient information or physician action, institutions that have achieved this capability are charged with delivering appropriate alerts. They may be delivering too many alerts for practitioners to act on, or they may be delivering unspecific alerts that fire in scenarios considered inappropriate by practitioners. Quantity without adequate attention to quality may be causing this issue.

The 'alert fatigue' hypothesis is further supported by another of our primary findings: systems that require the practitioner to give a reason for overriding the CCDSS advice were more likely to succeed than systems that did not demand a reason. Perhaps a way to force physicians' attention in an alert fatigue situation is to present a highly invasive alert that demands an explanation before going away. Recent direct experimental evidence confirms the effectiveness of this method in a CCDSS for drug prescribing (Scott, Shah, Wyatt, Makubate, & Cross, 2011). This feature may increase compliance, but is likely not extendable to many alerts before practitioners become very upset. Further, it may potentially facilitate automation bias (Goddard, Roudsari, &

Wyatt, 2011), where physicians simply accept recommendations to avoid giving an explanations. This is particularly problematic if the system's advice is incorrect.

Systems that give advice to patients, either directly or by providing materials to practitioners to relay to their patients, were more likely to succeed than systems that did not involve patients. Such systems may improve practitioner performance by activating the patient to inquire about issues with their practitioner. Especially in the context of chronic disease, patients are responsible for the majority of care and evidence suggests that their rates of adherence to dietary and medical regimens are very poor. Our estimate of association, however, was imprecise and statistically significant in only half of the simulated samples in our internal validation procedure.

The finding by Garg and colleagues (Garg et al., 2005) that systems tested by their developers were more likely to succeed than those tested by a third party emerged in our study also and proved very robust across modeling techniques and in internal validation. Determining its mechanism of influence, however, is challenging Some plausible explanations include: 1) authors with conflicts of interest are less likely to submit negative results for publication, 2) authors with conflicts of interest are more likely to report positive outcomes while ignoring negative outcomes within their study, 3) studies from trailblazer informatics institutions with cultures of quality improvement represent the leaders in this field and these people are more likely to be developing and evaluating (at the RCT level) systems with higher chances of success due to some constellation of factors which we have not measured 4) authors with conflicts of interest

have more motivation to design strong, appropriately powered RCTs with maximum chance of detecting benefit.

The presence of a co-intervention in the CCDSS group emerged in the exploratory analysis as a potentially important factor. It was negatively associated with success (marginally significant), but adjusting for it did not change other parameter estimates. It is possible that studies that include a co-intervention in the CCDSS group compared this group to an active control—non-CCDSS group with another intervention. If the control intervention was effective, the additional benefit attributable to the CCDSS may have been too small to detect. In post hoc analysis, we replaced this co-intervention factor with a modified version, in which the co-intervention was present only in the CCDSS group and no intervention other than usual care was present in the control group. We found no association between this version of the factor and CCDSS success, supporting our interpretation. We kept the original version in the exploratory model because we judged that its (nonsignificant) association warranted using it to adjust other factors.

4.3 Comparison to past reviews

Table 22 summarizes the findings of and key differences between this review and past CCDSS reviews that have searched for determinants of success. We used different methods than previous reviews to select factors for our analyses. We had a larger set of studies but limited our primary analysis to fewer hypotheses, maintaining a 10:1 event

per variable ratio in the primary analysis. We also did not use any automatic or screening methods for including factors in the primary analysis.

It should not be surprising that smaller reviews that tested more hypotheses than their estimation samples could reliably support found different conclusions. Our simulation study clearly demonstrated that smaller samples are prone to Type II error and instability. The variance of parameter estimates increases as the number of events per variable decreases. Separation problems become more common as sample size decreases when using MLE for parameter estimation. This is why Kawamoto and colleagues (Kawamoto et al., 2005) used exact logistic regression with MUE for parameter estimation. However, studies show that MUE produces overly-optimistic estimates under conditions of separation. Kawamoto and colleagues (Kawamoto et al., 2005) justified their findings with the argument that they were reasonable and consistent with personal experience, despite the significance risk of overfitting the data after conducting 15 unadjusted comparisons in a dataset with only 23 events. This may not be a valid justification because all factors selected for univariable screening were reasonable, and even completely spurious associations would satisfy this description.

4.4 Threats to validity

Publication bias, selective outcome reporting bias, selective factor reporting bias, and model misspecification pose major threats to the validity of our findings.

4.4.1 Publication bias

Publication bias describes a situation where studies are not published due to their findings. Usually, this means that successful studies are more likely to be published than unsuccessful studies. We can consider this problem using Rubin's common missing data framework (Little and Rubin 1987), discussed in section titled Missing Data in the statistical appendix. Publication bias means that studies are missing from the literature in a way that isn't random–their missingness is associated with their findings. Unfortunately, there is no reliable way to test for publication bias, and this is especially true in reviews of complex interventions where the primary study results have been reduced to binary summary outcomes.

Publication bias threatens the validity of our study differently than it threatens the validity of a typical systematic review. The latter is concerned with estimating the effectiveness of an intervention; we were interested in associations between CCDSS success and its potential determinants. If a factor is negatively associated with success, reducing the proportion of studies that demonstrate failure will affect the statistical efficiency and reliability of inferences about that factor. The factor's distribution in the data will become skewed, creating problems for the estimation algorithms.

It is possible that publication bias is more common in recent years than in the past, when CCDSS was novel and any finding warranted excitement and publication. Consider a factor that may be associated with year of publication, such as integration with an

electronic medical record. Electronic medical records did not exist at the time of early CCDSS studies and remained uncommon for years after. If the proportion of successful systems has increased in recent years due to publication bias, it may seem that electronic medical records are associated with success. Of course, we found a negative association between electronic medical records and success, but the example illustrates a scenario plausible with other time-dependent features.

4.4.2 Selective outcome reporting

The pressure to publish positive results spawns selective outcome reporting bias, where positive findings within a study are selected for reporting while negative findings are suppressed or given less prominence. Our method of determining study outcome may address this problem. By requiring that at least 50% of secondary or non-prespecified outcomes be positive in order to deem a system successful, we may be converting a number of studies falsely self-identified as demonstrating effect to correctly show no effect, or vice versa. Overall however, if the study prespecified one primary outcome, that is the only outcome we used to judge success, potentially reducing our rate of false negatives. We did not perform any tests to assess the validity of our method.

However, there is no reason to suspect an association between our outcome determination with any determinant of success. Classifying some studies incorrectly as positive or negative would decrease the precision of our estimates, decrease statistical

efficiency, and increase Type II error, but should not modify the direction of associations as long as the process is random.

4.4.3 Biased factor reporting

The reporting of some study factors may be biased in two ways. Under Rubin's missing data framework (Little and Rubin 1987), both are forms of informative missingness (NMAR). The first kind of selective factor reporting bias describes a situation where the probability of a factor being reported depends on the true value describing that factor—a given CCDSS characteristic was present or it wasn't. Authors have little reason to explicitly discuss what their systems do not do. For example, very few study reports mentioned that the CCDSS did not critique physician actions or that the CCDSS did not require an explanation from physicians who ignored its advice. Treating this as missing data and including the factor in our statistical models would greatly degrade statistical efficiency in the complete-case analysis. The large amount of missing data would also limit the effectiveness of multiple imputation, rendering the imputed analysis no more valid than the complete-case analysis. Analysts would have little choice but to simply omit the problematic factors from the logistic models. However, both factors proved to be significant determinants of CCDSS success and omitting them would bias inference about other factors. As detailed in the statistical appendix section on "Missing data", we inferred that these CCDSS characteristics were not present in studies that did not mention them. Contacting authors confirmed that our inferences were accurate.

This problem could be better addressed by a prospective database of CCDSS implementation details instead of a retrospective study of published reports.

The second kind of selective factor reporting bias describes a situation where a CCDSS characteristic is associated with the study's findings. For example, we initially considered *authors assessed barriers to success* for inclusion in our secondary analysis. During data extraction, however, we noticed that such efforts were mentioned in discussion sections of studies that failed to demonstrate benefit. This could be because the authors were discussing potential reasons for failure. Considering this factor would likely have led to a false negative association between CCDSS success and the practice of assessing barriers to success. Factors at risk of biased reporting would be better captured by a prospective database of CCDSS implementations. Reporting in trials would also be improved with increased adherence to the STARE-HI reporting standard (Talmon et al., 2008).

4.4.4 Misspecified model

Our analysis was based on RCTs but remains observational in nature and the findings should not be interpreted as if they come directly from head-to-head trials of CCDSS features (Thompson & Higgins, 2002). Failing to include important covariates in our model specifications could result in biased parameter estimates and false findings (Negassa & Hanley, 2007). We tested a large number of factors in our secondary and exploratory factor sets to ensure correctly specified models. We also contacted authors

with an opportunity to comment on the factors we were testing and we received a very positive response that we had selected important factors. It is not possible, however, to evaluate all potential determinants of success by means of systematic review. Mollon and colleagues (Mollon et al., 2009) pursued a number of potentially important factors that they could not reliably extract from RCT reports. We acknowledge that the inability to include factors like leadership and institutional support is a significant limitation of our study. A prospective database of CCDSS implementation details may be better suited to studying determinants of success than our retrospective study. The most methodologically sound solution is to undertake a cluster RCT that directly compare a CCDSS with a given determinant to its counterpart. Conducting such studies would be difficult for many of the potential determinants for which the community may be limited to relying on observational evidence. It would be useful to determine which kind of observational evidence we should prefer in this case: evidence from meta-regression analyses based on a limited number of RCTs (as in our study) or from large primary cohort studies.

Finally, we have discussed at length the statistical threats to validity associated with our small sample size. We modeled the data using four different methods and found that our associations were robust to choice of modeling technique. We assumed that the factors specified in our models are independent determinants of success because our sample size would not allow us to model interaction between factors. A

larger sample will be needed to improve the precision of our estimates and to allow for modeling interactions and conducting external validation procedures.

4.5 Moving forward

Best-practices derived from years of design and implementation experience (e.g. Osheroff, Pifer, Sittig, Jenders, & Teich, 2004) continue to provide valuable guidance. The findings from our study should caution researchers, developers, implementers, and policymakers that integrating CCDSS with clinical workflow and presenting advice in EMR or CPOE environments does not guarantee better outcomes from clinical decision support, and it appears that such intelligent EMR and CPOE systems are much less effective than anticipated. Still, standalone systems are not scalable to address the multitude of information problems that afflict practitioners and EMR and CPOE remain logical vehicles for delivering advice. The health informatics community may do better to focus on facilitating meaningful use of alerts and reminders and protecting physicians from alerts that are irrelevant or too numerous. These are only hypotheses, however, and more primary research is necessary to explore the issues.

We were encouraged by the finding that provision of decision support to patients in addition to practitioners is associated with effectiveness. Services that engage patients and practitioners will become increasingly feasible as fast internet connectivity and web-enabled devices become more common. This is a very exciting area for future

research and we need more primary studies to address what is and isn't possible in patient-oriented information systems.

5.0 Conclusions

We have identified several potential determinants of success in computerized clinical decision support. Researchers, vendors, and policy-makers should note that even presenting advice within electronic charting or order entry systems, often considered necessary for CCDSS success, may prove ineffective in practice. The CCDSS research agenda should focus on resolving this issue, given that decision support has gained prominence as a key requirement for EHR implementation. Providing support to patients and their practitioners, as well as requiring practitioners to respond to recommendations may also be avenues toward more effective computerized systems and we hope that the community explores them further.

Tables and figures

Table 1: Model for selection of comparisons presented in primary studies.

Available comparisons	Comparison we chose
CCDSS vs. CCDSS + Intervention X CCDSS vs. Usual Care CCDSS + Intervention X vs. Usual Care	CCDSS vs. Usual Care
CCDSS + Intervention X vs. Usual Care CCDSS + Intervention X vs. Intervention X Intervention X vs. Usual Care	CCDSS + Intervention X vs. Intervention X
CCDSS + Intervention X vs. Usual Care CCDSS + Intervention X vs. Intervention X CCDSS vs. Usual Care	CCDSS vs. Usual Care
CCDSS vs. feature-enhanced CCDSS CCDSS vs. Usual Care Feature-enhanced CCDSS vs. Usual Care	Feature-enhanced CCDSS vs. Usual Care

Table 2: Ad-hoc working group on determinants of success in computerized clinical decision support.

Member	Position
R. Brian Haynes, OC, MD, PhD, FRSC, FRCPC	Physician, Professor, Clinical Epidemiology and Biostatistics and Medicine; Chief, Health Information Research Unit, McMaster University, Hamilton, Canada.
John J. You, MD, MSc	Physician, Assistant Professor, Department of Medicine, McMaster University, Hamilton, Canada.
Harriette Van Spall, MD, MPH, FRCPC	Physician, Division of Cardiology, St Michael's Hospital, Toronto, Ontario, Canada.
Amit X. Garg, MD, PhD, FRCPC	Physician, Associate Professor, Epidemiology and Biostatistics, and Medicine; Director, London Kidney Clinical Research Unit, University of Western Ontario, London, Canada.
Steven M. Handler, MD, PhD, CMD	Physician, Assistant Professor of Biomedical Informatics, Geriatric Medicine, and Clinical and Translational Research, University of Pittsburgh, Pittsburgh, USA.
Paul P. Glasziou, MBBS, PhD, FRACGP	Physician, Professor of Evidence Based Medicine, University of Oxford, Oxford, UK.
Brian J. Hemens, RPh, MSc	Pharmacist, Graduate Student, Health Research Methodology Program, McMaster University, Hamilton, Canada.
Nathan M. Souza, MD, MSc	Physician, Graduate Student, Health Research Methodology Program, McMaster University, Hamilton, Canada.
Joseph Beyene, PhD	Associate Professor, Clinical Epidemiology and Biostatistics, McMaster University, Hamilton, Canada.
Jeffrey Wilczynski	Senior undergraduate student, Health Studies Program, McMaster University, Hamilton, Canada.
Natasha Fernandes, BHSc	Graduate student, Health Research Methodology Program, McMaster University, Hamilton, Canada.
Pavel S. Roshanov, BSc	Graduate student, Health Research Methodology Program, McMaster University, Hamilton, Canada.
Jeanette Prorok, MSc	Research staff, Health Information Research Unit, McMaster University, Hamilton, Canada.
Emma Iserman, MA	Research staff, Health Information Research Unit, McMaster University, Hamilton, Canada.
Robby Nieuwlaat, PhD	Assistant Professor, Clinical Epidemiology and Biostatistics, McMaster University, Hamilton, Canada.

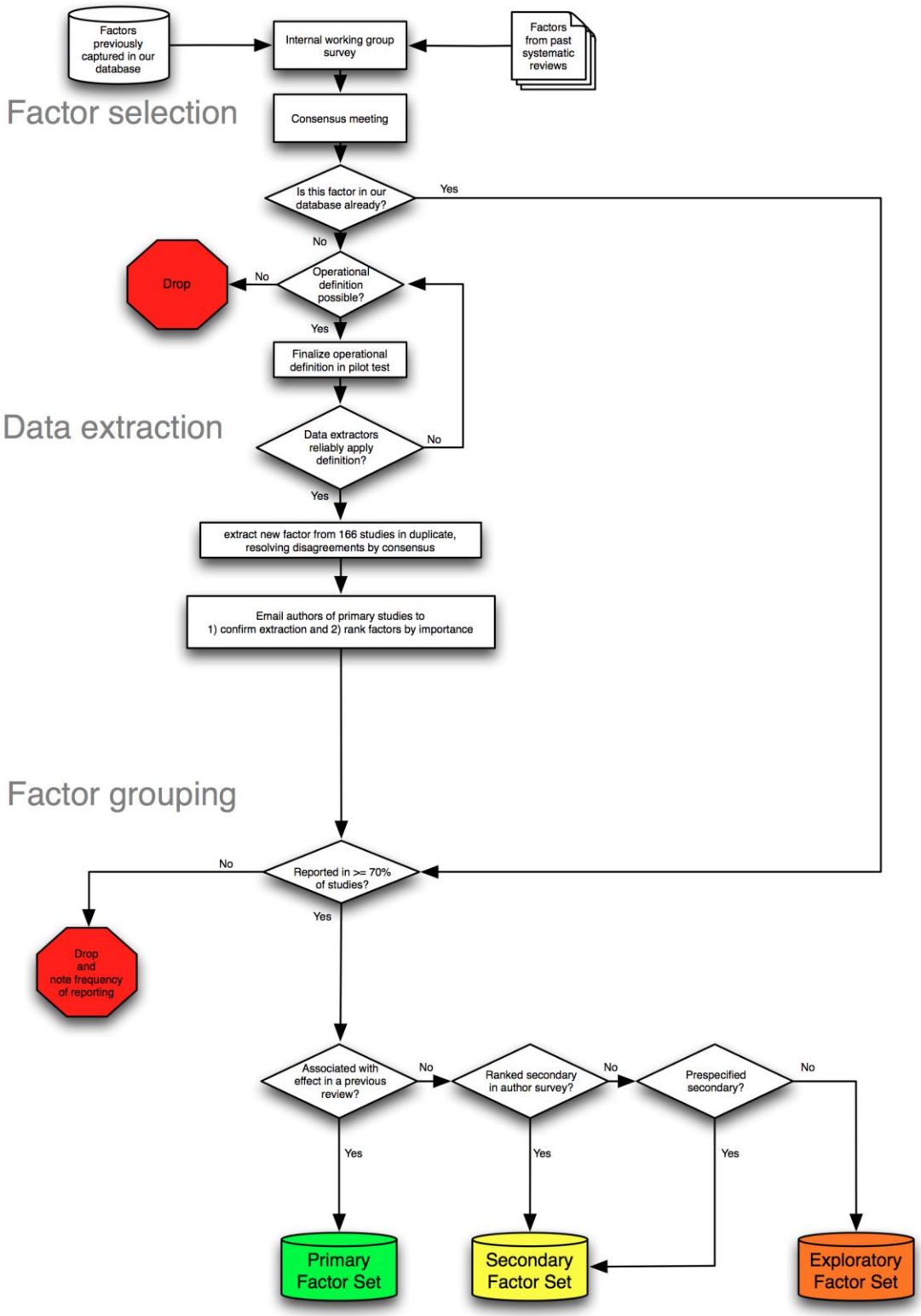

Figure 1: Process for selecting and extracting potential determinants of CCDSS success.

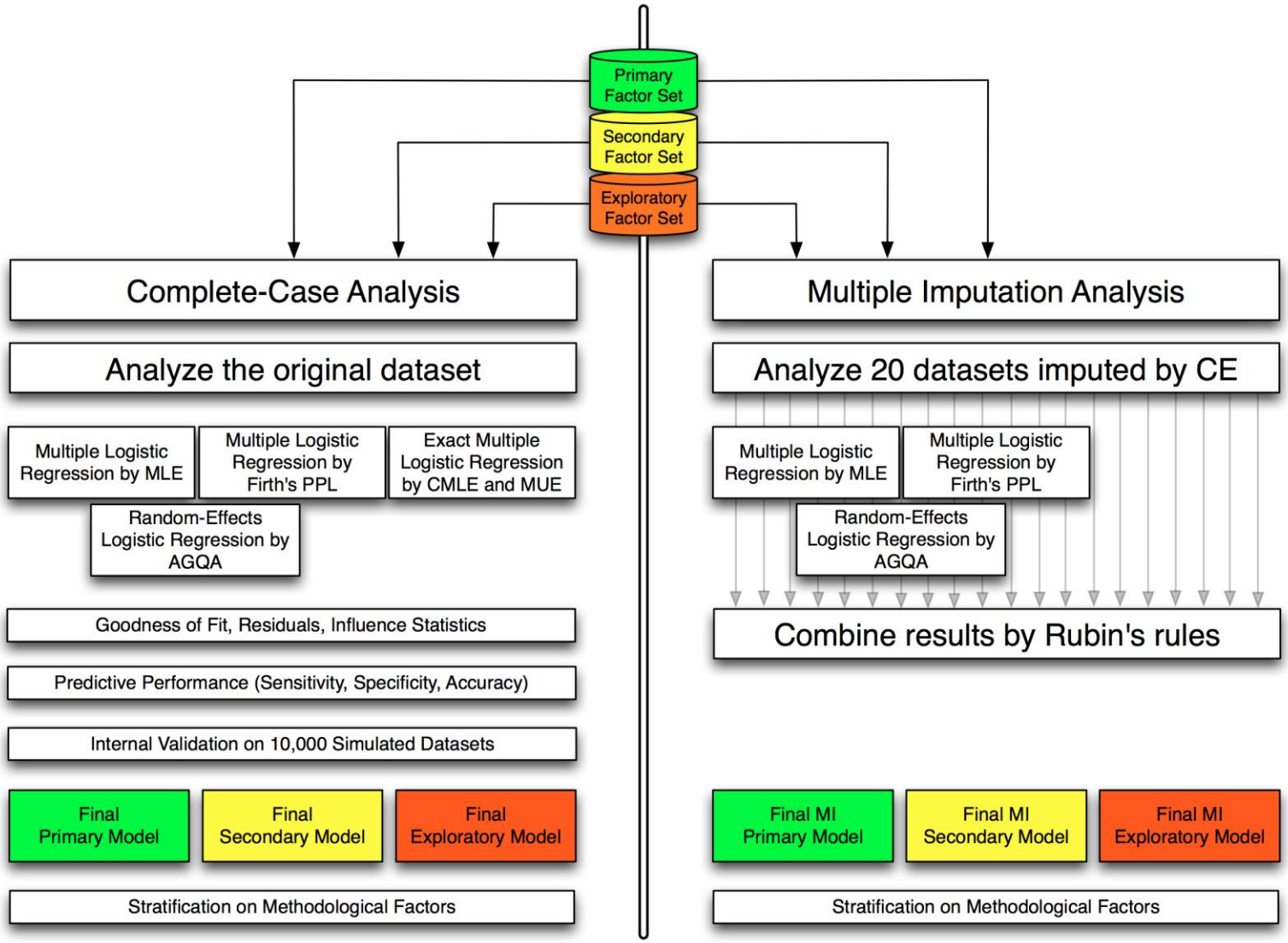

Figure 2: Analysis process.

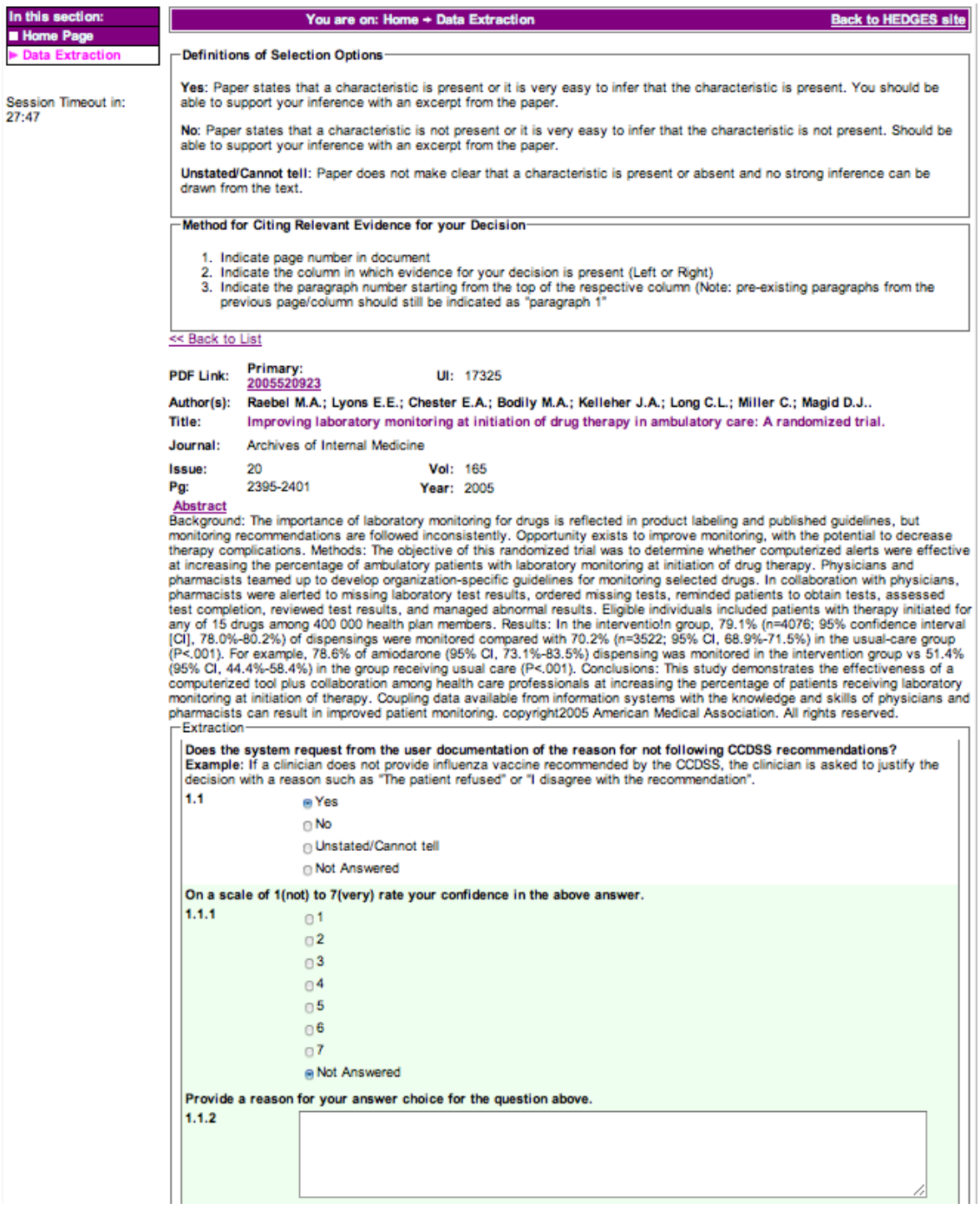

Figure 3: Screenshot from extraction interface.

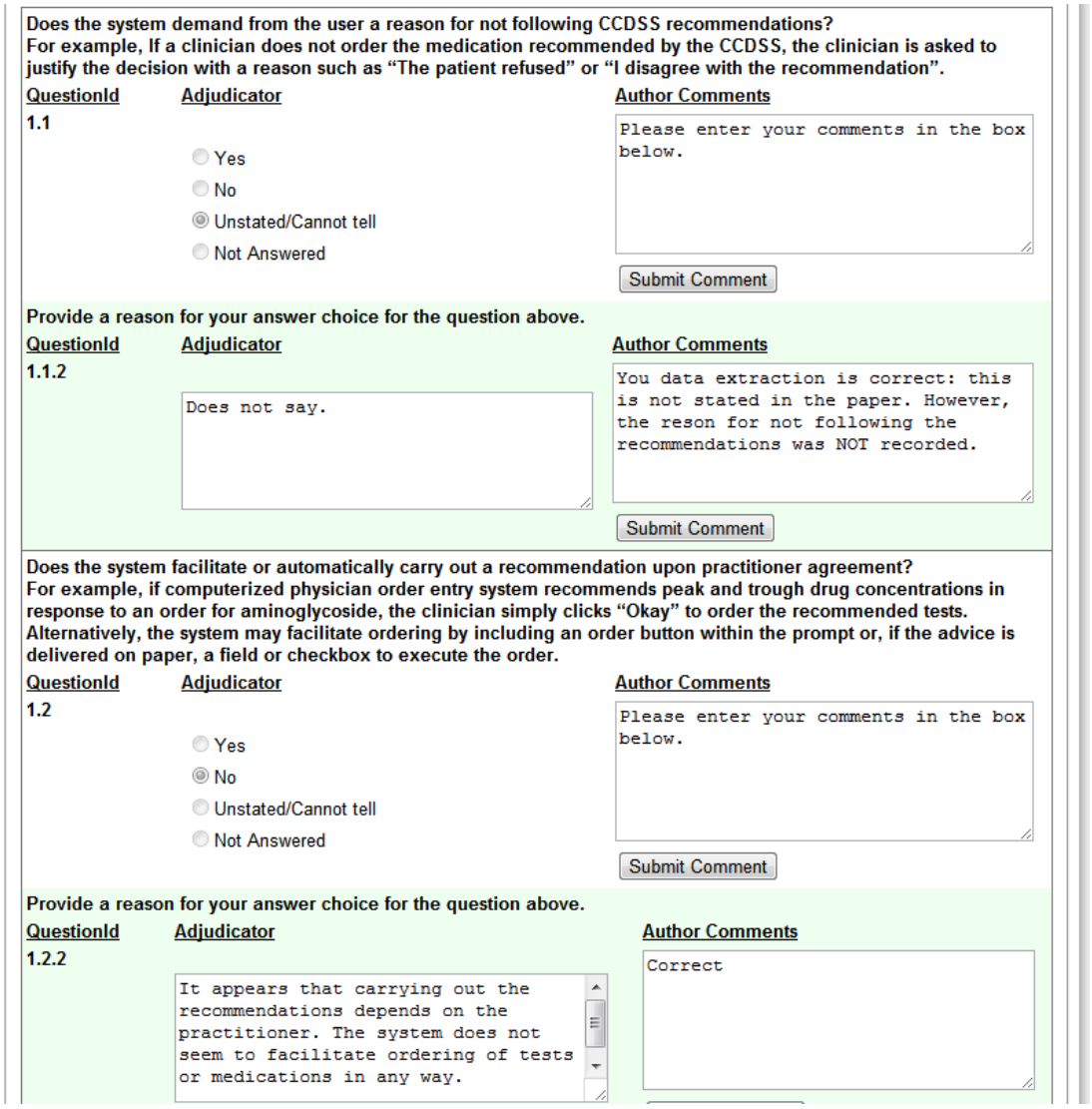

Figure 4: Screenshot from author confirmation interface.

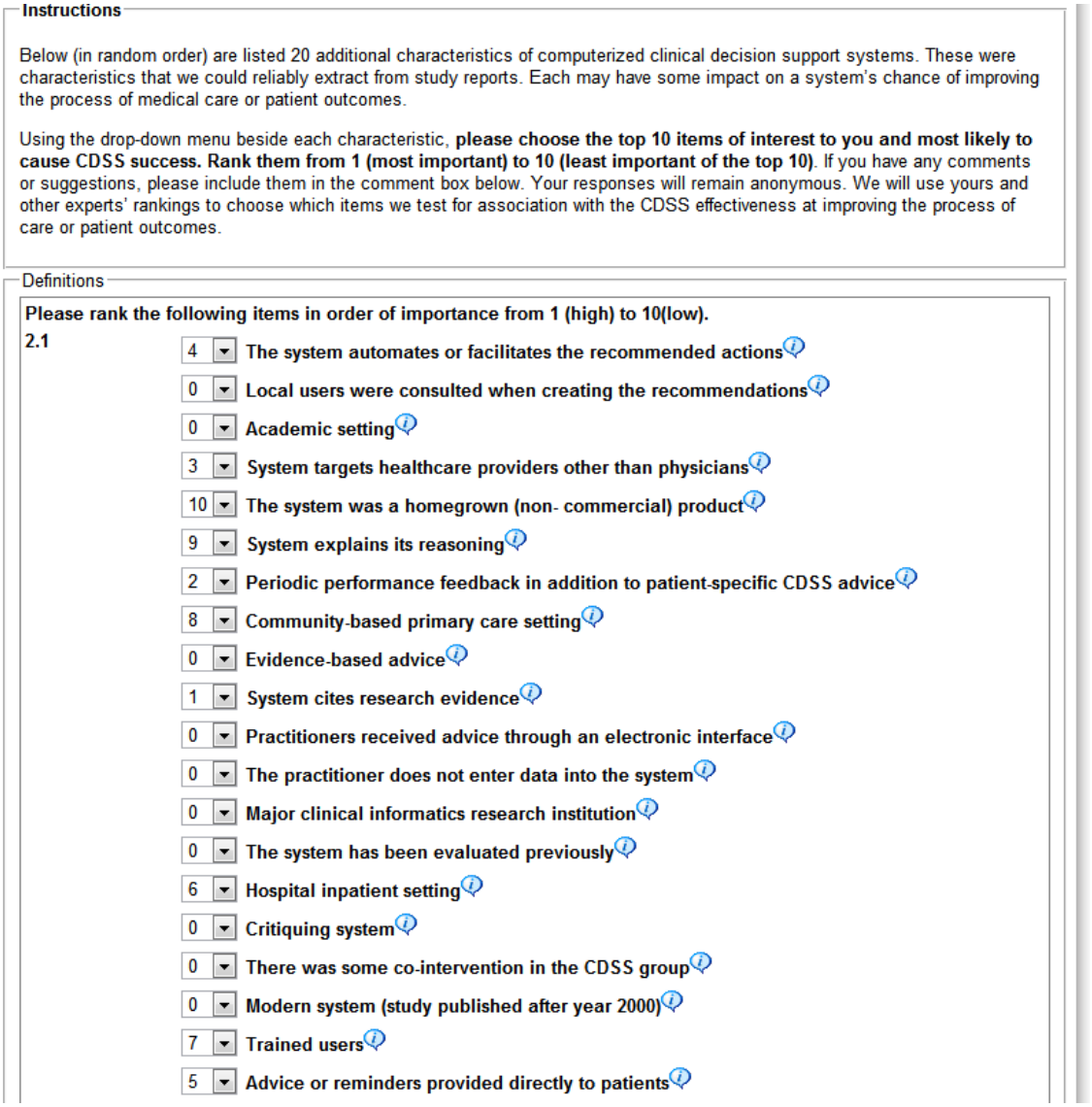

Figure 5: Screenshot from author survey interface.

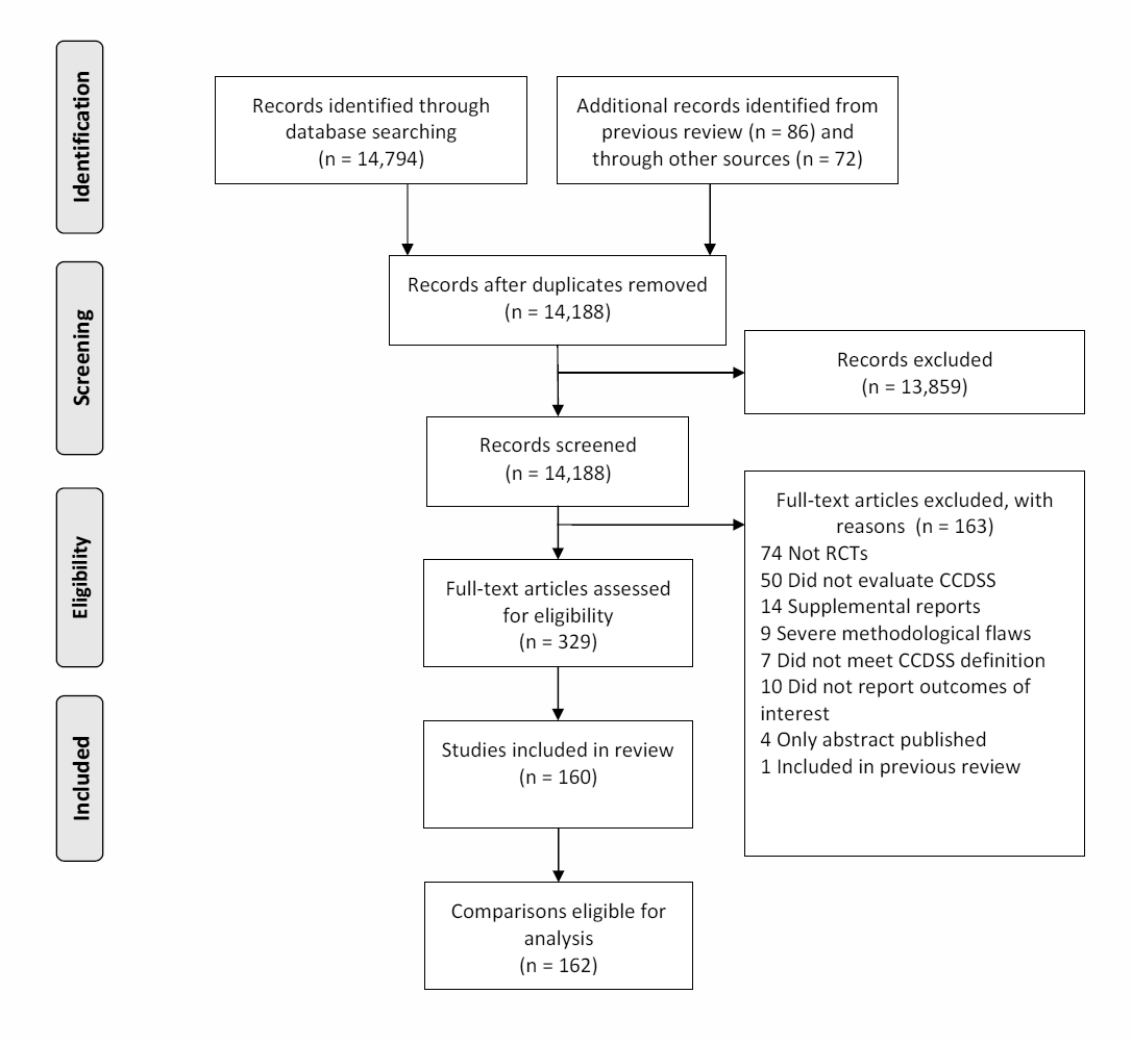

Figure 6: Flow of studies through screening process.

Table 3: Results of author survey.

Factor	Odds Ratio (95% CI)	*p*	Prespecified Factor set	Author-suggested Factor set
Primary Factor Set				
1. Authors are the developers	Not included in ranking survey	-	Primary	-
2. Automatic provision in workflow	Not included in ranking survey	-	Primary	-
3. Feedback at the time of care	Not included in ranking survey	-	Primary	-
4. Integration with EMR or CPOE	Not included in ranking survey	-	Primary	-
5. Require reason for ignoring advice	Not included in ranking survey	-	Primary	-
6. System provides advice to patients	Not included in ranking survey	-	Primary	-
Secondary Factor Set				
1. Facilitated or automated action	5.58 (2.68 to 11.61)	<0.001	Secondary	Secondary
2. Advice is evidence-based	2.53 (1.38 to 4.64)	0.003	Secondary	Secondary
3. Critiquing function	1.05 (0.60 to 1.86)	0.862	Secondary	-
4. Practitioner does not enter data	1.75 (0.98 to 3.13)	0.058	Secondary	-
5. Modern system (study after year 2000)	0.75 (0.42 to 1.33)	0.324	Secondary	-

6. Prompts or reminders given directly to patients	1.05 (0.60 to 1.86)	0.862	Secondary	-
7. Users trained to use the system	1.92 (1.07 to 3.44)	0.029	Exploratory	Secondary*
8. Local users consulted during development	2.30 (1.26 to 4.18)	0.006	Exploratory	Secondary*
9. Presents reasoning	2.79 (1.50 to 5.17)	0.001	Secondary	Secondary
10. Presents evidence	1.25 (0.70 to 2.20)	0.450	Secondary	-
Exploratory Factor Set				
1. Major institution	0.38 (0.20 to 0.73)	0.003	Secondary	Exploratory*
2. Previously evaluated	0.81 (0.46 to 1.45)	0.486	Exploratory	-
3. Commercial product	0.52 (0.28 to 0.95)	0.034	Exploratory	Exploratory
4. Electronic interface	1.14 (0.65 to 2.02)	0.642	Exploratory	-
5. Non-physician providers	0.97 (0.55 to 1.71)	0.907	Exploratory	-
6. Periodic performance feedback	0.97 (0.97 to 0.98)	<0.001	Secondary	Exploratory*
7. Co-intervention in CCDSS group	0.23 (0.11 to 0.49)	<0.001	Exploratory	Exploratory
8. Academic institution	0.38 (0.20 to 0.73)	0.003	Exploratory	Exploratory

9. Inpatient hospital setting	0.17 (0.08 to 0.39)	<0.001	Exploratory	Exploratory
10. Community-based primary care setting	0.38 (0.20 to 0.73)	0.003	Exploratory	Exploratory

* The results of the author survey guided us to move these factors from their prespecified set to the set suggested by the author survey.

Table 4: Descriptive statistics and results of simple logistic models for selecting factors for secondary and exploratory complete-case analyses.

Factor	Prevalence (95% CI)*	Prevalence in comparisons demonstrating CCDSS success (95% CI)*	Prevalence in comparisons demonstrating CCDSS failure (95% CI)*	Unadjusted OR (95% CI)*	*p**	n
Primary Factor Set (all prespecified for inclusion)						
1. Authors are the developers	81% (74% to 86%)	90% (82% to 95%)	68% (56% to 78%)	4.43 (1.81 to 10.84)	0.001	150
2. Automatic provision in workflow	65% (58% to 72%)	68% (58% to 77%)	62% (50% to 72%)	1.32 (0.69 to 2.54)	0.404	162
3. Feedback at the time of care	84% (78% to 89%)	82% (73% to 88%)	88% (78% to 94%)	0.62 (0.25 to 1.55)	0.309	160
4. Integration with EMR or CPOE	37% (30% to 45%)	31% (22% to 41%)	46% (34% to 57%)	0.53 (0.28 to 1.02)	0.056	162
5. Require reason for ignoring advice	14% (9% to 20%)	21% (14% to 31%)	3% (1% to 10%)	8.92 (2.01 to 39.61)	0.004	162
6. System provides advice to patients	19% (14% to 26%)	26% (18% to 35%)	10% (5% to 20%)	2.99 (1.20 to 7.42)	0.018	162
Secondary Factor Set						
1. Facilitated or automated action	13% (9% to 19%)	12% (7% to 20%)	15% (8% to 25%)	0.77 (0.31 to 1.93)	0.575	162

	Factor	Prevalence (95% CI)*	Prevalence in comparisons demonstrating CCDSS success (95% CI)*	Prevalence in comparisons demonstrating CCDSS failure (95% CI)*	Unadjusted OR (95% CI)*	*p**	n
2.	**Advice is evidence-based**	71% (64% to 77%)	73% (64% to 81%)	68% (56% to 78%)	1.32 (0.67 to 2.62)	0.426	162
3.	**Critiquing function**	17% (12% to 23%)	18% (12% to 27%)	15% (8% to 25%)	1.28 (0.55 to 3.00)	0.570	162
4.	**Practitioner enters data**	36% (29% to 44%)	37% (27% to 48%)	35% (24% to 47%)	1.10 (0.55 to 2.18)	0.793	144
5.	**Modern system (study after year 2000)**	66% (58% to 73%	66% (56% to 75%)	66% (54% to 76%)	0.99 (0.51 to 1.91)	0.977	162
6.	**Prompts or reminders given directly to patients**	10% (6% to 15%)	12% (7% to 20%)	7% (3% to 16%)	1.68 (0.56 to 5.10)	0.364	162
7.	**Users trained to use the system**	61% (52% to 68%)	65% (54% to 75%)	55% (42% to 67%)	1.52 (0.76 to 3.02)	0.239	137
8.	**Local users consulted during development**	19% (13% to 25%)	19% (12% to 28%)	18% (10% to 28%)	1.11 (0.49 to 2.48)	0.808	162
9.	**Presents reasoning**	50% (42% to 57%)	56% (46% to 66%)	43% (32% to 54%)	1.84 (0.98 to 3.47)	0.057	162

	Factor	Prevalence (95% CI)*	Prevalence in comparisons demonstrating CCDSS success (95% CI)*	Prevalence in comparisons demonstrating CCDSS failure (95% CI)*	Unadjusted OR (95% CI)*	*p**	n
10.	**Presents evidence**	18% (13% to 25%)	20% (13% to 29%)	15% (8% to 25%)	1.47 (0.64 to 3.40)	0.249	162
	Exploratory Factor Set						
1.	**Major institution**	37% (30% to 45%)	41% (32% to 52%)	31% (21% to 43%)	1.59 (0.82 to 3.06)	0.169	162
2.	**Previously evaluated**	47% (39% to 55%)	48% (38% to 58%)	46% (34% to 57%)	1.10 (0.59 to 2.05)	0.774	162
3.	**Commercial product**	21% (14%3 to 29%)	20% (12% to 32%)	22% (13% to 35%)	0.90 (.37 to 2.23)	0.826	114
4.	**Electronic interface**	73% (66% to 80%)	70% (60% to 78%)	78% (67% to 86%)	0.66 (0.32 to 1.36)	0.256	161
5.	**Non-physician providers**	40% (32% to 47%)	43% (33% to 53%)	35% (25% to 47%)	1.36 (0.71 to 2.59)	0.352	162
6.	**Periodic performance feedback**	5% (3% to 9%)	5% (2% to 12%)	4% (2% to 12%)	1.22 (0.28 to 5.28)	0.793	162
7.	**Co-intervention in CCDSS group**	12% (8% to 18%)	9% (4% to 16%)	18% (10% to 28%)	0.43 (0.17 to 1.13)	0.087	162
	Methodological Factors (for stratified analysis)						

	Factor	Prevalence (95% CI)*	Prevalence in comparisons demonstrating CCDSS success (95% CI)*	Prevalence in comparisons demonstrating CCDSS failure (95% CI)*	Unadjusted OR (95% CI)*	*p**	n
1.	**Cluster Randomization**	55% (47% to 62%)	47% (37% to 57%)	66% (54% to 76%)	Not estimated		162
2.	**Allocation Concealment**	54% (47% to 62%)	56% (46% to 66%)	51% (40% to 63%)	Not estimated		162
3.	**Objective Outcome**	100% (98% to 100%)	100% (96% to 100%)	100% (95% to 100%)	Not estimated		162
4.	**Baseline Differences**	90% (85% to 94%)	89% (82% to 94%)	91% (82% to 96%)	Not estimated		162
5.	**Adequate Follow up**	79% (72% to 85%)	78% (68% to 85%)	81% (70% to 88%)	Not estimated		162

*95% CIs for frequencies were computed using Wilson's method. 95% CIs for odds ratios were computed using the Likelihood Ratio.

Academic institution, Community-based primary care setting, and Inpatient hospital setting could not be extracted reliably and were removed before any analyses.

Table 5: Results of primary complete-case analyses.

Modeling method								
Factor	**MLE Logistic N=148**		**Firth's PPL Logistic N=148**		**Exact Logistic N=148**		**Random Effects Logistic N=148**	
	OR (95% CI)*	***P****	**OR (95% CI)****	***P****	**OR (95% CI)*****	***P******	**OR (95% CI)***	***P****
Authors are the developers	3.84 (1.40 to 10.48)	0.009	3.52 (1.34 to 9.27)	0.008	3.63 (1.26 to 11.63)	0.014	6.04 (1.17 to 31.02)	0.031
Automatic provision in workflow	1.52 (0.62 to 3.70)	0.361	1.48 (0.62 to 3.52)	0.378	1.48 (0.57 to 3.97)	0.504	1.90 (0.56 to 6.45)	0.301
Feedback at the time of care	0.58 (0.19 to 1.77)	0.340	0.61 (0.21 to 1.77)	0.354	0.59 (0.16 to 1.96)	0.493	0.56 (0.13 to 2.35)	0.432
Integration with EMR or CPOE	0.31 (0.13 to 0.73)	0.008	0.33 (0.14 to 0.76)	0.008	0.32 (0.12 to 0.81)	0.013	0.18 (.04 to .76)	0.020
System provides advice to patients	2.73 (1.01 to 7.35)	0.047	2.54 (0.98 to 6.57)	0.048	2.61 (0.92 to 8.24)	0.076	3.07 (0.86 to 10.91)	0.084
Require reason for ignoring advice	16.18 (2.01 to 130.03)	0.009	10.69 (1.87 to 61.02)	0.001	15.17 (2.13 to 673.25)	0.001	23.83 (1.93 to 293.84)	0.013
Predictive Performance								
Sensitivity (95% CI)******	0.79 (0.69 to 0.86)		N/A		N/A		N/A	
Specificity (95% CI)******	0.64 (0.52 to 0.75)		N/A		N/A		N/A	
AUROC (95% CI)***	0.77 (0.70 to 0.84)		N/A		N/A		0.78 (0.70 to 0.84)	

* Estimated by Likelihood Ratio method; ** Estimated by Wald method and may cross 1 even if p=<0.05; *** Estimated by exact method; **** Estimated by Wilson's method

Table 6: Results of primary complete-case analyses including only factors found important in the prespecified model.

Modeling method								
Factor	**MLE Logistic N=150**		**Firth's PPL Logistic N=150**		**Exact Logistic N=150**		**Random Effects Logistic N=150**	
	OR (95% CI)*	***P****	**OR (95% CI)****	***P****	**OR (95% CI)*****	***P******	**OR (95% CI)***	***P****
Authors are the developers	4.65 (1.72 to 12.56)	0.002	4.35 (1.66 to 11.44)	0.002	4.51 (1.57 to 14.43)	0.003	7.18 (1.47 to 34.97)	0.015
Integration with EMR or CPOE	0.36 (0.17 to 0.79)	0.010	0.37 (0.17 to 0.80)	0.010	0.37 (0.16 to 0.84)	0.016	0.24 (0.07 to 0.81)	0.021
System provides advice to patients	2.94 (1.11 to 7.87)	0.031	2.77 (1.07 to 7.17)	0.029	2.87 (1.01 to 9.02)	0.047	3.20 (0.93 to 11.02)	0.065
Require reason for ignoring advice	16.82 (2.11 to 134.28)	0.008	11.23 (1.98 to 63.72)	<0.001	15.98 (2.27 to 705.10)	<0.001	23.1 (2.10 to 254.73)	0.010
Predictive Performance								
Sensitivity (95% CI)******	0.80 (0.70 to 0.87)		N/A		N/A		N/A	
Specificity (95% CI)******	0.64 (0.52 to 0.74)		N/A		N/A		N/A	
AUROC (95% CI)***	0.78 (0.70 to 0.84)		N/A		N/A		0.77 (0.70 to 0.84)	

* Estimated by Likelihood Ratio method; ** Estimated by Wald method; *** Estimated by exact method; **** Estimated by Wilson's method

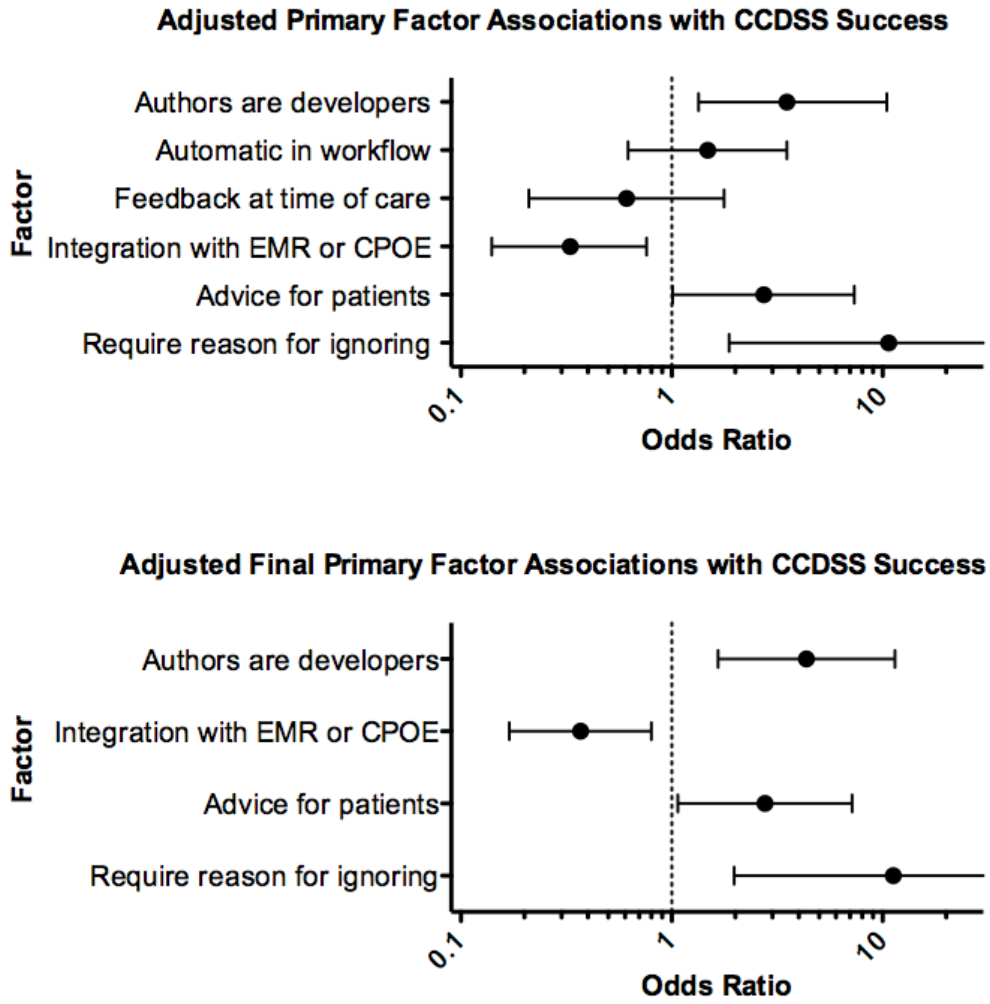

Figure 7: Forest plots of primary prespecified and final factor associations.

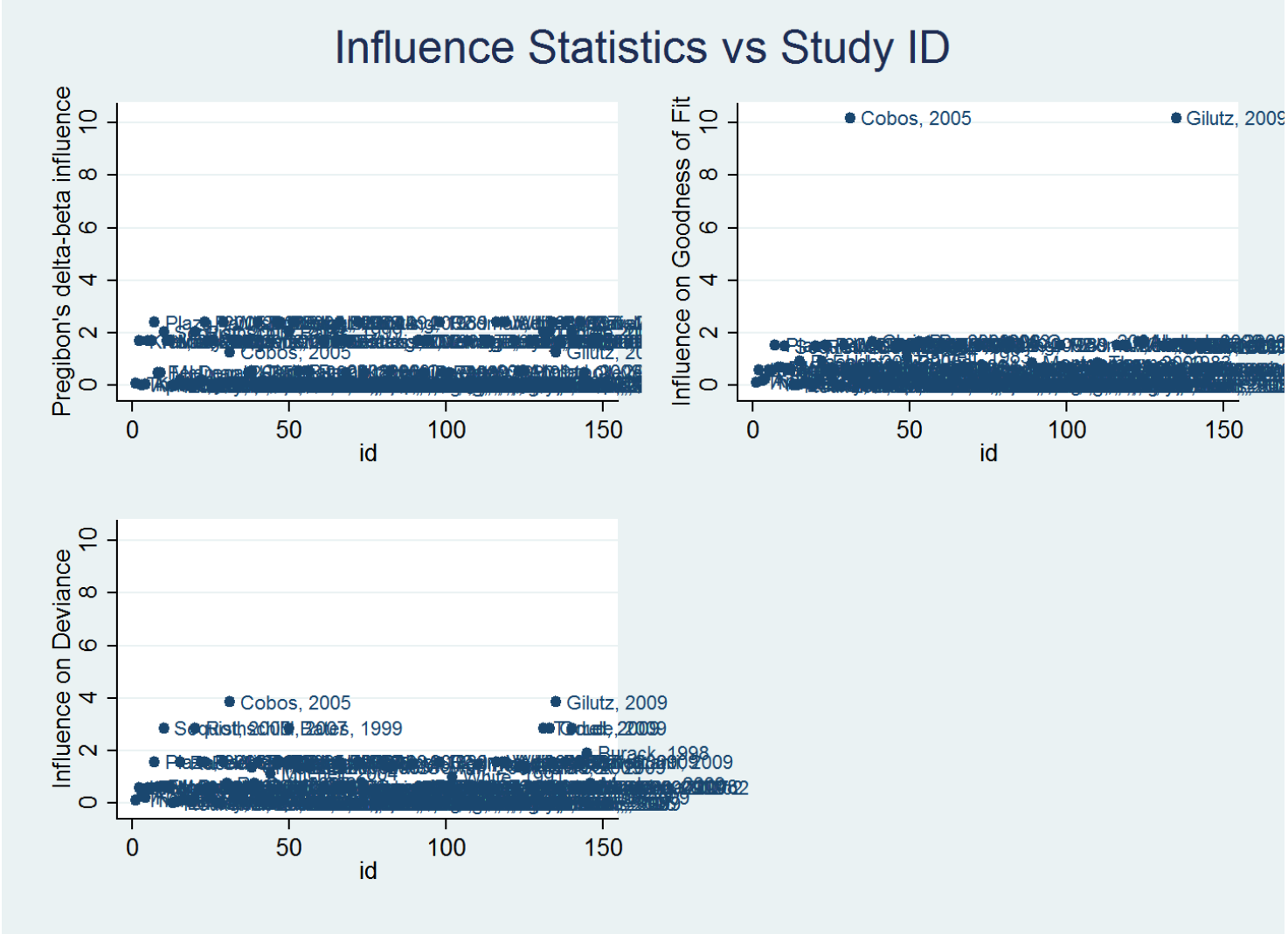

Figure 8 – Influence statistics vs study ID

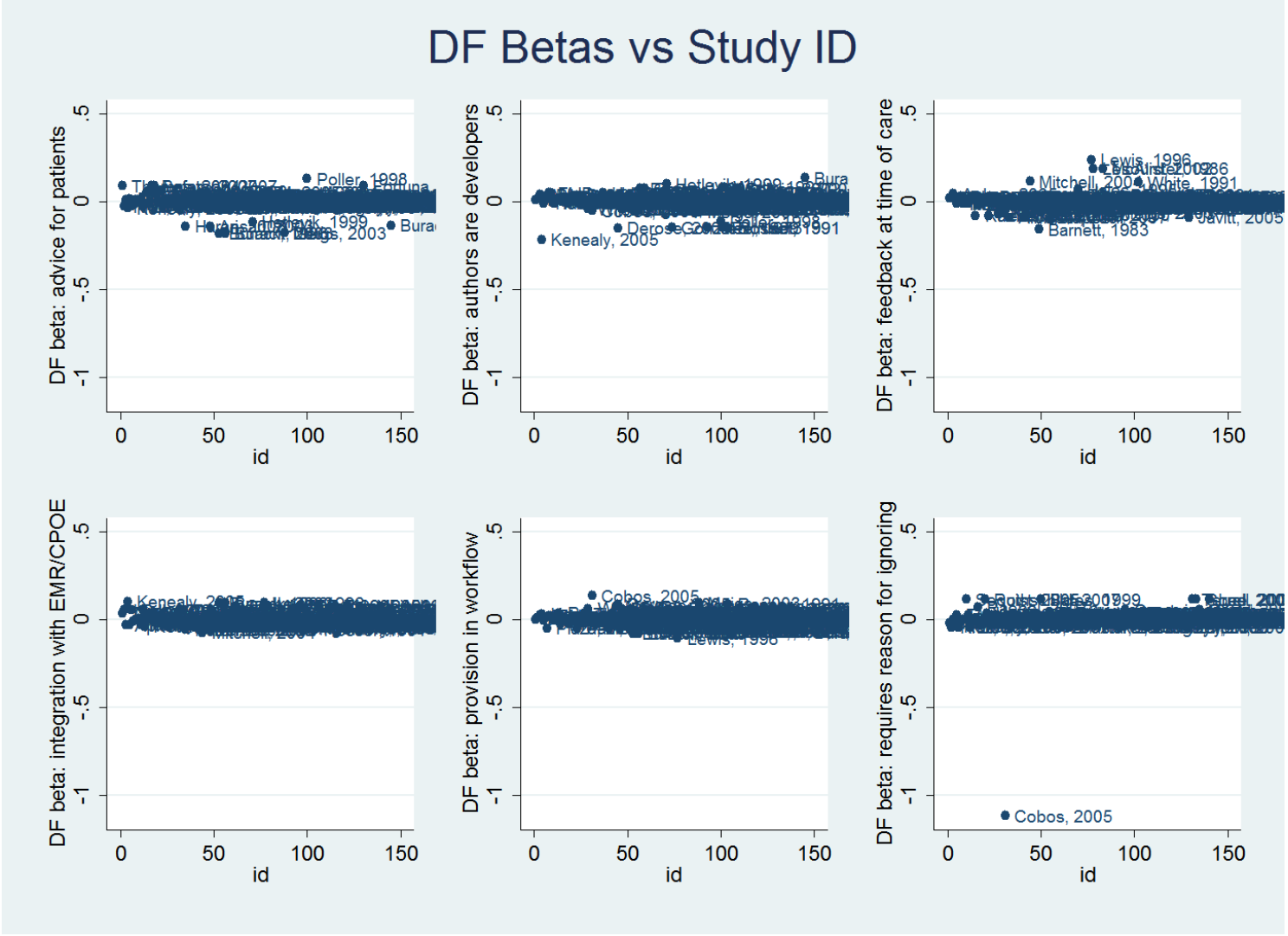

Figure 9 – DF betas vs study ID

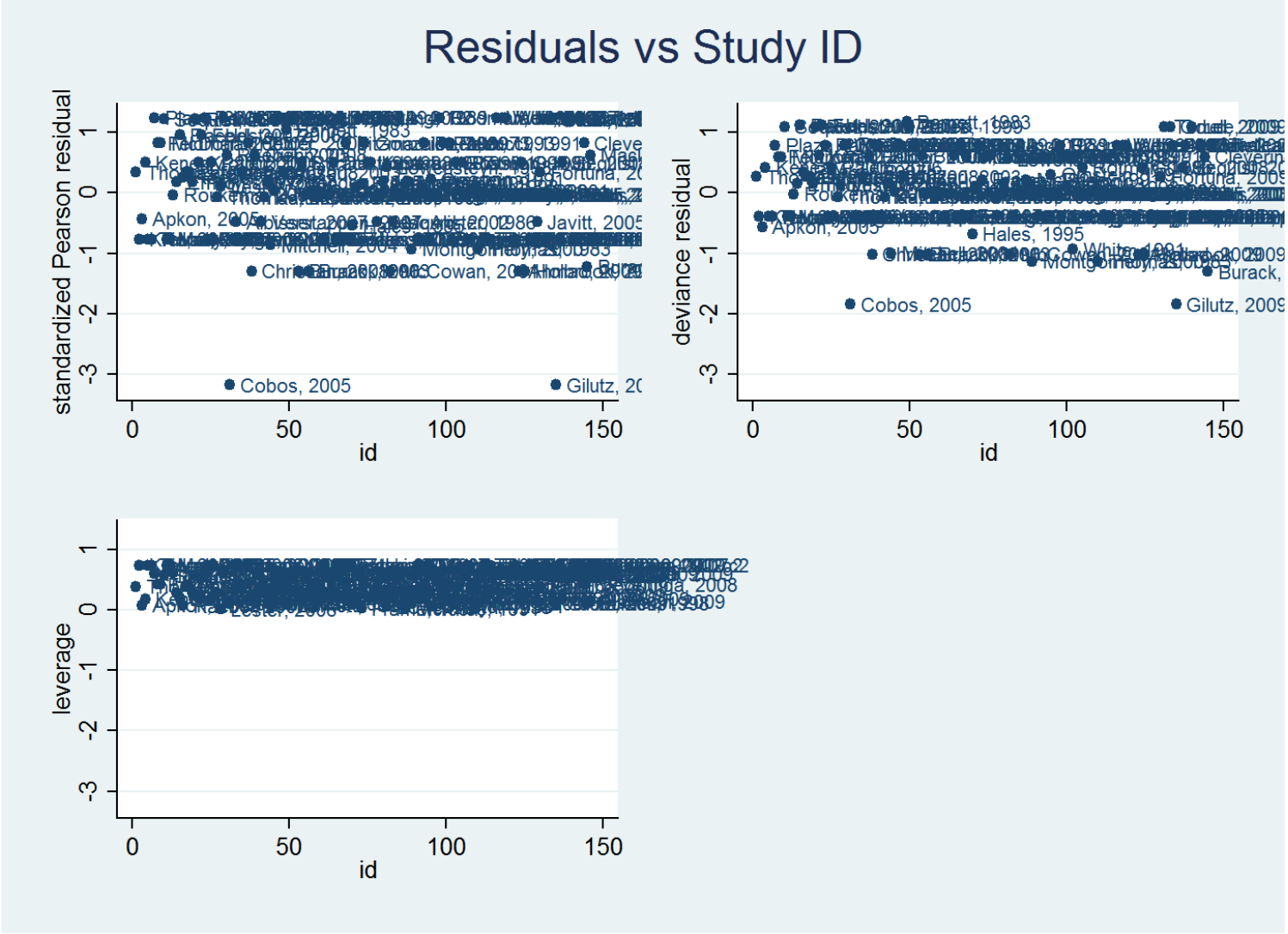

Figure 10 – Residuals vs study ID

Table 7: Results of secondary complete-case analyses.

Modeling method								
Factor	**MLE Logistic N=150**		**Firth's PPL Logistic N=150**		**Exact Logistic N=150**		**Random Effects Logistic N=150**	
	OR (95% CI)*	***P****	**OR (95% CI)****	***P****	**OR (95% CI)*****	***P****	**OR (95% CI)***	***P****
Authors are the developers	4.11 (1.50 to 11.31)	0.006	3.83 (1.44 to 10.21)	0.005	3.96 (1.36 to 12.88)	0.009	5.75 (1.29 to 25.61)	0.022
Integration with EMR or CPOE	0.33 (0.15 to 0.74)	0.007	0.35 (0.16 to 0.76)	0.007	0.34 (0.14 to 0.80)	0.011	0.25 (.08 to .78)	0.016
System provides advice to patients	2.89 (1.07 to 7.77)	0.036	2.69 (1.04 to 7.01)	0.035	2.79 (0.98 to 8.82)	0.057	3.03 (0.93 to 9.91)	0.066
Requires reason for ignoring advice	15.97 (2.00 to 127.45)	0.009	10.55 (10.87 to 59.58)	<0.001	14.98 (2.14 to 658.66)	0.001	19.71 (1.96 to 197.78)	0.011
System presents reasoning	1.54 (0.71 to 3.37)	0.275	1.52 (0.71 to 3.26)	0.281	1.53 (0.66 to 3.57)	0.373	1.40 (0.55 to 3.58)	0.481
Predictive Performance								
Sensitivity (95% CI)****	0.79 (0.69 to 0.86)		N/A		N/A		N/A	
Specificity (95% CI)****	0.67 (0.55 to 0.77)		N/A		N/A		N/A	
AUROC (95% CI)***	0.79 (0.71 to 0.85)		N/A		N/A		0.79 (0.71 to 0.85)	

* Estimated by Likelihood Ratio method

** Estimated by Wald method

*** Estimated by exact method

**** Estimated by Wilson's method

Table 8: Results of secondary complete-case analyses including only factors found important in the prespecified model.

Modeling method								
Factor	**MLE Logistic N=150**		**Firth's PPL Logistic N=150**		**Exact Logistic N=150**		**Random Effects Logistic N=150**	
	OR (95% CI)*	***P****	**OR (95% CI)****	***P****	**OR (95% CI)*****	***P****	**OR (95% CI)***	***P****
Authors are the developers	4.65 (1.72 to 12.56)	0.002	4.35 1.66 to 11.44)	0.002	4.51 (1.57 to 14.43)	0.003	7.18 (1.47 to 34.97)	0.015
Integration with EMR or CPOE	0.36 (0.17 to 0.79)	0.010	0.37 (0.17 to 0.80)	0.010	0.37 (0.16 to 0.84)	0.016	0.24 (0.07 to 0.81)	0.021
System provides advice to patients	2.94 (1.11 to 7.87)	0.031	2.77 (1.07 to 7.17)	0.029	2.87 (1.01 to 9.02)	0.047	3.20 (0.93 to 11.02)	0.065
Require reason for ignoring advice	16.82 (2.11 to 134.28)	0.008	11.23 (1.98 to 63.72)	<0.001	15.98 (2.27 to 705.10)	<0.001	23.1 (2.10 to 254.73)	0.010
Predictive Performance								
Sensitivity (95% CI)****	0.80 (0.70 to 0.87)		N/A		N/A		N/A	
Specificity (95% CI)****	0.64 (0.52 to 0.74)		N/A		N/A		N/A	
AUROC (95% CI)***	0.78 (0.70 to 0.84)		N/A		N/A		0.77 (0.70 to 0.84)	

* Estimated by Likelihood Ratio method

** Estimated by Wald method

*** Estimated by exact method

**** Estimated by Wilson's method

Table 9: Results of exploratory complete-case analyses.

Modeling method								
Factor	**MLE Logistic N=150**		**Firth's PPL Logistic N=150**		**Exact Logistic N=150**		**Random Effects Logistic, N=150**	
	OR (95% CI)*	***P****	**OR (95% CI)****	***P****	**OR (95% CI)*****	***P****	**OR (95% CI)***	***P****
Authors are the developers	4.51 (1.64 to 12.39)	0.003	4.15 (1.56 to 11.02)	0.003	4.29 (1.48 to 13.90)	0.005	8.19 (1.49 to 44.84)	0.015
Integration with EMR or CPOE	0.32 (0.14 to 0.72)	0.006	0.35 (0.15 to 0.75)	0.006	0.33 (0.14 to 0.79)	0.010	0.18 (.05 to .64)	0.009
System provides advice to patients	3.17 (1.15 to 8.73)	0.026	2.92 (1.11 to 7.76)	0.025	3.04 (1.04 to 9.86)	0.040	3.47 (0.90 to 13.40)	0.071
Require reason for ignoring advice	15.22 (1.90 to 122.09)	0.010	9.88 (1.74 to 55.88)	<0.001	13.98 (1.98 to 615.92)	0.002	27.80 (1.87 to 412.50)	0.016
Major institution	1.42 (0.62 to 3.27)	0.406	1.40 (0.62 to 3.14)	0.417	1.41 (0.58 to 3.49)	0.539	2.71 (0.48 to 15.29)	0.259
Co-intervention	0.37 (0.11 to 1.20)	0.097	0.39 (0.13 to 1.23)	0.100	0.38 (0.09 to 1.37)	0.164	0.22 (0.04 to 1.31)	0.096
Predictive Performance								
Sensitivity (95% CI)****	0.74 (0.64 to 0.82)		N/A		N/A		N/A	
Specificity (95% CI)****	0.70 (0.58 to 0.79)		N/A		N/A		N/A	
AUROC (95% CI)***	0.79 (0.72 to 0.86)		N/A		N/A		0.79 (0.71 to 0.85)	

* Estimated by Likelihood Ratio method
** Estimated by Wald method
*** Estimated by exact method
**** Estimated by Wilson's method

Table 10: Results of exploratory complete-case analysis including only factors found important in the prespecified model.

Modeling method								
Factor	**MLE Logistic N=150**		**Firth's PPL Logistic N=150**		**Exact Logistic N=150**		**Random Effects Logistic, N=150**	
	OR (95% CI)*	***P****	**OR (95% CI)****	***P****	**OR (95% CI)*****	***P****	**OR (95% CI)***	***P****
Authors are the developers	4.77 (1.75 to 13.03)	0.002	4.42 (1.67 to 11.71)	0.002	4.58 (1.58 to 14.80)	0.003	9.00 (1.49 to 54.38)	0.017
Integration with EMR or CPOE	0.34 (0.16 to 0.76)	0.008	0.36 (0.17 to 0.78)	0.008	0.33 (0.14 to 0.79)	0.013	0.20 (.05 to .73)	0.015
System provides advice to patients	3.02 (1.10 to 8.26)	0.031	2.92 (1.07 to 7.42)	0.030	2.92 (1.01 to 9.43)	0.048	3.26 (0.85 to 12.52)	0.086
Require reason for ignoring advice	16.10 (2.02 to 128.18)	0.009	10.57 (1.88 to 59.56)	<0.001	15.02 (2.15 to 660.08)	0.001	29.59 (1.94 to 451.40)	0.015
Co-intervention	0.33 (0.10 to 1.06)	0.063	0.36 (0.12 to 1.09)	0.062	0.35 (0.09 to 1.20)	0.106	0.19 (0.03 to 1.21)	0.078
Predictive Performance								
Sensitivity (95% CI)****	0.74 (0.64 to 0.82)		N/A		N/A		N/A	
Specificity (95% CI)****	0.70 (0.58 to 0.79)		N/A		N/A		N/A	
AUROC (95% CI)***	0.78 (0.71 to 0.84)		N/A		N/A		0.77 (0.70 to 0.84)	

* Estimated by Likelihood Ratio method; ** Estimated by Wald method; *** Estimated by exact method; **** Estimated by Wilson's method

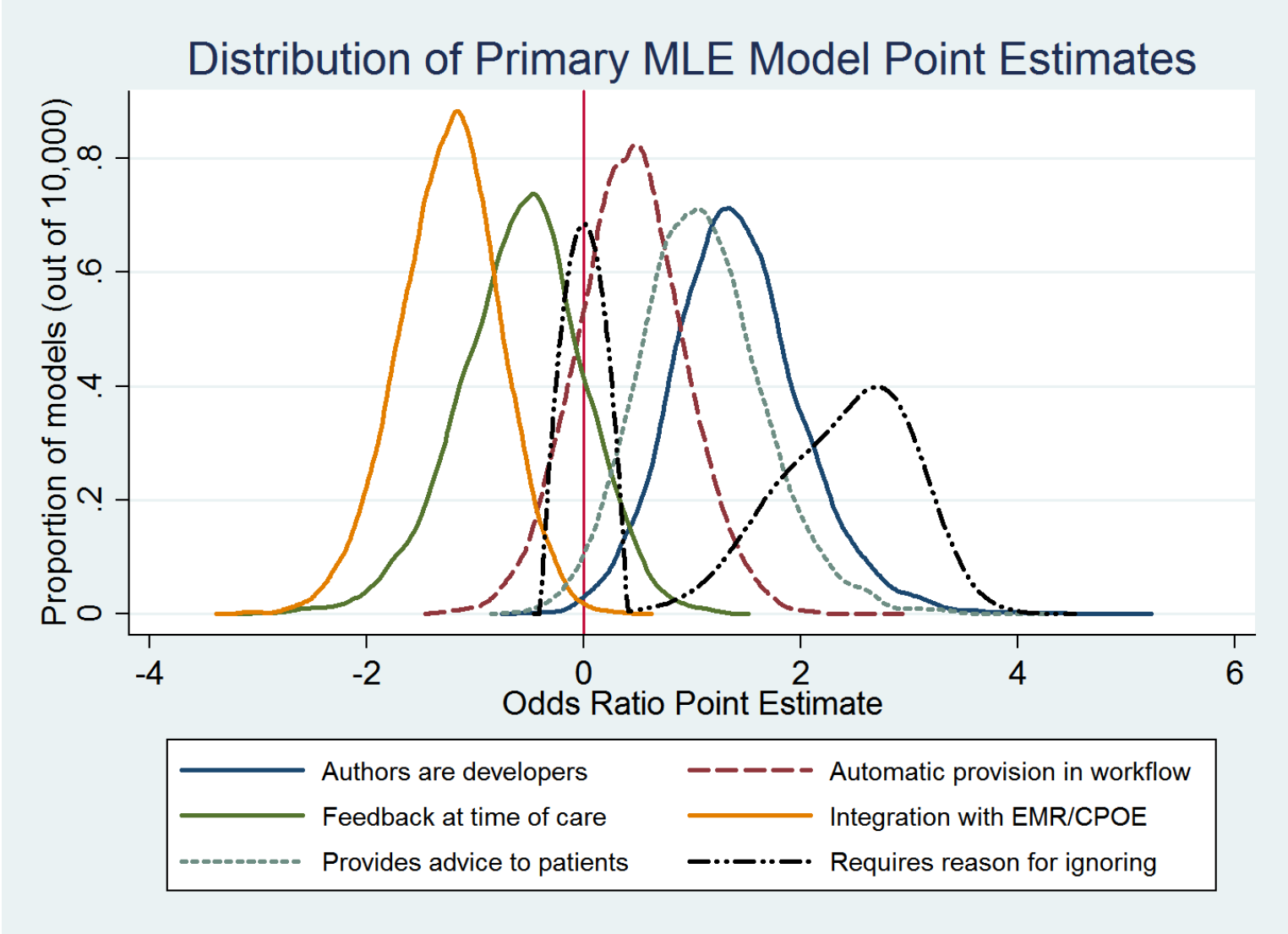

Figure 11: Results from internal validation of primary analysis using maximal likelihood estimation logistic regression.

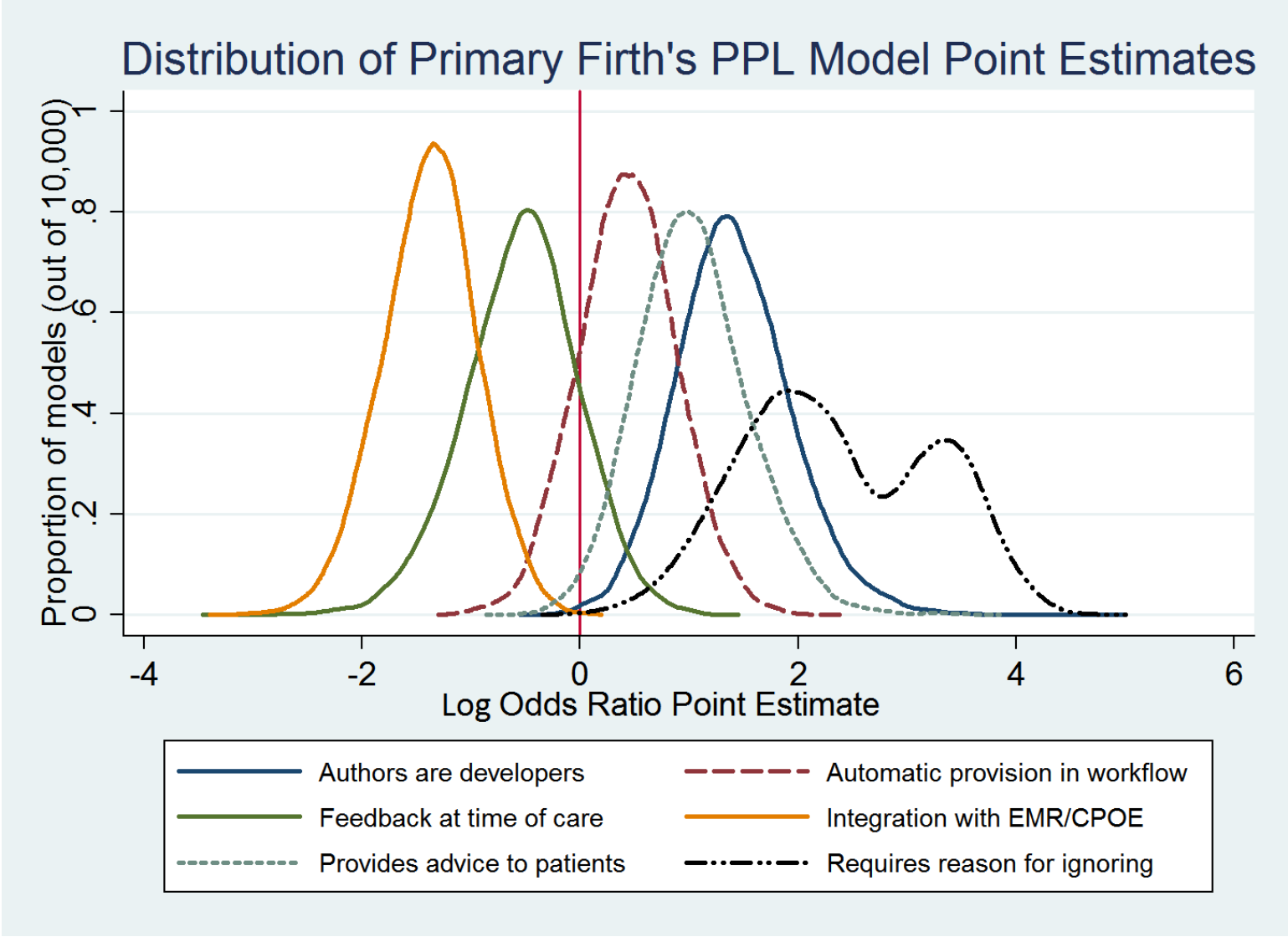

Figure 12: Results from internal validation of primary analysis using Firth's bias-corrected logistic regression.

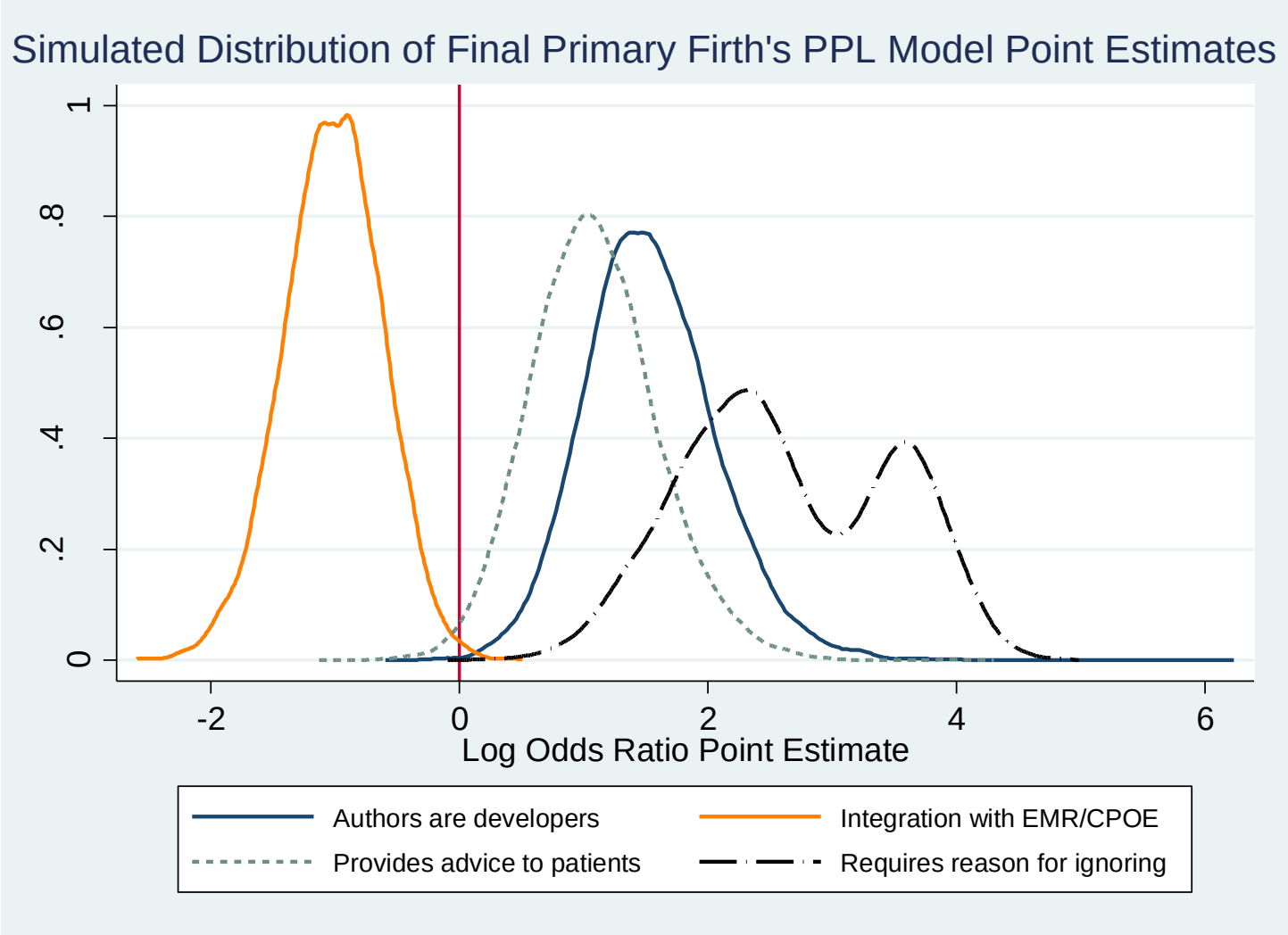

Figure 13: Results from internal validation of final primary model using Firth's bias-corrected logistic regression.

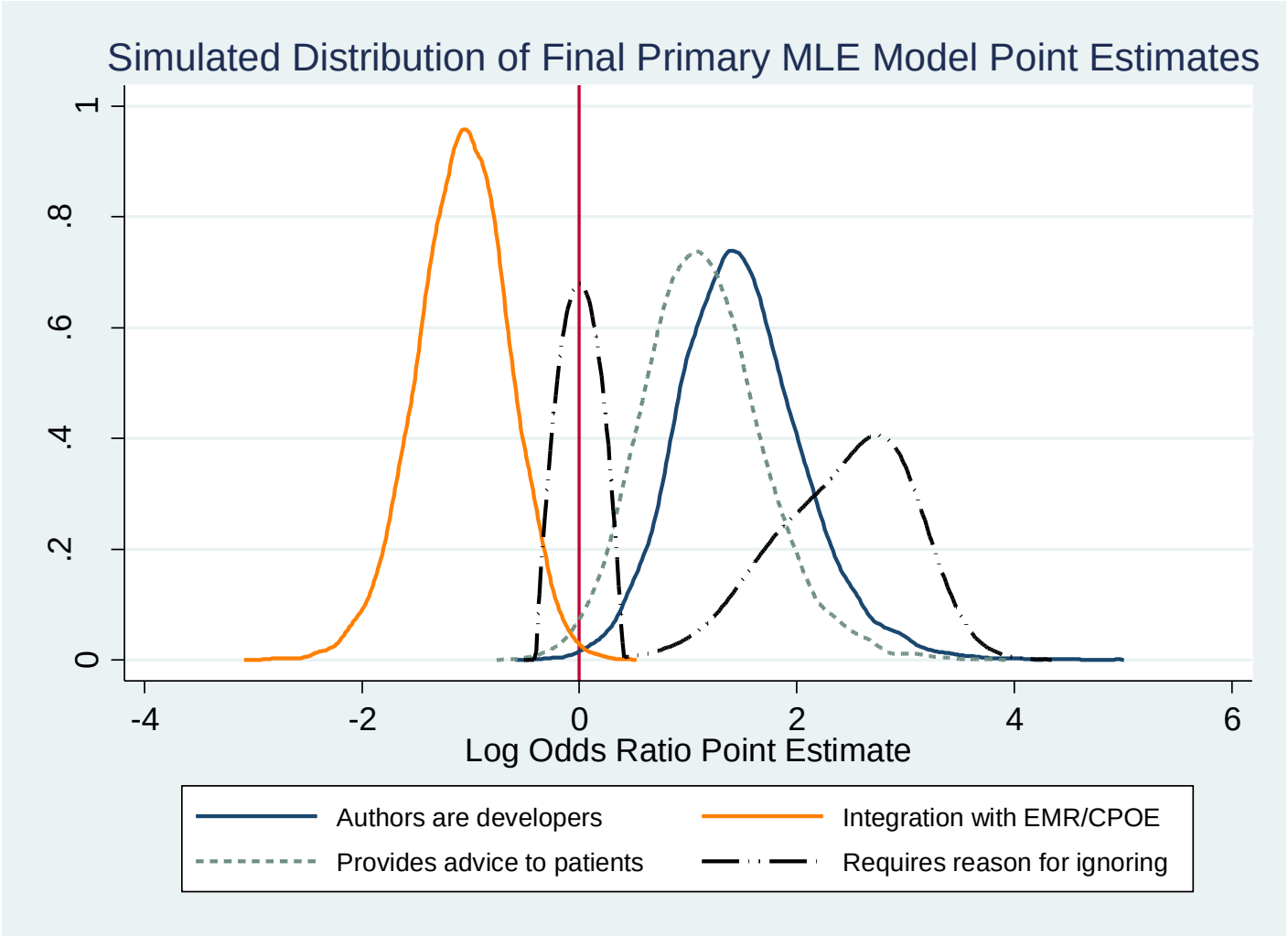

Figure 14: Results from internal validation of primary final model using maximal likelihood estimation logistic regression.

Table 11: Results from internal validation procedure.

Factor	MLE Logistic Proportion Wald Chi-sq p≤0.05 10,000 samples	Firth's PPL Logistic Proportion Wald Chi-sq p≤0.05 10,000 samples
Prespecified primary model		
Authors are the developers	75.6%	80.4%
Automatic provision in workflow	14.8%	14.7%
Feedback at the time of care	10.8%	9.5%
Integration with EMR or CPOE	77.9%	88.7%
System provides advice to patients	51.6%	46.0%
Require reason for ignoring advice	57.1%	75.6%
Final primary model		
Authors are the developers	89.0%	88.1%
Integration with EMR or CPOE	74.7%	73.7%
System provides advice to patients	59.6%	57.0%
Require reason for ignoring advice	59.3%	93.0%

Table 12: Results of primary complete-case analysis with Cobos 2005 and Gilutz 2009 removed from the dataset.

	Modeling method							
Factor	**MLE Logistic N=131**		**Firth's PPL Logistic N=146**		**Exact Logistic N=146**		**Random Effects Logistic N=146**	
	OR (95% CI)*	***P****	**OR (95% CI)****	***P****	**OR (95% CI)*****	***P****	**OR (95% CI)***	***P****
Authors are the developers	4.06 (1.47 to 11.23)	0.007	3.70 (1.39 to 9.87)	0.006	3.82 (1.31 to 12.48)	0.014	6.07 (1.33 to 27.77)	0.003
Automatic provision in workflow	1.32 (0.54 to 3.26)	0.541	1.30 (0.54 to 3.12)	0.559	1.31 (0.49 to 3.52)	0.504	1.54 (0.49 to 4.86)	0.448
Feedback at the time of care	0.61 (0.20 to 1.88)	0.391	0.64 (0.22 to 1.87)	0.406	0.62 (0.17 to 2.09)	0.493	0.60 (0.15 to 2.40)	0.467
Integration with EMR or CPOE	0.29 (0.12 to 0.71)	0.006	0.31 (0.13 to 0.74)	0.007	0.31 (0.12 to 0.79)	0.013	0.19 (0.05 to 0.71)	0.002
System provides advice to patients	2.69 (0.99 to 7.32)	0.052	2.51 (0.96 to 6.55)	0.054	2.58 (0.90 to 8.20)	0.076	2.95 (0.85 to 10.22)	0.088
Require reason for ignoring advice	omitted	n/a	32.98 (1.87 to 581.41)	<0.001	21.18 (3.32 to +∞)	<0.001	2.94[10] (0 to +∞)	n/a
ICC							0.27 (0.02 to 0.85)	

* Estimated by Likelihood Ratio method; ** Estimated by Wald method, may cross 1 even if p=<0.05; *** Estimated by exact method

Table 13: Results of primary complete-case analysis, with Cobos 2005 and Gilutz 2009 removed, including only factors found important in the prespecified model.

	Modeling method							
Factor	**MLE Logistic N=131**		**Firth's PPL Logistic N=148**		**Exact Logistic N=148**		**Random Effects Logistic N=148**	
	OR (95% CI)*	***P****	**OR (95% CI)****	***P****	**OR (95% CI)*****	***P****	**OR (95% CI)***	***P****
Authors are the developers	4.86 (1.78 to 13.30)	0.002	4.54 (1.71 to 12.07)	0.001	4.71 (1.62 to 15.34)	0.003	7.40 (1.64 to 33.34)	0.001
Integration with EMR or CPOE	0.33 (0.15 to 0.72)	0.006	0.34 (0.15 to 0.74)	0.005	0.33 (0.14 to 0.78	0.009	0.22 (0.07 to 0.71)	0.002
System provides advice to patients	2.89 (1.07 to 7.79)	0.036	2.72 (1.04 to 7.11)	0.035	2.81 (0.98 to 8.94)	0.057	3.07 (0.90 to 10.51)	0.078
Require reason for ignoring advice	(omitted)	n/a	34.70 (1.98 to 607.90)	<0.001	22.46 (3.57 to +∞)	<0.001	1.49^{10} (0 to +∞)	n/a
ICC							0.26 (0.03 to 0.83)	

* Estimated by Likelihood Ratio method; ** Estimated by Wald method; *** Estimated by exact method

Table 14: Descriptive statistics and results of univariable logistic models for selecting factors for secondary and exploratory imputed analysis.

	Factor	Prevalence (95% CI)*	Prevalence in comparisons demonstrating CCDSS success (95% CI)*	Prevalence in comparisons demonstrating CCDSS failure (95% CI)*	Unadjusted OR (95% CI)*	*p**	n
Primary Factor Set (all prespecified for inclusion)							
1.	**Authors are the developers**	80% (73% to 86%)	88% (81% to 96%)	68% (56% to 79%)	3.70 (1.53 to 8.94)	0.004	162
2.	**Automatic provision in workflow**	65% (58% to 72%)	68% (58% to 77%)	62% (50% to 72%)	1.32 (0.69 to 2.54)	0.404	162
3.	**Feedback at the time of care**	84% (79% to 90%)	82% (74% to 90%)	88% (79% to 96%)	0.62 (0.25 to 1.54)	0.303	162
4.	**Integration with EMR or CPOE**	37% (30% to 45%)	31% (22% to 41%)	46% (34% to 57%)	0.53 (0.28 to 1.02)	0.056	162
5.	**Require reason for ignoring advice**	14% (9% to 20%)	21% (14% to 31%)	3% (1% to 10%)	8.92 (2.01 to 39.61)	0.004	162
6.	**System provides advice to patients**	19% (14% to 26%)	26% (18% to 35%)	10% (5% to 20%)	2.99 (1.20 to 7.42)	0.018	162
Secondary Factor Set							
1.	**Facilitated or automated action**	13% (9% to 19%)	12% (7% to 20%)	15% (8% to 25%)	0.77 (0.31 to 1.93)	0.575	162
2.	**Advice is evidence-based**	71% (64% to 77%)	73% (64% to 81%)	68% (56% to 78%)	1.32 (0.67 to 2.62)	0.426	162
3.	**Critiquing function**	17% (12% to 23%)	18% (12% to 27%)	15% (8% to 25%)	1.28 (0.55 to 3.00)	0.570	162

	Factor	Prevalence (95% CI)*	Prevalence in comparisons demonstrating CCDSS success (95% CI)*	Prevalence in comparisons demonstrating CCDSS failure (95% CI)*	Unadjusted OR (95% CI)*	*p**	n
4.	**Practitioner enters data**	38% (30% to 46%)	39% (28% to 49%)	36% (24% to 48%)	1.11 (0.57 to 2.17)	0.761	162
5.	**Modern system (study after year 2000)**	66% (58% to 73%	66% (56% to 75%)	66% (54% to 76%)	0.99 (0.51 to 1.91)	0.977	162
6.	**Prompts or reminders given directly to patients**	10% (6% to 15%)	12% (7% to 20%)	7% (3% to 16%)	1.68 (0.56 to 5.10)	0.364	162
7.	**Users trained to use the system**	61% (53% to 70%)	65% (54% to 76%)	56% (43% to 69%)	1.42 (0.71 to 2.85)	0.326	162
8.	**Local users consulted during development**	19% (13% to 25%)	19% (12% to 28%)	18% (10% to 28%)	1.11 (0.49 to 2.48)	0.808	162
9.	**Presents reasoning**	50% (42% to 57%)	56% (46% to 66%)	43% (32% to 54%)	1.84 (0.98 to 3.47)	0.057	162
10.	**Presents evidence**	18% (13% to 25%)	20% (13% to 29%)	15% (8% to 25%)	1.47 (0.64 to 3.40)	0.249	162
			Exploratory Factor Set				
1.	**Major institution**	37% (30% to 45%)	41% (32% to 52%)	31% (21% to 43%)	1.59 (0.82 to 3.06)	0.169	162
2.	**Previously evaluated**	47% (39% to 55%)	48% (38% to 58%)	46% (34% to 57%)	1.10 (0.59 to 2.05)	0.774	162
3.	**Commercial product**	23% (14% to 31%)	21% (11% to 32%)	25% (12% to 37%)	0.83 (0.37 to 1.89)	0.662	162
4.	**Electronic interface**	73% (66% to 80%)	70% (61% to 79%)	78% (67% to 86%)	0.66 (0.32 to 1.36)	0.262	162
5.	**Non-physician providers**	40% (32% to 47%)	43% (33% to 53%)	35% (25% to 47%)	1.36 (0.71 to 2.59)	0.352	162

	Factor	Prevalence (95% CI)*	Prevalence in comparisons demonstrating CCDSS success (95% CI)*	Prevalence in comparisons demonstrating CCDSS failure (95% CI)*	Unadjusted OR (95% CI)*	*p**	n
6.	**Periodic performance feedback**	5% (3% to 9%)	5% (2% to 12%)	4% (2% to 12%)	1.22 (0.28 to 5.28)	0.793	162
7.	**Co-intervention in CCDSS group**	12% (8% to 18%)	9% (4% to 16%)	18% (10% to 28%)	0.43 (0.17 to 1.13)	0.087	162
	Methodological Factors (for stratified analysis)						
1.	**Cluster Randomization**	55% (47% to 62%)	47% (37% to 57%)	66% (54% to 76%)	Not estimated		162
2.	**Allocation Concealment**	54% (47% to 62%)	56% (46% to 66%)	51% (40% to 63%)	Not estimated		162
3.	**Objective Outcome**	100% (98% to 100%)	100% (96% to 100%)	100% (95% to 100%)	Not estimated		162
4.	**Baseline Differences**	90% (85% to 94%)	89% (82% to 94%)	91% (82% to 96%)	Not estimated		162
5.	**Adequate Follow up**	79% (72% to 85%)	78% (68% to 85%)	81% (70% to 88%)	Not estimated		162

*95% CIs for frequencies were computed using Wilson's method. 95% CIs for Odds Ratios were computed using the Likelihood Ratio. Academic institution, Community-based primary care setting, and Inpatient hospital setting could not be extracted reliably and were removed before any analyses.

Table 15: Results of primary imputed analysis.

	Modeling method					
Factor	**MLE Logistic N=162**		**Firth's PPL Logistic N=162**		**Random Effects Logistic N=162**	
	Adjusted OR (95% CI)*	***P****	**Adjusted OR (95% CI)****	***P****	**Adjusted OR (95% CI)***	***P****
Authors are the developers	3.69 (1.34 to 10.10)	0.011	3.44 (1.30 to 9.08)	0.013	7.90 (1.24 to 50.41)	0.029
Automatic provision in workflow	1.54 (0.65 to 3.62)	0.324	1.50 (0.65 to 3.46)	0.338	2.25 (0.61 to 8.32)	0.225
Feedback at the time of care	0.72 (0.26 to 2.01)	0.529	0.74 (0.27 to 1.99)	0.551	0.71 (0.16 to 3.11)	0.646
Integration with EMR or CPOE	0.36 (0.16 to 0.83)	0.017	0.38 (0.17 to 0.85)	0.019	0.16 (0.04 to 0.69)	0.014
System provides advice to patients	2.58 (0.98 to 6.79)	0.056	2.41 (0.95 to 6.13)	0.065	2.85 (0.72 to 11.37)	0.137
Require reason for ignoring advice	8.42 (1.81 to 39.24)	0.007	6.64 (1.65 to 26.71)	0.008	15.90 (1.67 to 151.28)	0.016
ICC					0.47 (0.09 to 0.89)	

* Estimated by Likelihood Ratio method
** Estimated by Wald method

Table 16: Results of primary imputed analysis including only factors found important in the prespecified model.

	Modeling method					
Factor	**MLE Logistic N=162**		**Firth's PPL Logistic N=162**		**Random Effects Logistic N=162**	
	Adjusted OR (95% CI)*	***P****	**Adjusted OR (95% CI)****	***P****	**Adjusted OR (95% CI)***	***P****
Authors are the developers	3.99 (1.47 to 10.83)	0.007	3.79 (1.44 to 9.99)	0.007	8.22 (1.32 to 51.08)	0.024
Integration with EMR or CPOE	0.43 (0.21 to 0.90)	0.024	0.44 (0.21 to 0.91)	0.027	0.23 (0.06 to 0.83)	0.025
System provides advice to patients	2.74 (1.05 to 7.14)	0.040	2.58 (1.02 to 6.54)	0.046	3.03 (0.79 to 11.59)	0.105
Require reason for ignoring advice	8.97 (1.93 to 41.66)	0.005	7.18 (1.78 to 28.95)	0.006	15.53 (1.77 to 136.08)	0.013
ICC					0.44 (0.07 to 0.89)	

* Estimated by Likelihood Ratio method

** Estimated by Wald method

Table 17: Results of secondary imputed analysis.

	Modeling method					
Factor	**MLE Logistic N=162**		**Firth's PPL Logistic N=162**		**Random Effects Logistic N=162**	
	Adjusted OR (95% CI)*	***P****	**Adjusted OR (95% CI)****	***P****	**Adjusted OR (95% CI)***	***P****
Authors are the developers	3.50 (1.26 to 9.70)	0. 0.016	3.31 (1.23 to 8.87)	0.018	6.43 (1.09 to 37.80)	0.039
Integration with EMR or CPOE	0.39 (0.18 to 0.84)	0.015	0.41 (0.19 to 0.85)	0.017	0.24 (0.07 to 0.81)	0.021
System provides advice to patients	2.67 (1.01 to 7.02)	0.047	2.51 (0.98 to 6.38)	0.054	2.91 (0.81 to 10.52)	0.102
System require reason for ignoring advice	8.68 (1.87 to 40.28)	0.006	6.89 (1.72 to 27.69)	0.007	13.22 (1.70 to 102.87)	0.014
System presents reasoning	1.59 (0.76 to 3.35)	0.218	1.57 (0.76 to 3.24)	0.224	1.40 (0.55 to 3.58)	0.506
ICC					0.37 (0.05 to 0.87)	

* Estimated by Likelihood Ratio method

** Estimated by Wald method

Table 18: Results of secondary imputed analysis including only factors found important in the prespecified model.

	Modeling method					
Factor	**MLE Logistic N=162**		**Firth's PPL Logistic N=162**		**Random Effects Logistic N=162**	
	Adjusted OR (95% CI)*	***P****	**Adjusted OR (95% CI)****	***P****	**Adjusted OR (95% CI)***	***P****
Authors are the developers	3.99 (1.47 to 10.83)	0.007	3.79 (1.44 to 9.99)	0.007	8.22 (1.32 to 51.08)	0.024
Integration with EMR or CPOE	0.43 (0.21 to 0.90)	0.024	0.44 (0.21 to 0.91)	0.027	0.23 (0.06 to 0.83)	0.025
System provides advice to patients	2.74 (1.05 to 7.14)	0.040	2.58 (1.02 to 6.54)	0.046	3.03 (0.79 to 11.59)	0.105
Require reason for ignoring advice	8.97 (1.93 to 41.66)	0.005	7.18 (1.78 to 28.95)	0.006	15.53 (1.77 to 136.08)	0.013
ICC					0.44 (0.07 to 0.89)	

* Estimated by Likelihood Ratio method

** Estimated by Wald method

Table 19: Results of exploratory imputed analysis.

	Modeling method					
Factor	**MLE Logistic N=162**		**Firth's PPL Logistic N=162**		**Random Effects Logistic N=162**	
	Adjusted OR (95% CI)*	***P****	**Adjusted OR (95% CI)****	***P****	**Adjusted OR (95% CI)***	***P****
Authors are the developers	3.87 (1.39 to 10.77)	0.010	3.62 (1.35 to 9.70)	0.011	8.20 (1.32 to 50.86)	0.024
Integration with EMR or CPOE	0.37 (0.17 to 0.81)	0.012	0.39 (0.18 to 0.83)	0.014	0.19 (0.05 to 0.69)	0.012
System provides advice to patients	3.09 (1.15 to 8.35)	0.026	2.86 (1.10 to 7.44)	0.031	3.43 (0.86 to 13.75)	0.082
Require reason for ignoring advice	8.31 (1.77 to 38.91)	0.007	6.51 (1.61 to 26.31)	0.009	16.04 (1.68 to 153.37)	0.016
Major institution	1.53 (0.69 to 3.38)	0.292	1.50 (0.69 to 3.25)	0.306	3.08 (0.51 to 18.75)	0.221
Co-intervention	0.39 (0.13 to 1.18)	0.094	0.41 (0.14 to 1.20)	0.103	0.21 (0.04 to 1.29)	0.093
ICC					0.44 (0.09 to 0.87)	

* Estimated by Likelihood Ratio method

** Estimated by Wald method

Table 20: Results of exploratory imputed analysis including only factors found important in the prespecified model.

	Modeling method					
Factor	**MLE Logistic N=162**		**Firth's PPL Logistic N=162**		**Random Effects Logistic N=162**	
	Adjusted OR (95% CI)*	***P****	**Adjusted OR (95% CI)****	***P****	**Adjusted OR (95% CI)***	***P****
Authors are the developers	4.12 (1.49 to 11.40)	0.006	3.88 (1.45 to 10.38)	0.007	9.71 (1.36 to 69.16)	0.023
Integration with EMR or CPOE	0.41 (0.19 to 0.86)	0.019	0.42 (0.20 to 0.88)	0.021	0.20 (0.05 to 0.77)	0.019
System provides advice to patients	2.93 (1.09 to 7.85)	0.033	2.73 (1.05 to 7.06)	0.038	3.22 (0.77 to 13.39)	0.109
Require reason for ignoring advice	8.52 (1.84 to 39.51)	0.006	6.75 (1.68 to 27.08)	0.007	17.67 (1.69 to 184.24)	0.016
Co-intervention	0.35 (0.12 to 1.03)	0.057	0.37 (0.13 to 1.05)	0.062	0.17 (0.03 to 1.18)	0.074
ICC					0.49 (0.10 to 0.89)	

* Estimated by Likelihood Ratio method

** Estimated by Wald method

Table 21: Results of simulation study with prespecified primary model.

Factor	Proportion with p≤0.05 out of 1000 simulated samples drawn with replacement				
	Sample size				
	162 studies	120 studies	97 studies	71 studies	32 studies
Firth's bias-corrected logistic regression with Wald tests					
Authors are the developers	0.729	0.607	0.454	0.359	0.059
Automatic provision in workflow	0.133	0.106	0.077	0.065	0.016
Feedback at the time of care	0.098	0.072	0.039	0.028	0.004
Integration with EMR or CPOE	0.761	0.669	0.521	0.439	0.107
System provides advice to patients	0.494	0.384	0.239	0.177	0.036
Require reason for ignoring advice	0.911	0.775	0.508	0.341	0.043
Logistic regression by maximum likelihood estimation with likelihood ratio tests					
Authors are the developers	0.751	0.641	0.489	0.389	0.066
Automatic provision in workflow	0.149	0.117	0.102	0.088	0.029
Feedback at the time of care	0.116	0.093	0.051	0.041	0.012
Integration with EMR or CPOE	0.787	0.694	0.559	0.485	0.133
System provides advice to patients	0.527	0.424	0.272	0.193	0.031
Require reason for ignoring advice	0.584	0.401	0.221	0.107	0.007

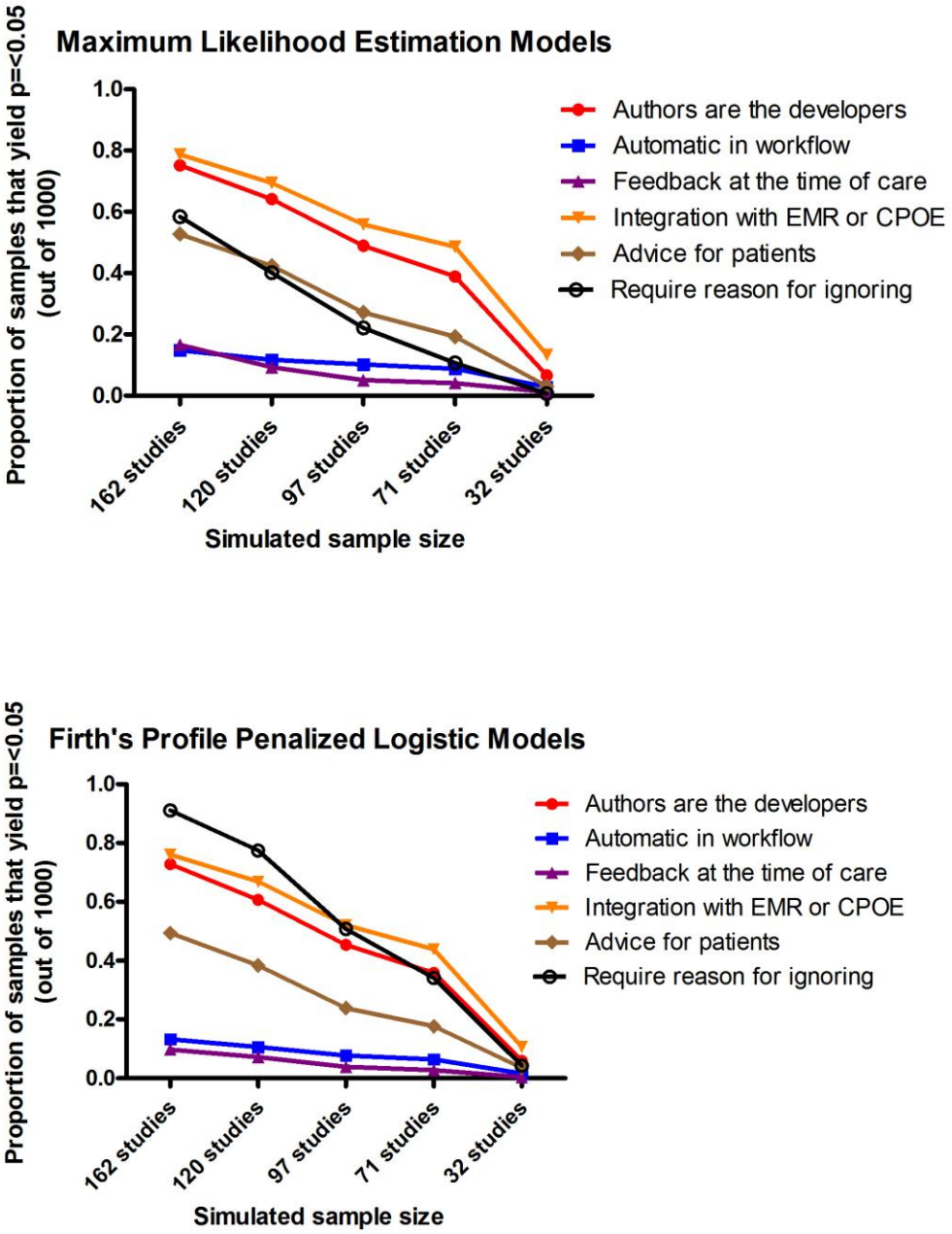

Figure 15: Results of simulation study with prespecified primary model.

Table 22: Comparison with other CCDSS reviews

Review	Eligible designs (comparisons)	Potential determinants tested	Key differences from our review
This review	RCTs (162)	**1. Integrated with electronic health records or order entry systems*** **(OR, 0.37; 95% CI, 0.17 to 0.80; p=0.01)** **2. Advice for patients in addition to practitioners*** **(OR, 2.77; 95% CI, 1.07 to 7.17; p=0.029)** **3. Requires practitioners to provide a reason before overriding CCDSS advice* (OR, 11.23; 95% CI, 1.98 to 63.72; p<0.001)** **4. Study conducted by the system's developers*** **(OR, 4.35; 95% CI, 1.66 to 11.44; p=0.002)** 5. Automatic provision in workflow 6. Feedback at time of care	-
Ballas et al. 2000(Balas et al., 2000)	RCTs (33)	1. Academic affiliation 2. Ratio of residents 3. Delivery technique	Comparisons of interest included physician prompts vs. no prompt controls and also included non-computer-based interventions. Continuous outcomes were used; we used a dichotomous outcome.
Garg et al. 2005(Garg et al., 2005)	RCTs cohort studies (97)	**1. Automatic prompting*** **(OR, 2.8; 95% CI, 1.2 to 6.6; p=.02)** 2. Integration with EMR/CPOE 3. Recommendations instead of just information 4. Study quality **5. Studied by the developers*** **(OR, 6.7; 95% CI, 1.7 to 25.3; p=.001**) 6. Described pilot testing 7. Described user training	Some studies were non-randomized. Only practitioner performance outcomes were used to judge success when testing determinants; we used success at improving process or patient outcomes.
Kawamoto et al. 2005(Kawamoto et al., 2005)	RCTs (71)	**1. Integration with charting or order entry system*** **sig positive in univariable screening only; p not reported.** **2. Use of a computer to generate the decision support*** **(OR, 6.3; 95% CI 1.2 to 45.0; p = 0.0294)** **3. Automatic provision in workflow***	Comparisons of interest included computer-based or non-computer-based decision support vs. no decision support. Exact logistic regression was used to

		(OR, 112.1; 95% CI 12.9 to ∞; p < 0.00001) 4. No need for additional clinician data entry 5. Request documentation of the reason for not following CDSS recommendations **6. Support at time and location of decision making*** **(OR, 15.4; 95% CI 1.3 to 300.6; p = 0.0263)** 7. Recommendations executed by noting agreement **8. Recommendation, not just assessments*** **(OR, 7.1; 95% CI 1.3 to 45.6; p = 0.0187)** 9. Promotion of action rather than inaction 10. Justification of decision support via provision of reasoning 11. Justification of decision support via provision of research evidence 12. Local user involvement in development process 13. Provision of decision support results to patients as well as providers 14. Accompanied by periodic performance feedback 15. Accompanied by conventional education	estimate associations. Only process outcomes were used to judge success; we used success at improving process or patient outcomes.
Mollon et al. 2009(Mollon et al., 2009)	RCTs (41)	-	Comparisons of interest included prescribing CDSS vs. non-CDSS controls. The authors did not test any factors because of difficulties with factor extraction from primary studies.
Shojania et al. 2010(Shojania et al., 2010)	RCTs, quasi RCTs (32)	1. Targeted underuse vs. overuse 2. Specific vs. generic reminder 3. Active (automatic) vs. passive (must retrieve) delivery 4. Explanation provided **5. Response required*** **(median 12.9% [IQR 2.7%–22.7%] vs. 2.7% [IQR 0.6%–5.6%] for no response required; p = 0.09)** 6. Developed in consultation with recipients 7. Delivered via CPOE system	Comparisons of interest included reminder systems vs. non-reminder controls. RCTs and quasi-RCTs were included in the review. Adherence to process of care reminders was used to judge effectiveness; we used process or patient outcomes. Outcome was continuous (median and IQR); we used a dichotomous outcome. Mann-Whitney tests were used to test associations; we used logistic regression.

Table 23: Table of CCDSS characteristics

		Primary Factor Set						Secondary Factor Set										Exploratory Factor Set							Methods				
Study	CCDSS effect	Authors are the developers	Automatic in workflow	Feedback at time of care	Integrated with EMR or CPOE	Requires reason for ignoring	Gives advice to patients	Facilitates action	Evidence based advice	Critiquing function	Practitioners enters data	After year 2000	Advice directly to patients	Trained users	Local users consulted	Presents reasoning	Presents evidence	Major HI institution	Previously evaluated	Commercial product	Electronic interface	Non-physician providers	Periodic performance feedback	Co-intervention	Cluster randomized study	Baseline balanced or adjusted	Objective outcome or blinding	>80% follow up	Allocation concealed
Ahmad, 2009[1]	+	+	+	+	0	0	+	0	+	0	0	+	+	+	+	+	0	0	+	0	0	0	0	0	0	+	+	+	+
Albisser, 2007[2]	+	+	0	0	0	0	0	0	+	0	0	+	0	+	+	+	0	0	+	?	+	0	0	0	0	+	+	+	+
Ansari, 2003[3]	0	+	+	+	+	0	+	0	+	0	0	+	+	0	0	0	0	+	0	?	+	0	0	0	+	+	+	+	0
Apkon, 2005[4]	0	0	0	0	+	0	0	0	0	0	+	+	0	+	0	0	0	0	0	+	+	0	0	0	0	+	+	+	0
Augstein, 2007[5]	+	?	0	+	0	0	0	0	0	0	?	+	0	+	0	+	0	0	+	?	+	0	0	0	0	+	+	+	+
Barnett, 1983[6]	+	+	+	0	+	0	0	0	+	0	0	0	0	0	0	0	0	+	0	0	+	+	0	0	0	+	+	+	0
Bates, 1999[7]	+	+	+	+	+	+	0	+	+	+	0	0	0	0	0	+	0	+	0	0	+	+	0	0	0	+	+	+	+
Begg, 1989[8]	+	+	0	+	0	0	0	0	+	0	+	0	0	0	0	0	0	0	0	?	+	0	0	0	0	+	+	0	0
Bertoni, 2009[9]	+	+	0	+	0	0	0	0	+	0	+	+	0	+	0	0	+	0	0	0	+	+	0	0	+	+	+	+	+
Bogusevicius, 2002[10]	0	+	0	+	0	0	0	0	0	0	?	+	0	0	0	0	0	0	+	0	+	0	0	0	0	+	+	+	+
Borbolla, 2007[11]	+	+	0	+	0	0	0	0	0	0	0	+	0	+	0	0	0	0	0	0	0	+	0	+	+	+	+	+	0
Bosworth, 2009[12]	0	+	+	+	+	0	0	0	+	0	0	+	0	0	0	+	+	+	+	0	+	+	+	0	+	+	+	+	+
Brothers, 2004[13]	0	+	0	+	0	0	0	0	0	0	+	+	0	+	+	+	0	+	+	0	+	+	0	0	0	+	+	0	+
Burack, 1994[14]	+	+	+	+	0	+	0	0	+	0	+	0	0	0	0	+	0	0	0	?	+	0	0	0	0	+	+	+	+
Burack, 1996[15]	0	+	+	+	0	0	+	0	0	0	0	0	+	0	0	+	0	0	+	0	+	0	0	0	0	+	+	+	+
Burack, 1997[16,17]	+	+	+	+	0	0	0	0	+	0	+	0	0	0	0	0	0	0	+	?	+	0	0	0	0	+	+	+	+

		Primary Factor Set						Secondary Factor Set										Exploratory Factor Set							Methods				
Study	**CCDSS effect**	**Authors are the developers**	**Automatic in workflow**	**Feedback at time of care**	**Integrated with EMR or CPOE**	**Requires reason for ignoring**	**Gives advice to patients**	**Facilitates action**	**Evidence based advice**	**Critiquing function**	**Practitioners enters data**	**After year 2000**	**Advice directly to patients**	**Trained users**	**Local users consulted**	**Presents reasoning**	**Presents evidence**	**Major HI institution**	**Previously evaluated**	**Commercial product**	**Electronic interface**	**Non-physician providers**	**Periodic performance feedback**	**Co-intervention**	**Cluster randomized study**	**Baseline balanced or adjusted**	**Objective outcome or blinding**	**>80% follow up**	**Allocation concealed**
Burack, 1998[17]	0	0	+	+	0	0	+	0	0	0	0	0	+	?	0	0	0	0	0	?	0	0	0	0	0	+	+	+	0
Burack, 2003[18]	0	+	+	+	0	0	+	0	0	0	0	+	+	0	0	+	0	0	+	0	+	0	0	0	0	+	+	+	+
Burton, 1991[19]	0	0	+	+	0	0	0	+	0	0	?	0	0	0	0	0	0	+	+	?	0	0	0	0	+	+	+	0	0
Cannon, 2000[20]	+	+	+	0	0	0	0	0	+	0	+	+	0	?	0	0	0	+	0	0	+	+	0	0	0	+	+	0	0
Carter, 1987[21]	0	0	0	?	0	0	0	0	+	0	0	0	0	+	0	0	0	+	0	0	0	0	0	0	0	0	+	0	0
Casner, 1993[22]	0	0	+	+	0	0	0	+	+	0	+	0	0	+	0	0	0	0	+	0	0	0	0	0	0	+	+	0	0
Cavalcanti, 2009[23]	+	+	0	+	0	0	0	0	0	0	0	+	0	+	0	+	0	0	0	0	+	+	0	0	0	+	+	+	+
Chambers, 1991[24]	+	+	+	+	0	0	0	0	+	0	0	0	0	?	+	0	0	0	0	0	+	0	0	0	+	+	+	0	+
Christakis, 2001[25]	+	+	+	+	+	0	0	0	+	0	+	+	0	0	0	+	+	+	0	0	+	+	0	0	+	+	+	0	0
Christian, 2008[26]	+	+	+	+	0	0	+	0	0	0	0	+	+	+	0	0	0	0	0	?	0	0	0	0	0	+	+	+	+
Claes, 2005[27,28]	0	?	0	0	0	+	0	0	0	0	0	+	0	+	0	0	0	0	+	+	0	0	0	0	+	+	+	+	0
Cleveringa, 2008[29-32]	0	0	0	+	0	0	0	0	+	0	+	+	0	+	0	0	0	0	+	+	+	+	0	+	+	+	+	+	0
Cobos, 2005[33]	0	+	0	+	0	+	0	0	+	0	0	+	0	?	0	0	0	0	0	?	+	0	0	+	+	+	+	+	+
Coe, 1977[34]	0	+	+	+	0	0	0	0	0	0	+	0	0	0	0	0	0	0	+	?	+	0	0	0	0	+	+	0	0
Davis, 2007[35]	+	+	+	+	+	0	0	0	+	+	0	+	0	+	0	+	+	+	+	0	+	+	0	0	+	+	+	+	+
Demakis, 2000[36]	+	+	+	+	0	0	0	0	+	0	+	+	0	+	0	+	0	+	0	?	+	0	0	0	+	+	+	+	0
Derose, 2005[37]	+	0	+	+	0	0	0	0	+	0	?	+	0	?	+	+	0	+	+	0	0	0	0	0	0	+	+	+	+

		Primary Factor Set						Secondary Factor Set										Exploratory Factor Set							Methods				
Study	**CCDSS effect**	**Authors are the developers**	**Automatic in workflow**	**Feedback at time of care**	**Integrated with EMR or CPOE**	**Requires reason for ignoring**	**Gives advice to patients**	**Facilitates action**	**Evidence based advice**	**Critiquing function**	**Practitioners enters data**	**After year 2000**	**Advice directly to patients**	**Trained users**	**Local users consulted**	**Presents reasoning**	**Presents evidence**	**Major HI institution**	**Previously evaluated**	**Commercial product**	**Electronic interface**	**Non-physician providers**	**Periodic performance feedback**	**Co-intervention**	**Cluster randomized study**	**Baseline balanced or adjusted**	**Objective outcome or blinding**	**>80% follow up**	**Allocation concealed**
Dexter, 1998[38]	+	+	+	+	0	+	0	0	+	0	0	0	0	0	0	0	0	+	+	0	+	0	0	0	+	+	+	+	0
Dexter, 2001[39]	+	+	+	+	+	0	0	+	+	0	0	+	0	0	+	+	0	+	+	0	+	0	0	0	+	+	+	+	+
Downs, 2006[40]	0	+	+	+	+	0	0	0	+	0	0	+	0	+	0	0	0	0	+	0	+	+	0	0	+	+	+	+	+
Eccles, 2002[41]	0	+	+	+	+	0	0	0	+	0	+	+	0	+	0	0	0	0	0	0	+	0	0	0	+	+	+	+	+
Emery, 2007[42]	+	+	0	+	0	0	+	0	+	0	+	+	0	+	0	+	+	0	+	?	+	+	0	0	+	+	+	+	+
Feldman, 2005[43]	0	0	0	+	0	0	0	0	+	0	0	+	0	?	0	+	0	0	0	0	+	+	0	0	+	+	+	+	+
Feldstein, 2006a[44]	+	+	+	0	+	0	+	0	+	0	?	+	0	?	0	+	+	+	0	?	+	+	0	0	+	+	+	+	+
Feldstein, 2006b[44]	+	?	+	+	+	0	0	0	+	0	0	+	0	?	0	+	+	+	0	?	+	0	0	0	0	+	+	+	+
Field, 2009[45]	0	+	+	+	+	0	0	0	+	+	0	+	0	0	0	+	+	0	0	0	+	0	0	0	+	+	+	+	0
Fihn, 1994[46]	+	+	0	+	0	0	0	0	0	0	+	0	0	+	0	0	0	+	0	?	+	0	0	0	0	+	+	0	0
Fiks, 2009[47]	0	+	+	+	+	0	0	0	+	0	0	+	0	+	0	0	0	0	0	0	+	+	0	0	+	+	+	+	0
Filippi, 2003[48]	+	?	+	+	+	0	0	0	+	0	0	+	0	+	0	0	0	0	0	?	?	0	0	0	+	+	+	+	0
Fitzmaurice, 2000[49,50]	0	0	0	+	0	0	0	0	+	0	0	+	0	+	0	0	0	0	+	+	+	+	0	+	+	+	+	0	0
Flanagan, 1999[51]	0	+	+	+	+	0	0	+	+	0	0	0	0	+	0	0	0	0	0	0	+	0	0	0	+	0	+	0	0
Flottorp, 2002[52,53]	0	+	+	+	+	0	0	0	+	0	+	+	0	0	0	0	0	0	0	+	+	+	0	+	+	+	+	+	+
Flottorp, 2002c2[52,53]	0	+	+	+	+	0	0	0	+	0	+	+	0	0	0	0	0	0	0	+	+	+	0	+	+	+	+	+	+
Fortuna, 2009[54]	+	+	+	+	+	0	+	0	+	+	0	+	0	?	0	0	+	0	0	0	+	+	0	0	+	+	+	+	+

		Primary Factor Set						Secondary Factor Set										Exploratory Factor Set							Methods				
Study	**CCDSS effect**	**Authors are the developers**	**Automatic in workflow**	**Feedback at time of care**	**Integrated with EMR or CPOE**	**Requires reason for ignoring**	**Gives advice to patients**	**Facilitates action**	**Evidence based advice**	**Critiquing function**	**Practitioners enters data**	**After year 2000**	**Advice directly to patients**	**Trained users**	**Local users consulted**	**Presents reasoning**	**Presents evidence**	**Major HI institution**	**Previously evaluated**	**Commercial product**	**Electronic interface**	**Non-physician providers**	**Periodic performance feedback**	**Co-intervention**	**Cluster randomized study**	**Baseline balanced or adjusted**	**Objective outcome or blinding**	**>80% follow up**	**Allocation concealed**
Frame, 1994[55]	+	+	+	+	0	+	+	0	+	0	+	0	+	+	0	0	0	0	0	0	+	+	0	0	0	+	+	0	+
Gilutz, 2009[56]	+	+	0	+	0	+	0	0	+	0	0	+	0	+	0	+	0	0	0	?	0	+	0	0	+	+	+	+	0
Gonzalez, 1989[57]	+	0	0	+	0	0	0	0	0	0	?	0	0	+	0	0	0	0	+	+	+	0	0	0	0	+	+	+	0
Goud, 2009[58,59]	+	+	+	+	+	+	0	0	+	0	0	+	0	+	0	+	+	0	+	+	+	+	0	0	+	+	+	0	+
Gurwitz, 2008[60]	0	0	+	+	+	0	0	0	+	+	+	+	0	0	0	+	0	0	0	0	+	+	0	0	+	0	+	+	+
Hales, 1995[61]	0	0	+	0	+	0	0	0	+	+	0	0	0	0	0	+	0	+	0	+	+	+	0	0	0	+	+	0	0
Hamilton, 2004[62]	0	?	0	+	0	0	0	0	0	0	0	+	0	?	0	+	0	0	0	?	+	+	0	0	0	+	+	+	+
Harari, 2008[63]	0	+	+	+	+	0	+	0	+	0	0	+	+	+	0	0	0	0	+	?	+	0	0	0	0	+	+	+	+
Heidenreich, 2005[64]	0	+	+	+	0	0	0	0	+	0	0	+	0	?	0	+	0	+	0	0	0	0	0	0	0	+	+	0	+
Heidenreich, 2007[65]	+	+	+	+	0	0	0	0	+	0	0	+	0	0	0	0	+	+	0	0	0	+	0	0	0	+	+	+	+
Helder, 2008[66]	0	0	0	+	0	0	0	0	0	0	0	+	0	?	0	0	0	0	+	+	+	+	0	0	0	+	+	+	0
Hetlevik, 1999[67,68]	0	0	0	+	0	0	+	0	+	0	?	0	0	+	0	0	0	0	0	?	+	+	0	+	+	+	+	+	+
Hickling, 1989[69]	+	+	0	+	0	0	0	0	+	0	?	0	0	0	0	0	0	0	0	?	+	0	0	0	0	0	+	+	0
Hicks, 2008[70]	+	?	+	+	+	0	0	0	+	0	0	+	0	+	0	+	0	+	+	0	+	+	0	0	+	+	+	+	0
Holbrook, 2009[71,72]	+	+	+	+	0	0	+	0	+	0	+	+	+	+	0	+	0	0	+	0	+	+	0	0	0	+	+	+	+
Hurley, 1986[73]	0	0	0	?	0	0	0	0	+	0	0	0	0	0	0	0	0	0	0	0	+	0	0	0	0	+	+	+	+

		Primary Factor Set						Secondary Factor Set										Exploratory Factor Set								Methods				
Study	**CCDSS effect**	**Authors are the developers**	**Automatic in workflow**	**Feedback at time of care**	**Integrated with EMR or CPOE**	**Requires reason for ignoring**	**Gives advice to patients**	**Facilitates action**	**Evidence based advice**	**Critiquing function**	**Practitioners enters data**	**After year 2000**	**Advice directly to patients**	**Trained users**	**Local users consulted**	**Presents reasoning**	**Presents evidence**	**Major HI institution**	**Previously evaluated**	**Commercial product**	**Electronic interface**	**Non-physician providers**	**Periodic performance feedback**	**Co-intervention**	**Cluster randomized study**	**Baseline balanced or adjusted**	**Objective outcome or blinding**	**>80% follow up**	**Allocation concealed**
Javitt, 2005[74]	+	+	0	0	0	0	0	0	+	+	0	+	0	?	0	+	+	0	0	0	0	0	0	0	0	+	+	+	+
Javitt, 2008[75]	+	?	0	0	0	0	0	0	+	0	0	+	0	?	0	+	+	0	+	+	0	+	0	0	0	+	+	+	+
Judge, 2006[76]	0	+	+	+	+	0	0	0	+	+	0	+	0	0	+	+	+	0	0	0	+	+	0	0	+	0	+	+	+
Kattan, 2006[77]	+	+	+	0	0	0	0	0	+	+	0	+	0	+	0	+	+	0	0	?	0	0	0	0	0	+	+	+	+
Kenealy, 2005[78]	+	0	+	+	+	0	0	0	0	0	0	+	0	+	0	0	0	0	0	0	+	0	0	0	+	+	+	+	+
Krall, 2004[79]	+	+	+	+	+	0	0	+	0	0	0	+	0	+	0	+	0	+	+	0	+	+	0	0	+	+	+	+	+
Kroth, 2006[80]	+	+	+	+	0	+	0	0	0	0	+	+	0	+	0	+	0	+	0	+	+	+	0	0	+	0	+	+	+
Kuilboer, 2006[81]	0	+	+	+	+	0	0	+	+	+	0	+	0	+	0	+	+	0	+	0	+	0	0	0	+	+	+	+	+
Kuperman, 1999[82]	+	+	+	+	0	+	0	0	+	0	0	0	0	+	0	0	0	+	+	0	0	0	0	0	0	0	+	0	+
Lafata, 2007[83]	+	+	+	+	+	0	+	+	+	0	0	+	+	+	0	+	0	0	0	?	+	0	0	+	+	+	+	+	+
Lee, 2009[84]	+	+	+	+	+	+	0	0	+	0	+	+	0	+	0	+	+	0	0	0	+	+	0	0	+	+	+	+	0
Lesourd, 2002[85]	0	+	0	0	0	0	0	0	+	0	+	+	0	0	0	0	0	0	+	0	+	0	0	0	0	+	+	+	0
Lester, 2006[86,87]	+	+	0	0	0	+	+	+	+	+	0	+	+	+	0	+	0	+	0	?	+	0	0	0	0	+	+	+	+
Lewis, 1996[88]	0	+	+	0	0	0	0	0	0	0	0	0	0	0	+	0	0	0	0	?	0	0	0	0	0	+	+	+	0
Lo, 2009[89]	0	+	+	+	+	0	0	0	+	0	0	+	0	0	+	0	0	+	0	0	+	+	0	0	+	+	+	+	+
Lobach, 1997[90,91]	+	+	+	+	0	+	0	0	+	0	+	0	0	0	+	0	0	+	+	0	0	+	0	0	+	+	+	+	0
Locatelli, 2009[92]	0	+	0	+	0	0	0	0	+	0	?	+	0	?	0	+	0	0	0	?	+	0	0	0	+	+	+	+	0

		Primary Factor Set						Secondary Factor Set										Exploratory Factor Set							Methods				
Study	**CCDSS effect**	**Authors are the developers**	**Automatic in workflow**	**Feedback at time of care**	**Integrated with EMR or CPOE**	**Requires reason for ignoring**	**Gives advice to patients**	**Facilitates action**	**Evidence based advice**	**Critiquing function**	**Practitioners enters data**	**After year 2000**	**Advice directly to patients**	**Trained users**	**Local users consulted**	**Presents reasoning**	**Presents evidence**	**Major HI institution**	**Previously evaluated**	**Commercial product**	**Electronic interface**	**Non-physician providers**	**Periodic performance feedback**	**Co-intervention**	**Cluster randomized study**	**Baseline balanced or adjusted**	**Objective outcome or blinding**	**>80% follow up**	**Allocation concealed**
Lowensteyn, 1998[93]	+	+	0	0	0	0	+	0	+	0	0	0	0	0	0	+	0	0	+	0	0	0	0	0	+	+	+	0	0
Maclean, 2009[94,95]	+	+	+	0	0	0	+	0	+	0	0	+	+	+	0	+	0	0	+	+	0	+	+	+	+	+	+	+	0
Manotti, 2001[96]	+	+	0	+	0	0	+	0	+	0	+	+	0	0	0	+	0	0	+	?	+	0	0	0	0	+	+	0	0
Martens, 2007[97,98]	0	+	+	+	+	0	0	0	+	+	+	+	0	+	+	+	0	0	+	0	+	0	0	0	+	+	+	+	+
Martens, 2007c2[97,98]	0	+	+	+	+	0	0	0	+	+	+	+	0	+	+	+	0	0	+	0	+	0	0	0	+	+	+	+	+
Martin, 2004[99]	+	?	+	0	+	+	0	0	+	+	?	+	0	+	0	+	0	0	+	+	+	+	0	0	+	+	+	0	+
Matheny, 2004[100]	0	+	+	+	+	0	0	0	+	0	0	+	0	+	0	+	0	+	+	0	+	0	0	0	+	+	+	+	0
Mazzuca, 1990[101]	0	+	+	+	0	0	0	0	0	0	0	0	0	+	0	+	0	+	+	0	0	0	0	0	+	+	+	+	0
McAlister, 1986[102]	0	+	0	0	0	0	0	0	+	+	+	0	0	0	0	0	0	0	0	0	0	0	0	+	+	+	+	+	+
McCowan, 2001[103]	+	+	+	+	0	0	+	0	+	0	+	+	0	+	+	0	0	0	+	0	+	0	0	0	+	+	+	0	+
McDonald, 1976[104]	+	+	+	+	0	0	0	0	+	+	0	0	0	0	0	+	+	+	0	0	0	0	0	0	0	0	+	0	0
McDonald, 1980[105]	+	+	+	+	0	0	0	0	0	0	0	0	0	0	0	+	+	+	+	0	0	+	0	0	+	0	+	+	0
McDonald, 1984[106]	+	+	+	+	0	0	0	0	+	0	0	0	0	0	+	+	+	+	+	0	0	+	0	0	+	+	+	0	0
McDonald, 2005[107]	0	0	0	+	0	0	0	0	+	0	+	+	0	?	0	+	0	0	0	?	+	+	0	0	+	+	+	+	+
McPhee, 1989[108]	+	+	+	+	0	0	0	0	+	0	0	0	0	+	0	+	0	+	0	0	0	0	0	0	+	+	+	+	0

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	CCDSS effect	Authors are the developers	Automatic in workflow	Feedback at time of care	Integrated with EMR or CPOE	Requires reason for ignoring	Gives advice to patients	Facilitates action	Evidence based advice	Critiquing function	Practitioners enters data	After year 2000	Advice directly to patients	Trained users	Local users consulted	Presents reasoning	Presents evidence	Major HI institution	Previously evaluated	Commercial product	Electronic interface	Non-physician providers	Periodic performance feedback	Co-intervention	Cluster randomized study	Baseline balanced or adjusted	Objective outcome or blinding	>80% follow up	Allocation concealed
McPhee, 1991[109]	+	+	+	+	0	+	+	0	+	0	0	0	0	+	0	+	0	+	+	0	0	0	0	+	+	+	+	+	0
Meigs, 2003[110]	0	+	0	+	0	0	+	0	+	0	0	+	0	+	0	+	+	+	0	?	+	+	0	0	+	+	+	+	0
Mitchell, 2004[111]	0	+	0	0	+	0	0	0	+	0	0	+	0	0	0	0	0	0	0	0	+	0	+	+	+	+	+	0	+
Mitra, 2005[112]	+	?	0	+	0	+	0	0	0	0	?	+	0	?	0	0	0	0	+	+	+	0	0	0	0	+	+	+	0
Montgomery, 2000[113]	0	+	0	+	+	0	0	0	+	0	+	+	0	+	0	0	0	0	0	?	+	0	0	+	+	+	+	+	+
Murray, 2004[114]	0	+	+	+	+	0	0	+	+	0	0	+	0	+	+	+	0	+	+	0	+	+	0	0	+	+	+	0	0
Nilasena, 1995[115]	0	+	+	+	0	0	0	0	+	0	0	0	0	0	0	0	0	+	+	0	0	0	0	0	+	+	+	+	0
Ornstein, 1991[116]	+	0	+	+	0	+	+	+	+	0	0	0	0	0	0	0	0	0	+	?	0	0	0	0	+	+	+	+	0
Overhage, 1996[117]	0	+	+	+	+	0	0	+	+	0	0	0	0	0	+	+	0	+	+	0	+	0	0	0	+	+	+	+	+
Overhage, 1997[118]	+	+	+	+	+	0	0	+	+	0	+	0	0	0	0	+	0	+	+	0	+	0	0	0	+	+	+	0	+
Palen, 2006[119]	0	0	+	+	+	0	0	0	+	0	0	+	0	+	+	0	+	+	0	0	+	0	0	+	+	+	+	+	+
Paul, 2006[120]	+	+	0	+	0	0	0	0	0	0	0	+	0	0	0	+	0	0	+	0	+	0	0	0	+	+	+	+	+
Peck, 1973[121]	+	0	0	+	0	0	0	0	0	0	+	0	0	0	0	0	0	0	0	?	+	0	0	0	0	+	+	+	0
Peterson, 2007[122]	+	+	+	+	+	0	+	+	+	+	+	+	0	+	0	+	0	+	+	0	+	+	0	0	0	0	+	+	0
Peterson, 2008[123]	+	+	+	+	0	0	0	0	+	0	0	+	0	0	0	+	0	0	0	?	0	+	+	+	+	+	+	+	+
Petrucci, 1991[124]	+	0	0	+	0	0	0	0	0	0	?	0	0	+	0	0	0	0	+	0	+	+	0	0	+	+	+	0	0

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Study	**CCDSS effect**	**Authors are the developers**	**Automatic in workflow**	**Feedback at time of care**	**Integrated with EMR or CPOE**	**Requires reason for ignoring**	**Gives advice to patients**	**Facilitates action**	**Evidence based advice**	**Critiquing function**	**Practitioners enters data**	**After year 2000**	**Advice directly to patients**	**Trained users**	**Local users consulted**	**Presents reasoning**	**Presents evidence**	**Major HI institution**	**Previously evaluated**	**Commercial product**	**Electronic interface**	**Non-physician providers**	**Periodic performance feedback**	**Co-intervention**	**Cluster randomized study**	**Baseline balanced or adjusted**	**Objective outcome or blinding**	**>80% follow up**	**Allocation concealed**
Plaza, 2005[125]	+	+	0	+	0	0	0	0	+	0	+	+	0	+	0	0	0	0	0	0	+	0	0	+	+	+	+	+	+
Poels, 2009[126]	0	+	+	+	0	0	0	0	0	0	0	+	0	+	0	+	0	0	+	+	+	+	0	0	+	+	+	+	+
Poller, 1993[127]	0	0	0	+	0	0	0	0	0	0	+	0	0	0	0	0	0	0	+	0	+	0	0	0	0	+	+	+	0
Poller, 1998[128]	+	0	0	+	0	0	+	0	0	0	+	0	0	+	0	0	0	0	+	+	+	0	0	0	0	0	+	+	0
Poller, 2008[129-131]	+	?	0	+	0	0	0	0	0	0	?	+	0	+	0	0	0	0	+	+	+	0	0	0	0	+	+	+	0
Quinn, 2008[132]	+	+	+	0	0	0	+	0	0	+	0	+	+	+	0	0	0	0	0	+	0	0	0	0	0	+	+	+	0
Raebel, 2005[133]	+	+	+	0	0	0	+	0	+	0	?	+	0	?	+	0	+	+	0	0	0	+	0	0	0	+	+	+	+
Raebel, 2007a[134]	+	+	+	0	+	0	+	0	+	0	0	+	0	?	+	+	0	+	+	?	+	+	0	0	0	+	+	+	+
Raebel, 2007b[134]	+	+	+	0	+	+	0	0	+	+	0	+	0	?	+	0	0	+	0	0	+	+	0	0	0	+	+	+	+
Rodman, 1984[135]	+	+	0	+	0	0	0	0	+	0	+	0	0	+	0	0	0	0	+	?	+	+	0	0	0	+	+	0	+
Rogers, 1984[136-138]	+	+	+	+	0	0	0	0	0	0	?	0	0	0	+	0	0	0	0	0	0	0	0	0	0	+	+	0	0
Rood, 2005[139]	+	+	+	+	+	0	0	0	+	0	0	+	0	+	0	0	0	0	0	0	+	+	0	0	0	+	+	+	+
Rosser, 1991[140]	+	0	+	+	0	0	0	0	+	0	0	0	0	0	0	0	0	0	+	?	0	0	0	0	0	+	+	+	0
Rossi, 1997[141]	+	+	+	+	0	+	0	0	+	+	0	0	0	0	0	+	+	+	0	?	0	+	0	0	+	+	+	+	+
Rothschild, 2007[142]	+	+	+	+	+	+	0	+	+	+	+	+	0	0	+	+	+	+	0	?	+	0	0	0	+	0	+	+	+
Rotman, 1996[143]	0	0	+	+	+	0	0	0	+	+	+	0	0	+	0	0	0	+	+	0	+	0	0	0	+	+	+	+	0
Roukema, 2008[144]	+	+	+	+	0	0	0	0	0	0	0	+	0	+	0	0	0	0	+	0	+	+	0	0	0	+	+	+	0

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Rubenstein, 1995[145]	0	+	+	+	0	0	0	0	0	0	0	0	0	+	0	0	0	+	0	?	0	0	0	+	+	+	+	+	0
Saager, 2008[146]	+	?	0	+	0	0	0	0	+	0	?	+	0	?	0	0	0	+	+	+	+	+	0	0	0	+	+	+	0
Schriger, 2001[147]	0	0	+	+	0	0	0	0	+	0	0	+	0	+	0	0	0	0	+	+	0	0	0	0	0	+	+	+	+
Selker, 2002[148]	0	0	+	+	0	0	0	0	0	0	0	+	0	0	0	0	0	0	0	?	0	0	0	0	0	+	+	+	+
Sequist, 2005[149]	+	+	+	+	+	+	0	0	+	0	0	+	0	0	+	+	0	+	+	0	+	0	0	0	+	+	+	0	0
Sequist, 2009[150]	0	0	+	+	+	0	0	+	+	0	0	+	0	+	0	+	0	0	0	?	+	0	0	0	+	+	+	+	+
Stengel, 2004[151]	+	+	0	+	0	0	0	0	0	0	+	+	0	+	0	+	0	0	0	+	+	0	0	0	0	+	+	+	+
Sundaram, 2009[152]	0	+	+	+	+	0	0	+	+	0	0	+	0	+	0	+	+	+	0	0	+	+	+	0	+	+	+	+	0
Tamblyn, 2003[153]	+	+	+	+	+	0	0	0	0	+	0	+	0	+	+	+	0	0	0	?	+	0	0	0	+	+	+	+	0
Terrell, 2009[154]	+	+	+	+	+	+	0	+	+	+	+	+	0	0	0	+	0	+	0	?	+	0	0	0	+	+	+	+	+
Thomas, 1983[155]	0	+	0	+	+	0	0	0	0	0	?	0	0	0	0	0	0	0	0	0	+	0	0	0	0	0	+	0	0
Thomas, 2004[156]	+	+	+	+	+	0	+	0	0	0	?	+	0	?	+	+	0	0	+	0	+	0	0	0	0	+	+	+	+
Thomas, 2006[157]	+	+	+	0	0	0	0	0	0	+	0	+	0	?	0	+	0	0	+	0	+	0	+	0	+	+	+	+	0
Thomson, 2007[158]	+	+	0	+	0	0	+	0	+	0	+	+	+	+	0	+	0	0	0	0	+	0	0	0	0	+	+	+	+
Tierney, 1986[159]	+	+	+	+	0	0	0	+	+	0	0	0	0	+	0	+	0	+	+	0	0	0	+	0	+	0	+	+	0
Tierney, 1988[160]	+	+	+	+	+	0	0	0	0	0	+	0	0	+	+	0	0	+	+	0	+	0	0	0	0	0	+	+	+
Tierney, 1993[161]	0	+	+	+	+	0	0	0	0	+	0	0	0	+	0	+	0	+	+	0	+	0	0	0	+	+	+	+	+

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	CCDSS effect	Authors are the developers	Automatic in workflow	Feedback at time of care	Integrated with EMR or CPOE	Requires reason for ignoring	Gives advice to patients	Facilitates action	Evidence based advice	Critiquing function	Practitioners enters data	After year 2000	Advice directly to patients	Trained users	Local users consulted	Presents reasoning	Presents evidence	Major HI institution	Previously evaluated	Commercial product	Electronic interface	Non-physician providers	Periodic performance feedback	Co-intervention	Cluster randomized study	Baseline balanced or adjusted	Objective outcome or blinding	>80% follow up	Allocation concealed
Tierney, 2003[162]	0	+	+	+	+	0	0	+	+	0	+	+	0	+	+	+	+	+	+	0	+	+	0	0	+	+	+	+	+
Tierney, 2005[163]	0	+	+	+	+	0	0	+	+	0	+	+	0	+	+	+	+	+	+	0	+	+	0	0	+	+	+	+	+
Turner, 1994[164]	0	+	+	+	0	0	0	0	0	0	0	0	0	+	0	0	0	0	0	0	0	0	0	0	+	0	+	+	0
Unrod, 2007[165]	+	?	+	+	0	0	+	0	+	0	0	+	+	+	0	+	0	0	+	?	0	0	0	+	+	+	+	+	+
Vadher, 1997[166,167]	0	+	0	+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	+	0	+	+	0	0	0	+	+	+	0
van Wyk, 2008[168]	+	+	+	+	+	0	0	0	+	0	+	+	0	+	0	+	0	0	0	0	+	0	0	0	+	+	+	+	+
Verstappen, 2007[169]	+	+	0	0	0	0	0	0	+	+	+	+	0	?	0	0	0	0	0	0	+	0	0	+	0	+	+	0	+
Weir, 2003[170]	0	+	0	+	0	0	0	0	+	0	+	+	0	0	0	+	0	0	0	?	0	0	0	0	+	+	+	+	0
White, 1984[171]	+	+	+	+	0	0	0	0	0	0	0	0	0	+	0	0	0	+	+	0	0	0	0	0	0	+	+	0	0
White, 1987[172]	+	+	0	+	0	0	0	0	+	0	+	0	0	+	0	0	0	+	0	+	+	+	0	0	0	+	+	+	0
White, 1991[173]	0	0	0	0	0	0	0	0	0	0	+	0	0	0	0	0	0	0	0	+	+	0	0	0	0	+	+	+	0
Wilson, 2005[174]	0	+	0	+	0	0	0	0	+	0	+	+	0	+	+	0	0	0	0	0	+	0	0	+	+	+	+	0	0
Wolfenden, 2005[175]	+	+	0	+	0	0	+	0	+	0	0	+	+	+	+	0	0	0	0	?	+	+	+	0	0	+	+	+	+
Zanetti, 2003[176]	+	+	+	+	+	0	0	0	+	0	0	+	0	?	0	+	0	+	0	0	+	+	0	0	0	+	+	+	+

Table 24: Description of CCDSS Interventions

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Ahmad, 2009[1]	Unique	Screening for intimate partner violence in primary care.	CCDSS used to screen for intimate partner violence at a multiphysician hospital-affiliated, academic family practice clinic. The program administered a survey to patients and generated risk reports for physicians and recommendation sheets for patients.
Albisser, 2007[2]	Unique	Prediction of glycemia and risk for hypoglycemia in insulin-dependent patients in primary care.	CCDSS predicted individual patient glycemia and risks for hypoglycemia based on daily patient reports of self-measured blood glucose and life-style factors. Patients entered data into a database shared with providers through the Internet or by telephone, through an interactive voice response system. During remote, weekly, telemedical interventions, providers accessed the shared database using a graphical user interface to review the risks displayed on-screen.
Ansari, 2003[3]	Veterans Administration	Use of beta-blockers for patients with stable CHF receiving outpatient primary care at a Veterans Affairs Medical Centre from general internists, cardiologists, other internal medicine specialists, medical residents and nurse practitioners.	Providers received a list of heart failure patients who were candidates for β-blocker therapy. CCDSS generated computer alerts for these patients when providers accessed their EMRs during the first 2 visits after randomization. Letters were also sent to the patients advising them to discuss β-blocker therapy with their primary care provider. Providers also received education on β-blocker use in heart failure patients and had access to guidelines on β-blocker initiation and uptitration.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Apkon, 2005[4]	Unique	Screening, preventive care, and management of acute or chronic conditions for patients receiving routine ambulatory care in military facilities.	CCDSS (Problem-Knowledge Couplers) were incorporated into an EMR system and used patient and provider responses to structured questions (generally complaint-specific) and a medical knowledge database to provide suggestions for patient care, including diagnosis and treatment. Suggestions were based on national organization recommendations (e.g. AHRQ). Patients entered data into the system with assistance from a coordinator not associated with the study.
Augstein, 2007[5]	Unique	Management of diabetes in outpatients.	The Karlsburg Diabetes Management System (KADIS) used patient-specific data to produce a model of each patient's glucose metabolism and to simulate patient's therapeutic regime to optimize blood glucose. Practitioners also received continuous glucose monitoring system data.
Barnett, 1983[6]	Partners Healthcare	Follow-up of patients with newly-dentified elevated blood pressure readings in an acute care setting.	CCDSS embedded in electronic health record (COSTAR) sent reminders and encounter forms on which the target date of next visit could be recorded to physicians when patient with initial hypertension reading (diastolic measurement 100-120) was not followed by two repeat visits that included blood pressure measurement. Reminders continued until an appropriate follow-up occurred.
Bates, 1999[7]	Partners Healthcare	Reduction of redundant clinical laboratory tests in hospital inpatients.	CCDSS used data from an integrated hospital information system, including CPOE, to automatically generate reminders for physicians about potentially redundant laboratory tests when orders were entered. The CCDSS indicated if the test had recently been done or was pending, and provided results if available. The default response option was test cancellation; if physicians did not accept the reminder, they had to provide a reason from a menu selection.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Begg, 1989[8]	Christchurch	Individualized aminoglycoside dosing for inpatients receiving gentamicin or tobramycin.	CCDSS used pharmacokinetic analysis (one-compartment model) to predict individualized aminoglycoside doses and dose intervals needed to achieve a peak level at end of infusion of 8 mg/L and trough level of 1.5 mg/L.
Bertoni, 2009[9]	Unique	Guideline-consistent screening and treatment of dyslipidemia in primary care.	CCDSS ran on personal digital assistants (PDAs) given to providers (physicians, physician assistants, and nurse practitioners) in the intervention group. CCDSS generated a 1-page report summarizing patient data, low-density lipoprotein cholesterol (LDL-C) level goals, and treatment recommendations, based on National Cholesterol Education Program Third Adult Treatment Panel (ATP III) guidelines. Providers also received print copies of guidelines, education, and academic detailing.
Bogusevicius, 2002[10]	Unique	Diagnosis of acute small bowel obstruction in surgical inpatients.	CCDSS used a Bayesian posterior probability formula and 36 significant historical, clinical, and laboratory test results together with plain abdominal radiography to diagnose type of mechanical acute small bowel obstruction (complete or partial). Physicians determined appropriate treatment based on diagnosis.
Borbolla, 2007[11]	Unique	Surveillance and monitoring of blood pressure in outpatients and primary care patients with chronic disease (including hypertension, diabetes, CV disease, and lipid disorders).	CCDSS uses information from both EHRs and Appointment Scheduling Software to detect patients without blood pressure registries (condition I) or with high blood pressure measurements (condition II) and generate reminder lists for receptionists. Receptionists sent identified patients to assistants who assessed BP, weight, height, and risk factors, reminded patients to measure blood pressure weekly and follow treatment directions, and provided educational material. All data was entered in EHRs before physician appointments.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Bosworth, 2009[12]	Veterans Administration	Management of hypertension at a Veteran's affair primary care clinic.	CCDSS used EMR data to produce and display electronic patient-specific BP treatment recommendations, including recommendations to increase dose or use a preferred drug. Providers were also given quarterly audit and feedback profiling of their entire panel of patients with respect guideline-recommended BP targets and medication choices (CCDSS). Some CCDSS patients (CCDSS+BI) were randomized to also receive a nurse-delivered, telephone, behavioral intervention.
Brothers, 2004[13]	Veterans Administration	Surgical management of patients with peripheral arterial disease.	Markov surgical CCDSS predicted quality-adjusted life years for each of four therapeutic interventions and recommended optimal treatments. Analysis was based on patient data (e.g., utility assessment) and surgeon data (e.g., surgeon surgical results).
Burack, 1994[14]	Detroit HMO	Mammography for women in primary care in inner cities.	Full intervention included all components of the limited intervention plus a computerized mammography appointment reminder system operated by research staff. The system produced reminder forms, which were printed for physicians 1 month before mammography appointments and placed in patients' charts, postcard reminders for patients 1 week before scheduled mammography appointments, and an appointment rescheduling system for patients unable to keep their appointments.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Burack, 1996[15]	Detroit HMO	Screening mammography for women in two primary care sites.	CCDSS operated by research team and provided 1 of 3 randomized mammography reminder options, generated off-site and based on HMO administrative data and mammography history in women ≥ 39.5 years of age: a) brightly colored, single-page physician reminders, which were placed in charts of women within 1 month of mammography due date during 1st year of study for 20 participating physicians (2 primary care, 9 general internal medicine, and 9 gynecology); b) personalized patient reminder letters suggesting a physician visit mailed in 1st 4 months of study to patients due for mammography; or c) both physician and patient reminders. Mammography due date (unless recommended otherwise): 1y after last mammogram in women > 49 y; 2y after last mammogram in women 40-49 y; 1st day of study if no prior mammogram. Note: 1 of the 2 sites participated in authors 1994 trial
Burack, 1997[16,17]	Detroit HMO	Mammography reminders for women in primary care.	Full intervention included all components of the limited intervention plus computer-generated mammography appointment reminders. The system produced reminder forms, which were printed for physicians 1 month before mammography appointments and placed in patients' charts by the research team. Note: This is a follow-up study to the 1994 publication and includes some patients from the 1994 study.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Burack, 1998[17]	Detroit HMO	Pap smear screening in urban minority primary care.	CCDSS generated Pap reminders, triggered by patients' Pap due dates, in accordance with HMO policy. Physician reminders were placed within the medical records by the research team two months before due Pap due date and removed after the test had been performed. Patients were mailed a personalized letter containing the rationale concerning Pap smear as well as a brochure from the National cancer Institute with information about pelvic examination and the Pap smear procedure.
Burack, 2003[18]	Detroit HMO	Mammography and pap smear tests for HMO primary care patients.	CCDSS generated physician and patient reminders for mammography and pap smear tests based on HMO administrative data for women ≥ 40 years of age. For the 20 participating physicians (2 primary care, 9 general internal medicine, and 9 gynecology), the brightly-colored physician reminder was placed in patient charts within 2 month of procedure due dates. The personalized patient reminder letter was mailed. Procedure due dates were 1 year after last procedure unless recommended otherwise (e.g., 2y period for mammography in women 40-49 years). Note: 1 of the 2 sites participated in authors 1994 trial.
Burton, 1991[19]	Veterans Administration	Aminoglycoside dosing for inpatients with clinical infections.	CCDSS Bayesian-based algorithm used serum aminoglycoside level data to predict aminoglycoside dosage needed to achieve peak (gentamicin and tobramycin, 5-10 mg/L; amikacin, 20-30 mg/L) and trough (gentamicin and tobramicin, <2mg/L; amikacin, <5mg/L) target levels.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Cannon, 2000[20]	Veterans Administration	Screening and diagnosis of mood disorder in an outpatient mental health clinic.	CCDSS (CaseWalker) produced daily lists for providers (clinical psychologist, registered nurse, social worker, or addiction therapist) of patients eligible for mood disorder screening. When the provider opted to process the guideline-based reminder, the system provided an interactive checklist used for diagnosing major depressive disorder according to DSM-IV criteria. The system scored the criteria and produced a progress note.
Carter, 1987[21]	Veterans Administration	Warfarin initiation dosing for hospital inpatients.	CCDSS warfarin dosages (analog-computer method) or a single dosage prediction was made using a formula (linear-regression method) for adult inpatients.
Casner, 1993[22]	Unique	Theophylline dosing for inpatients with asthma or COPD.	Pharmacokinetic CCDSS (linear one-compartment model) was used to predict theophylline infusion rates to achieve a target serum level of 15 mg/L. The CCDSS was run on hand-held computers and adjusted dosing based on 2 early measures of serum theophylline levels.
Cavalcanti, 2009[23]	Unique	Glucose measurement and insulin dosing for glucose control for ICU patients	CCDSS (computer assisted insulin protocol: CAIP) used patient data including current infusion rate, glucose level and time between previous glucose measurements to make recommendations for intravenous insulin dosing and glucose monitoring to maintain a blood glucose between 100 and 130 mb/dL. The CCDSS was available via desktop or handheld computers for nursing staff at hospital based ICUs. The nurses input patient data and followed the recommendations provided. Recommendations were determined by the authors who created the algorithms.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Chambers, 1991[24]	Unique	Influenza vaccination in university-based primary care practice.	CCDSS-generated reminders identified patients eligible for influenza vaccination based on physician-determined rules and patient contact history (recorded by physicians and entered in the patient database after each visit by office staff). Reminders were always or sometimes included in clinical encounter forms placed on patient charts before visits.
Christakis, 2001[25]	Washington	Use of antibiotics for children with otitis media in a University outpatient teaching clinic.	Providers (residents, nurse practitioners, and attending physicians) used an electronic prescription writer. When antibiotics were ordered, the CCDSS displayed evidence-based data relating to the selected antibiotic, indication for treatment, and proposed duration of treatment. Full articles or article abstracts were available if requested.
Christian, 2008[26]	Unique	Setting and review of goals for health lifestyle counselling in obese patients with type 2 diabetes at community-based health centers.	CCDSS provided individualized feedback, based on patient self-reports, to increase motivation and readiness to make lifestyle changes, and identify barriers to change. Physicians received a companion report with patient-specific counselling recommendations.
Claes, 2005[27,28]	Unique	Oral anticoagulation therapy dosing for outpatients receiving anticoagulation for atrial fibrillation, deep-vein thrombosis, pulmonary embolism, mechanical prosthetic heart valve, antiphospholipid syndrome, or to prevent arterial	All physicians received multifaceted education. (Group 1) Dawn AC computer assisted advice provided dosing and visit recommendations based on patients' INR values. Advice was faxed by pathologist to physician the afternoon blood was drawn. Physicians could follow or ignore advice.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
		thromboembolism.	
Cleveringa, 2008[29-32]	Unique	Management of type 2 diabetes in primary care.	The Diabetes Care Protocol (DCP) included a CCDSS that contained a diagnostic and treatment algorithm based on the Dutch type 2 Diabetes guidelines that provided patient-specific treatment advice, a diabetes consultation with a practice nurse, a recall system and feedback every three months regarding the percentage of patients meeting the treatment targets.
Cobos, 2005[33]	Unique	Management of patients with hypercholesterolemia in primary care.	CCDSS generated recommendations for hypercholesterolemia therapy, follow-up visit frequency, and laboratory test ordering, based on patient data entered by physicians, including CV risk and LDL cholesterol goals. Recommendations were adapted from the European Society of Cardiology and ther societies for Hypercholesterolemia Management's (ESCHM) guidelines. Physicians could adopt or ignore the recommendations. The intervention included availability of patient education promotions such as tablecloths and refrigerator magnets.
Coe, 1977[34]	Unique	Treatment of hypertension in patients attending hypertension clinics.	CCDSS created a compact sequential record of all visits, including a graphic display of blood pressure and drugs in use and provided physicians with hypertension treatment recommendations based on an adaptive algorithm. Physicians were free to follow or reject these recommendations.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Davis, 2007[35]	Washington	Electronic prescribing for pediatric care (conditions included acute otitis media, allergic rhinitis, sinusitis, constipation, pharyngitis, croup, urticaria, and bronchiolitis) in outpatient and primary care settings.	Physicians used an electronic prescription writer on 1 of several computer work stations or wireless hand-held computers to prescribe antibiotics (including selection of indication and treatment duration). CCDSS then displayed evidence-based data relating to the prescription. Full articles or article abstracts were available if requested.
Demakis, 2000[36]	Veterans Administration	Screening, monitoring, and counselling in accordance with predefined standards of care in ambulatory care.	Residents received CCDSS-generated reminders relating to 13 prespecified standards of care in 2 ways. 1) On entering a patient name into a computer terminal in the examining room, applicable reminders were automatically displayed in bold letters. 2) Applicable reminders were printed on the standard patient health summary which is attached to patient charts at visits.
Derose, 2005[37]	Kaiser Permanente	Prescription of ACE-Is, ARBs, and statins in outpatients with diabetes mellitus or atherosclerotic vascular disease who are at risk for cardiovascular events.	CCDSS generated recommendations for CV medications (ACE-Is or statins) in patients at high-risk for CVD. A single-page patient summary sheet, including the recommendations, was faxed to physicians on the morning of a patient visit and attached to the patient's medical chart.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Dexter, 1998[38]	Regenstrief Institute/Wishard Memorial Hospital	Reminders to discuss and complete advanced directives in outpatients	Primary care physicians routinely received computer-generated reminders for patients with scheduled visits. These reminders recommend one or both of two types of advance directives for a total of 3 intervention groups: instruction directive and proxy directive reminders, instruction directive reminders only, and proxy directive reminders only.
Dexter, 2001[39]	Regenstrief Institute/Wishard Memorial Hospital	Preventive therapies in hospital inpatients.	CCDSS provided guideline-based reminders for preventative care procedures (pneumococcal vaccination, influenza vaccination, prophylactic entericoated aspirin for cardiovascular disease, and prophylactic subcutaneous heparin for thromboembolic events) to physicians and medical students.
Downs, 2006[40]	Unique	Investigation and management of dementia in primary care.	CCDSS was built into the EMR software for real-time, real case learning. It produced prompts for the investigation and management of dementia. (group 1).
Eccles, 2002[41]	Unique	Management of asthma and angina in adults in primary care.	CCDSS provided internally-developed evidence-based guidelines and care suggestions to general practitioners and practice nurses for management of adults with asthma or angina in primary care, based on electronic patient records. CCDSS was triggered when EMRs of eligible patients were opened or a relevant morbidity code was entered.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Emery, 2007[42]	Unique	Management of familial cancer risk in primary care.	All clinicians attended an education session on cancer genetics. The (Genetic Risk Assessment on the Internet with Decision Support [GRAIDS]) software was accessed by primary care clinicians for assessment and management of familial cancer risk. It provides a pedigree-drawing tool and patient-specific management advice regarding a family history of breast/ovarian and colorectal cancer, and provides additional numerical risk information about breast cancer.
Feldman, 2005[43]	Unknown Repeat 1	Nurse-coordinated management of patients with heart failure receiving home care in an urban setting.	CCDSS identified eligible patients based on initial assessment data and generated patient-specific e-mails highlighting 6 heart failure clinical recommendations for the patient's assigned nurse. The recommendations were chosen by an expert panel from HF clinical practice guidelines. The CCDSS was provided alone (basic intervention) or with provider prompts (laminated card on medication management and prompter card for physician-nurse communication), patient education material, and follow-up outreach from a clinical nurse specialist (augmented intervention).

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Feldstein, 2006a[44]	Kaiser Permanente	Laboratory monitoring at initiation of specific drug treatment (ACE/ARB, allopurinol, carbamazepine, diuretic, metformin, phenytoin, pioglitazone, potassium, statins serum, or terbinafine) in primary care.	3 intervention groups: EMR, automated voice message (AVM), and pharmacy team outreach (PTO). CCDSS initiated specific baseline laboratory monitoring reminders for patients with new prescriptions for any of 10 study medications or medication classes. Reminders were delivered at baseline and 9 to 10 days later for nonrespondents. EMR reminders were sent electronically to practitioners from the chair of patient safety committee. AVM reminders were delivered via recorded telephone messages to patients, prompting them to have preordered tests completed. PTO group reminders were delivered to patients by telephone from pharmacy nurses who indicated preordered tests could be completed at designated labs.
Feldstein, 2006b[44]	Kaiser Permanente	Guideline-recommended osteoporosis care for 50-89 year old women in primary care who experience a fracture.	Patient-specific advice, based on guidelines for osteoporosis management (ordering a BMD measurement and prescribing osteoporosis medication), was delivered via EMR to primary care physicians. Providers who had not ordered a BMD measurement or medication within 3 months of first reminder received a second reminder. In 1 of 2 intervention arms, patients also received a mailed reminder with educational materials.
Field, 2009[45]	Baycrest	Alerts for drug dosing and frequency, potentially inappropriate medications, and missing lab values for long-term care residents with renal insufficiency.	CCDSS embedded in the order-entry system component of the EMR provided alerts regarding maximum medication dosages and frequencies of administration, inappropriate medications, and missing creatinine clearance results or weights required to calculate appropriate dosages. Alerts were triggered and displayed on the order screen upon initial ordering of a medication for patients with renal insufficiency and could be ignored.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Fihn, 1994[46]	Veterans Administration	Frequency of warfarin monitoring in outpatients.	CCDSS generated recommendations for scheduling patient follow-up visits for physicians at the anticoagulation clinic. Recommendations were based on patient data and physician-selected PTR/INR targets. Physicians were allowed to disregard or modify the scheduling recommendations as well as reweight or discount a patient's past history of prothrombin time ratio.
Fiks, 2009[47]	Unique	Influenza vaccination for children and adolescents with asthma in primary care.	EHR-based alerts were generated for influenza vaccination in children 5-19 years of age, based on recommendations of the Advisory Committee on Immunization Practices. Bolded and highlighted alerts appeared at the top of the computer screen when an EHR encounter form was opened for an eligible patient, along with a link for ordering vaccine. An influenza education session, with information on the alert system, was provided by 2 expert primary care pediatricians.
Filippi, 2003[48]	Unique	Prescribing of anti-platelet medications to diabetic primary care patients with ≥1 additional cardiovascular risk factor.	CCDSS was integrated into a standard clinical practice management system, and displayed an electronic reminder when GPs opened medical records of diabetic patients ≥ 30 years of age. Physicians could deactivate the reminder. A letter summarizing practice guidelines, including the benefits of anti-platelet drugs in high-risk diabetics, was also sent to practitioners.
Fitzmaurice, 2000[49,50]	Birmingham	Warfarin maintenance for outpatients with a range of indications including atrial fibrillation, deep-vein thrombosis, pulmonary or systemic embolism, arterial disease, mechanical prosthetic	CCDSS recommended warfarin dosing based on patient INR and individual therapeutic range in nurse-led clinic. Recommendations could be overridden.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
		valves, transient ischemic attack or cerebrovascular accident, cardiomyopathy, mitral or aortic stenosis, coronary artery bypass, or heart valve replacement.	
Flanagan, 1999[51]	Unique	Tetanus, hepatitis, pneumococcal, measles, and influenza vaccination for adult primary care outpatients.	Computer used patient age and vaccine history to recommend or flag for consideration various vaccines. Physician could override recommendation or order vaccine or other vaccines.
Flottorp, 2002[52,53]	Flottorp 2002 repeat	Management of urinary tract infections (UTIs) in women in primary care.	CCDSS provided support and reminders during consultations for management of UTIs based on locally-developed guidelines. Guidelines recommended that most patients did not need antibiotics or lab tests for sore throats and antibiotics could generally be used without lab tests in non-pregnant women with UTIs. Patients could be given advice by telephone (except for patients with a UTI who had no previous UTIs). CCDSS was part of a broader intervention that also provided treatment recommendations and patient and provider education material electronically and in print, increased telephone consultation fees, and credited participants with points for continuing medical education.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Flottorp, 2002c2[52,53]	Flottorp 2002 repeat	Management of sore throat in primary care.	CCDSS provided support and reminders during consultations for management of sore throats based on locally-developed guidelines. Guidelines recommended that most patients did not need antibiotics or lab tests for sore throats and antibiotics could generally be used without lab tests in non-pregnant women with UTIs. Patients could be given advice by telephone (except for patients with a UTI who had no previous UTIs). CCDSS was part of a broader intervention that also provided treatment recommendations and patient and provider education material electronically and in print, increased telephone consultation fees, and credited participants with points for continuing medical education.
Fortuna, 2009[54]	Harvard Vanguard Medical Associates	Prescribing of heavily marketed hypnotic drugs (Ambien®, Lunesta®, Sonata®, and Rozerem®) in ambulatory primary and urgent care settings.	CCDSS triggered an alert when physicians, nurse practitioners, or physician assistants entered new prescription for any of the specified drugs in the EHR-integrated electronic prescribing system. Alerts were based on Harvard Vanguard Medical Associates Pharmaceutical and Therapeutics Committee guidelines and recommended alternative medications (zolpidem, trazodone), linked to evidence summaries, provided co-payment and prescribing information, and provided patient education materials about insomnia and sleep hygiene. Alerts were randomly combined with group education or no additional education.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Frame, 1994[55]	Unique	Cancer screening, cardiovascular disease preventive screening, identification of at-risk behavior, patient education, and vaccination in a rural primary care setting.	CCDSS generated physician reminders for 11 health maintenance procedures (including stool occult blood, Papanicolaou, breast examination, and mammogram tests; blood pressure, cholesterol, and body weight screening; and vaccination), based on health maintenance protocols and patient visit data recorded by physicians and entered by data entry staff. Reminders were placed at the front of patient charts annually and patients also received telephone reminders.
Gilutz, 2009[56]	Unique	Lipid monitoring and treatment of patients previously hospitalized with coronary artery disease (CAD) and followed up in primary care.	CCDSS collected data from 3 databases (discharge and diagnosis; laboratory; and pharmacy) and automatically generated reminders for management of dyslipidemia in patients with coronary artery disease based on National Cholesterol Education Program-III and Israeli guidelines. The patient-specific reminders were mailed to physicians and nurses at primary care clinics. The reminders indicated the patient's risk factors, lipoprotein values, and know medications and recommended lipid lowering drug treatment if appropriate. Physicians and nurses could accept or reject CCDSS recommendations.
Gonzalez, 1989[57]	Unique	Drug-dosing of aminophylline for acute asthma exacerbations in the ED.	CCDSS used a Bayesian pharmacokinetic model to estimate aminophylline loading and maintenance dosing for individual patients to achieve serum theophylline levels of 15 mg/L (12 mg/L if oral theophylline given within 6h).

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Goud, 2009[58,59]	Unique	Use of guideline-concordant care plans for the outpatient rehabilitation of cardiac patients.	The cardiac rehabilitation decision support system (CARDSS) used electronic patient records, needs assessment data (collected and entered into CARDSS by one of the multidisciplinary team), and guideline information (Netherlands Heart Foundation and Netherlands Society for Cardiology) to automatically formulate therapeutic recommendations for each of 4 treatments: exercise training, education therapy, lifestyle change therapy, and relaxation and stress management training. The team was responsible for final therapeutic decisions. CARDSS also provided information management services.
Gurwitz, 2008[60]	Unique	Prevention of drug-related adverse events in long-term care.	CPOE-embedded CCDSS displayed evidence-based alerts for potential serious drug interactions in a pop-up box when prescribers (physicians, nurse practitioners, or physician assistants) ordered targeted drugs. Alerts did not require specific action. Some alerts were unnecessary as the CCDSS could not distinguish different forms or strengths of drugs.
Hales, 1995[61]	Intermountain Healthcare	Computer system for hospital admission screening.	A personal CCDSS (Review Criteria) used data from the HELP hospital information system and data input by nurses to prescreen patients and identify unnecessary hospital admissions. Nurses consulted with physicians about unnecessary admissions. Physicians had the final decision.
Hamilton, 2004[62]	Unique	Evaluating labor progress and need for Cesarean sections.	CCDSS used data from clinical examination and obstetrical monitor to create a reference range of women in the same labor conditions. System assigned a percentile ranking of the labor progress of that particular mother against the reference population. This information was used by physicians to determine whether to deliver the baby by cesarean section.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Harari, 2008[63]	Unique	Primary preventative care and screening for functionally independent community dwelling geriatric patients in primary care.	Self-administered health risk appraisal questionnaire leading to computer-generated individualized feedback to participants and GPs as part of primary care practice IT systems. Patient feedback was a 20-35 page personalized report which included advice on modifying health risks, a personalized prevention checklist, sources of support, and information on when to see medical or social advice. Feedback to GPs included a 1 page clinical information summary.
Heidenreich, 2005[64]	Veterans Administration	Prescription of ACE inhibitors or appropriate alternative treatment for inpatients and outpatients with reduced ejection fraction.	CCDSS-generated reminders were automatically printed in echocardiography reports of patients with ejection fraction <40%. The reminder noted that ACE-inhibitors improve survival in patients with ejection fraction ≤40% and provided a goal dose for lisinopril and fosinopril.
Heidenreich, 2007[65]	Veterans Administration	Prescription of β-blockers for inpatients and outpatients with reduced LVEF.	CCDSS-generated reminders were automatically printed in echocardiography reports of patients with left ventricular ejection fraction (LVEF) <45%. The reminder noted that β-blockers improve survival in patients with reduced LVEF, provided initial doses for carvedilol and metoprolol, and recommended cardiology follow-up for patients with NYHA class III or IV symptoms.
Helder, 2008[66]	Unique	Management of incubator settings in neonatal ICU.	CCDSS used infant birth weight, gestational and postnatal ages, room air temperature, incubator design, and use of phototherapy to suggest incubator air temperature and humidity levels for premature, low birth weight neonates.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Hetlevik, 1999[67,68]	Unique	Diagnosis and management for hypertension, diabetes mellitus, and hypercholesterolemia in primary care.	CCDSS provided guidance for diagnosis, history taking, physical exams, tests, and treatment based on Norwegian clinical guidelines for patients with hypertension, diabetes, or hypercholesterolemia in primary care. The CCDSS was external to, but accessible from, the main computerized medical record system and was initiated by the physician at their discretion.
Hickling, 1989[69]	Christchurch	Pharmacokinetic dosage prediction for aminoglycosides based on estimated creatinine clearance in critically ill patients.	CCDSS pharmacokinetic model was used to predict early therapeutic dose and dose interval of aminoglycoside to achieve any desired peak and trough concentration in critically ill patients, based on 3 post-distributional plasma concentrations after the initial dose.
Hicks, 2008[70]	Partners Healthcare	Management of hypertension in a racially diverse group of adult patients in primary care.	CCDSS generated reminders of hypertension treatment recommendations and displayed them to clinicians at patient visits as part of main EMR screen. Paper version of reminders could be printed. 1 of the 7 clinics in the CCDSS group was also randomized to receive additional visits from a nurse practitioner.
Holbrook, 2009[71,72]	Unique	Tracking of diabetes monitoring in adults in primary care.	Intervention involved shared access by primary care providers and patients to a Web-based, color-coded diabetes tracker which interfaced with EMRS and an automated telephone reminder system for patients. The tracker system monitored 13 diabetes risk factors, their respective targets and gave brief, prioritized advice, based on national guidelines and a literature review.
Hurley, 1986[73]	Unique	Theophylline dosing for inpatients with acute air-flow obstruction.	Initial loading and infusion doses of theophylline were based on a nomogram; subsequent infusion and oral doses were adjusted based on CCDSS pharmacokinetic analysis of theophylline serum levels.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Javitt, 2005[74]	Unique	Management of patients when care deviates from recommended evidence-based practices in primary care.	CCDSS scanned administrative data and used > 1000 decision rules to detect potential deviations from recommended care practices. Deviations triggered recommendations and supporting literature, which were sent to treating physicians
Javitt, 2008[75]	Unique	Detecting and correcting medical errors in a health maintenance organization setting.	CCDSS collected information on patients > 11 years of age from billing records, lab feeds, and pharmacies, created a virtual EMR, and applied decision rules to produce patient-specific care considerations (CCs) if indicated. CCs fell into three categories (stop a drug, do a test, and add a drug) and included 3 severity levels. Each CC included issues of concern, suggested actions, and relevant literature citations. CCDSS-associated physicians reviewed each CC. Those that passed review were forwarded to patient physicians by telephone (level 1 severity) or to HMO nurses (level 2 or 3 severity), who reviewed them and could choose to fax them to patient's physicians.
Judge, 2006[76]	Baycrest	Safety of medication prescribing in a long-term care setting.	CCDSS displayed evidence-based real-time alerts in a pop-up box on the CPOE system when prescribers entered drug orders that posed a potential risk, required monitoring for adverse events, or needed action to prevent adverse events. The 41 potential alerts were informational and did not require specific actions.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Kattan, 2006[77]	Unique	5- to 11-year-old children with moderate to severe asthma receiving health care in hospital and community-based clinics and private practices in inner city urban areas.	Information was collected from each child's caretaker using a standardized computer-assisted interview every 2 months. The CCDSS used this information and national guidelines to generate a single-page feedback letter that was mailed directly to the child's primary care physician. The letter included a color photograph of the child, identifying information, details about medication use, asthma symptoms, and health service use, and a 1-sentence treatment recommendation to step up, step down, or don't change medications
Kenealy, 2005[78]	Unique	Screening for diabetes in outpatients attending a family practice.	Computer reminders - the computer showed a slowly flashing icon on the task bar when the doctor opened the file of an eligible patient. When the FP clicked on this icon, a brief message appeared suggesting screening for diabetes. The icon flashed each time the patient record was opened until the FP marked the task as ''complete.''
Krall, 2004[79]	Kaiser Permanente	Use of low dose aspirin therapy in primary care.	CCDSS automatically alerted clinicians (physicians, osteopaths, nurse practitioners, or physician assistants) in a pop-up window when certain components of EMRs of patients eligible for aspirin therapy were accessed. Eligible patients were identified by off-line data processing and flagged. Clinicians had to respond to the alert by indicating whether aspirin was prescribed or there was an exclusion/contraindication, or postpone the alert.
Kroth, 2006[80]	Regenstrief Institute/Wishard Memorial Hospital	Improve accuracy of temperature capture by nurses at the bedside of non-critical care hospital patients.	CCDSS identified patients' low temperature values and generated prompts for nurses to repeat the measurement. Nurses could take or override the recommendation.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Kuilboer, 2006[81]	Unique	Monitoring and treatment of asthma and COPD in daily practice in primary care.	CCDSS uses data in EHR and clinical guidelines to provide feedback on treatment to physicians for patients with asthma or COPD.
Kuperman, 1999[82]	Brigham	Detection of critical laboratory results in hospital inpatients.	The CCDSS was used to detect critical laboratory results for all medical and surgical inpatients and page the health provider that the results were ready. The intervention signaled single laboratory results, changes in laboratory results and detection of drug-laboratory interaction.
Lafata, 2007[83]	Unique	Osteoporosis screening for female outpatients aged 65-89 years in a primary care setting.	Patient-mailed reminders and physician prompts were used to improve osteoporosis screening among female patients aged 65-89 years in a primary care setting. Patient-mailed reminders consisted of initial and follow-up information about osteoporosis, patient risk factors, and screening information. Women receiving screening were also mailed information regarding injury prevention and tips. Physician prompts included a computerized EMR prompt and 3-6 month post screen mailing reminder.
Lee, 2009[84]	Unique	Diagnosis of obesity in acute and primary care.	Personal digital assistant (PDA) based CCDSS enabled adherence to obesity guidelines (undefined). Registered nurses completing advanced practice nurse training used the clinical log to enter patient data into the system, which generated decision support for screening, diagnosis and obesity care planning. The system also provided information on obesity based guidelines through a context specific link.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Lesourd, 2002[85]	Unique	Hormonal ovarian stimulation for infertile women in a teaching hospital.	CCDSS used data related to patient fertility, age, and current response to treatment to evaluate likely response of ovaries to FSH stimulation and suggest next steps for treatment, including adjustment of FHS regimen and monitoring, hCG induction of ovulation, or cycle cancellation. If patients did not become pregnant, the CCDSS suggested a protocol for a new treatment cycle based on data entered by clinicians.
Lester, 2006[86,87]	Partners Healthcare	Management of patients at high risk for hyperlipidemia in primary care.	CCDSS identified high-risk patients with elevated LDL cholesterol levels (> 100mg/dL 6 to 24 mo before study initiation) for cholesterol management and sent a single, customized email to physicians. Via emails, users could review patient information and, with a single click, generate a statin prescription, repeat fasting lipid profile, or decline change in medical management. CCDSS recommendations were based on evidence-based guidelines. Existing EHRs were automatically updated.
Lewis, 1996[88]	Unique	Assessment of common mental disorders in primary care.	Patients scoring >1 on the manually scored, self-report 12-item General Health Questionnaire (GHQ) completed a self-report computerized assessment for minor psychiatric disorders (PROQSY using the revised Clinical Interview Schedule [CIS-R]) within 7 days. Physicians reminded patients assigned to the PROQSY group to return within 1 week when the PROQSY assessment would be placed in patient charts.
Lo, 2009[89]	Partners Healthcare	Reminders for laboratory tests when prescribing new medications in primary care.	CCDSS generated a non-interruptive alert for missing baseline lab test when physicians ordered new medications on-line. Alerts displayed an on-screen warning in a reserved area of the screen. Providers did not have to act upon or acknowledge notifications to complete medication requests.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Lobach, 1997[90,91]	Unique	Primary care of diabetes mellitus for outpatients, including screening, vaccination, and monitoring of HbA1c.	Rule-based CCDSS used routinely collected data from individual patient EMRs to generate 8 personalized care recommendations for diabetes mellitus based on established guidelines. The recommendations were printed on 'encounter forms' used by clinicians to record consultation results. The program was invoked upon request for an encounter form.
Locatelli, 2009[92]	Unique	Management of chronic kidney disease (CKD) in nephrology units.	EMR – embedded CCDSS provided management advice, based on European Best Practices Group (EBPG) guidelines, for patients with CKD at nephrology units.
Lowensteyn, 1998[93]	Unique	Calculating coronary risk factor profile for outpatients.	Computerized system used mailed physician- and patient-reported data to produce an individualized coronary risk profile. The profile was mailed back to the physician and a copy given to the patient after physician interpretation.
Maclean, 2009[94,95]	Unique	Management of diabetes in primary care.	The Vermont Diabetes Information System (VDIS) is for internal or family medicine practice providers (physicians, nurse practitioners, and physician assistants) and their patients with diabetes. Providers and patients were faxed and mailed reminders, flow sheets and reports on the management of their diabetes. The system used laboratory results on hemoglobin A1C, cholesterol, creatinine and urine protein and sent reminders when testing was overdue, results were elevated and reported on general status of diabetes.
Manotti, 2001[96]	Unique	Oral anticoagulation therapy maintenance for outpatients receiving anticoagulation for VTE, non-ischemic heart disease, arterial	CCDSS (Program for Archive, Refertation, and Monitoring of Anticoagulated [PARMA] patients) used an algorithm based on patient demographic, clinical, and follow-up data, to suggest oral anticoagulant doses and follow-up appointments.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
		disease, heart-valve prosthesis, and other diagnoses.	
Martens, 2007[97,98]	Martens 2007 repeat	Reminders to change GP's prescribing behavior for antibiotics and asthma/COPD.	CCDSS generated reminders for antibiotic/asthma/COPD prescriptions. Reminders were based on evidence-based prescribing guidelines and patient data stored in the GPs medical information system; the system included a computerized prescription module.
Martens, 2007c2[97,98]	Martens 2007 repeat	Reminders to change GP's prescribing behavior for cholesterol lowering medications.	CCDSS generated reminders for statin prescriptions. Reminders were based on evidence-based prescribing guidelines and patient data stored in the GPs medical information system; the system included a computerized prescription module.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Martin, 2004[99]	Unique	Drug prescribing, disease management (for congestive heart failure, falls, nutrition, depression, and diabetes mellitus), and case management for patients ≥ 65 years of age in a health maintenance organization setting.	The Senior Life Management (SLM) program created an electronic health care management record, integrating lab test results and data from claims, prescriptions, and patient surveys and phone calls. CCDSS algorithms generated alerts for program staff about changes in patient clinical status and need for case management screening or service intervention. Program staff included a full-time medical director, an administrator, a social worker, a nurse care coordinator, and 2 non-clinical personal service representatives. The nurse care coordinator was responsible for communication with hospitals, home health care, and physicians (including primary care physicians). Based on published guidelines, the CCDSS also identified when any of 30 medications contraindicated for the elderly were prescribed, and faxed the prescribing physician to suggest reconsideration.
Matheny, 2004[100]	Partners Healthcare	Routine medication laboratory monitoring in primary care.	CCDSS-generated reminders for laboratory testing (potassium, creatinine, liver or thyroid function, and therapeutic drug levels) appeared on EHRs during visits of patients who were on an included medication for ≥ 365 days with no relevant laboratory test in the past 365 days.
Mazzuca, 1990[101]	Regenstrief Institute/Wishard Memorial Hospital	Management of non-insulin dependent diabetes mellitus in outpatients.	3 treatment groups: CCDSS patient-specific reminders + seminar (B); B + seminar-related clinical materials (C); and C + diabetes patient education service (D). CCDSS reminders were generated from the medical record system and placed in patients' clinic records whenever the computer detected history, physical, laboratory, or pharmacy data indicating that a seminar recommendation should be considered.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
McAlister, 1986[102]	Unique	Management of hypertension in primary care.	25 practices in each group. Physicians recorded patient-specific data, including information about medications and date of next scheduled visit, on encounter forms after visits with hypertensive patients. Forms were mailed to a central test centre, data entered into a CCDSS, and feedback generated for physicians including a chart of diastolic blood pressure, intra- and inter-practice blood pressure percentile rankings, and treatment suggestions based on the "stepped care" protocol. Appointment reminders were also mailed to patients and if a patient missed the appointment, a reminder letter was sent.
McCowan, 2001[103]	Unique	Management of asthma in primary care.	CCDSS (Asthma Crystal Byte) used current asthma guidelines and data entered during consultation to provide management recommendations and reminders. Patient-specific self-management plans and advice sheets could be printed for patients. Physicians and practice nurses evaluated the CCDSS.
McDonald, 1976[104]	Regenstrief Institute/Wishard Memorial Hospital	Use of laboratory tests to detect potential medication-related events in adults attending a diabetes clinic.	CCDSS generated protocol-driven recommendations for repeat laboratory tests and treatment changes based on EMR data, including past lab results, medications prescribed, and time since previous tests. Recommendations were printed as part of patient reports and placed at the front of patient charts before visits.
McDonald, 1980[105]	Regenstrief Institute/Wishard Memorial Hospital	Detection of clinical events that may need follow-up (e.g., ordering a test, changing a treatment) in outpatients.	Computerized medical record system used patient data and 410 physician-developed rules, mostly related to use and follow-up of medications, to produce reports for physicians at patient visits. Reports included patient medical history and management reminders for physicians, with or without literature references.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
McDonald, 1984[106]	Regenstrief Institute/Wishard Memorial Hospital	Cancer screening (stool occult blood, mammogram), counselling (weight reduction), immunization (influenza, pneumococcal) in addition to >1000 physician behavior rules for outpatients.	CCDSS used 1491 physician-developed rules to review data in electronic medical record and produce reminder messages for physicians. Printed reports of reminders were attached to patient charts before visits.
McDonald, 2005[107]	Unknown Repeat 1	Home care nurses' adherence to cancer pain assessment and management guidelines.	Home Care nurses assessed cancer pain and adhered to management guidelines by either responding to a patient-specific, one-time e-mail reminder highlighting six pain-specific clinical recommendations, or the basic intervention augmented by patient education material including a pocket card providing instruction on pain assessment with a 1-10 visual scale to measure patient pain, a prompter card to help improve nurse-physician communication, a self-care guide to review with patients, as well as clinical nurse specialist outreach.
McPhee, 1989[108]	University of California San Francisco	Outpatient screening (stool occult blood, digital rectal examination, sigmoidoscopy, pelvic examination, Papanicolaou test, breast examination, mammography).	3 x 2 study. 1 & 2. CCDSS generated reminders for cancer screening, based on audit and visit data entered by research staff. Research staff printed reminders and placed in patient charts prior to visits. Also randomized to provide education (mailed letter and pamphlets) to female patients on professional breast exams and mammography or not. 3 & 4. Manual audit and feedback with or without patient education. 5. Patient education alone.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
McPhee, 1991[109]	University of California San Francisco	Cancer screening (digital rectal examination, stool occult blood, sigmoidoscopy, pelvic examination, Papanicolaou test, breast examination, mammography) and preventive counselling (smoking assessment and counselling, dietary assessment and counselling).	Research staff audited files and entered pre-intervention data into the Cancer Prevention Reminder System (CPRS). Subsequent patient data were entered by office staff. The CPRS generated physician and patient reports indicating current patient status and cancer prevention activities due, and office staff printed and attached the reminders to patient charts prior to visits. Patient education material was also available.
Meigs, 2003[110]	Partners Healthcare	Management of type 2 diabetes in a hospital-based internal medicine clinic.	Web-based CCDSS (Diabetes Management Application [DMA]) had to be initiated by providers (included physicians and nurses). It displayed patient-specific information, including laboratory data, on a single screen in real time, allowing for decision support at time of patient contact. The CCDSS interactively linked to evidence-based treatment recommendations and other provider and patient care resources.
Mitchell, 2004[111]	Unique	Identification, treatment, and control of hypertension in elderly patients in primary care.	Audit only (A) practices received “rule of halves” feedback on patients 65 to 79 years of age, including numbers of patients with BP recorded, receiving antihypertensives, and with additional risk factors. Audit plus Strategic (S) practices received “rule of halves” feedback plus color-coded, patient-specific list ranked according to absolute risk of death from stroke in next 10 years for patients with a risk of ≥10%. (this is not very clear in article)

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Mitra, 2005[112]	Unique	Warfarin dosing in hospitalized rehabilitation patients.	CCDSS (Dawn AC) provided instructions to physicians for warfarin dosing and timing and frequency of blood draws to maintain a target INR of 2.0 to 3.0.
Montgomery, 2000[113]	Unique	Management of hypertension in primary care.	CCDSS used patient-specific data to calculate the patient's 5-year risk of a cardiovascular event (newly diagnosed angina, myocardial infarction, coronary heart disease, stroke, or transient ischemic attack) based on New Zealand guidelines for management of high blood pressure. Cardiovascular risk chart, which provides similar risk information, was also provided.
Murray, 2004[114]	Regenstrief Institute/Wishard Memorial Hospital	Treatment suggestions for patients with uncomplicated hypertension managed in a primary care internal medicine practice.	2x2 factorial trial (physician intervention, pharmacist intervention, intervention for physician and pharmacist, no intervention). Existing computer workstations were programmed to provide treatment suggestions to physicians and pharmacists based on evidence-based guidelines for hypertension management and data in patient EMRs. Physicians received CCDSS-generated care suggestions on paper medication lists at patient visits and on computer workstations when writing orders. Pharmacists received them electronically and could choose to fill the prescription or discuss suggestions with patients or physicians. On-line and printed treatment suggestions were available for all study groups.
Nilasena, 1995[115]	Veterans Administration	Screening (foot examination, retinal examination, renal tests), cardiovascular disease prevention, neurological assessment, and glycemic control in diabetic outpatients.	CCDSS generated reminder reports describing diabetes preventive-health status and listing upcoming or past due preventive health activities for patients with diabetes. Clinical alerts were issued for high-risk aspects of patient's profile. These were placed at the front of patients' charts.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Ornstein, 1991[116]	Unique	Use of preventive care services for adults in university-based family medicine clinic.	CCDSS generated reminders for five preventive care services (cholesterol measurement, fecal occult blood testing, mammography, pap smears, and tetanus immunization), based on the patients computerized medical records. Reminders were delivered to physicians at the time of patient visits (placed in patient record) (A), mailed to patients (B), or both (C). All practitioners received educational and administration services including quarterly audits of the percentage of patients in each physician's practice that were up to date on the 5 preventive services and a health maintenance flow sheet placed in all adult patients' medical records.
Overhage, 1996[117]	Regenstrief Institute/Wishard Memorial Hospital	Compliance with 22 US Preventive Services Task Force preventive care measures for hospital inpatients, including cancer screening, preventive screening and medications, diabetes care reminders, and vaccinations.	CCDSS was incorporated into the electronic medical record and order-entry system and used data from these sources to generate reminders for 22 preventive care measures. CCDSS ran overnight and provided reminders to physicians in 2 ways: printed at the top of daily patient reports, and displayed at the bottom of the workstation screen in red when physicians entered orders for patients. Physicians could accept or reject orders generated by the reminder program.
Overhage, 1997[118]	Regenstrief Institute/Wishard Memorial Hospital	Identification of corollary orders to prevent errors of omission for tests and treatments in hospital inpatients on a general medicine ward.	A rule-based reminder CCDSS determined corollary orders for 87 target orders and displayed these on-line to physicians using the computerized order entry system. Corollary orders could be accepted or rejected by physicians.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Palen, 2006[119]	Kaiser Permanente	Reminders for laboratory monitoring based on medication orders in primary care.	CCDSS was integrated with EMR and CPOE systems and generated nonintrusive alert messages recommending baseline and ongoing laboratory monitoring when physicians entered orders for selected medications.
Paul, 2006[120]	Unique	Management of antibiotic treatment in hospital inpatients.	By imputing variables that significantly influence the probability of pathogens, physicians used the TREAT CCDSS to assess the probability of infection, pathogen distribution, mortality and antibiotic coverage, and prescribe empirical antibiotic treatment for microbiologically documented infections.
Peck, 1973[121]	Unique	Digoxin dosing recommendations for outpatients with congestive heart failure.	CCDSS used patient data, including a measure of renal function, and physician objectives to provide a digoxin dosing scheme that would achieve a desired steady-state serum digoxin level. Physicians could choose to accept or reject the computer-provided dosing scheme.
Peterson, 2007[122]	Unique	Drug dosing for patients ≥ 65 years in a tertiary care academic health center.	CCDSS provided initial dose advice for sedatives, neuroleptics, anti-emetics, and skeletal muscle relaxants and discouraged prescription of contraindicated drugs for patients ≥65 years old in emergency rooms, intensive care units, and subacute units. Practitioners were not prevented from selecting higher doses than recommended.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Peterson, 2008[123]	Unique	Organization of care for primary care patients with type 2 diabetes.	CCDSS was embedded in an electronic registry and provided visit reminders, patient-specific physician alerts, a monthly progress review, and proactive support of patients at risk. This was part of a multicomponent intervention directed at patients, physicians, and clinic staff to: •Target high-risk patients •Develop Registry •Set-up Administration for staff changes •Notify patients of targets & appointments; give practitioners patient-specific reminders at visit. •Identify site coordinator •Identify local physician champion •Audit & feedback monthly •Track outcomes and activity •Educate staff
Petrucci, 1991[124]	Unique	Recommendations for nurse management of urinary incontinence in elderly patients in nursing homes.	CCDSS (Urological Nursing Information System [UNIS]) asked questions and provided recommendations for nurses caring for elderly, incontinent patients in nursing homes. Nurses had UNIS for 10 weeks with user support for either 2 (A) or 10 (B) weeks. Patient information was taken by nurses and recommendations were delivered via computers in nurses stations.
Plaza, 2005[125]	Unique	Management and cost-effectiveness of asthma management in primary care.	CCDSS provided recommendations to general practitioners and pneumologists for asthma treatment based on the Global Initiative for Asthma (GINA) guidelines GINA based intervention included information about chronic inflammatory illness, technique when using an inhaler, maximum expiratory flow (FEM), FEM self-monitoring techniques and GINA recommendations.
Poels, 2009[126]	Unique	Diagnosis and management of chronic airway diseases in primary care.	CCDSS (SpidaXpert®) used algorithms based on patient data, including FEV1, to present pre-and post-bronchodilator values of FEV1 and FEV1/FVC with 95% CIs. This was presented to practitioners graphically and with a textual interpretation.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Poller, 1993[127]	Unique	Warfarin maintenance and dosing for outpatients who started anticoagulation for VTE; arterial, heart, or cerebrovascular disease; lone atrial fibrillation; rheumatic heart disease; or another disorder.	2 CCDSSs: (A) Charles Anticoagulant Clinic Manager, and (B) Coventry program suggested warfarin doses or warfarin suspension and interval to next clinic visit based on patient INR values. Note: Hillingdon system was discontinued during study and is not included in this review.
Poller, 1998[128]	Unique	Anticoagulation therapy initiation and maintenance for outpatients.	CCDSS (DAWN AC) generated anticoagulant dosing schedules and time to next INR test using 2 main modules. The induction module was for dosing initial warfarin therapy over the first 4 days to reach a dose within 1 mg of eventual maintenance dose.The maintenance module adjusted the dose to reach and sustain the therapeutic range.
Poller, 2008[129-131]	Unique	Oral anticoagulant therapy initiation and maintenance in outpatients receiving anticoagulation for AF, DVT or PE, mechanical heart valves, or other indications.	1 of 2 CCDSSs (PARMA or DAWN AC) determined appropriate oral anticoagulant dosing (warfarin, acenocoumarol, or phenprocoumon) to maintain INR within target range and date for next patient visit. Both programs had separate algorithms for induction dosing vs maintenance or steady-state dosing. Computer decisions were reviewed by an experienced physician at each visit.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Quinn, 2008[132]	Unique	Diabetes management, with remote monitoring of blood glucose, in primary care patients with type 2 diabetes.	WellDoc System (WDS) is a cell phone-based diabetes management software system that incorporates real-time patient coaching based on blood glucose (BG) measures taken with a bluetooth-adapted One Touch Ultra™ BG meter. The WDS also provided feedback for practitioners, including patient BG logbooks with automated analysis and suggested medication changes. Patients were provided with cell phones and adapted BG meters.
Raebel, 2005[133]	Kaiser Permanente	Laboratory monitoring for initiating treatments with targeted medications in adult outpatients.	CCDSS automatically alerted pharmacists at a call center when targeted medications were ordered for patients who had not completed all pre-determined laboratory tests. Pharmacists reminded patients to obtain laboratory test(s) if previously ordered by physicians or ordered tests accordingly. Pharmacists notified prescribing clinicians of abnormal lab results in writing or by telephone (if urgent).
Raebel, 2007a[134]	Kaiser Permanente	Alerts for potentially inappropriate prescriptions in ambulatory patients ≥65 years of age.	CCDSS, as part of the Pharmacy Information Management System (PIMS) linked prescription and age information (electronically obtained from admin and EMR/CPOE databases) and automatically alerted pharmacists when a patient ≥65 years of age was newly prescribed 1 of 11 potentially inappropriate medications. The alert did not allow the prescription label to print until the pharmacist determined whether the prescription should be dispensed. If a safer drug was available, the pharmacist consulted with the prescribing physician by telephone. The targeted medication list was developed by pharmacists and physicians.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Raebel, 2007b[134]	Kaiser Permanente	Alerts for potentially inappropriate prescriptions (US FDA category D or X drugs) in ambulatory pregnant women ≥18 years of age.	CCDSS, as part of the Pharmacy Information Management System (PIMS), linked prescription and pregnancy information (electronically obtained from admin and EMR/CPOE databases) and automatically alerted pharmacists when a pregnant patient was prescribed US FDA category D or X medications. The CCDSS did not allow the prescription label to print until the pharmacist determined whether the prescription should be dispensed. Pharmacists consulted with prescribing physicians by telephone to develop plan to resolve alerts.
Rodman, 1984[135]	Unique	Lidocaine dosing for patients in ICUs or coronary care units.	CCDSS recommended lidocaine infusion regimen based on patient's age, sex, height, weight, cardiac index, past lidocaine therapy, and desired lidocaine concentration for ICU and coronary care unit patients.
Rogers, 1984[136-138]	Unique	Management of hypertension, obesity and renal disease in outpatients.	CCDSS summarized patient demographics, status, and health records and made suggestions based on deficiencies in patient's care. The 8-page patient medical summary (Northwestern University Computerized Medical Record Summary System, NUCRSS) was available to the physician at each visit.
Rood, 2005[139]	Unique	Management of glucose regulation in critically ill inpatients.	CCDSS monitored the interval between glucose measurements and made guideline-based recommendations for timing between glucose measurements and administration of insulin doses in ICU patients. Recommendations were displayed electronically in pop-up windows when patient records were activated.
Rosser, 1991[140]	Unique	Cancer screening (Papanicolaou test), blood pressure measurement, assessment of smoking	CCDSS generated paper reminders to physicians, or generated letter reminders sent to patients or telephone reminders to patients when the patient was due for any of five screening procedures.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
		status, and vaccination (influenza, tetanus toxoid) in outpatients.	
Rossi, 1997[141]	Veterans Administration	Treatment of hypertension in patients treated with calcium channel blockers in primary care.	CCDSS automatically generated reminders which were placed in patient charts by the clinic pharmacist and attached to the medication refill forms given to primary care providers. The reminder highlighted the prescription and offered alternative drugs and doses to calcium channel blockers.
Rothschild, 2007[142]	Partners Healthcare	Decision support for non-emergent inpatient transfusion orders.	CCDSS suggested new orders if blood products (red blood cells, platelets, and fresh frozen plasma) ordered through CPOE were inconsistent with guidelines. Recommendations could be overridden.
Rotman, 1996[143]	Veterans Administration	Recommendations for less expensive drug substitutes when available, and alerts for drug interactions in outpatients.	CCDSS was accessed through a physician workstation, included a drug ordering module, and provided alerts to physicians for suggested drug substitutions to reduce costs and prevent adverse drug interactions. It used an internal knowledge base and data uploaded from the hospital information system and allowed users to track medications, problems, and laboratory values in a graphical format that displayed changes over time.
Roukema, 2008[144]	Unique	Diagnostic management for children with fever without apparent source in ED.	CCDSS used prediction rules to generate a serious bacterial infection risk score for children < 17 years presenting to the ED with a fever without apparent source. For patients with high-risk: Users of CCDSS were given advice to “order laboratory tests” for patients randomized to CCDSS intervention.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Rubenstein, 1995[145]	Veterans Administration	Computer-generated feedback designed to identify and suggest management for functional deficits in primary care.	After physicians attended a ½ hour education session, they started to receive CCDSS-generated patient-specific functional status reports, which included bar graphs, summarized functional deficits and assessment findings, and provided problem-specific resource and management suggestions. The reports were attached to the front of each new patient's medical record. Physicians received a booster education session after 3 months, and patients were mailed post-intervention functional status surveys 6 months after their enrollment.
Saager, 2008[146]	Washington	Glucose management in diabetic patients in cardiothoracic ICUs.	CCDSS (EndoTool Glucose Management System) recommended insulin dose, glucose determination frequency, and a 50% dextrose dose (when appropriate) for hypoglycemia, based on blood glucose readings from a point-of-care device. It uses the previous 4 dose responses to regulate the dosing relationship, and is designed to be used by trained health care professionals.
Schriger, 2001[147]	Unique	Psychiatric interview and diagnosis in the emergency department.	Eligible patients completed a self-administered computer interview (Primary Care Evaluation of Mental Disorders [PRIME-MD]) in the waiting room. PRIME-MD screened for 7 domains: mood disorder, anxiety disorder, alcohol abuse, eating disorder, obsessive compulsive disorder (OCD), phobia, and somatization disorder. When screening was positive for a particular domain, the CCDSS presented additional questions to establish or reject diagnoses within that domain. A report that indicated presence or absence of each psychiatric diagnosis considered was attached to the front of the physician section of the medical record.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Selker, 2002[148]	Unique	Management of thrombolytic and overall reperfusion therapy in acute myocardial infarction.	Thrombolytic Predictive Instrument (TPI) is an electrocardiograph-based CCDSS. When there is an ST segment elevation on the ECG, TPI prints on ECG text header its prediction of five key outcomes of thrombolytic therapy for acute myocardial infarction patients.
Sequist, 2005[149]	Partners Healthcare	Management of diabetes and coronary artery disease in primary care.	When clinicians opened patient charts within EMRs, the CCDSS determined whether the patient had received care in accordance with the recommended evidence-based practice guidelines for care of diabetes or coronary artery disease. Appropriate reminders were then displayed on the patient summary screen of the EMR. Physicians could also choose to have the reminders printed. All physicians received electronic reminders for overdue preventive care services.
Sequist, 2009[150]	Harvard Vanguard Medical Associates	Screening for colorectal cancer in primary care.	EMR-embedded reminders to physicians and patients for colorectal cancer screening. (Physician Intervention) Physicians received EMR-embedded colorectal cancer screening reminders during patient visits. Physicians could electronically order screening examinations through the reminder. (Patient Intervention) Patients received a mailing which included a letter, an educational pamphlet, a fecal occult blood test (FOBT) kit and phone number to call and schedule a flexible sigmoidoscopy or colonoscopy. (Randomization strategy) Physicians were randomized to receive the Physician Intervention or not. Each physician's patients were then randomized to receive the Patient Intervention or not. Thus, for each patient, either, both, or neither type of intervention could be delivered.
Stengel, 2004[151]	Unique	Diagnosis in patients admitted to orthopedic ward. Purpose of study is to compare	Handheld CCDSS guides entry of patient signs and symptoms and offers clinically reasonable diagnoses for physician selection in orthopedic hospital ward. Data are transferred to desktop unit daily.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
		thoroughness of documentation of clinical findings.	
Sundaram, 2009[152]	Veterans Administration	Risk assessment and screening for HIV in primary care.	EMR-embedded CCDSS used patient data to generate reminders for HIV risk assessments and HIV testing. Physicians and registered nurse practitioners received electronic reminders to assess HIV risk or test for HIV when they were in the patient medical record system or paper reminders on laboratory result and medication print outs. The reminders included a link to the CDC guideline for HIV testing and counselling. Electronic reminders appeared each time a patient's medical record was opened until the practitioner completed an interactive dialog box. Providers also received electronic and paper feedback on their actions to resolve reminders every two months. All providers received an educational session on the importance of HIV screening and watched a demonstration of the CCDSS reminders

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Tamblyn, 2003[153]	Unique	Inappropriate drug prescribing for elderly patients (>65 years of age) in primary care.	Physicians were given a computer, printer, health-record software that documented patient health problems and medications, and dial-up internet access. Trained personnel abstracted patient health problems from physician charts using standardized forms and entered data in the CCDSS. Physicians accessed drug prescribing data for patients through a dedicated computer link to the drug insurance program, and the CCDSS generated alerts for physicians when any of 159 clinically relevant prescribing problems were identified. Alerts identified the problem, possible consequences, and suggested alternative therapies. They were displayed when an electronic chart was opened, health or prescription data were recorded in the chart, or prescription data were downloaded from the insurance provider.
Terrell, 2009[154]	Regenstrief Institute/Wishard Memorial Hospital	Reduce prescription of potentially inappropriate medications to older adults discharged from EDs.	CCDSS data was only provided when a physician in the intervention group attempted to prescribe one of the nine targeted potentially inappropriate medications in patients aged 65 and older who was being discharged from the ED. The system provides either an option to order a recommended alternative therapy or to reject the recommendation. When the latter option was chosen, a second menu was displayed to query the most important reason for rejecting the CCDSS recommendation.
Thomas, 1983[155]	Unique	Modification of physician actions at control points (diagnostic test ordering, prescribing treatment, early clinical problem recognition) in ambulatory care	CCDSS (Automated Medical Record Audit System [AMRAS]) updated medical records using data entered by research staff, performed audits based on patient data and protocol-based algorithms, and generated recommendations which were printed in patient reports for physicians before each clinic session. Most recommendations related to general medicine and preventive care.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
		process in primary care.	
Thomas, 2004[156]	Unique	Identification and management of patients with anxiety and depression in outpatients.	Patient specific computerized guidelines along with a computer generated report of psychiatric symptoms, probable psychiatric diagnosis, social impairment, major life events, likely suicide risk, and patient-specific treatment recommendations were delivered to physicians.
Thomas, 2006[157]	Unique	Laboratory test orders in primary care.	2 intervention groups. CCDSS identified requests for 9 targeted laboratory tests and automatically added locally-developed brief educational reminder messages to printed and electronic test result reports. The reminders were randomly combined with a quarterly feedback booklet that graphically presented practice-level data on ordering rates for the targeted laboratory tests compared with regional rates, and included educational messages beside each graph. Booklets were updated and mailed to family practitioners every 3 months.
Thomson, 2007[158]	Unique	Treatment decisions about warfarin or aspirin therapy for patients with atrial fibrillation in primary care.	CCDSS presented information to patients about warfarin treatment, including individualized information about benefits and potential harms. The CCDSS risk communication screen, presented information graphically and numerically, and was followed by a shared decision-making component for patients and practitioners.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Tierney, 1986[159]	Regenstrief Institute/Wishard Memorial Hospital	Cancer screening (stool occult blood, Papinicolaou test, mammogram), pneumococcal vaccination, tuberculosis skin test, use of antidepressants, metronidazole for trichomonas, cardiovascular medications (β-blockers, long-acting nitrates, aspirin), prophylactic antacids, and calcium supplements for outpatients.	13 identified preventive care protocols were randomly divided into two groups (A and B). CCDSS (as part of the Regenstrief Medical Record System) identified eligible patients who had not received protocol care and generated monthly feedback reports for physicians indicating any actions that should be taken for each patient. Physicians received reports on either A or B protocols and had to respond with 1 of 5 options (including 'not applicable') to each item on the report. Physicians were also randomized to receive CCDSS-generated reminders for Group A or B protocols at patient visits. The reminders were generated the night before visits and placed in the patient clinic charts.
Tierney, 1988[160]	Regenstrief Institute/Wishard Memorial Hospital	Discourages ordering of unnecessary diagnostic tests in primary care.	CCDSS embedded in CPOE system electronically displayed likelihood of abnormal test results for 8 outpatient tests, based on locally-developed statistical equations, EMRs, and data entered by physicians ordering tests. Physicians could cancel tests if desired.
Tierney, 1993[161]	Regenstrief Institute/Wishard Memorial Hospital	Alerts for drug allergies and drug interactions, and options for cost-effective testing in inpatients.	CCDSS embedded in computerized order entry system displayed item charges, listed the most cost-effective tests and test intervals, and indicated drug allergies and potential interactions, based on data from patient electronic medical records, hospital billing system, and entered by physicians ordering tests.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Tierney, 2003[162]	Regenstrief Institute/Wishard Memorial Hospital	Management of heart disease in primary care.	3 intervention groups: physician, pharmacist, or both. All physicians used an EMR system with computerized order entry. Physician intervention: CCDSS generated cardiac care suggestions approved by local cardiologists and general internists and based on EMR data, data entered by physicians after visits, and evidence-based guidelines (Agency for Health Care Policy and Research). Suggestions were printed on the patient encounter form and displayed on physician workstations. Physicians could follow or disregard the suggestions. Pharmacist intervention: CCDSS (Pharmacist Intervention Recording System [PIRS] printed a note (rather than bottle labels) when prescriptions were filled for eligible patients, directed pharmacists to care suggestions in PIRS and provided 3 options for action: fill the prescription as usual, discuss care suggestions with the patient, or contact the physician by telephone or PIRS-facilitated e-mail which would be displayed for the physician at next workstation log in.
Tierney, 2005[163]	Regenstrief Institute/Wishard Memorial Hospital	Management of asthma and COPD in adults in primary care.	Existing computer workstations were programmed to provide care suggestions to physicians and pharmacists based on evidence-based guidelines for asthma and COPD management and data in patient EMRs. Physicians received CCDSS-generated care suggestions on paper medication lists at patient visits and on computer workstations when writing orders. Pharmacists received them electronically and could choose to do nothing or discuss suggestions with patients or physicians. They received the same educational material as the control group.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Turner, 1994[164]	Unique	Cancer screening (stool occult blood, Papanicolaou test, breast examination, mammogram) and influenza vaccination in primary care.	Physicians in the computer group received a computer with a 20-megabyte hard disk, and a CCDSS written in spreadsheet data software which generated a prompt sheet for health care activities: influenza vaccination, stool occult blood tests, pap smears, physician-performed breast exams, and mammograms. The prompt sheet was placed in front of patients' charts.
Unrod, 2007[165]	Unique	Computerized intervention designed to increase smoking cessation counselling and quit rates within a primary care setting.	CCDSS used to increase physician smoking cessation counselling using a patient-tailored expert-system report. Patients were classified by level of readiness to quit, nicotine dependence level, measurement on Pros and Cons smoking association scale, self-efficacy scale, patient smoking/cessation history, and by existing medical conditions.
Vadher, 1997[166,167]	Unique	Warfarin initiation and maintenance for inpatients and outpatients with DVT, PE or SE, AF, valve disease, or mural thrombus, or who needed prophylaxis.	CCDSS used simple proportional-derivative control methods to provide recommendations for initial and maintenance dosing of oral anticoagulation. Maintenance dosing was based on previous dose and difference between target and actual INR. Physicians could choose to accept or reject dosing recommendations, and also received guidelines on anticoagulation.
van Wyk, 2008[168]	Unique	Screening and treatment of dyslipidemia in primary care.	There are 2 versions of the CCDSS: on-demand and automatic alerting, both integrated with an EHR and based on guidelines from the Dutch College of General Practitioners. The CCDSS generated patient-specific recommendations for preventative care and displayed them on an interactive patient overview screen in the EHR. With the on-demand CCDSS, users had to actively initiate the overview screen. With the automatic alerting CCDSS, recommendations were automatically displayed to users.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Verstappen, 2007[169]	Unique	Adjustment of methotrexate dosing to achieve remission in early rheumatoid arthritis.	CCDSS used information on swollen joint count, tender joint count, erythrocyte sedimentation rate, and visual analogue scale for general well-being to determine whether criteria of response to treatment was met. Changes to treatment were made based on response to treatment according to algorithm. Patients attended outpatient clinic every 4 weeks.
Weir, 2003[170]	Unique	Prescribing for antiplatets and anticoagulants following acute ischemic stroke or TIA in in- and out-patients.	CCDSS used patient's history and clinical findings to estimate the risk of recurrent ischemic stroke, hemorrhagic stroke, MI, or other ischemic or hemorrhagic complications associated with each of 6 possible antiplatelet or anticoagulant therapy. The estimated event rates were provided in a graph of total ischemic event risk and total hemorrhagic event risk which was placed in the patient record for medical staff.
White, 1984[171]	Intermountain Healthcare	Monitoring signs and risk factors for digoxin intoxication in inpatients.	CCDSS (Health Evaluation through Logical Processing [HELP]) accessed a clinical patient database nightly and used expert-determined decision criteria to identify concerns (drug interactions or signs of potential digoxin intoxication) for patients taking digoxin. Concerns were summarized in alert reports placed in patient charts.
White, 1987[172]	Veterans Administration	Warfarin initiation and dosing for patients hospitalized with DVT, cerebrovascular accident, transient ischemic attack, PE, or AF.	CCDSS (Warfcalc) used Bayesian forecasting methods to determine appropriate warfarin dosing based on patient data including response to warfarin therapy. Warfarin therapy was managed by a physician or pharmacist familiar with the CCDSS but who were not experts in management of warfarin therapy. Primary physicians selected target prothrombin ratio.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
White, 1991[173]	Unique	Warfarin maintenance and dosing for outpatients on long-term warfarin therapy.	CCDSS used Bayesian forecasting methods, pharmacokinetic and pharmacodynamics modeling, and patient data to predict steady-state warfarin dosing needed to reach a target prothrombin time. Nurse-specialists entered warfarin doses and steady-state prothrombin times into the CCDSS.
Wilson, 2005[174]	Unique	Computer support system for breast cancer genetic risk in a primary care setting.	The CCDSS CD ROM provided a referral guide based on the Scottish referral guidelines for breast, ovarian and colorectal cancer. It also included background information on these cancers, locally relevant information sheets, downloadable data from the referral guide, web links for practitioners and patients, and an e-mail link to contact the Cancer Genetics Service for advice.
Wolfenden, 2005[175]	Unique	Improving smoking cessation in patients attending a noncardiac preoperative clinic.	CCDSS was part of a multi-faceted intervention. CCDSS provided interactive behavioral smoking cessation counselling; written prompts for nurses (n=5) and anesthetists (n=13) to provide brief cessation advice, preoperative nicotine replacement therapy (NRT) if smoking >10 cigarettes/d, and a prescription for postoperative NRT if smoking >10 cigarettes/d and expect >1d on ward; and tailored self-help material based on patient responses to cessation information provided by the CCDSS. Other elements of the intervention included: identifying opinion leaders, staff involvement in intervention development (establishing consensus), nurse and anesthetist staff training, and monitoring and feedback of care provision.

Study	Location/institution for clustered analysis	CCDSS indication	CCDSS intervention
Zanetti, 2003[176]	Partners Healthcare	Redosing of prophylactic antibiotics during prolonged cardiac surgery.	CCDSS provided an automated audible alarm and visual intraoperative alert on the operating room computer console for physicians to redose prophylactic antibiotics during cardiac surgery at 225 minutes after administration of preoperative antibiotics. A reply was required to clear the display. If planned redosing was indicated, a new alarm and alert was issued after 30 minutes and the circulating nurse was required to indicate whether a follow-up dose of antibiotics had been administered.

Table 25: Outcomes of CCDSS Comparisons

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
Ahmad, 2009[1]	primary outcomes 1. Opportunity to discuss the possibility of the patient being at risk for IPV in % (n/N), adjusted RR (95% CI) 2. detection of IPV when the patient identified that risk as being present and recent. IPV in % (n/N), adjusted RR (95% CI) secondary outcomes 3. physician assessment of patient safety (n/N) 4. provision of appropriate referrals 5. advice for follow-up appointment	1. 35%(48/139) vs 24% (34/141); 1.4 (1.1 to 1.9) 2. 18%(25/139) vs 9% (12/141); 2.0 (0.9 to 4.1) 3. 9/25 vs 1/12 4. 3/25 vs 1/12 5. 20/25 vs. 8/12	...	...	1	...
Albisser, 2007[2]	Secondary 1. Mean (SD) daily insulin (U/day) over 2 months. Not specified 2. Mean (SD) number of days to change hypoglycemia episodes/wk (corresponds with patient outcome #1). 3. Range of dosing adjustments over 2 months (U/day).	1. 37 (16) vs 43 (16), p<0.01. 2. 46 (16) vs 61, p=NS 3. -27 to 0 vs -4 to 16, p=NS	Primary 1. Mean (SD) hypoglycemia episodes/wk over 2 months. Secondary 2. Mean (SD) glycated hemoglobin A1c over 2 months. 3. Pre-meal glycemia shown for each group in figure 3 of article.	1. 0.2 (0.3) vs 2.0 (0.9), p<0.0001. (N rand = 11 vs 11; in study group, most <=1 episode/month) 2. 7.5% (0.9) vs 7.6% (1.3), p = NS 3. No data reported.	1	1
Ansari, 2003[3]	Primary outcomes. 1. Proportion of patients who were	CCDSS vs Provider Education only vs Nurse	1 y follow-up. Prespecified.	CCDSS vs Provider Education only vs	0	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	initiated or uptitrated and maintained on β-blockers at 1 y, n/N (%) 2. Proportion of β-blocker-naive patients who were initiated on β-blockers at 1 y, n/N (%) 3. Proportion of patients on target β-blocker doses at 1 y, n/N (%). Prespecified. 4. Mean time from initiation to achievement of target dose of β-blockers (for patients who reached the target dose. Note: target doses were carvedilol 50 mg, metoprolol tartrate 100mg, or atenolol 100 mg.	Facilitator (NF) 1.10/64 (16%) vs 14/51 (27%) vs 36/54 (67%)p<0.001 for NF vs other 2 groups; NS for CCDSS vs provider education. 2. 5/41 (12%) vs 10/35 (29%) vs 22/36 (61%), p<0.001 for NF vs other 2 groups; NS for CCDSS vs provider education. 3. 1/64 (2%) vs 5/51 (10%) vs 23/54 (43%), p<0.001 for NF vs other 2 groups; P=NR for CCDSS vs provider education. [If in-house calculations are used for primary outcomes, CCDSS vs Education, p=0.048 uncorrected chi-square, p=0.12 Yates-corrected chi-square, calculated by RA] 4. 9.3 mo vs 5.9 mo vs 8.5 mo, p<0.001 for NF vs other 2 groups.	1. Number of patients hospitalized or with ED visits, n/N (%). 2. Number of patients hospitalized for chronic heart failure, n/N (%). 3. Median hospitalization or ER visits per patient, n. 4. Deaths, n/N (%).	Nurse Facilitator 1. 29/64 (45%) vs 25/51 (49%) vs 23/54 (43%), p=0.81 2. 9/64 (14%) vs 5/51 (10%) vs 5/54 (9%), p=0.66 3. 1/64 (2%) vs 1/51 (2%) vs 2/54 (4%), p=0.14 4. 1/64 (2%) vs 7/51 (14%) vs 5/54 (9%), p=0.05		
Apkon, 2005[4]	Primary (and components of primary) 1. Healthcare opportunities fulfilled	1. 805/2374 vs 695/2265 (33.9% vs 30.7%), p=0.12; OR 1.14 (0.95 to 1.38),	Not prespecified 1. Adverse events.	1. None reported.	0	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	at 60 days, n (%); odds ratio (95% CI). 2. Screening/prevention healthcare opportunities fulfilled at 60 days n (%). 2a. Overall. 2b. Alcohol screening. 2c. Breast cancer. 2d. Cervical cancer. 2e. Chlamydia. 2f. Colorectcal cancer. 2g. Depression. 2h. Dietary counseling. 2i. Exercise counseling. 2j. Lipid. 2k. Pneumococcal vaccine. 2l. Smoking/advice to quit. 2m. Smoking screening. 3. Acute/chronic healthcare opportunities fulfilled at 60 days n (%). 3a. Overall. 3b. Asthma. 3c. Back pain imaging. 3d. Back pain treatment. 3e. Diabetes (ACE-I). 3f. Diabetes (eye exam). 3g. Diabetes (hypertension). 3h. Diabetes (glycosylated hemoglobin). 3i. GERD. 3j. Hypertension. 3k. Lipid abnormalities.	p=0.16 2a. 722/2074 vs 603/1983 (34.8% vs 30.4%), p=0.03 2b. 51/79 vs 36/68 (64.6% vs 52.9%), p=0.07 2c. 3/11 vs 4/12 (27.3% vs 33.3%), p=0.43 2d. 26/95 vs 22/98 (27.4% vs 22.4%), p=0.47 2e. 22/73 vs 19/64 (30.1% vs 29.7%), p=0.90 2f. 4/32 vs 2/58 (12.5% vs 3.4%), p=0.15 2g. 164/422 vs 155/419 (38.9% vs 37.0%), p=0.58 2h. 149/493 vs 108/449 (30.2% vs 24.1%), p=0.04 2i. 157/509 vs 109/462 (30.8% vs 23.6%), p=0.01 2j. 13/49 vs 18/48 (26.5% vs 37.5%), p=0.32 2k. 1/61 vs 0/72 (1.6% vs 0%), p=0.25 2l. 92/209 vs 101/200 (44.0% vs 50.5%), p=0.14 2m. 40/41 vs 29/33 (97.6% vs 87.9%), p=0.08 3a. 83/300 vs 92/282 (27.7% vs 32.6%), p=0.26 3b. 12/18 vs 8/16 (66.7% vs 50.0%), p=0.57 3c. 4/4 vs 2/2 (100% vs				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	3l. Rhinosinusitus. 3m. Upper respiratory tract infection. Secondary 4. Mean patient satisfaction score at 60 days (scale range and anchors not described). 4a. Speed, efficiency, and courtesy during visit. 4b. Health care provider. 4c. Personal issues. 4d. Overall visit assessment. Data also reported separately in article for the 2 participating sites.	100%), p=NA 3d. 0/4 vs 2/2 (0% vs 100%), p=0.05 3e. 0/2 vs 1/1 (0% vs 100%), p=NA 3f. 2/15 vs 3/16 (13.3% vs 18.8%), p=0.75 3g. 2/2 vs 1/1 (100% vs 100%), p=NA 3h. 3/6 vs 1/3 (50% vs 33.3%, p=0.48 3i. 22/138 vs 19/114 (15.9% vs 16.7%, p=0.85 3j. 7/7 vs 3/7 (100% vs 42.9%), p=0.03 3k. 12/66 vs 11/69 (18.2% vs 15.9%, p=0.81 3l. 2/3 vs 1/1 (66.7% vs 100%), p=0.56 3m. 17/35 vs 40/50 (48.6% vs 80%), p=0.01 4a. 4.17 vs 4.19, p=0.23 4b. 4.40 vs 4.37, p=0.82 4c. 4.24 vs 4.27, p=NA 4d. 4.27 vs 4.30, p=0.74				
Augstein, 2007[5]	...	...	N randomized/completed study: 24/22 vs 25/24 Primary outcomes for 3-mo follow-up (A1c subgroup by baseline % not prespecified).	1a. [7.75 ± 1.21 vs 7.41 ± 1.07] vs [7.18 ± 1.42 vs 7.44 ± 1.50]; -0.34 ± 0.49% vs 0.27 ± 0.67%, p<0.01 1b. 0.03 ± 0.42 vs 0.24 ± 0.64	...	1

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			1. A1c. 1a. Mean ± SD A1c % [before vs after] vs [before vs after]; change ± SD. 1b. Mean change ± SD in A1c % for 17 patients with A1c <7.0% at baseline: CCDSS vs control. 1c. Mean change ± SD in A1c % for 18 patients with A1c 7.0 to 8.0% at baseline: CCDSS vs control. 1d. Mean change ± SD in A1c % for 11 patients with A1c > 8.0% at baseline: CCDSS vs control. 1e. Multiple regression analysis for change in A1c associated with CCDSS: beta coefficient, SE, p-value, R2. 2. Mean Sensor Glucose (MSG) levels (mmol/L), mean change ± SD [before vs after] vs [before vs after] Secondary outcomes	1c. -0.23 ± 0.36 vs 0.74 ± 0.81, p<0.01 1d. -0.77 ± 0.55 vs -0.12 ± 0.36, p<0.05 1e. -0.608, 0.175, p=0.001, 21.5% 2. [8.43 ± 1.33 vs 7.59 ± 1.47] vs [7.75 ± 1.33 vs 8.45 ± 2.46] 3a. [4.6 (1.8 to 8.3) vs 1.0 (0.0 to 3.5]) vs [3.2 (0.4 to 6.0) vs 3.5 (1.0 to 9.0)] 3b. [0.0 (0.0 to 0.0) vs 0.0 (0.0 to 0.0)] vs [0.0 (0.0 to 0.1) vs 0.0 (0.0 to 0.0)] 4. [12.6 ± 3.8 vs 12.6 ± 3.9] vs [11.8 ± 4.4 vs 12.9 ± 5.3] 5. [53 (37 to 77) vs 48 (35 to 72)] vs [50.5 (35 to 66) vs 54 (33 to 71)]		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			for 3-mo follow-up [before vs after] vs [before vs after] 3. Duration of: 3a. hyperglycemic excursions (h/day), mean (interquartile range). 3b. hypoglycemic excursions (h/day), mean (interquartile range). 4. Bread exchange unit intake (BU), mean ± SD. 5. Daily insulin dose (IU), mean (interquartile range). Note: euglycemic range = 4.4 to 8.9 mmol/L			
Barnett, 1983[6]	1. (1 of 2 primary outcomes) number (%) of patients in whom follow-up was attempted or achieved 1a. 6-12 months 1b. 6-24 months 2. (1 of 2 primary outcomes) number (%) of patients for whom a repeat BP measurement was	1a. 53 (84%) vs 13 (25%) (p<0.01) 1b. 62 (98%) vs 24 (46%) (p<0.01) 2a. 31 (49%) vs 16 (31%) (p<0.05) 2b. 44 (70%) vs 27 (52%) (p<0.05)	1. (secondary outcome- article states that "blood pressure control in the 2 groups was analyzed, although improved blood pressure control was not an objective of this experiment") degree of blood pressure control	1a. 32 (51%) vs 17 (33%) (p<0.05) 1b. 44 (70%) vs 27 (52%) (p<0.05)	1	1

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	recorded 2a. 6-12 months 2b. 6-24 months		1a. 6-12 months 1b. 6-24 months			
Bates, 1999[7]	During 4 month study period: 1. Number (%) tests performed after reminder triggered. (primary). 2. Test performed when reminder was triggered by test; number performed/number ordered (%). 2a. Urinalysis. 2b. Chemistry-20 profile. 2c. Urine culture. 2d. Sputum culture. 2e. Stool culture. 2f. Other. 2g. Total. Note: only 44% of redundant tests had a computer order, the rest were ordered outside of the CPOE system, and 41% of redundant test overrides were justified on chart review.	1. 117437 (27%) vs 257/502 (51%), p<0.001 2a. 35/136 (26%) vs 85/185 (46%) 2b. 37/113 (33%) vs 81/143 (57%) 2c. 22/110 (20%) vs 50/91 (55%) 2d. 14/39 (36%) vs 18/28 (64%) 2e. 3/15 (20%) vs 3/14 (21%) 2f. 6/24 (25%) 20/41 (49%) 2g. 117/437 (27%) vs 257/502 (51%)	...	...	1	...
Begg, 1989[8]	N=22 vs 23 patients analyzed. 1. Number of patients achieving both peak (6-10 mg/L) and trough (1-2 mg/L) aminoglycoside levels at d2 (main outcome). 2. Number of patients achieving both peak and trough aminoglycoside levels at d5 (main outcome).	1. 6 vs 0, p=0.007 2. p=NS 3a. 0 vs 0, p=NR 3b. 9 vs 2, p=0.01 3c. 7 vs 7, p=NR	Prespecified 1. Number of deaths (follow-up period NR). 2. Change in creatinine clearance during therapy (altered renal function?).	1. 1 vs 5, p=0.2 2. p=0.32 (9 vs 7 patients no change; 9 vs 6 patients small reversible decreases; rest had small increases)	1	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	3. Number of patients achieving peak aminoglycoside levels (mg/L) in specific ranges at d2. 3a. > 10 (not prespecified) 3b. 6–10 (main outcome) 3c. 4-6 (not prespecified) 3d. < 4 (not prespecified) 4. Number of patients achieving peak aminoglycoside levels (mg/L) in specific ranges at d5. 4a. > 10 (not prespecified) 4b. 6–10 (main outcome) 4c. 4-6 (not prespecified) 4d. < 4 (not prespecified) 5. Number of patients achieving trough (mg/L) aminoglycoside levels in specific ranges at d2. 5a. 2-4 (not prespecified) 5b. 1-2 (main outcome) 5c. 0.5 – 1 (not prespecified) 5d. < 0.5 (not prespecified) 6. Number of patients achieving trough aminoglycoside levels (mg/L) in specific ranges at d5. 6a. 2-4 (not prespecified) 6b. 1-2 (main outcome) 6c. 0.5 – 1 (not prespecified) 6d. < 0.5 (not prespecified) Other prespecified outcomes. 7. Mean (SEM) peak aminoglycoside level at d2 (mg/L). 8. Mean (SEM) trough aminoglycoside level at d2 (mg/L).	3d. 0 vs 8, p=NR 4a. 1 vs 0, p=NR 4b. 5 vs 4, p=NS 4c. 4 vs 8, p=NR 4d. 0 vs 6, p=NR 5a. 2 vs 3, p=NR 5b. 9 vs 2, p=0.013 5c. 5 vs 6, p=NR 5d. 0 vs 5, p=NR 6a. 4 vs 2, p=NR 6b. 4 vs 2, p=NS 6c. 2 vs 6, p=NR 6d.0 vs 2, p=NR 7. 6.49 (0.39) vs 4.27 (0.52), p=0.001 8. 1.44 (0.22) vs 0.94 (0.21), p=0.054 9. 7.23 (0.79) vs 5.03 (0.46),p=0.01 10. 1.76 (0.28) vs 1.07 (0.15), p=0.013 11. 312 (17) vs 203 (13), p=0.001 12. p=0.15 (14 vs 9 had no dose change; 0 vs 4 had >3 changes).				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	9. Mean (SEM) peak aminoglycoside level at d5 (mg/L). 10. Mean (SEM) trough aminoglycoside level at d5 (mg/L). 11. Mean (SEM) daily aminoglycoside dose (mg) during treatment. 12. Number of patients with dose changes (follow-up period NR).					
Bertoni, 2009[9]	3-year follow-up 1. Lipid screening rates for patients (secondary)1a. Proportion of patients at baseline (n=2216 vs 2841); Difference 1b. Proportion of patients at follow-up (n=1811 vs 2010); Difference 1c. Change from follow-up to baseline; Difference; intra-class correlation 2. Appropriate lipid management (met 1 of 7 criteria based on LDL-C level and risk strata) (primary) 2a. Proportion of patients at baseline (n=842 vs 855); Difference 2b. Proportion of patients at follow-up (n=709 vs 771); Difference 2c. Change from follow-up to baseline; Difference; intra-class	1a. 43.6% vs 40.1%; +3.5; p=0.41 1b. 49% vs 50.8%; -1.8; p=0.72 1c. +6.6 vs +10.7; -5.3; p=0.22; 0.22 2a. 73.4% vs 79.7%; -6.3; p=0.02 2b. 72.3% vs 68.9%; +3.4; p=0.18 2c. -1.1 vs -10.8; +9.7; p=0.01; 0.01 2d. +9.2%, p=0.02 3a. 6.6% vs 4.2%; +2.4; p=0.15 3b. 3.9% vs 6.4%; -2.5; p=0.07 3c. -2.7 vs +2.2; -4.9; p=0.01	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	correlation 2d. Group difference in subgroup of 58 practices with both baseline and follow-up data.not prespecified 3. Inappropriate prescription of lipid-lowering therapy (LLT) (secondary). 3a. Proportion of patients at baseline (n=626 vs 650); Difference 3b. Proportion of patients at follow-up (n=519 vs 571); Difference 3c. Change from follow-up to baseline; Difference 4. Appropriate prescription of LLT. (secondary) 4a. Proportion of patients at baseline (n=216 vs 205); Difference 4b. Proportion of patients at follow-up (n=190 vs 200); Difference 4c. Change from follow-up to baseline; Difference Stratified subgroup analyses 5-7. Appropriate lipid management* of patient dyslipidemia by Risk Category* 5. Low risk patients: baseline n=296 vs 357; follow-up n=309 vs 336	4a. 38.8% vs 45.3%; -6.5; p=0.27 4b. 24.8% vs. 24.1%; +0.7; p=0.88 4c. -14.0 vs. -21.2; +7.2; p=0.37 5a. 91.4% vs 94.1%; -2.7; p=0.29 5b. 90.9% vs. 89.2%; +1.7; p=0.49 5c. -0.5 vs. -4.9; +4.4; p=0.21; 0.01 6a. 69.4% vs 73.9%; -4.5; p=0.60 6b. 70.3% vs. 62.6%; +7.7; p=0.07 6c. +0.9 vs. -7.3; +8.2; p=0.03; 0.01 7a. 47.5% vs 55.6%; -8.1; p=0.14 7b. 24.4% vs. 28.7%; -4.3; p=0.41 7c. -23.1 vs -26.9; +3.8; p=0.65; 0.01				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	6. Intermediate low-risk or intermediate high-risk: baseline n=315 vs 281; follow-up n=253 vs 254 7. High risk patients: baseline n=231 vs 217; follow-up n=147 vs 181 a. Proportion of patients at baseline; Difference. b. Proportion of patients at follow-up; Difference c. Change from follow-up to baseline; Difference; intraclass correlation *Risk category defined by Framingham risk score (history and 10-year risk of coronary heart disease [CHD]) (1) Low risk (0-1 risk factor for CHD); (2) intermediate low risk (≥2 risk factors and a 10 year risk of <10%) (3) intermediate high risk (≥2 risk factors and a 10 year risk of 10% to 20%)(4) high risk (CHD risk equivalent [diabetes, CHD, stroke, or peripheral vascular disease] and/or ≥2 risk factors with a 10 year risk of >20%)					
Bogusevicius, 2002[10]	Prespecified 1. Diagnosis of acute SBO (no statistical comparisons) 1a. Sensitivity.	1. Article reports results similar. 1a. 87.5% vs 76.9% 1b. 100% vs 100%	Prespecified with follow-up time NR 1. Number (proportion) of	1. 1(3%) vs 1(3%), p=1.0 2. 4(10%) vs 3(8%), p=0.76	0	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	1b. Specificity. 1c. Positive predictive value. 1d. Negative predictive value. 2. Diagnosis of partial SBO (no statistical comparisons) 2a. Sensitivity. 2b. Specificity. 2c. Positive predictive value. 2d. Negative predictive value. 3. Mean (SD) time to diagnosis (hours). 4. Number (proportion) of patients receiving each type of surgical procedure. 4a. open lysis of adhesion 4b. laparoscopic lysis of adhesion 4c. bowel resection The database and Garg paper both indicate improvement on practitioner outcomes. Not sure about that. Although there is a difference in time to diagnosis, the accuracy data is not compared and the authors conclude that "computer-aided diagnosis had no significant advantage over contrast radiography in the accuracy of diagnosis…".	1c. 100% vs 100% 1d. 92.3% vs 90% 2. Article reports results similar. 2a. 100% vs 100% 2b. 87.5% vs 76.9% 2c. 92.3% vs 90% 2d. 100% vs 100% 3. 1 (NR) vs 16 (18), p<0.001 4a. 17/21 (81%) vs 10/16 (63%), P=0.23 4b. 3/21 (14%) vs 3/16 (19%), P=0.69 4c. 1/21 (5%) vs 1/16 (6%), P=0.90	patients with bowel necrosis. 2. Number (proportion) of patients with morbidity. 3. Number (proportion) of patient deaths. 4. Length of hospital stay (days). 5. Postoperative length of hospital stay (days). In Table II, postoperative hospital stay (8 days) was longer than overall hospital stay (6 days). Seems as if these data have been reversed. The author did not respond to a request for clarification.	3. 2(5%) vs 0(0%), p=0.16 4. 6 vs 6, p=0.84 5. 8 vs 8, p=1.0		
Borbolla, 2007[11]	Primary outcome 1. Proportion of patients (without BP registries) with at least one	1. 207(49.9%, 45 to 55) vs 195 (37%, 33 to 41), p<0.001	Secondary outcome 1. Mean systolic and diastolic blood	1. 140/78 vs 138/78, p=0.162/p=0.914	1	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	blood pressure measurement during the three months period, n (%, 95% CI). 2. Proportion of patients (with high BP measurements) with at least one blood pressure measurement during the three months period, n (%, 95% CI).	2. 224 (61%, CI NR) vs 239 (50%, CI NR), p=0.002	pressure, mm Hg.			
Bosworth, 2009[12]	1. Number of primary care visits over 24 mo.	1. 7.1 (CCDSS+BI) vs 7.7 (CTRL alone): P=0.52	1. % (SEM) of patients in BP control over 24-mo: baseline / 24 mo / difference: p value for expected baseline to 24-month change within each group (primary) a. CCDSS+BI b. CCDSS alone c. CTRL+BI d. CTRL alone 2. Change in BP control between groups (intervention groups compared to CTRL alone group) (primary). 3. % (SEM) of patients in systolic BP control over 24-mo: baseline / 24 mo / difference: p value for expected	1a. 36.2 (4.8) / 48.1 (8.4) / 11.8 (9.8): P=0.23 1b. 44.9 (5.1) / 43.7 (7.7) / -1.2 (9.1): P=0.89 1c. 44.2 (5.1) / 59.5 (7.6) / 15.7 (8.9): P=0.08 1d. 32.0 (4.6) / 43.9 (7.7) / 11.9 (8.8): P=0.18 1d. 1.8(9.8), 0.23 2. Overall intervention group by time effect P=0.56 3a. 139.2 (1.4) / 136.8 (1.7) / -2.3 (2.1): P=0.26 3b. 139.1 (1.4) / 136.9 (1.6) / -2.1	0	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			baseline to 24-month change within each group (secondary) 3a. CCDSS+BI 3b. CCDSS alone 3c. CTRL+BI 3d. CTRL alone 4. Change in systolic BP control between groups (intervention groups compared to CTRL alone group). 5. Change in control. CCDSS vs Control 5a. BP (primary) 5b. systolic BP (secondary)	(1.9): P=0.27 3c. 138.8 (1.4) / 136.3 (1.6) / -2.5 (2.0): P=0.20 3d. 141.6 (1.4) / 136.8 (1.6) / -4.9 (1.9): P=0.01 4. Overall intervention group by time effect P=0.73 5a. p=.34 5b. p=.46		
Brothers, 2004[13]	Primary 1. Agreement between surgeon's initial and final treatment plan, % (kappa). Prespecified 2. Surgeon level of comfort with management decision at 1 week (Provider Decision-Process Instrument, metric not reported). Not clearly prespecified 3. Initial intervention (primary amputation, bypass operation, balloon angioplasty, medical therapy) (number of patients).	1. 88% (0.77) vs 88% (0.81), Not significant 2. 47.2 (4.4) vs 46.0 (5.1), p=NS N=100 vs 106 3. 4,21,6,69 vs 6,39,5,56, p<0.1 4. 3,14,5,78 vs 6,28,3,69, p<0.1 5. 10,17,4,69 vs 16,30,5,55, p<0.1	...	...	0	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	4. Intervention within 3 months (primary amputation, bypass operation, balloon angioplasty, medical therapy) (number of patients). 5. Last intervention (primary amputation, bypass operation, balloon angioplasty, medical therapy) (number of patients).					
Burack, 1994[14]	Prespecified 1. Evaluation of medical record reminder. Proportion of women with scheduled mammography appointments over 6 months; difference (95% CI) 1a. Across all 5 sites. 1b. Health Department #1. 1c. Health Department #2. 1d. Health Maintenance Organization (HMO). 1e. Hospital #1. 1f. Hospital #2. 1g. Increase with intervention, Health Departments vs HMO. 1h. Increase with intervention, HMO vs hospitals 2. Evaluation of patient postcard reminder. Proportion of women with completed mammography appointment within 2 months of 1st scheduled appointments; difference (95% CI). 2a. Across all 5 sites.	1a. 47% vs 25%; NR 1b. 65% vs 37%; 28.7% (20.7 to 36.7) 1c. 40% vs 11%; 29.3% (21.1 to 37.5) 1d. 41% vs 28%; 13% (5.9 to 20) 1e. 38% vs 23%; 15.3% (5.2 to 25.4) 1f. 46% vs 24%; 22.7% (14.8 to 30.6) 1g. 29% vs 13%, p=0.005 1h. 13% vs 19%, p=0.202 2a. 77% vs 78%; NR 2b. 77% vs 84%; -6.6% (-16.1 to 2.9) 2c. 83% vs 57%; 25.5% (2.7 to 48.4) 2d. 82% vs 80%; 1.3% (-8.9 to 11.5) 2e. 81% vs 74%; 7.1% (-10.5 to 24.6) 2f. 67% vs 74%; -6.3% (-20.1 to 7.4)	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	2b. Health Department #1. 2c. Health Department #2. 2d. HMO. 2e. Hospital #1. 2f. Hospital #2. 3. Evaluation of rescheduling system. Proportion of women eligible for rescheduling and subsequently completing mammographies; difference (95% CI) 3a. Across all 5 sites. 3b. Health Department #1. 3c. Health Department #2. 3d. HMO. 3e. Hospital #1. 3f. Hospital #2. 4. Proportion of women with completed mammography appointment over 6 months (includes initial completion, deferred completion, and completion after telephone follow-up). 4a. Across all 5 sites. 4b. Health Department #1. 4c. Health Department #2. 4d. HMO. 4e. Hospital #1. 4f. Hospital #2. 5. Evaluation of full intervention over 12 months. Proportion of women having mammography;	3a. 23% vs 22%; NR 3b. 32% vs 13%; 19.2% (-2.4 to 40.8) 3c. 38% vs 22%; 16.2% (-21.7 to 54.1) 3d. 37% vs 16%; 21.2% (-3.3 to 45.8) 3e. 36% vs 22%; 14.1% (-25.2 to 53.5) 3f. 37% vs 69%; -32.2% (-59.2 to -5.1) 4a. 85% vs 84%, p=NS 4b. 84% vs 86%, p=NS 4c. 89% vs 67%, p=NS 4d. 88% vs 83%, p=NS 4e. 88% vs 80%, p=NS 4f. 79% vs 92%, p=NS 5a. 53% vs 41%; NR 5b. 64% vs 44%; 19.5% (11.6 to 27.5) 5c. 50% vs 25%; 25.2% (16.3 to 34.2) 5d. 59% vs 46%; 12.1% (5.2 to 19.1) 5e. 43% vs 28%; 14.2% (4.0 to 24.4) 5f. 45% vs 28%; 16.5% (9.0 to 24.0)				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	difference (95% CI). 5a. Across all 5 sites. 5b. Health Department #1. 5c. Health Department #2. 5d. HMO. 5e. Hospital #1. 5f. Hospital #2. Note: Outcomes 1b-1f and 5b-5f evaluated for effect (outcomes relating to CCDSS use). The overall outcomes for #1 and #5 (i.e., 1a and 5a) were not evaluated because no statistical comparisons were reported.					
Burack, 1996[15]	3 intervention groups (physician reminder, patient reminder, and both reminders) and 1 control group. Data reported separately for the 2 participating sites. Prespecified 1. Primary care visit during study year for 1527 women due for mammography within 1st 4 months of study. 1a. Site 1. 1b. Site 2. 2. Time to 1st primary care visit after patient reminder for 1099 women due for mammography within 1st 4 months of study and continuing in HMO	1a. 63-64%, p=0.934 (multivariate analysis) across groups. 1b. 50-59%, p=0.466 (multivariate analysis) across groups. 2a. 9 vs 9, p=0.504 2b. NR 3a. Approximately 30% for each group, p=0.524 across groups. 3b. 36%/36% vs 22%, p=0.002 (multivariate analysis). 3c. 21% vs 22%, p=NS 4a. 48% vs 46%; 1.01 (0.77 to 1.31). 4b. 59% vs 43%, p<0.001	...	...	0	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	(median, wks). 2a. Site 1. Patient reminder vs no patient reminder. 2b. Site 2. Reported by nonrandomized insurance subgroups only. 3. Mammography rate during the study year for 1527 women due for mammography within 1st 4 months of study. 3a. Site 1. 3b. Site 2. Both physician reminder groups vs no reminder. 3c. Site 2. Patient reminder vs no reminder. 4. Mammography rate for 1627 women who visited physicians during the study year. Physician reminders vs no physician reminders. 4a. Site 1. %; OR (95% CI). 4b. Site 2. %. Paper also reports subgroup analyses (not pre-specified) by age and due date for mammography (≤4mo, >4mo).					
Burack, 1997[16,17]	Prespecified 1. Mammography completion rates in study year 1. % (estimated from figure 2); adjusted OR (95% CI). Note: additional data for year 1 analyses are reported in the 1994	1a. 58% vs 36%; 2.74 (2.17 to 3.46) 1b. 58% vs 47%; 1.59 (1.23 to 2.05) 2a. 44% vs 28%; 1.85 (1.41 to 2.41)	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	paper and differ slightly because N's differ. 1a. Health Departments. 1b. HMO. 2. Mammography completion rates in study year 2. %; adjusted OR (95% CI). 2a. Health Departments. 2b. HMO. Not prespecified 3. Difference between year 1 and year 2 effectiveness for both groups.	2b. 45% vs 46%; 1.07 (0.80 to 1.42) 3. P<0.010				
Burack, 1998[17]	(Combined patient & physician intervention vs physician only vs patient only vs control) 1. Number (%) of patients with primary care visit: Odds ratios (compared with control): (95% CI). (primary) 2. Proportion of patients with Pap smear completed: Odds ratios, 95% CI. (primary) (note re #3 and #4 - these are secondary outcomes, although they were not specified that they would be broken down in subgroups) 3. Proportion of patients with Pap	1. 960 (79%) 1.23 (0.99 to 1.52) vs 960 (77%) 1.07 (0.87 to 1.32) vs 964 (75%) 0.98 (0.80 to 1.21) vs 964 (75%) reference (n/a): P>0.05 2. 32% 1.23 (1.01 to 1.50) vs 29% 1.05 (0.86 to 1.28) vs 29% 1.07 (0.88 to 1.30) vs 28% reference (n/a) P>0.05 3a. 46% vs. 44% 3b. 46% vs. 44% 3c. 44% vs. 41% 4a. no difference between groups 4b. 16 vs 9 (adjusted	...	...	0	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	smear completed at (other sub-group comparisons at each site available): Physician reminders vs no physician reminders a. site 1 b. site 2 c. site 3 4. Median time (weeks) between reminder intervention and time to a visit (95% CI): Patient reminders vs no patient reminders 4a. among women with a chronic illness 4b. among women without a chronic illness	coefficient 0.77; 0.13 to 1.41)				
Burack, 2003[18]	4 Pre-specified "primary" outcomes listed. 1. Primary care visit during study year; %; adjusted OR (95% CI). 2. Gynecology visit during study year; %; adjusted OR (95% CI). 3. Mammogram completed during study year; %; adjusted OR (95% CI). 4. Pap smear test completed during study year; %; adjusted OR (95% CI). Unspecified subgroup analyses. 5. In women who had a mammogram < 2y before study. 5a. Primary care visit in study year.	1. 76% vs 77%; 0.90 (0.73 to 1.11) 2. 34% vs 29%; 1.33 (1.08 to 1.63) 3. 39% vs 40%; 0.94 (0.78 to 1.14) 4. 30% vs 23%; 1.39 (1.07 to 1.89) 5a. 86% vs 88%, p=NS 5b. 45% vs 37%, p=0.012 5c. 51% vs 57%, p=0.04 5d. 45% vs 37%, p=0.012 6a. 85% vs 92%, p=0.002 6b. 52% vs 45%, p=0.06 6c. 47% vs 50%, p=NS 6d. 52% vs 45%, p=NS	...	...	0	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	5b. Gynecology visit during study year. 5c. Mammogram completed during study year. 5d. Pap smear test completed during study year. 6. In women who had a pap smear test in < 2y before study (%). 6a. Primary care visit in study year. 6b. Gynecology visit during study year. 6c. Mammogram completed during study year. 6d. Pap smear test completed during study year. No differences were reported in subgroups of women who did not have mammogram or pap smear tests in 2y before study.					
Burton, 1991[19]	Not clearly pre-specified (follow-up unclear) 1. Mean (SD) beginning aminoglycoside dose (mg/day). 2. Mean (SD) ending aminoglycoside dose (mg/day). 3. Mean (SD) ending aminoglycoside dose interval (h). 4. Mean (SD) peak aminoglycoside level (mg/L). 5. Number (proportion) of patients with peak aminoglycoside level > 4mg/L. 6. Mean (SD) trough	1. 238 (64.8) vs 230 (49.7), p=NS 2. 272 (92.5) vs 261 (75.8), p=NS 3. 13.0 (3.7) vs 9.6 (2.9), p=NS 4. 5.3 (1.8) vs 4.4 (1.7), p=0.001 5. 58/70 (82.9%) vs 44/73 (60.3%), p=NS 6. 1.1 (0.9) vs 1.2 (0.8), p=NS 7. 6/69 (8.7%) vs 11/75 (14.7%), p=NS	1. Proportion of patients cured. 2. Proportion of patients with response to therapy. 3. Proportion of patients with treatment failure. 4. Proportion of deaths. 5. Proportion of patients with indeterminate response.	1. 25.7% vs 25.3%. p=NS 2. 60% vs 48%, p=NS 3. 2.9% vs 5.3%, p=NS 4. 1.4% vs 4%, p=NS 5. 7.1% vs 8%, p=NS 6. 4/72, 5.6% vs 7/75, 9.3%, p=NS 7. 16 (1.3) vs 20.3 (1.7), p=0.028 8a. 8.8 vs 16.5, P=NS 8b. 11.8 vs 25.9, P=0.008	0	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	aminoglycoside levels (mg/L). 7. Number (proportion) of patients with trough aminoglycoside levels ≥2mg/L. 8. Mean (SEM) length of aminoglycoside therapy (days).	8. 7.3 (6.4) vs 8.3 (0.5), P=0.093	6. Proportion of patients with nephrotoxicity. 7. Mean (SEM) length of hospital stay (days). 8. Mean (SEM) length of hospital stay after start of antibiotics (days). 8a. sepsis 8b. pneumonia 8c. cellulitis 8d. soft-tissue infections 8e. urinary tract infection 8f. gangrene 8g. postoperative wound infection 8h. peritonitis 8i. neutropenic, empiric therapy 8j. osteomyelitis 8k.cholangitis/cholecystitis 8l. catheter-tip infection 8m. subacute bacterial endocarditis 8n. septic arthritis 8o. pyelonephritis 8p. overall	8c. 13.4 vs 18.0, P=NS 8d. 17.8 vs 18.5, P=NS 8e. 11.0 vs 11.2, P=NS 8f. 14.8 vs 25.6, P=NS 8g. 12.6 vs 8.5, P=NS 8h. 12.6 vs 9.7, P=NS 8i. 6.0 vs 6.0 (LOS available for only 1 of 2 patients in control group), P=NS 8j. 10.0 vs 18.0, P=NS 8k. 6.5 vs 14.0, P=NS 8l. 32.0 vs (0 patients), P=NS 8m. (0 patients) vs 30.0, P=NS 8n. (0 patients) vs 4.0, P=NS 8o. 13.0 vs (0 patients), P=NS 8p. 13.0 (6.9) vs 17.6 (1.6), p=0.013		
Cannon,	1. Proportion of patients screened	1. 86.5% vs 61%, p=0.008	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
2000[20]	for mood disorder over 9 months. (primary) 2. Number, proportion, of major depressive disorder cases with fully documented DSM-IV diagnostic criteria over 9 months (primary).	2. 17/17, 100% vs 1/18, 5.6%, p<0.001				
Carter, 1987[21]	1. For patients who achieved a stable PT ratio before discharge, the mean (SD) number of days from administration of the first warfarin dose to achievement of the stabilization dosage (pre-specified). 2. Number, proportion, of patients with stable PT before or at hospital discharge (not prespecified). 3. Mean (SD) stabilization warfarin dosage (not prespecified). 4. Proportion of PT ratios within each PT ratio category as measured between the time of the third warfarin dose and either achievement of a stable PT ratio or discharge (not prespecified). 4a. PT ratio ≤1.3 4b. PT ratio 1.31-2.0 4c. PT ratio 2.01-2.5 4d. PT ratio ≥2.5 (Actual versus predicted dosages	Analog vs Linear vs Empiric 1. 6.8 (1.26) vs 7.33 (2.06) vs 8.42 (3.47), p=NS 2. 20/31, 64.5% vs 15/22, 68.2% vs 19/34, 55.9% 3. 7.16 (4.41) vs 7.44 (2.6) vs 7.82 (3.2) 4a. 2.4 vs 9.6 vs 13.1 4b. 88.3 vs 63.8 vs 81.7 4c. 6.7 vs 24.5 vs 5.2 4d. 0.8 vs 2.1 vs 0 * No statistical analyses provided for these measures.	1. mean (SD) time to discharge in patients without stable PT (not prespecified)	Analog / Linear / Empiric 1. 6.3 (1.3) / 7.7 (3.5) / 6.5 (1.2) * No statistical analyses provided for these measures.	0	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	for various warfarin dose numbers in analog group provided)					
Casner, 1993[22]	Pre-specified (time NR). 1. Mean serum theophylline levels (mg/L) (SD) 1a. ≥ 8 hours after intravenous therapy had been initiated (C1) 1b. ≥ 6 hours after the first measurement (C2) 1c. just before discontinuation of the intravenous theophylline infusion (C3) 1d. time interval (mean or median not specified)between C1 and C3 (hours) 2. Mean (SD) absolute difference between final and target (15 mg/L) theophylline levels (mg/L). 3. Mean (SD) difference between target (15 mg/L) and mean final theophylline level (mg/L). 4. Number of patients with subtherapeutic (<10 mg/L) final theophylline levels. 5. Number of patients with toxic (>20 mg/L) final theophylline levels. Not clearly pre-specified (no units provided). 6. Mean (SD) pH levels, d1. 7. Mean (SD) pH levels, d2.	1a. 10.2 (6.4) vs 9.8 (3.9), p=NS 1b. 10.6 (3.3) vs 9.7 (3.2), p=NS 1c. 14.8 (4.4) vs 12.6 (4.1), p=NS 1d. 48 vs 40, p=NS 2. 3.5 (2.7) vs 3.9 (2.6), p=NS 3. 0.21 (4.49) vs 2.41 (4.07), p=NS 4. 4 vs 3, p=NS 5. 1 vs 1, p=NS 6. 7.36 (0.10) vs 7.36 (0.12), p=NS 7. 7.39 (0.08) vs 7.42 (0.04), p=NS 8. 7.39 (0.11) vs 7.45 (0.07), p=NS 9. 43.47 (13.44) vs 45.19 (13.77), p=NS 10. 41.22 (12.04) vs 36.58 (5.53), p=NS 11. 46.50 (14.76) vs 38.33 (9.42), p=NS	Not clearly pre-specified. 1. Number of patients with theophylline-associated toxicity (nausea, vomiting, tremor, tachycardia, and seizures) (follow-up time NR): n/N. 2. Mean (SD) length of hospital stay (days). 2a. Mean length of hospitalization without one outlier in each group (days) 3. Mean (SD) duration of treatment (days).	1. 1/17 vs 0/18. Event was tachycardia secondary to high initial theophylline level. 2. 11.4 (21.6) vs 8.8 (15.4), p=NS 2a. 6.1 vs 5.2, p=NS 3. 4.1 (3.3) vs 3.2 (1.5), p=NS	0	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	8. Mean (SD) pH levels, d3. 9. Mean (SD) PCO2 levels, d1. 10. Mean (SD) PCO2 levels, d2. 11. Mean (SD) PCO2 levels, d3. 12. Mean (SD) clearance (L/hr) 13. Mean (SD) elimination rate constant (hr-1) 14. Mean (SD) half-life (hr) 15. Mean (SD) number of days of theophylline administration 16. Mean (SD) prediction error	12. 6.6 (5.5) vs 4.2 (2.4), P=NS 13. 0.16 (0.09) vs 0.14 (0.08), P=NS 14. 5.3 (2.4) vs 6.2 (2.9), P=NS 15. 4.1 (3.3) vs 3.2 (1.5), P=NS 16. 0.21 (4.49) vs 2.41 (4.07), p>0.05				
Cavalcanti, 2009[23]	1. Median (IQR) number of BG measurements obtained per patient (secondary) 2. Mean (SD) proportion of time with BG controlled between 60 and 140 mg/dL (secondary)	1. 100 (33 to 192) vs 105 (35 to 312) vs 49(39-77) P [CCDSS vs Leuven] =.52; P [CCDSS vs Conventional] =.01 2. 71.8 (18.0) vs 67.9(20.8) vs 47.1(30.2); P [CCDSS vs Leuven] =.50; P [CCDSS vs Conventional] <.001	All outcomes are presented in the order: CCDSS vs Leuven vs Conventional 1. Mean of patients' median BG during the ICU stay (mg/dL) (primary) 2. Number (%) of patients with hypoglycemia (≥ 1 blood glucose measurement ≤ 40 mg/dL)(primary) 3. Mean of proportion of patients' glucose measurements ≤40 mg/dL (secondary)(inconsistency < or ≤40 mg/dL) 4. Median (IQR)	1. 125.0 vs 127.1 vs 158.5 P [CCDSS vs Leuven] =0.34; P [CCDSS vs Conventional] <0.001 2. 12 (21.4) vs 24 (41.4) vs 2 (3.8); P [CCDSS vs Leuven] =.02; P [CCDSS vs Conventional] =.006 3. 0.43 vs 0.55 vs 0.03 P [CCDSS vs Leuven] =.04; P [CCDSS vs Conventional] =.007 4. 4.2 (2.0 to 9.6) vs 8.7(2.5 to 20.2) vs	1	1

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			hyperglycemic index, with a cutoff at 140 mg/dL (mg/dL per hour) (secondary)	20.5(5.1 to 42.8); P [CCDSS vs Leuven] =.10; P [CCDSS vs Conventional] <.001		
Chambers, 1991[24]	Prespecified. 4 groups reported: always reminders vs sometimes reminders (reminder printed vs no reminder printed) vs no reminders. 1. Influenza vaccines given during 2 months of study; n/N (%). Subgroup analyses (not clear which, if any, prespecified) 2. Influenza vaccines given during 2 months of study by subgroup (%). 2a. Patient age 0-64y. 2b. Patient age 65-74y. 2c. Patient age 75+y. 2d. Moderate risk level (adapted from CDC recommendations). 2e. High risk level (adapted from CDC recommendations). 2f. 1 patient visit during study. 2g. 2 patient visits during study. 2h. 3+ patient visits during study. 2i. Primary physician = resident. 2j. Primary physician = attending fellow. Note: analyses excluded all patients (n=61) of 1 physician in the 'no reminder' group who had a high rate of immunization during	1. 137/271 (51%) vs 27/72 (38%) vs 15/74 (20%) vs 65/218 (30%), p<0.001 overall; p<0.001 for always reminders vs no reminders; Yates-corrected chi-square p=0.92 for sometimes reminders (printed or not) vs no reminders (latter calculated by RA). 2a. 41% vs 18% vs 6% vs 22%, p=0.001 2b. 48% vs 43% vs 33% vs 31%, p=NS 2c. 61% v 13% vs 38% vs 38%, p=0.005 2d. 49% vs 35% vs 21% vs 30%, p<0.001 2e. 55% vs 45% vs 19% vs 28%, p=0.002 2f. 47% vs 30% vs 16% vs 28%, p<0.001 2g. 59% vs 43% vs 29% vs 25%, p<0.001 2h. 45% vs 55% vs 14% vs 42%, p=NS 2i. 36% vs 26% vs 16% vs	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	the study (75%) and in the year before the study (61% compared with <30% for other physicians).	26%, p=NS 2j. 56% vs 64% vs 28% vs 32% , p<0.001				
Christakis, 2001[25]	Primary 1. Mean (SE) change in proportion of time antibiotics prescribed for <10 days over 8 months. Secondary 2. Mean (SE) change in frequency of no antibiotic prescribing for otitis media over 8 months. Note: some of this data is also included in Davis, 2007	1. 44.43% (4.24) vs 10.48% (5.25), p<0.01 2. -4.33% (5.15) vs -16.81% (5.09), p=0.095	...	...	1	...
Christian, 2008[26]	...	...	Primary 1. Mean (SD) weight change at 12 months. 2. Proportion (number) of patients with ≥5% weight loss at 12 months. Secondary 3. Mean (SD) change in physical activity (metabolic-equivalent task minutes/wk) at 12 months. 4. Mean (SD) reduction in calorie intake (kcal/wk) over 12 months. 5. Mean (SD) change in total cholesterol	1. -0.18 (10.92) vs 1.39 (10.60), p=0.23 2. 21% (30/141) vs 11% (14/132), p=0.02 3. 354 (574) vs 51 (443), p<0.001 4. 947 (1936) vs 507 (1963), p=0.07 5. -15.84 (44.76) vs -3.93 (45.15), p=0.03 6. -0.43 (17.10) vs 1.56 (11.60), p=0.26 7. -14.62 (38.52) vs -3.81 (38.51), p=0.01 8. -13.60 (97.06) vs -9.48 (95.67), p=0.72 9. -0.14% (1.76) vs -0.46% (1.63), p=0.12	...	1

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			(mg/dL) at 12 months. 6. Mean (SD) change in HDL-C (mg/dL) at 12 months. 7. Mean (SD) change in LDL-C (mg/dL) at 12 months. 8. Mean (SD) change in triglycerides (mg/dL) at 12 months. 9. Mean (SD), %, change in HbA1c levels at 12 months. Not specified 10. Change (SD) in mean SBP (mm Hg) at 12 months. 11. Change (SD) in mean DBP (mm Hg) at 12 months. 12. Change (SD) in waist circumference (cm) at 12 months. 13. Proportion with ≥6 lbs loss at 12 months. 14. Proportion with weight change +/- 5.9 lbs at 12 months 15. Proportion with ≥6 lbs gain at 12 months. 16. Proportion of patients with HbA1c ≤6.0 at 12 months.	10. -2.55 (20.37) vs -4.66 (20.81), p=0.40 11. -2.60 (13.79) vs -2.54 (11.63), p=0.97 12. -1.764 (7.045) vs -0.543 (6.498), p=0.14 13. 32% vs. 19%, p=0.01 14. 41% vs 48%, p=0.27 15. 26% vs 33%, p=0.25 16. 22% vs 17%, p=NR 17. 1 vs 2		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			17. Number of patients who had adverse events.			
Claes, 2005[27,28]	1. mean (SE) proportion of time that INR values were within 0.5 INR-units of target range (2.5 or 3.5 depending on indication) during median 4.8 month follow-up (primary outcome) 2. mean proportion of time that INR values were within 0.75 INR-units of target range (2.5 or 3.5 depending on indication) during median 4.8 month follow-up (primary outcome) 3. proportion (SE) of patients with at least 1 INR < 2 (not pre-specified) 4. proportion (SE) of patients with at least 1 INR > 5 (not pre-specified) 5. median number (SE) of tests per patient per month (not pre-specified) 6. proportion of patients (SE) with treatment changes (not pre-specified) 7. % change (95% CI) per GP-practice from baseline for target within 0.5 INR units (prespecified). 8. % change (95% CI) per GP-practice from baseline for target within 0.75 INR units	Dawn AC (CCDSS) / CoaguChek / Feedback / Control / Baseline values (p – differences among 4 intervention groups on final values; p' – overall differences between baseline values and intervention group values, p" – interaction between groups on difference from baseline) 1. 55% [2.3] / 57% [2.2] / 60% [2.2] / 63% [2.5] / 49% [1.4], p=0.13; p'<0.0001, p"=0.80 2. 73% [2.3] / 74% [2.2] / 78% [2.3] / 80% [2.4] / 79% [1.4], p=0.12; p'<0.0001, p"=0.90 3. 41% [4.3] / 45% [4.1] / 45% [4.3] / 45% [4.6] / 44% [2.2], p=0.86; p'=0.67, p"=0.74 4. 19% [3.4] / 9% [2.2] / 7% [1.8] / 15% [3.1] /21% [1.9], p=0.009; p'=0.019, p"=0.28	1. number of thromboembolic complications (pre-specified secondary outcome) during median 4.8 months follow-up. 2. number of hemorrhages (pre-specified secondary outcome) during median 4.8 months follow-up. 3. death from other causes (not pre-specified) during median 4.8 months follow-up. Note: Doesn't report # pts/grp or #pts with event (rand by practice)	Dawn AC (CCDSS) / CoaguChek / Feedback / Control 1. 3 / 4 / 6 / 4 (p=0.83) 2. Minor bleedings 4 / 11/ 14 / 6 (p=0.28) Major bleedings 2 / 5 / 4 / 3 (p=0.78) 3. 0 / 3 / 2 / 0 (p=0.09)	0	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	(prespecified). Not prespecified 9. Incremental cost-effectiveness (vs usual care); additional cost per day within a 0.5 range from INR target.	5. 1.6 [0.1] / 1.7 [0.1] / 1.7 [0.1] / 1.7 [0.1] / 2 [0.06], p=0.88; p<0.001,p"=0.58 6. 65% [7.7] / 85% [4.4] / 74% [6.4] / 70% [6.9] / NR, p=0.11 7. 11% (5.5 to 16.5) vs 11% (6 to 16.5) vs 9% (4 to 13.5) vs 8% (2 to 13.5), p=0.8 8. 12% (6.5 to 17.5) vs 12% (7 to 17) vs 10% (6 to 15) vs 10% (4.5 to 15.5), p=0.9 9. 4.90 Euros / Dominant (less costly and more effective than usual care) / 5.02 Euros / 5.23 Euros. Other results are available in supplemental paper.				
Cleveringa, 2008[29-32]	1. Mean (SD) score on diabetes treatment satisfaction (DTSQ): baseline / 1 year CCDSS vs baseline / year Control: Per protocol mean difference (95% CI): ITT mean difference (95% CI). Secondary outcome in unpublished manuscript accepted for publication at Diabetic Medicine.) Not prespecified 2. Total costs per QALY gained(Euros): difference between CCDSS and control	1. 32.4 (±4.7) / 32.8 (± 4.1) vs 32.2 (± 5.1) / 32.6 (±4.8): 0.116 (-0.51 to 0.75): 0.106 (-0.25 to 0.47) 2a. 38 243 2b. 14 814 2c. 121 285 3a. 10 107 3b. 5457 3c. 16 980	1. 1-year difference in mean (SD)A1C (%); baseline / 1-year; difference between groups(95% CI) (primary) 2. Percentage of patients with A1C ≤7%: baseline / 1-year; OR(95% CI) (secondary) 3. Percentage of patients with systolic blood pressure ≤140	1. 7.1 (1.3) / 6.9 (1.1) vs 7.0 (1.1) / 6.9 (1.0); 0.07 (-0.02 to 0.16), p=NS 2. 60.8 / 68.0 vs 61.6 / 64.2, 1.4 (1.0-1.8), p<0.05 3. 41.0 / 53.9 vs 39.5 / 42.2; 1.7 (1.2-2.2), p<0.05 4. 36.2 / 49.0 vs 38.5 / 45.3; 1.3 (1.0-1.6), p<0.05 5. 41.1 / 53.5 vs 43.8	0	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	2a. all patients 2b. patients with history of CVD 2c. patients without history of CVD 3. Total costs per life-year gained (Euros): difference between CCDSS and control 3a. all patients 3b. patients with history of CVD 3c. patients without history of CVD		mmHg: OR(95% CI) (secondary) 4. Percentage of patients with total cholesterol ≤4.5 mmol/l: OR(95% CI) (secondary) 5. Percentage of patients with LDL cholesterol ≤2.5 mmol/l: OR(95% CI) (secondary) 6. Percentage of patients with all treatment targets: OR(95% CI) (secondary) 7. Systolic blood pressure (mmHg); baseline / 1-year; difference between groups(95% CI) (not prespecified) 8. Diastolic blood pressure (mmHg); baseline / 1-year; difference between groups(95% CI) (not prespecified)	/ 49.8; 1.3 (1.0-2.8), p<0.05 6. 10.3 / 18.9 vs 10.9 / 13.4; 1.6 (1.3-2.1), p<0.05 7. 149 (22) / 143 (20) vs 149 (21) / 147 (20.8); 3.3 (0.5-6.0), p<0.05 8. 83 (11) / 80 (11) vs 82 (11) / 82 (10.6); 2.2, (1.0-3.5), p<0.05 9. 5.0 (1.0) / 4.6 (0.9) vs 4.9 (1.1) / 4.8 (1.1); 0.2 (0.1-0.3), p<0.05 10. 1.36 (0.36) / 1.37 (0.37) vs 1.32 (0.35) / 1.33 (0.36); -0.007 (-0.038 to 0.023), p=NS 11. 2.8 (0.92) / 2.5 (0.88) vs 2.8 (0.95) / 2.6 (0.97); 0.15 (0.07 to 0.23), p<0.05 12. 22.5(16.5) / 20.6 (15.0) vs 21.7 (15.8) / 21.6 (15.6); 1.5 (0.3-2.6), p<0.05 13a. 0.037 (-0.066 to 0.14)		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
				13b. 0.07 (-0.051 to 0.19)		
			9 Total cholesterol (mmol/l); baseline / 1-year; difference between groups(95% CI) (not prespecified)	13c. 0.014 (-0.141 to 0.169)		
				14a. 0.14 (-0.12 to 0.40)		
			10. HDL cholesterol (mmol/l); baseline / 1-year; difference between groups(95% CI) (not prespecified)	14b. 0.19 (-0.07 to 0.45)		
				14c. 0.10 (-0.26 to 0.46)		
			11. LDL cholesterol (mmol/l); baseline / 1-year; difference between groups(95% CI) (not prespecified)	15a. -0.11 (-0.18 to -0.04)		
				15b. -0.08 (-0.17 to 0.007)		
			12. 10-year UKPDS CHD risk estimate (%); baseline / 1-year; difference between groups(95% CI) (secondary)	15c. -0.14 (-0.25 to -0.036)		
				18a. 83.1 (±11.9) / 82.9 (±12.0) vs 83.6 (±11.4) / 84.3 (±11.5): -0.880 (-1.94 to 0.12): -0.439 (-1.01 to 0.08)		
			13. Quality adjusted life-years: difference between CCDSS and control (95% CI) (not prespecified)	18b. 85.7 (±13.7) / 84.7 (±13.7) vs 86.1 (± 13.2) / 86.3 (±13.3): -1.163 (-2.34 to 0.03): -0.676 (-1.30 to -0.03)		
			13a. all patients 13b. patients with history of CVD 13c. patients without history of CVD	18c. 89.6 (±11.1) / 89.0 (±12.4) vs 90.7		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
				(±10.6) / 90.8		
			14. Life-years: difference between CCDSS and control (95% CI) (not prespecified)	(±11.1): -0.634 (-1.72 to 0.43): -0.366 (-0.97 to 0.22)		
				18d. 71.7 (±20.7) / 71.9 (±21.1) vs 72.4 (± 20.9) / 74.4		
			14a. all patients	(±19.6): -1.832 (-3.64 to -0.07): -0.920 (-1.99 to 0.07)		
			14b. patients with history of CVD	18e. 72.5 (±25.4) / 71.5 (±25.7) vs 73.6 (±23.3) / 72.0		
			14c. patients without history of CVD	(±24.0): 0.530 (-1.07 to 2.16): 0.154 (-0.73 to 1.05)		
			15. Number of cardiovascular events: difference between CCDSS and control (95% CI) (not prespecified)	18f. 85.4 (±19.9) / 82.6 (±22.4) vs 85.8 (±19.2) / 84.6		
				(±19.6): -1.569 (-4.30 to 0.72): -1.031 (-2.52 to 0.25)		
			15a. all patients	18g. 71.8 (±39.8) / 70.5 (±39.4) vs 75.3 (±37.0) / 71.8		
			15b. patients with history of CVD	(±39.6): 2.258 (-1.61 to 6.31): 0.983 (-1.21 to 3.27)		
			15c. patients without history of CVD	18h. 80.4 (±36.4) / 81.0 (±35.4) vs 83.4 (±33.9) / 83.8		
			(**All data below reported as secondary outcomes in an unpublished manuscript accepted for publication at Diabetic Medicine.)	(±33.9): 0.107 (-3.25 to 4.10): 0.112 (-1.79		
			18. Mean (SD) Health			

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			Status Questionnaire score: baseline / 1 year CCDSS vs baseline / year Control: Per protocol mean difference (95% CI): ITT mean difference (95% CI) (*Note: non-inveriority threshold above delta=-2%)	to 2.35) 18i. 76.7 (±17.4) / 76.4 (±18.4) vs 77.7 (±16.5) / 77.6 (±16.6): -0.240 (-1.52 to 1.15): -0.152 (-0.86 to 0.61) 18j. 63.3 (± 20.2) / 62.9 (± 20.4) vs 64.8 (±19.7) / 64.8 (±19.8): -0.344 (-2.48 to 1.66): -0.211 (-1.43 to 0.95) 18k. 79.7 (±23.4) / 77.8 (±23.8) vs 81.2 (±21.8) / 77.7 (±24.1): 1.629 (-0.48 to 3.78): 0.636 (-0.57 to 1.85) 18l. 60.4 (±17.9) / 59.8 (±18.5) vs 62.3 (±18.4) / 61.8 (±19.0): -0.136 (-1.71 to 1.46): -0.137 (-0.98 to 0.74) 18m. 50.6 (±18.8) / 52.0 (±19.2) vs 51.9 (±18.2) / 49.8 (±17.5): 3.514 (1.23 to 5.82): 1.913 (0.62 to 3.23)
			18a. DHP total score 18b. DHP Barriers to activity 18c. DHP Psychological distress 18d. DHP Disinhibited eating 18e. SF-36 Physical functioning 18f. SF-36 Social functioning 18g. SF-36 Role physical 18h. SF-36 Role emotional 18i. SF-36 Mental health 18j. SF-36 Vitality 18k. SF-36 Bodily pain 18l. SF-36 General health 18m. SF-36 Health change	19a. 76.5 (±15.7) /

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			19. Mean (SD) score on Other Health Status Questionnaires: baseline / 1 year CCDSS vs baseline / year Control: Per protocol mean difference (95% CI): ITT mean difference (95% CI) 19a. EQ-VAS 19b. EQ-5D 657 20. Mean (SD) score on diabetes empowerment (DES-SF): baseline / 1 year CCDSS vs baseline / year Control: Per protocol mean difference (95% CI): ITT mean difference (95% CI)	76.1 (±15.3) vs 78.2 (±14.0) / 76.5 (±15.1): 1.235 (-0.62 to 2.85): 0.573 (-0.48 to 1.48) 19b. 0.817 (±0.22) / 0.813 (±0.23) vs 0.838 (±0.20) / 0.827(±0.21): 0.007 (-0.01 to 0.03): 0.003 (-0.008 to 0.01) 20. 3.78 (±0.64) / 3.78 (±0.69) vs 3.73 (±0.65) / 3.69 (±0.67): 0.042 (-0.06 to 0.14): 0.019 (-0.03 to 0.07)		
Cobos, 2005[33]	Mean follow-up 12.2 vs 11.2 months All secondary 1. Mean number of physician visits. 1a. Scheduled. 2. Mean number of assessments. 2a. Lipid assessments.	1a. 1.8 vs 1.9, p=0.311 2a. 1.83 vs 1.87, p=0.298 2b. 1.41 vs 1.31, p=0.033 2c. 0.54 vs 0.24, p=0.053 3a. 427 (40.8%) vs 677 (59.1%); 0.37 (0.26 to 0.52), p<0.0001 Note: Effect was	Mean follow-up 12.2 vs 11.2 months. Primary outcome & analysis: 1. n/N (%) patients with successful management* in ITT analysis; difference (95% lower confidence	1. 565/1046 (54.02%) vs 578/1145 (50.48%); 3.53% (-4.97)*; 1.02 (0.58 to 1.77) 2. 516/789 (65.40%) vs 526/832 (63.22%); 2.18% (-3.96)*; 1.06 (0.72 to 1.55)	0	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	2b. AST/ALT measurements. 2c. CK determinations. 3. Number (%) patients treated with LLDs; odds ratio (95% CI). 3a. Overall (ITT: 1046 vs 1145 patients). 3b. Patients with CHD. 3c. High-risk patients without CHD. 3d. Low-risk patients without CHD. 3e. Patients not previously treated with LLDs. 3f. Patients previously treated with LLDs.	heterogeneous across CV risk categories (p=0.002) and previous LLD use (p=0.013) 3b. 102 (92.7%) vs 125 (85.0%); 2.54 (0.92 to 6.98) 3c. 201 (70.5%) vs 260 (76.9%); 0.69 (0.44 to 1.06) 3d. 124 (19.0%) vs 292 (44.2%); 0.25 (0.16 to 0.41) 3e. 286 (50.3%) vs 472 (74.8%); 0.15 (0.09 to 0.26) 3f. 141 (29.5%) vs 205 (39.9%); 0.64 (0.43 to 0.95)	limit); odds ratio (95% CI). Primary outcome – sensitivity analysis 2. n/N (%) patients with successful management* in per-protocol analysis (≥1 post-baseline assessment); difference (95% lower confidence limit); odds ratio (95% CI). Primary outcome – sensitivity analysis 3. n/N (%) patients with successful management* in per-protocol analysis (≥9 months follow-up); difference (95% lower confidence limit); odds ratio (95% CI). Not clear if subgroup analyses prespecified. 4. Proportion of patients with successful management (ITT: 1046 vs 1145 patients). 4a. Patients with coronary heart disease	3. 422/620 (68.06%) vs 356/544 (65.44%); 2.62 (-3.21)*; 1.12 (0.72 to 1.76) *Lower CI <-5% meets non-inferiority criterion. 4a. 23.69% vs 23.39%, p=NS 4b. 22.26% vs 21.98%, p=NS 4c. 21.53% vs 21.25%, p=NS 4d. 20.20% vs 19.94%, p=NS 4e. 73.68% vs 73.36% , p=NS 4f. 72.09% vs 71.76%, p=NS Note: No significant interactions for group by CV risk level or group by previous LLD treatment. 5. Note: CIs seem incorrect. Both are negative although the difference is positive. No response from		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			(CHD) and no previous lipid-lowering drug (LLD) treatment. 4b. Patients with CHD and previous LLD treatment. 4c. High-risk patients without CHD and no previous LLD treatment. 4d. High-risk patients without CHD and previous LLD treatment. 4e. Low-risk patients without CHD and no previous LLD treatment. 4f. Low-risk patients without CHD and previous LLD treatment. Secondary outcomes 5. Mean final lipid values (mg/dL) ; difference (95% CI) (ITT: 1046 vs 1145 patients). 5a. Total cholesterol. 5b. LDL-cholesterol. 5c. HDL-cholesterol. 5d.	author when requested confirmation. 5a. 233.8 vs 231.0; 2.8 (-1.7, -7.3); p=0.218 5b. 149.2 vs 146.5; 2.7 (-1.7, -7.1); p=0.227 5c. 58.0 vs 56.3; 1.6 (-0.6, -3.6); p=0.142 5d. 136.6 vs 135.2; 1.4 (-8.3, -11.2); p=0.766 6a. 0.03 vs 0.03, p=0.855		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			Tryglycerides.Management success: *If CV risk ≥20% over 10 yrs, success = LDL-C < 115mg/dL at study end for patients with CHD or < 130mg/dL for those without CHD. If CV risk <20% over 10 years, success = CVR still <20% at study end. Secondary: 6. Mean number of physician visits 6a. Unscheduled and related to drug treatment or hypercholesterolemia.			
Coe, 1977[34]	...	...	BP measures were prespecified; other measures were not clearly prespecified. 1a. Number of patients that achieved adequate BP control (DBP <95 mmHg during treatment). 1b. Number of patients that achieved incomplete but	1a. 23/56 vs 30/60 1b. 17/56 vs 20/60 1c. 16/56 vs 10/60 Authors report "blood pressure...response was similar for both groups, as were drug side effects and overt non-compliance with treatment." 2a. 172(3)/113(2) vs	...	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			substantial BP control (DBP 95-105 mmHg during treatment). 1c. Number of patients that did not achieve BP control (DBP >105 mmHg during treatment). 2. Mean (SEM) BP measurements. 2a. SBP/DBP mmHg overall: pretreatment; reduction after treatment. 2b. Mean (SEM) SBP pretreatment/posttreatment in patients with DBP <95 mmHg during treatment. 2c. Mean (SEM) DBP pretreatment/posttreatment in patients with DBP <95 mmHg during treatment. 2d. Mean (SEM) SBP pretreatment/posttreatment in patients with DBP 95 to 105 mmHg during treatment. 2e. Mean (SEM) DBP pretreatment/posttreatment in patients with	167(4)/111(2); 19.5(2.5)/13.4(1.4) vs 18.3(3.3)/14.5(1.4) Note: p<0.02 for difference in CCDSS and control regression slopes for SBP; no difference reported for DBP. 2b. 165(4)/142(3) vs 162(5)/136(3) 2c. 105(2)/90(0.9) vs 107(2)/89(0.9) 2d. 167(5)/151(6) vs 163(7) /154(4) 2e. 110(2)/100(0.7) vs 108(2)/98(0.6) 2f. 187(5)/168(5) vs 189(11)/173(7) 2g. 129(3)/112(2) vs 129(4)/116(3) 3a. 74.2% vs 79.6% 3b. 72.8% vs 58.6% 3c. 54.3% vs 44.6% 4a. 20.9 (3.3) vs 24.8 (2.8) 4b. 28.6 (3.7) vs 39.6 (2.3) 4c. 35.7 (2.9) vs 22.8 (6.1)		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			DBP 95 to 105 mmHg during treatment. 2f. Mean (SEM) SBP pretreatment/posttreatment in patients with DBP >105 mmHg during treatment. 2g. Mean (SEM) DBP pretreatment/posttreatment in patients with DBP >105 mmHg during treatment. 3. Time in compliance, %. 3a. For patients with DBP <95 mmHg during treatment. 3b. For patients with DBP 95 to 105 mmHg during treatment. 3c. For patients with DBP >105 mmHg during treatment. 4. Weeks of treatment, ?mean (SEM). 4a. For patients with DBP <95 mmHg during treatment. 4b. For patients with DBP 95 to 105 mmHg during treatment.	5a. 15.5 (2.7) vs 19.8 (2.6) 5b. 20.8 (3.4) vs 23.2 (3.1) 5c. 19.4 (2.8) vs 10.2 (1.7) 6Ia. 1 vs 2 6IIa. 16 vs 13 6IIb. 3 vs 0 6IIc. 2 vs 1 6IId. 0 vs 3 6IIe. 2 vs 1 6IIf. 1 vs 2 6IIIa.12 vs 2 6IIIb. 2 vs 0 6IIIc. 1 vs 0 6IIId. 1 vs 0 6IIIe. 1 vs 0		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			4c. For patients with DBP >105 mmHg during treatment. 5. Weeks of compliance, ?mean (SEM). 5a. For patients with DBP <95 mmHg during treatment. 5b. For patients with DBP 95 to 105 mmHg during treatment. 5c. For patients with DBP >105 mmHg during treatment. 6. Number of patients with side effects from different anti-hypertensive drugs. I.Thiazide (n=NR) a. Gout II.Alphamethyldopa (n=26 vs 21) a. Somnolence b. Syncope c. Depression d. Reaction e. Cannot take f. No higher dose III. Guanethidine (n=19 vs 9)			

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			a. Postural dizziness b. Syncope c. Impotence d. Diarrhea e. Reaction Note: Type of drugs prescribed in each group also reported by final DBP control (Table 3 in article).			
Davis, 2007[35]	Primary 1. Change in proportion of prescriptions consistent with evidence-based recommendations over 18-50 months (difference, 95% CI). By study site: Pediatric Care Center (PCC, University of Washington outpatient teaching clinic) or Skagit Pediatrics (SP. Primary care pediatric clinic) 2. Change in proportion of prescriptions for otitis media consistent with evidence-based recommendations (difference, 95% CI). PCC over 50 months / SP over 18 months 2a. Antibiotic treatment. 2b. Amoxicillin. 2c. Twice daily treatment. 2d. <10 days of antibiotics.	1. 4% vs 1% (8%, 1 to 15) 2a. -20% vs -23% (15%, 2 to 30) / -5% vs -27% (24%, 8 to 40) 2b. 12% vs -23% (-2%, -17 to 13) / 3% vs -7% (12%, -12 to 37) 2c. 20% vs 36% (-8%, -28 to 11) / 0% vs 3% (6%, -21 to 32) 2d. 7% vs 13% (-7%, -21 to 6) / 0% vs 0% (0%, -0.1 to 0.6) 2e. 7% vs 15% (9%, -6 to 24) / -10% vs -3% (-3%, -17 to 11) 3a. 11% vs 5% (19%, 4 to 35) / 6% vs -21% (39%, -32 to 110) 4a. 21% vs 32% (-6%, -18 to 7) 5a. 15% vs 3% (15%, -1 to	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	2e. Dosage. 3. Change in proportion of prescriptions for allergic rhinitis consistent with evidence-based recommendations (difference, 95% CI). PCC over 50 months / SP over 18 months 3a. Appropriate treatment choice. 4. Change in proportion of prescriptions for bronchiolitis consistent with evidence-based recommendations at PCC over 50 months (difference, 95% CI). [Insufficient data for SP site] 4a. Albuterol. 5. Change in proportion of prescriptions for sinusitis, pharyngitis, croup, constipation, or urticaria consistent with evidence-based recommendations (difference, 95% CI). PCC over 50 months / SP over 18 months. 5a. Appropriate treatment choice. Note: Proportional changes were based on individual-prescription-level data; differences were obtained using analyses adjusted for provider clustering and volume of provider visits. Note: Very limited data were provided for 2 subanalyses: use of	32) / -14% vs -19% (26%, -41 to 94)				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	a 1-click prescription change option and exploration of provider fatigue over time.					
Demakis, 2000[36]	Primary outcomes 1. Proportion of patients in compliance with all 13 standards of care over 17 months. N, % adherent; OR (95% CI). 1a. All standards. 1b. Coronary artery disease, lipid levels. 1c. Hypertension: weight, exercise, sodium. 1d. Diabetes: glycosylated hemoglobin level. 1e. Diabetes: nutrition counselling. 1f. Diabetes: urinalysis. 1g. Diabetes: eye exam. 1h. Diabetes of peripheral vascular disease: foot exam. 1i. Smokers: cessation counselling. 1j. Age =>65 or high risk: pneumonoccal vaccination. 1k. Warfarin treatment monitoring. 1l. Atrial fibrillation: warfarin, aspirin, or ticlopidine. 1m. Myocardial infarction: beta-blocker. 1n. Gastrointestinal bleeding/NSAID therapy: switch drugs. 2. Proportion of all visits for which	1a. 19,373, 58.8% vs 20,575, 53.5%; 1.24 (1.08 to 1.42, P = 0.002) 1b. 1813, 79.0% vs 1894, 78.3%; 1.05 (0.82 to 1.34, p=0.72) 1c. 4244, 55.2% vs 4471, 49.3%; 1.27 (0.92 to 1.75, p=0.14) 1d.1904, 70.6% vs 2089, 65.9%; 1.24 (0.89 to 1.73, p=0.19) 1e. 1896, 61.6% vs 2064, 53.3%; 1.29 (0.93 to 1.79, p=0.12) 1f. 1614, 69.8% vs 1804, 62.6%; 1.38 (1.13 to 1.68, p=0.001) 1g. 1760, 73.5% vs 1942, 63.4%; 1.60 (1.29 to 2.00, p<0.001) 1h. 2160, 48.6% vs 2330, 42.8%; 1.26 (1.02 to 1.56, p=0.03) 1i. 935, 63.5% vs 968, 54.8%; 1.44 (1.01 to 2.05, p=0.04) 1j. 1759, 12.7% vs 1688, 4.3%; 3.26 (2.09 to 5.09, p<0.001)	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	care was indicated and residents provided proper care over 17 months. N, % adherent; OR (95% CI). 2a. All standards. 2b. Coronary artery disease: lipid levels. 2c. Hypertension: weight, exercise, sodium. 2d. Diabetes: glycosylated hemoglobin level. 2e. Diabetes: nutrition counselling. 2f. Diabetes: urinalysis. 2g. Diabetes: eye exam. 2h. Diabetes or peripheral vascular disease: foot exam. 2i. Smoking cessation counselling. 2j. Age =>65y or high risk: pneumococcal vaccination. 2k. Warfarin treatment: monitoring. 2l. Atrial fibrillation: warfarin, aspirin, or ticlopidine. 2m. Myocardial infarction: beta-blocker. 2n. Gastrointestinal bleeding/NSAID therapy: switch drugs.	1k. 287, 67.3% vs 276, 64.5%; 1.13 (0.68 to 1.88, p=0.63) 1l. 236, 75.0% vs 241, 81.7%; 0.67 (0.41 to 1.09), p=0.10 1m. 275, 44.7% vs 334, 41.3%; 1.15 (0.81 to 1.62, p=0.42) 1n. 490, 65.5% vs 474, 67.9%; 0.90 (0.65 to 1.23, p=0.49) 2a. 12,759, 17.9% vs 14,013 12.2%; 1.57 (1.45 to 1.71, p < 0.001) 2b.833, 30.4% vs 815, 24.4%; 1.35 (1.07 to 1.71, p=0.01) 2c. 3540, 17.0% vs 3896, 10.3%; 1.77 (1.53 to 2.05, p<0.001) 2d. 1037, 26.5% vs 1184, 20.1%; 1.43 (1.17 to 1.77, p=0.001) 2e. 1596, 17.0% vs 1800, 13.7%; 1.29 (1.05 to 1.58, p=0.02) 2f. 972, 20.3% vs 1190, 16.0%; 1.34 (1.06 to 1.68, p=0.01) 2g. 796, 17.7% vs 1094, 9.0%; 2.19 (1.63 to 2.94,				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
		p<0.001) 2h. 2169, 13.1% vs 2201,5.5%; 2.57 (2.02 to 3.26, p<0.001) 2i. 471, 12.5% vs 514, 8.2%; 1.61 (1.02 to 2.53, p=0.04) 2j. 883, 7.9% vs 829, 1.1%; 7.85 (3.83 to 16.08, p<0.001) 2k. 105, 32.4% vs 122, 42.6%; 0.64 (0.36 to 1.15, p=0.13) 2l. 62, 54.8% vs 66, 53.0%; 1.08 (0.51 to 2.28, p=0.85) 2m. 150, 18.0% vs 189, 18.0%; 1.00 (0.54 to 1.85, p>0.99) 2n. 145, 24.8% vs 113, 31.0%; 0.74 (0.40 to 1.34, p=0.31)				
Derose, 2005[37]	1-4 primary outcomes 1. Rate of dispensed prescriptions for ACEIs or ARBs within 2 weeks after the 1st visit by an eligible patient: n/N (%, 95% CI), p-value. 2. Rate of dispensed prescriptions for statins within 2 weeks after the 1st visit by an eligible patient: n/N (%, 95% CI), p-value. 3. Rate of dispensed prescriptions	1. 164/2311 (7.1%, 6.1 to 8.2) vs 134/2367 (5.7%, 4.8 to 6.7), p= 0.048 2. 171/2103 (8.1%, 7.6 to 10.2 vs 160/2080 (7.7%, 6.6 to 8.9, p= 0.61 3. NR/4414 (7.6%, 6.8 to 8.4) vs NR/4447 (6.6%, 5.9 to 7.4), p=0.08 4. 1.192 (1.01 to 1.40), p=0.04 5. 1.16/1.20, p=0.92 for	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	for either type of medication (ACE-I/ARB or statin) within 2 weeks after the 1st visit by an eligible patient: n/N (%, 95% CI); OR, 95% CI, p-value. 4. Odds ratio (95% CI) for prescribing ACE-I, ARB, or statins in intervention vs control group, controlling for number of visits, medication recommended, and patient age, sex, and past medication use. Subgroup analyses (not clearly prespecified). 5. Odds ratio for intervention vs control specialists/primary care physicians. 6. Interaction for number of visits (1 vs >1) and treatment group (CCDSS vs control). Note: Included pts were those eligible for ACE-I/ARB but not dispensed drug in past 12 mo or eligible for statins or other lipid-lowering drug but not dispensed drug in past 6 mo.	interaction. 6. No significant interaction for # visits and treatment group.				
Dexter, 1998[38]	Pre-specified - rate of discussions and rate of form completion 1. Rate (%) of advance directive discussions at 1 year; OR (95%CI)	1a. 24 vs 4; 7.7(3.4-18) 1b. 14 vs 4; 4.4(2.1-9.4) 1c. 8 vs 4; 2.5(1.1-5.5)	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	a. Instruction directives and proxy directive reminders b. Instruction directive reminders c. Proxy directive reminders 2. Rate (%) form completion of either directive at 1 year; OR (95%CI) a. Instruction directives and proxy directive reminders b. Instruction directive reminders c. Proxy directive reminders	2a. 15 vs 4; 7.0(2.9-17) 2b. 7 vs 4; 3.0(1.1-8.0) 2c. 3 vs 4; 1.0(0.4-2.7)				
Dexter, 2001[39]	(primary outcomes-"the rates at which the various preventive therapies were ordered") 1 Proportion of hospitalizations with an order for therapy 1a. Pneumococcal vaccination 1b. Influenza vaccination 1c. Prophylactic heparin 1d. Prophylactic aspirin at discharge 2 Proportion of hospitalizations during which therapy was ordered for an eligible patient 2a. Pneumococcal vaccination 2b. Influenza vaccination 2c. Prophylactic heparin 2d. Prophylactic aspirin at discharge	1a. 8.5% vs. 0.9%, p<0.001 1b. 5.4% vs. 0.4%, p<0.001 1c. 10.5% vs. 8.2%, p<0.001 1d. 29.7% vs. 25.4%, p=0.005 2a. 35.8% vs. 0.8%, p<0.001 2b. 51.4% vs. 1.0%, p<0.001 2c. 32.2% vs. 18.9%, p<0.001 2d. 36.4% vs. 27.6%, p<0.001	...	...	1	...
Downs,	Pre-specified; 9-mo follow-up	1. 32 (30%) vs 11 (20%) vs	...	...	0	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
2006[40]	Main outcomes Group 1 (CCDSS) vs 2 (CD-ROM) vs 3 (Workshop) vs 4 (Control) 1. Detection of dementia in patients ≥ 75 y of age: n (%). 2. Concordance with guidelines regarding diagnosis: n, mean (SD) (primary outcome). 3. Concordance with guidelines regarding management: n, mean (SD). Note: Pre-intervention detection and concordance rates were also reported; however, authors indicated these were not directly comparable because pre-intervention data were collected for up to 12 years while post-intervention data was collected for 9 months.	21 (31%) vs 6 (11%); CCDSS vs control, p=0.01; Workshop vs control, p=0.01 2. n=32 vs 11 vs 21 vs 6; 3.1 (2.4) vs 3.6 (1.4) vs 3.5 (2.4) vs 3.3 (2.0), p=0.4 overall 3. n=163 vs 102 vs 112 vs 73; 1.8 (1.4) vs 1.5 (1.4) vs 2.3 (1.5) vs 1.3 (1.3), p=0.3 overall				
Eccles, 2002[41]	Prespecified (adherence) 1. Adherence to angina guideline recommendations for all patients (n=2335; n=1117 computerized system, n=1218 controls) proportion of patients 12 months before/12 months after intervention period; odds ratio (95%CI). 1a. BP recorded. 1b. Exercise recorded or advised. 1c. Weight recorded or advised.	1a. 77%/80% vs 77%/80%; 1.01 (0.74 to 1.39) 1b. 9%/10% vs 13%/13%; 0.91 (0.55 to 1.50) 1c. 23%/26% vs 24%/30%; 0.86 (0.54 to 1.35) 1d. 20%/22% vs 22%/32%; 0.68 (0.42 to 1.11) 1e. 3%/4% vs 3%/4%; 1.08 (0.86 to 1.77) 1f. 15%/14% vs 16%/14%; 1.01 (0.68 to 1.52)	Prespecified 1. Change in overall quality of life (SF-36 and EQ-5D questionnaires) from 12 months before to 12 months after intervention. 2. Change in disease-specific quality of life (Seattle angina questionnaire,	1. No difference between groups (data not reported) 2. No difference between groups (data not reported) 3a. 8.5 (6.4) vs 8.6 (6.2); 1.10 (0.91 to 1.11) 3b. 1.6 (2.4) vs 1.6 (2.3); 1.05 (0.83 to	0	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	1d. Smoking status known. 1e. Smoking education given. 1f. 12 lead electrocardiogram recorded. 1g. Exercise electrocardiogram recorded. 1h. Hemoglobin concentration recorded. 1i. Thyroid function recorded. 1j. Cholesterol or other lipid concentrations recorded. 1k. Blood glucose or HbA1c concentrations recorded. 2. Adherence to angina guideline recommendations for patients consulting during the intervention period (n=2276; n=1084 computerized system, n=1192 controls) proportion of patients 12 months before/12 months after intervention period; odds ratio (95%CI). 2a. BP recorded. 2b. Exercise recorded or advised. 2c. Weight recorded or advised. 2d. Smoking status known. 2e. Smoking education given. 2f. 12 lead electrocardiogram recorded. 2g. Exercise electrocardiogram recorded. 2h. Hemoglobin concentration	1g. 4%/3% vs 4%/3%; 1.01 (0.56 to 1.80) 1h. 29%/33% vs 29%/33%; 1.01 (0.72 to 1.42) 1i. 17%/19% vs 18%/22%; 0.83 (0.62 to 1.12) 1j. 35%/43% vs 35%/47%; 0.85 (0.65 to 1.12) 1k. 20%/27% vs 22%/27%; 0.96 (0.67 to 1.39) 2a. 79%/82% vs 79%/82%; 1.95 (0.75 to 1.46) 2b.9%/10% vs 13%/13%; 0.90 (0.54 to 1.46) 2c.23%/26% vs 24% vs 30%; 0.87 (0.55 to 1.37) 2d. 20%/22% vs 22%/32%; 0.68 (0.41 to 1.13) 2e. 3%/4% vs 3%/4%; 1.09 (0.66 to 1.78) 2f. Only post-intervention data: 9% vs 8%; 0.94 (0.58 to 1.53) 2g. Only post-intervention data; 2% vs 2%; 1.05 (0.56 to 1.98) 2h. Only post-intervention data: 29% vs 26%; 1.08 (0.74 to 1.56) 2i. Only post-intervention data: 16% vs 16%; 0.94	Newcastle asthma symptoms questionnaire, and the asthma quality of life questionnaire) from 12 months before to 12 months after intervention. 3. Mean (SD) number of consultations by angina patients; OR (95%CI), 3a. During intervention period. 3b. For angina. 4. Mean (SD) number of consultations by asthma patients; OR (95%CI), 4a. During intervention period. 4b. For asthma.	1.33) 4a. 6.7 (6.3) vs 6.8 (5.8); 1.01 (0.92 to 1.11) 4b. 1.5 (2.3) vs 1.6 (2.2); 0.94 (0.81 to 1.06)		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	recorded. 2i. Thyroid function recorded. 2j. Cholesterol or other lipid concentrations recorded. 2k. Blood glucose or HbA1c concentrations recorded.	(0.67 to 1.33) 2j. Only post-intervention data: 45% vs 48%; 0.87 (0.66 to 1.14) 2k. Only post-intervention data: 28% vs 28%; 0.97 (0.67 to 1.41)				
	3. Drugs prescribed for patients with angina (n=2881; n=1415 computerized system, n=1466 controls) proportion of patients 12 months before/12 months after intervention period; odds ratio (95%CI). 3a. Short acting glyceryl trinitrate. 3b. Beta blockers. 3c. Verapamil. 3d. Modified release glyceryl trinitrate. 3e. Transdermal glyceryl trinitrate. 3f. Isosorbide dinitrate (short acting and modified release). 3g. Isosorbide monomitrate (short acting and modified release). 3h. Diltiazem. 3i. Calcium channel blockers. 3j. Statins. 3k. Beta blocker and dinitrate (guideline specifically recommended not using these combinations). 3l. Calcium blocker and dinitrate	3a. 58%/57% vs 57%/55%; 1.11 (0.87 to 1.41) 3b. 47%/48% vs 49%/49%; 0.99 (0.73 to 1.33) 3c. 2%/2% vs 1%/1%; 1.02 (0.57 to 1.82) 3d. 3%/3% vs 3%/3%; 0.97 (0.50 to 1.54) 3e. 1%/1% vs 2%/2%; 1.03 (0.54 to 1.98) 3f. 5%/4% vs 6%/5%; 0.91 (0.63 to 1.31) 3g. 37%/37% vs 38%/37%; 1.11 (0.79 to 1.56) 3h. 19%/19% vs 21%/20%; 1.43 (0.87 to 2.34) 3i. 28%/27% vs 26%/25%; 1.12 (0.80 to 1.58) 3j. 29%/35% vs 30%/38%; 0.92 (0.67 to 1.25) 3k. 1%/1% vs 2%/2%; 1.24 (0.66 to 2.33) 3l. 2%/2% vs 3%/3%; 1.15 (0.68 to 1.95) 3m. 8%/7% vs 8%/8%;				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	(guideline specifically recommended not using these combinations). 3m. Nitrate, calcium blocker and beta blocker (guideline specifically recommended not using these combinations). 4. Adherence to asthma guideline recommendations for patients consulting during the intervention period (n=2363; n=1200 computerized system, n=1163 controls); proportion of patients 12 months before/12 months after intervention period; odds ratio (95%CI)). 4a. Lung function assessed. 4b. Compliance checked. 4c. Inhaler technique assessed. 4d. Asthma education, action plan, or both. 4e. Smoking status known. 4f. Smoking cessation advice or nicotine replacement therapy. 5. Adherence to asthma guideline recommendations for all patients (n=2230; n=1129 computerized system, n=1101 controls); proportion of patients 12 months before/12 months after intervention period; odds ratio	0.75 (0.46 to 1.22) 4a. 43%/43% vs 42%/45%; 0.94 (0.67 to 1.33) 4b. 36%/37% vs 38%/41%; 0.82 (0.58 to 1.15) 4c. 17%/19% vs 20%/23%; 0.8 (0.5 to 1.28) 4d. 7%/5% vs 9%/7%; 0.84 (0.4 to 1.74) 4e. 24%/32% vs 26%/32%; 0.97 (0.65 to 1.45) 4f. 5%/7% vs 6%/9%; 0.75 (0.45 to 1.26) 5a. 45%/45% vs 45%/47%; 0.94 (0.66 to 1.34) 5b. 37%/39% vs 40%/43%; 0.82 (0.58 to 1.16) 5c. 18%/20% vs 21%/24%; 0.81 (0.5 to 1.28) 5d. 7%/5% vs 10%/7%; 0.81 (0.39 to 1.67) 5e. 25%/33% vs 28%/33%; 0.98 (0.66 to 1.46) 5f. 5%/8% vs 6%/9%; 0.76 (0.46 to 1.27) 6a. 82%/80% vs 84%/80%; 1.04 (0.83 to 1.31) 6b. 77%/72% vs 73%/70%; 0.95 (0.78 to 1.16)				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	(95%CI)). 5a. Lung function assessed. 5b. Compliance checked. 5c. Inhaler technique assessed. 5d. Asthma education, action plan, or both. 5e. Smoking status known. 5f. Smoking cessation advice or nicotine replacement therapy. 6. Drugs prescribed for patients with asthma (n=2776; n=1391 computerized system, n=1385 controls) proportion of patients 12 months before/12 months after intervention period; odds ratio (95%CI). 6a. Short acting β2 agonists. 6b. Inhaled corticosteroids. 6c. Long acting β2 agonists. 6d. Oral steroids. 6e. Oral bronchodilators. 7. Mean (SD) number of consultations by angina patients; OR (95%CI), 7a. During intervention period. 7b. For angina. 8. Mean (SD) number of consultations by asthma patients; OR (95%CI), 8a. During intervention period.	6c. 13%/14% vs 12%/13%; 0.84 (0.59 to 1.20) 6d. 23%/23% vs 21%/21%; 1.0 (0.82 to 1.22) 6e. 7%/7% vs 9%/9%; 1.38 (0.56 to 3.39) 7a. 8.5 (6.4) vs 8.6 (6.2); 1.10 (0.91 to 1.11) 7b. 1.6 (2.4) vs 1.6 (2.3); 1.05 (0.83 to 1.33) 8a. 6.7 (6.3) vs 6.8 (5.8); 1.01 (0.92 to 1.11) 8b. 1.5 (2.3) vs 1.6 (2.2); 0.94 (0.81 to 1.06)				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	8b. For asthma.					
Emery, 2007[42]	At practice level: 1.Mean referral rate per 10,000 registered patients per practice per year (SD); difference (95% CI), p-value (primary-outcome related) 2.Proportion (n, %) of referrals made to regional genetics clinic that were consistent with referral guidelines at 12 months, OR (95% CI), p-value (primary outcome). 2a. Breast and bowel cancer. 2b. Breast cancer. 2c. Bowel cancer. Proportions with increased risk (determined by Regional Genetics Clinic): 2d. Breast and bowel cancer. 2e. Breast cancer. 2f. Bowel cancer.	1. 6.2 (3.1) vs 3.2 (2.8); 3.0 (1.12 to 4.8), P=0.002 2a. 174/183 (95%) vs 67/85 (79%), 5.2 (1.7 to 15.8), P=0.006 2b. 99/107 (93%) vs 44/60 (73%); 4.5 (1.6 to 13.1) 2c. 75/76 (99%) vs 23/25 (92%); 6.5 (0.5 to 83.7) 2d. 90/132 (68%) vs 40/53 (75%); 0.7 (0.3 to 1.5), p=0.35 2e. 60/78 (77%) vs 23/33 (70%); 1.4 (0.6 to.3.5) 2f. 30/54 (56%) vs 17/20 (85%); 0.2 (0.1 to 0.8)	All predefined and assessed at referral. 1.Mean cancer worry score (lower is better) (SD), difference (95% CI), p-value 2.Risk perception score (lower is better) (SD);, difference (95% CI), p-value 3. Accuracy of patient risk perception compared with Regional Genetics Clinic assessment; n (%) 3a. Accurate assessment. 3b. Under-estimation. 3c. Over-estimation 4.Knowledge about familial cancer (SD);, difference (95% CI), p-value a.Colorectal b.Breast	1.5.74 (3.04) vs 7.18 (3.43), -1.44 (-2.64 to -0.23), P=0.02 2.4.99 (1.14) vs 5.04 (0.88);-0.09 (0.34 to -0.51) 3a. 59 (68%) vs 22 (55%) 3b. 18 (21%) vs 9 (23%) 3c. 10 (11%) vs 9 (23%) 4 a.5.50 (2.46) vs 4.86 (3.30); 0.64 (-1.01 to 2.29), NS b.5.77 (2.90) vs 5.66 (2.78); 0.11 (-1.05 to 1.27), NS	1	0
Feldman, 2005[43]	Not prespecified as an outcome; data obtained from patient chart abstraction. Augmented intervention (n=118 nurses) vs usual care (n=122); basic	1a. 23.9% vs 3.7%, p<0.001; 13.8% vs 3.7%, p=0.006 1b. 48.7% vs 27.6%, p=0.001; 38.2% vs 27.6%,	Patients included/evaluated: Augmented (404/202), Basic (390/199), Usual Care (448/227).	1a. 45.6 vs 40.4, p=0.048; 46.6 vs 40.4, p=0.013 1b. 43.0 vs 37.8, p=0.231; 42.5 vs	0	0

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	intervention (n=114) vs usual care.	p=0.076		37.8, p=0.333		
	1) Proportion of nurses recording the following assessments over 45 days: %, p-value.	1c. 34.4% vs 24.8%, p=0.109; 31.1% vs 24.8%, p=0.285	All main outcomes at 45 days after admission (augmented	1c. 53.6 vs 48.6, p=0.277; 55.6 vs 48.6, p=0.091		
	1a. Comprehensive HF assessment (weight, shortness of breath, and edema) at all visits for all assigned patients.	1d. 59.6% vs 48.2%, p=0.077; 62.7% vs 48.2%, p=0.024	intervention vs usual care; basic intervention vs usual	1d. 53.3% vs 44.6%, p=0.042; 48% vs 44.6%, p=0.407		
	1b. Current diet (≥ 1 time for each assigned patient).	1e. 23.6% vs 12.7%, p=0.03; 15.3% vs 12.7%, p=0.558	care):	1e. 35.2% vs 27.8%, p=0.064; 34.8% vs 27.8%, p=0.09		
	1c. Medication knowledge (≥ 1 time for each assigned patient).		1. Kansas City Cardiomyopathy Questionnaire (KCCQ)	1f. 86.3% vs 85.8%, p=0.88; 86.8% vs 85.8%, p=0.756		
	1d. Adherence to medication (≥ 1 time for each assigned patient).	2a. 59.5% vs 42.1%, p=0.007; 53.9% vs 42.1%, p=0.07,	mean score (score range 0-100, higher scores = better			
	1e. Medication side effects (≥ 1 time for each assigned patient).	2b. 28.9% vs 18.1%, p=0.053; 31.1% vs 18.1%, p=0.021	outcome), p-value.	2. 40.2 vs 39.3, p=0.777; 48.9 vs 39.3, p=0.003		
	2. Proportion of nurses instructing patients (or caregivers) on the following over 45 days: %, p-value.	2c. 39.7% vs 20.6%, p=0.001; 29.9% vs 20.6%, p=0.097	1a. Summary score. 1b. (Mean?) physical limitation score. 1c. (Mean?) symptom score.	3. 36.9% vs 36.3%, p=0.888; 37.4% vs 36.3%, p=0.802		
	2a. HF signs and symptoms (shortness of breath, fluid weight gain, or fatigue, or general signs and symptoms ≥ 1 time for each assigned patient).	2d. 15.9% vs 11.8%, p=0.353; 10.5% vs 11.8%, p=0.752	1d. Proportion of patients with quality of life scores ≥ 50.	4a. 44.1 vs 35.2, p=0.053; 43.6 vs 35.2, p=0.048		
	2b. HF symptom: shortness of breath (≥ 1 time for each assigned patient).	2e. 48.7% vs 16.0%, p<0.001; 37.2% vs 16.0%, p<0.001	1e. Proportion of patients with social limitation scores ≥ 50.	4b. 24.2% vs 25%, p=0.839; 30.3% vs 25%, p=0.209		
	2c. HF symptom: fluid weight gain (≥ 1 time for each assigned patient).	2f. 11.9% vs 5.7%, p=0.116; 8.0% vs 5.7%, p=0.505	1f. Proportion of patients with self efficacy scores ≥ 50.	4c. 2.33 vs 1.8, p=0.383; 1.97 vs 1.8, p=0.729		
	2d. HF symptom: fatigue (≥ 1 time for each assigned patient).	2g. 49.6% vs 22.7%, p<0.001; 40.4% vs 22.7%, p=0.003	2. (?Mean) EuroQoL EQ-5D scale score.	4d. 32.1% vs 28.8%, p=0.459; 28.2% vs 28.8%, p=0.882		
		2h. 59.7% vs 51.2%,	3. Proportion of			

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	2e. Weighing self (≥ 1 time for each assigned patient). 2f. Managing fluid weight gain (≥ 1 time for each assigned patient). 2g. Low salt diet (≥ 1 time for each assigned patient). 2h. Medication management (≥ 1 time for each assigned patient). 2i. Methods to improve medication adherence (≥ 1 time for each assigned patient). 2j. When to contact a physician (≥ 1 time for each assigned patient). 2k. Provided HF self-care guide (≥ 1 time for each assigned patient). 3. Proportion of patients with the following self-management indicators: %, p-value. 3a. Patient skips medicine. 3b. Patient is sure about when to take HF medication. 3c. Patient recognized own HF medicines: None/≤50%/>50%. 3d. Patient salts food. 3e. Patient's weighing behavior: no scale/weighs self < daily/weigh self daily.	p=0.195; 57.0% vs 51.2%, p=0.385 2i. 18.0% vs 15.0%, p=0.532; 26.5% vs 15.0%, p=0.03 2j. 42.8% vs 27.3%, p=0.014; 36.2% vs 27.3%, p=0.147 2k. 46.2% vs 10.5%, p<0.001; 17.6% vs 10.5%, p=0.113 3a. 25.4% vs 27.6%, p=0.604; 27.7% vs 27.6%, p<0.99 3b. 69.6% vs 67.4%, p=0.613; 70.3% vs 67.4%, p=0.494 3c. 34.3%/30.6%/35.0% vs 43.9%/29.8%/26.3%, p=0.023; 31.1%/30.5%/38.4% vs 43.9%/29.8%/26.3%, p=0.002 3d. 23.3% vs 30.7%, p=0.095; 27.6% vs 30.7%, p=0.490 3e. 27.9%/44.7%/27.4% vs 34.6%/44.0%/21.4%, p=0.082; 38.3%/43.0%/18.7% vs 34.6%/44.0%/21.4%, p=0.352	patients with Geriatric Depression Scale score ≥ 6 (high scores = depression). 4. Service use measures (prespecified). 4a. (?Mean) number of home care-related visits. 4b. Proportion for (patients with?) any hospitalization. 4c. (?Mean) number of inpatient nights. 4d. Proportion for (patients with?) ED visits. 4e.(?Mean) number of ED visits. 4f. Proportion for (patients with?) any outpatient doctor visit. 4g. (?Mean) number of outpatient doctors' visits. Notes: Data estimated from regression analyses. 5. Cost per patient to	4e. 0.53 vs 0.4, p=0.12; 0.44 vs 0.4, p=0.573 4f. 85.1% vs 82.2%, p=0.404; 83.7% vs 82.2%, p=0.639 4g. 2.62 vs 2.85, p=0.546; 2.98 vs 2.85, p=0.771 5a. $235 / $183 5b. $513 / $246 6a. NA*/$116 6b. NA*/$181 *Augmented intervention not effective for improving this outcome.		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			produce a 5% improvement in KCCQ summary score: Augmented/Basic interventions (not clearly prespecified). 5a. Home-care related costs. 5b. Overall costs. 6. Cost per patient to produce a 5% improvement in EuroQoL EQ-5D score: Augmented*/Basic interventions (not clearly prespecified). 6a. Home-care related costs. 6b. Overall costs. *Augmented intervention not effective for improving this outcome. Notes: %'s estimated from regression analyses.			
Feldstein, 2006a[44]	3 CCDSS reminder groups: EMR, automated voice message (AVM), and pharmacy team outreach (PTO). 1. Number (proportion) of patients	EMR vs AVM vs PTO vs Control 1a. 61/196 (31.3%) vs 117/267 (43.8%) vs 184/261 (70.5%) vs 34/237 (14.3%), p<0.001; p<0.05	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	who completed all baseline laboratory monitoring 1a. by day 9, immediately before second reminder 1b. by day 25 (primary) 2. Time to completion of lab tests: hazard ratio (95% CI) (prespecified). 2a. EMR vs control. 2b. AVM vs control. 2c. PTO vs control. HR >1 indicates benefit for treatment group. 3. Number (proportion) of patients with abnormal test results detected (prespecified). Economic analysis reported in a supplementary article. Costs were determined from trial data and a mix of other sources, including expert opinion (US $). 4. Total cost of interventions per 100 patients. 5. Incremental cost per 100 patients (incremental cases completed); ICER per additional completed case. 5a. EMR. 5b. AVM vs control.	for all differences among arms. 1b. 95/196 (48.5%) vs 177/267 (66.3%) vs 214/261 (82.0%) vs 53/237 (22.4%), p<0.001; p<0.05 for all differences among arms. 2a. 2.5 (1.8 to 3.5), p<0.001 2b. 4.1 (3.0 to 5.6), p<0.001 2c. 6.7 (4.9 to 9.0), p<0.001 3. 10/196 (5.1%) vs 18/267 (6.7%) vs 22/261 (8.4%) vs 7/237 (3.0%), p=0.06 4. $3748 vs $4159 vs $5160 vs $2092 5a. ICER = dominated by mix of AVM and control (mix would be less expensive and more effective than EMR). 5b. $2067 (44); $47 5c. $1001 (16); $64 6a. 0.02 vs 0.14 vs 0.00 vs 0.84				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	5c. PTO vs AVM. 6. Probability of cost-effectiveness for maximum willingness-to-pay level for an additional completed case. 6a. Willingness to pay, $40. 6b. Willingness to pay, $60. 6c. Willingness to pay, $80. 7. Incremental cost per 100 patients (incremental abnormal cases found); ICER per additional abnormal case found. 7a. EMR. 7b. AVM vs control. 7c. PTO vs AVM. 8. Probability of cost-effectiveness for maximum willingness-to-pay level for an additional abnormal case found. 8a. Willingness to pay, $400. 8b. Willingness to pay, $600. 8c. Willingness to pay, $800. 9. Sensitivity analysis based on estimates of time for ordering, reviewing, and follow-up of tests. 9a. Low estimates. 9b. High estimates. 10. Sensitivity analysis of cost of contact for patients in EMR group.	6b. 0.00 vs 0.59 vs 0.39 vs 0.01 6c. 0.00 vs 0.16 vs 0.84 vs 0.00 7a. ICER dominated. 7b. $2067 (3.79); $546 7c. $1001 (1.69); $593 8a. 0.09 vs 0.18 vs 0.11 vs 0.62 8b. 0.13 vs 0.30 vs 0.35 vs 0.22 8c. 0.12 vs 0.32 vs 0.50 vs 0.07 9a. No difference in ICER ranking, AVM ICER = $44 9b. No difference in ICER ranking, AVM ICER = $50 10. Data not reported. States “even if the cost of patient contact were reduced to zero…the EMR arm would never be the optimal strategy.”				
Feldstein,	At 6 months	1a. 43.1% vs 5.9%; p<0.01	1. Mean change in	1. 0.08 vs 0.07 vs -	1	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
2006b[44]	1. % of participants who received BMD measurement or osteoporosis medication within 6 months of the start of the study; p-value (primary). 1a. provider reminder + patient reminder vs control 1b. provider reminder alone vs control 1c. provider reminder + patient reminder vs provider reminder alone 2. Change in probability of BMD measurement as predicted by linear model: coefficient (represents absolute change)(95% CI); p-value 2a. Provider reminder + patient reminder vs control 2b. Provider reminder vs control 3. Change in probability of osteoporosis medication prescription as predicted by linear model; coefficient (represents absolute change)(95% CI); p-value 3a. Provider reminder + patient reminder vs control 3b. Provider reminder vs control 4. Change in probability of EITHER BMD measurement or osteoporosis	1b. 51.5% vs 5.9%, p<0.01 1c. 43.1% vs 51.5%, p=0.88 2a. 0.31 (0.21 to 0.43) 2b. 0.39 (0.28 to 0.50) 3a. 0.15 (0.05 to 0.26) 3b. 0.23 (0.12 to 0.33) 4a. 0.38 (0.26 to 0.50) 4b. 0.47 (0.35 to 0.59) 5a. 22.9% vs 0.9%, p<0.01 5b. 23.8% vs 0.9%; p<0.01 5c. 22.9% vs 23.8%, p=0.43 6a. 10.1% vs 4.0%; p<0.01 6b. 11.9% vs 4.0%; p<0.01 6c. 10.1% vs 11.9% ; p=0.54 7. 0.08 vs 0.07 vs -0.07; p<0.81	patient satisfaction with care and service score (EMR plus patient reminders vs EMR reminders alone vs control); p-value (secondary) 2. Caloric expenditure per week at baseline, at 6 months; p-value (secondary) 2a. Provider reminder + patient reminder vs control 2b. Provider reminder vs control 3. n/N, % of responders participating in regular physical activity at baseline, at 6 months; p-value (secondary) 3a. Provider reminder + patient reminder vs control 3b. Provider reminder vs control 4. Total calcium intake (mg/day) baseline, at 6 months; p-value (secondary)	0.07; p=0.81 2a. 2614.4, 2525.9 vs 2325.7, 1980.9; p=0.32 2b. 3082.9, 2312.7 vs 2325.7, 1980.9; p=0.96 3a. 11/42, 26.2%, 12/42, 28.6% vs 7/33, 21.2%, 10/33, 30.3%; p=0.55 3b. 9/41, 22%, 8/41,19.5% vs 7/33, 21.2%, 10/33, 30.3%; p=0.17 4a. 1221.5, 1224.7 vs 1308.6, 851.2; p=0.05 4b. 1116.5, 1311.4 vs 1308.6, 851.2; p=0.02		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	medication prescription as predicted by linear model; coefficient (represents absolute change)(95% CI); p-value 4a. Provider reminder + patient reminder vs control 4b. Provider reminder vs control 5. % of participants who received only BMD measurement within 6 months of the start of the study (component of primary); p-value 5a. provider reminder + patient reminder vs control 5b. provider reminder alone vs control 5c. provider reminder + patient reminder vs provider reminder alone 6. % of participants who received only medication within 6 months of the start of the study (component of primary); p-value 6a. provider reminder + patient reminder vs control 6b. provider reminder alone vs control 6c. provider reminder + patient reminder vs provider reminder alone 7. Mean change in patient satisfaction with care and service		4a. Provider reminder + patient reminder vs control 4b. Provider reminder vs control			

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	score (EMR plus patient reminders vs EMR reminders alone vs control); p-value (secondary) Note: n's for those receiving specified treatment can be calculated from article.					
Field, 2009[45]	1. Number of final drug orders that were appropriate; number of appropriate orders/number of alerts (%), Relative Risk (95% CI). (primary) 1a. Dose 1b. Frequency 1c. Avoid 1d. Missing information 1e. Total 2. Final orders for drugs that should have been avoided. Number per 1000 patient-days, Rate ratio, (95% CI) (secondary) 3. Number of drug orders that were appropriate by drug; number of appropriate orders / number of alerts (%) (not prespecified); no p values or CIs provided 3a. Allopurinol 3b. Amantadine 3c. Amoxicillin 3d. Cefprozil 3e. Cefuroxime	1a. 86/114 (75.4%) vs 107/134 (79.9%), 0.95 (0.83 to 1.1) 1b. 30/49 (61.2%) vs 9/35 (25.7%), 2.4 (1.4 to 4.4) 1c. 26/64 (40.6%) vs 10/65 (15.4%), 2.6 (1.4 to 5.0) 1d. 30/47 (63.8%) vs 8/23 (34.8%), 1.8 (1.1 to 3.4) 1e. 172/274 (62.8%) vs 134/257 (52.1%), 1.2 (1.0 to 1.4) 2. 3.5 vs 5.2, 0.68 (0.45 to 1.0) 3a. 0/0 vs 1/2 (50%) 3b. 0/2 (0%) vs 0/3 (0%) 3c. 1/1 (100%) vs 0/0 3d. 0/0 vs 1/1 (100%) 3e. 1/1 (100%) vs 0/0 3f. 16/31 (52%) vs 3/23 (13%) 3g. 7/7 (100%) vs 24/26 (92%) 3h. 1/1 (100%) vs 0/0	...	...	0	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	3f. Cephalexin	3i. 0/0 vs 2/3 (67%)				
	3g. Ciprofloxacin	3j. 18/21 (86%) vs 4/10				
	3h. Clarithromycin	(40%)				
	3i. Colchicine	3k. 0/0 vs 1/5 (20%)				
	3j. Cotrimoxazole	3l. 8/9 (89%) vs 9/9 (100%)				
	3k. Diclofenac	3m. 4/4 (100%) vs 0/1				
	3l. Digoxin	(0%)				
	3m. Famciclovir	3n. 9/10 (90%) vs 28/28				
	3n. Gabapentin	(100%)				
	3o. Glyburide	3o. 4/22 (18%) vs 2/15				
	3p. Ibuprofen	(13%)				
	3q. Indomethacin	3p. 0/0 vs 0/3 (0%)				
	3r. Levofloxacin	3q. 1/2 (50%) vs 0/0				
	3s. Lithium	3r. 50/68 (74%) vs 31/50				
	3t. Loratadine	(62%)				
	3u. Meloxicam	3s. 1/1 (100%) vs 6/6				
	3v. Memantine	(100%)				
	3w. Metformin	3t. 4/5 (80%) vs 0/2 (0%)				
	3x. Metoclopropamide	3u. 0/0 vs 0/5 (0%)				
	3y. Metronidazole	3v. 1/2 (50%) vs 1/1				
	3z. Nitrofurantoin	(100%)				
	3aa.Norfloxacin	3w. 10/26 (39%) vs 3/13				
	3ab. Pentoxifyline	(23%)				
	3ac. Pramipexole	3x. 1/2 (50%) vs 0/0				
	3ad. Primidone	3y. 4/4 (100%) vs 1/1				
	3ae. Ranitidine	(100%)				
	3af. Tetracycline	3z. 15/26 (58%) vs 6/32				
	3ag. Trimethoprim	(19%)				
	3ah. Venlafaxine	3aa. 0/0 vs 1/1 (100%)				
		3ab. 1/1 (100%) vs 0/0				
		3ac. 1/1 (100%) vs 0/0				
		3ad. 0/1 (0%) vs 0/0				
		3ae. 2/4 (50%) vs 2/7				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
		(29%) 3af. 2/2 (100%) vs 0/0 3ag. 1/1 (100%) vs 0/0 3ah. 9/19 (47%) vs 8/10 (80%)				
Fihn, 1994[46]	Mean patient follow-up: 8 months. 1. Ability to increase intervals between visits for CCDSS (n=301 patients) vs control (n=319 patients): Mean number of weeks ± SD. a. Recommended return interval b. Scheduled return interval (primary). c. Actual return interval (primary). 2. Mean ± SD absolute deviation of measured prothrombin times (PTRs) and INRs from their target values (primary). a. PTR. b. INR. Secondary outcome 3. Frequency of dosage changes (dose changes per year). Note: Data also reported separately for 5 participating clinics.	1a. 5.5 ±2.1 vs 5.2 ±2.2, p=NS 1b. 4.4 ±1.8 vs 3.5 ±1.4, p<0.001 1c. 4.4 ±1.8 vs 4.1 ±1.8, p<0.05 2a. 0.19 ±0.16 vs 0.18 ±0.09, p=NS 2b. 0.71 ±1.21 vs 0.66 ±0.40, p=NS 3. 11.2 vs 11.8	Pre-specified outcome; mean follow-up 8 mo. 1. Clinically important bleeding: Number of patients; incidence per 100 patients years. 1a. Serious events. 1b. Life-threatening events. 1c. Relative risk for bleeding complications adjusted for anticoagulation intensity: RR, 95% CI. 2. Thromboembolic complications: Number of patients; incidence per 100 patients years. 2a. Serious events. 2b. Life-threatening events. 2c. Relative risk for thromboembolic complications adjusted for anticoagulation intensity: RR, 95% CI. 3. Deaths. Not prespecified	N=301 vs 319 1a. 11 vs 14; 5.4 vs 6.7 1b. 2 vs 1; 1.0 vs 0.5, p=0.74 for 1a and 1b combined. 1c. 1.1, 0.5 to 2.3 2a. 5 vs 3; 2.4 vs 1.4 2b. 1 vs 0; 0.5 vs 0, p=0.28 for 2a and 2b combined. 2c. 2.1, 0.5 to 8.4 3. No deaths occurred. 4. 15% vs ~50% 5. 3 vs 3	1	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			4. Proportion of hemorrhagic complications that occurred when PTR ratio > 2.0. 5. Number of patients who experienced a 2nd complication.			
Fiks, 2009[47]	Primary outcomes over 6 month intervention. 1. Change in rates of captured opportunities for vaccination (visit-level analysis). Pre to post study, difference (95% CI). 1a. Unadjusted rates. 1b. Rates adjusted for selected covariates. 2. Up-to-date vaccination rates (patient-level analysis). Pre to post study, difference (95% CI). 2a. Unadjusted rates. 2b. Rates adjusted for selected covariates. Secondary outcomes over 6 months. 3. Difference (95% CI) in proportion of children who had ≥1 vaccine dose (intervention vs control). 4. Subgroup analyses by site type	1a. 14.4% to 19.2% vs 12.3% to 16.1%, 1% (-2.4 to 4.9) 1b. 14.4% to 18.6% vs 12.7% to 16.3%, 0.3% (-1.9 to 2.5). 2a. 45% to 53% vs 44.2% to 48.2%, 4.0% (-1.3 to 9.1) 2b. 45.7% to 51% vs 46% to 47.9%, 3.4% (-1.4 to 9.1) 3. 4.0% (-1.1 to 10.7) 4a. P=0.23 4b. 46.8% to 59% vs 47.7%	...	...	0	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	(4 urban teaching practices or 16 mainly suburban, non-teaching practices) for up-to-date vaccination rates over 6 month study. Pre to post study, difference (95% CI). 4a. Overall effect of practice type on up-to-date vaccination rates. 4b. Urban teaching practices – unadjusted rates. 4c. Non-teaching practices – unadjusted rates. 4d. Urban teaching practices – rates adjusted for selected covariates. 4e. Non-teaching practices – rates adjusted for selected covariates. 5. Secondary analysis limited to visits on days when sites administered ≥ 2 doses of influenza vaccine. 6. Proportion of children with a particular number of visits to the office during the influenza season. Percentage points improvement in intervention practices vs control practices. 6a. 1 visit 6b. 2 visits 6c. 3 visits 6d. 4 visits	to 53.9%, 6.0% (0.8 to 11.8) 4c. 44% to 49.5% vs 42.6% to 45.5%, 2.6 (-2.2 to 7.0) 4d. 47.1% to 58.5% vs 47.8% to 53.8%, 5.4 (1.6 to 9.7) 4e. 44.5% to 46.2% vs 44.8% to 44.8%, 1.7 (-2.7 to 5.9) 5. data not provided; impact of intervention was similar to impact in #1 above 6. Overall P = 0.38 6a. 5% 6b. 5.4% 6c. 9.8% 6d. 7.5% 7. Overall P = 0.61 7a. 6.5% 7b. 3.2%				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	7. Improvement in vaccination rate at intervention sites versus control sites. 7a. Children who had received the influenza vaccine previously 7b. Children who had not received the influenza vaccine previously					
Filippi, 2003[48]	1. n (%) patients with antiplatelet drug prescription: baseline (12 mo pre-study/follow-up (over 7 mo study); difference (%); OR (95% CI). 1a. Patients with 1 cardiac risk factor and without CVD. (N=2,651 vs 2,578) 1b. Patients with ≥ 2 cardiac risk factors and without CVD. (N=1,577 vs 1,440) 1c. Patients with CVD. (N=3,802 vs 3,295) 1d. All patients (primary). (N=8,030 vs 7,313)	1a. 358 (13.5%)/736 (27.8%) vs 263 (10.2%)/440 (17.1%); 378 (14.3%) vs 177 (6.9%); 2.38 (1.97 to 2.87) 1b. 224 (14.2%)/508 (32.2%) vs 180 (12.5%)/276 (19.2%); 284 (18.0%) vs 9.6 (6.7%); 3.22 (2.52 to 4.12) 1c. 1,304 (34.3%)/1,768 (46.5%) vs 1,229 (37.3%)/1,526 (46.3%); 464 (12.2%) vs 297 (9.0%); 1.36 (1.16 to 1.59) 1d. 1,886 (23.5%)/3,012 (37.5%) vs 1,672 (22.9%)/2,242 (30.7%); 1,126 (14.0%)* vs 570 (7.8%)*; 1.99 (1.79 to 2.22); * = p<0.001 for change from baseline.	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
Fitzmaurice, 2000[49,50]	1. Point prevalence of patients achieving therapeutic INR target over 12 months (primary outcome – 1 of 2). Baseline/Study % (95% CI) 2. Percentage of time spent in target INR range over 12 months (primary outcome – 1 of 2). Baseline/Study % (95% CI) 3. Proportion of tests in INR range over 12 months. Baseline/Study % (95% CI) Note: Target range varied by clinical indication for treatment: 2.0 to 3.0 or 3.0 to 4.5,	Intervention vs Intrapractice control vs Interpractice control vs Total control NOTE: Only intervention vs Interpractice control assessed for effect. 1. 63% (54 to 71)/71% (63 to 79) vs 50% (40 to 60)/62% (52 to 71) vs 54% (46 to 62)/66% (58 to 73) vs 53% (46 to 59)/ 64% (51 to 65) p=NS for Intervention vs Interpractice control 2. 57% (50 to 63)/69% (66 to 73) vs 52% (44 to 60)/57% (50 to 63) vs 62% (53 to 70)/65% (61 to 70) vs 57% (46 to 69)/62% (54 to 70) (p<0.001 for intervention vs intrapractice control; p=NS for Intervention vs Interpractice control) 3. 61% (55 to 67)/62% (58 to 66) vs 51% (43 to 58)/53% (48 to 59) vs 61% (53 to 68)/62% (58 to 66) vs 55% (44 to 66)/58% (51 to 65)	All prespecified (12 mo study) 1. Serious adverse events. 1a. Deep vein thrombosis. 1b. Transient Ischemic attack.. 1c. Fatal cerebrovascular accident. 1d. Nonfatal cerebrovascular accident. 1e. Saddle embolus 1f, Epistaxis 1g. Total 2. Cause of death.. 2a. Stroke. 2b. Congestive cardiac failure 2c. Ischemic heart disease. 2d. Left ventricular failure. 2e. Renal failure. 2f. Carcinoma. 2g. Total. 3. Patient satisfaction	Intervention/Intrapractice control/Interpractice control/Total control Number of patients;patient-y follow-up per group = 87.3 vs 68.4 vs 97.3 vs 165.7 1a. 1/0/0/0 1b. 0/1/3/4 1c. 1/0/1/1 1d. 0/1/3/4 1e. 0/1/0/1 1f. 1/0/0/0 1g. 3/3/7/10 (NS) Number of patients; rand per group = 122/102/143/245 2a. 1/0/1/1 2b. 1/0/1/1 2c. 0/0/1/1 2d. 0/1/0/1 2e. 0/1/0/1 2f. 1/1/0/1 2g. 3/3/3/6 (NS) 3. Results not presented.	0	0
Flanagan, 1999[51]	1. proportion of sessions by all physicians where at least 1 vaccine	1. 54% (391/726) vs 67% (169/254) (p<0.0005, 0.73,	...	...	0	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	was ordered (number of sessions with at least 1 order/total sessions) (p-value, RR, 95% CI) (prespecified) 2. number of correct vaccine decisions (main outcome) 2a. Tetanus 2b. Hepatitis 2c. Influenza 2d. Pneumococcal 2e. Measles 2f. Total 3. number of correct/incorrect tetanus decisions in which ≥2 vaccine was ordered for CCDSS vs control Many other results (not-pre-specified) provided	0.60 to 0.87) 2a. 346 vs 118 (p=0.771) 2b. 555 vs 206 (p=0.137) 2c. 630 vs 218 (p=0.749) 2d. 593 vs 196 (p=0.119) 2e. 503 vs 188 (p=0.174) 2f. 726 vs 254 (p value not provided) 3.88/23 vs 26/16 (p=0.037)				
Flottorp, 2002[52,53]	Primary outcomes for sore throat (evaluated for 18 wks before and after the intervention) 1. Use of antibiotics: % at follow-up (n/N), % change from baseline, % difference; intracluster correlation coefficient (95%), p value. 2. Use of laboratory tests: % at follow-up (n/N), % change from baseline, % difference; intracluster correlation coefficient (95%), p value. 3. Telephone consultations: % at follow-up (n/N), % change from baseline, % difference; intracluster	1. 43.8% (2202/5031) vs. 49.5% (1552/3135), -4.3% vs. -1.3%, 3.0% 0.085 (0.056 to 0.114), p=0.032 2. 42.0% (2111/5031) vs. 39.7% (1246/3135), -2.6% vs. -2.2%, 0.5%; 0.207 (0.148 to 0.266), p=0.638. 3. 12.9% (612/4751) vs. 14.1% (417/2956), 0.4% vs. 1.6%, 1.2%; 0.050 (0.032 to 0.068), p=0.128	...	...	0	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	correlation coefficient (95%), p value.	Note: Variations in rates of antibiotic use and telephone consultations are also displayed in figure 2 p.4.				
Flottorp, 2002c2[52,53]	Primary outcomes for urinary tract infection (evaluated for 18 wks before and after the intervention) 4. Use of antibiotics: % at follow-up (n/N), % change from baseline, % difference; intracluster correlation coefficient (95%), p value. 5. Use of laboratory tests: % at follow-up (n/N), % change from baseline, % difference; intracluster correlation coefficient (95%), p value. 6. Telephone consultations: % at follow-up (n/N), % change from baseline, % difference; intracluster correlation coefficient (95%), p value.	4. 46.3% (1167/2522) vs. 43.4% (1285/2961), -0.2% vs. 0.2%, 0.4%; 0.085 (0.057 to 0.113), p=0.639 5. 49.8% (1256/2522) vs. 55.0% (1629/2961), -3.6% vs. 1.5%, 5.1%; 0.119 (0.082 to 0.156), p=0.046 6. 19.8% (458/2318) vs. 18.9% (533/2822), -0.3% vs. -1.2%, 0.9%; 0.076 (0.05 to 0.102), p=0.874 Note: Variations laboratory tests and telephone consultations are also displayed in figure 2 p.4.	...	...	0	...
Fortuna, 2009[54]	Primary 1. Change in proportion of hypnotic drug prescriptions that were for heavily marketed hypnotics over 1 y. 1a. Alerts vs control. Adjusted* RR (95% CI) for change from baseline; ratio of RRs (95% CI). 1b. Alerts + education vs control. Adjusted RR (95% CI) for change	1a. 0.97 (0.82 to 1.14) vs 1.31 (1.08 to 1.60); 0.74 (0.57 to 0.96), p=0.02 1b. 0.98 (0.83 to 1.17) vs1.31 (1.08 to 1.60); 0.74 (0.58 to 0.97), p=0.03 1c. 0.97 (0.82 to 1.14) vs 0.98 (0.83 to 1.17); 1.02 (0.80 to 1.29), p=0.90	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	from baseline; ratio of RRs (95% CI). 1c. Alerts vs alerts + education. Adjusted RR (95% CI) for change from baseline; ratio of RRs (95% CI). RR <1 = prescribing decreased; RR>1, prescribing increased. Adjusted for clinician age, gender, full time status, years in practice, degree, and primary care or not.					
Frame, 1994[55]	Prespecified 1. Overall change in provider compliance with 11 health maintenance procedures over 2 years (%). 1a. For 1,324 initially active patients (those seen ≥ 1 time in previous 2y). 1b. For 145 initially inactive patients. 2. Change in provider compliance with 11 specific health maintenance procedures over 2 years for initially active or inactive patients: total N (% initial compliance); % change in compliance; difference (95% CI). 2a. Teach self-exam. 2b. Teach to report postmenopausal bleeding. 2c. Mammography. 2d. Tetanus booster.	1a. 13.5% vs 3.3%, p<0.001 1b. 27.1% vs 13.5%, p=0.02 2a. 1469 (4% vs 3%); 37% vs 10%, 27% (23 to 31) 2b. 261 (9% vs 10%); 39% vs 13%; 26% (15 to 35) 2c. 261 (44% vs 47%); 11% vs -12%; 23% (9 to 40) 2d. 1469 (20% vs 21%); 36% vs 15%; 21% (16 to 26) 2e. 776 (40% vs 34%); 18% vs 3%; 15% (6 to 23) 2f. 806 (49% to 47%); 8% vs -3%; 11% (2 to 19) 2g. 696 (52% vs 52%) ; 10% vs 1%; 9% (1 to 19) 2h. 1268 (48% vs 45%); 17% vs 11%; 6% (1 to 11) 2i. 1469 (89% vs 86%); -7%	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	2e. Fecal occult blood test. 2f. Clinical breast exam. 2g. Papanicolaou test. 2h. Cholesterol measurement. 2i. BP measurement. 2j. Weight measurement. 2k. History of tobacco use. Not prespecified 3. Proportion of patients active at final audit. 3a. Initially inactive patients (n=145). 3b. All patients. 3c. Initially active patients (those seen at least once in previous 2y, n=1,324). Note: study included inactive and never seen patients only if a family member was active	vs -10%; 3% (-2 to 7) 2j. 1469 (93% vs 94%); 1% vs -1%; 2% (-1 to 4) 2k. 1469 (82% vs 80%); 11% vs 11%; 0% (-3 to 4) 3a. 51% vs 37%, p=0.81 3b. 73% vs 69%, p=0.059 3c. 82% vs 78%, p=0.045				
Gilutz, 2009[56]	Mean 21-month follow-up 1. Appropriate initiation, up-titration, or continuation of statin therapy; % (unclear if represents patients); difference; OR (unclear if lower & upper ranges represent 95% CIs) (primary). 2. Appropriate uptitration in patients with LDL≥110 mg/dL, % (unclear if represents patients - not prespecified).	1. 59.1% vs 53.7%; 5.4% (2.5% drug initiation, 1.8% up-titration, and 1.1% avoiding drug cessation), p<0.003; 1.232 (lower 1.112, upper 1.365), p=0.001 2. 8.6% vs 7.4%, p=NS 3. 54.8% vs 48.7%, p<0.001; 1.28 (lower 1.17,	Mean 21 month follow-up. 1. Change in LDL level in 52.5% of patients with initial LDL >120 mg/dL: Baseline/Final mean(SD), % reduction (primary). Note: data for 38.5% of patients with initial LDL <110 mg/dL and 9% with initial LDL 110-	1. 145.5 (22.3) / 121.9 (34.2), 16.2% vs 145.8 (22.9) / 124.3 (34.6), 14.8%, p<0.02 2. 57.1% vs 59.2%, p<0.03 (Data and text not clearly consistent; could not confirm with author).	1	1

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	3. Rate of adequate lipoprotein monitoring: % (not clear if represents patients); OR (unclear if lower & upper ranges represent 95% CIs) (primary). 4. Effect of intervention on monitoring in 3425 patients not rehospitalized, RR, CI (not clear if 95% CI) (not prespecified).	upper 1.41), p<0.001 4. 1.423 (1.24 to 1.64), p<0.0001	120 mg/dL were not reported. 2. Proportion of patients who are live and have not had a cardiovascular rehospitalization, % (secondary).			
Gonzalez, 1989[57]	Outcomes not clearly prespecified. 1. Mean (SD) aminophylline loading dose (mg/kg) to achieve target serum theophylline level (intervention: 15mg/L, control 10-20mg/L). 2. Mean (SD) aminophylline maintenance dose (mg/kg/h) to achieve target serum theophylline level (intervention: 15mg/L, control 10-20mg/L). 3. Mean (SD) theophylline level (mg/L); Baseline 6.7 (5.2) vs 6.8 (6.0), p=NS 3a. 1h. 3b. 2h. 3c. 4h.	1. 4.2 (2.4) vs 3.8 (2.4), p=NS 2. 0.6 (0.2) vs 0.4 (0.2), p<0.001 3a. 14.0 (2.5) vs 12.5 (3.7), p=NS 3b. 14.6 (2.7) vs 12.2 (3.8), p<0.002 3c. 14.6 (3.1) vs 11.4 (3.9), p<0.001	Outcomes not clearly - prespecified 1. Patients discharged from ED within 8 hrs (i.e., not admitted to hospital). 2. Proportion of patients with adverse effects (nausea and vomiting) in ED. 3. Peak flow rate throughout the study	N rand = 82; analyzed 37 vs 30 (# pts NR, only %). 1. 52% vs 47%, p<0.7 2. 10% vs 7%, p<0.7 3. values not given, did not differ	1	0
Goud, 2009[58,59]	Main outcome 1. Concordance with guideline recommendations over 6 months: Number (%) of patients; crude difference, adjusted* difference	1a. 1508/1629 (92.6%) vs 933/1102 (84.7%); 7.9%, 3.5% (0.1 to 5.2); 0.086, 56 (2.1%) 1b. 1411/1610 (87.6%) vs	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	(95% CI), intra-cluster correlation; Data not available, number of patients (%). 1a. Exercise training. 1b. Education therapy. 1c. Relaxation therapy. 1d. Lifestyle change therapy. 2. Number (%) of patients undertreated. (Prespecified) 2a. Exercise training. 2b. Education therapy. 2c. Relaxation therapy. 2d. Lifestyle change therapy. 3. Number (%) of patients overtreated. (Prespecified) 3a. Exercise training. 3b. Education therapy. 3c. Relaxation therapy. 3d. Lifestyle change therapy. * Adjusted for age, sex, diagnosis, weekly centre volume of new patients, and centre specialized or part of an academic hospital. Note: 5 of 15 control centers discontinued participation during trial; and data from 4 intervention and 1 additional control center were excluded for poor data quality or missing data.	709/1110 (63.9%), 23.7%, 23.7% (15.5 to 29.4); .0.187, 67 (2.4%) 1c. 959/1610 (59.6%) vs 373/1094 (34.1%); 25.5%, 41.6% (25.2 to 51.3); 0.479, 83 (3.0%) 1d. 924/1610 (57.4%) vs 601/1110 (54.1%); 3.3%, 7.1% (-2.9 to 18.3); 0.110, 67 (2.4%) 2a. 79/1629 (4.8%) vs 100/1102 (9.1%). 2b. 156/1610 (9.7%) vs 334/1110 (30.1%). 2c. 634/1610 (39.4%) vs 676/1094 (61.8%). 2d. 672/1610 (41.7%) vs 458/1110 (41.3%). 3a. 42/1629 (2.6%) vs 69/1102 (6.3%) 3b. 43/1610 (2.7%) vs 67/1110 (6.0%) 3c. 17/1610 (1.1%) vs 45/1094 (4.1%) 3d. 14/1610 (0.9%) vs 51/1110 (4.6%)				
Gurwitz,			1 y follow-up in 1 of 2	1a. 411 (100%) vs	...	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
2008[60]			sites and 6 mo follow-up in the 2nd site for 3,803 vs 3,257 resident-months of observation. Primary 1. Number (%) of adverse drug events; rate per 100 resident-months; adjusted rate ratio (95% CI). 1a. All. 1b. Preventable. 1c. More severe 1d. Preventable more severe. 1e. Less severe. 1f. Preventable less severe. Analyses not prespecified 2. Number (%) of adverse drug events by event type: all events; preventable events. 2a. Hemorrhagic. 2b. Neuropsychiatric (including oversedation, confusion, hallucinations, and	340 (100%); 10.8 vs 10.4; 1.06 (0.92 to 1.23) 1b. 152 (37.0%) vs 126 (37.1%); 4.0 vs 3.9; 1.02 (0.81 to 1.30) 1c. 123 (30.0%) vs 97 (28.5%); 3.2 vs 3.0; 1.07 (0.82 to 1.40) 1d. 79 (19.2%) vs 58 (17.1%); 2.1 vs 1.8; 1.15 (0.82 to 1.61) 1e. 288 (70.1%) vs 243 (71.5%); 7.6 vs 7.5; 1.06 (0.89 to 1.26) 1f. 73 (17.8%) vs 68 (20.0%); 1.9 vs 2.1; 0.92 (0.66 to 1.28) 2a. 102 (24.8%) vs 85 (25.0%); 22 (14.5%) vs 20 (15.9) 2b. 87 (21.2%) vs 71 (20.9%); 42 (27.6%) vs 28 (22.2%) 2c. 70 (17.0%) vs 49 (14.4%); 17 (11.2%) vs 18 (14.3%) 2d. 43 (10.5%) vs 32 (9.4%); 24 (15.8%) vs 13 (10.3%)		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			delirium). 2c. Gastrointestinal. 2d. Metabolic or endocrine. 2e. Renal or electrolytic. 2f. Cardiovascular. 2g. Dermatological. 2h. Fall without injury. 2i. Extrapyramidal signs or symptoms. 2j. Syncope or dizziness. 2k. Infection. 2l. Hematological. 2m. Anticholinergic (including dry mouth, dry eyes, urinary retention, and constipation). 2n. Respiratory. 2o. Anorexia. 2p. Functional decline (decline in activities of daily living without other more-specific events). 2q. Fall with injury. 2r. Ataxia or difficulty with gait. 2s. Hepatic. Analyses not	2e. 31 (7.5%) vs 47 (13.8%); 15 (9.9%) vs 29 (23.0%) 2f. 20 (4.9%) vs 15 (4.4%); 13 (8.6%) vs 8 (6.4%) 2g. 9 (2.2%) vs 14 (4.1%); 0 (0%) vs 1 (0.8%) 2h. 14 (3.4%) vs 7 (2.1%); 8 (5.3%) vs 2 (1.6%) 2i. 12 (2.9%) vs 7 (2.1%); 6 (4.0%) vs 1 (0.8%) 2j. 7 (1.7%) vs 11 (3.2%); 5 (3.3%) vs 4 (3.2%) 2k. 12 (2.9%) vs 4 (1.2%); 0 (0%) vs 0 (0%) 2l. 4 (1.0%) vs 0 (0%); 1 (0.7%) vs 0 (0%) 2m. 2 (0.5%) vs 5 (1.5%); 2 (1.3%) vs 2 (1.6%) 2n. 2 (0.5%) vs 5 (1.5%); 1 (0.7%) vs 3 (2.4%) 2o. 2 (0.5%) vs 4 (1.2%); 2 (1.3%) vs 2 (1.6%)		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			prespecified 3. Number (%) of adverse drug events by drug category: all events; preventable events. 3a. Antiplatelet. 3b. Antipsychotic. 3c. Anticoagulant. 3d. Diuretic. 3e. Anti-infective. 3f. Cardiovascular. 3g. Hypoglycemic. 3h. Gastrointestinal. 3i. Antidepressant. 3j. Opioid. 3k. Sedative or hypnotic. 3l. Antiepileptic. 3m. Nutrient or supplement. 3n. Steroid. 3o. Anti-Alzheimer's. 3p. Thyroid. 3q. Digoxin. 3r. Anti-Parkinson's. 3s. Antihistamine. 3t. Muscle relaxant. 3u. Topical. 3v. Ophthalmic. 3w. Gout. 3x. Antineoplastic. 3y. Respiratory.	2p. 2 (0.5%) vs 2 (0.6%); 2 (1.3%) vs 2 (1.6%) 2q. 2 (0.5%) vs 1 (0.3%); 2 (1.3%) vs 1 (0.8%) 2r. 2 (0.5%) vs 0 (0%); 2 (1.3%) vs 0 (0%) 2s. 1 (0.2%) vs 0 (0%); 0 (0%) vs 0 (0%) 3a. 66 (16.1%) vs 58 (17.1%); 11 (7.2%) vs 11 (8.7%) 3b. 52 (12.7%) vs 40 (11.7%); 25 (16.5%) vs 13 (10.3%) 3c. 42 (10.2%) vs 39 (11.5%); 17 (11.2%) vs 10 (7.9%) 3d. 33 (8.0%) vs 36 (10.6%); 18 (11.8%) vs 23 (18.3%) 3e. 38 (9.3%) vs 30 (8.8%); 1 (0.7%) vs 7 (5.6%) 3f. 30 (7.3%) vs 38 (11.2%); 18 (11.8%) vs 24 (19.1%) 3g. 36 (8.8%) vs 17 (5.0%); 19 (12.5%) vs		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			3z. Osteoporosis. 3zz. Miscellaneous. Post-hoc analysis 4. Number (%) of preventable events that could have been prevented as a result of ≥ 1 alert; rate per 100 resident-months; adjusted rate ratio (95% CI).	6 (4.8%) 3h. 39 (9.5%) vs 11 (3.2%); 9 (5.9%) vs 5 (4.0%) 3i. 25 (6.1%) vs 25 (7.4%); 14 (9.2%) vs 9 (7.1%) 3j. 26 (6.3%) vs 20 (5.9%); 11 (7.2%) vs 9 (7.1%) 3k. 17 (4.1%) vs 23 (6.8%); 10 (6.6%) vs 12 (9.5%) 3l. 17 (4.1%) vs 14 (4.1%); 7 (4.6%) vs 9 (7.1%) 3m. 9 (2.2%) vs 15 (4.4%); 4 (2.6%) vs 8 (6.3%) 3n. 12 (2.9%) vs 6 (1.8%); 1 (0.7%) vs 0 (0%) 3o. 7 (1.7%) vs 7 (2.1%); 4 (2.6%) vs 0 (0%) 3p. 4 (1.0%) vs 8 (2.3%); 3 (2.0%) vs 5 (4.0%) 3q. 5 (1.2%) vs 5 (1.5%); 4 (2.6%) vs 2 (1.6%) 3r. 6 (1.5%) vs 3 (0.9%); 4 (2.6%) vs 1		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
				(0.8%) 3s. 6 (1.5%) vs 2 (0.6%); 3 (2.0%) vs 1 (0.8%) 3t. 5 (1.2%) vs 3 (0.9%); 2 (1.3%) vs 2 (1.6%) 3u. 3 (0.7%) vs 1 (0.3%); 2 (1.3%) vs 0 (0%) 3v. 1 (0.2%) vs 2 (0.6%); 0 (0%) vs 0 (0%) 3w. 0 (0%) vs 3 (0.9%); 0 (0%) vs 2 (1.6%) 3x. 1 (0.2%) vs 1 (0.3%); 0 (0%) vs 0 (0%) 3y. 1 (0.2%) vs 1 (0.3%); 0 (0%) vs 1 (0.8%) 3z. 0 (0%) vs 1 (0.3%); 0 (0%) vs 0 (0%) 3zz. 2 (0.5%) vs 4 (1.2%); 0 (0%) vs 3 (2.4%) 4. 59/152 (38.8%) vs 56/126 (44.4%); 1.55 vs 1.72; 0.89 (0.61 to 1.28)		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
Hales, 1995[61]	1. Proportion (number) of hospital admissions considered unnecessary over 6 months. 2. Expected vs actual % change in unnecessary hospital admissions over 6 months. Note: Discrepancy in text (Overall Performance, p.730, 11.6% as expected or measured change?).	1. 3.6% (36/992) vs 3.9% (38/979), p>0.43 2. 11.6% vs 6.5%, P=NS Note: Discrepancy in text (Overall Performance, p.730, 11.6% as expected or measured change?).	...	...	0	...
Hamilton, 2004[62]	1. total number (%) of cesarean sections (primary) 2. total number (%) of vaginal births (not pre-specified) 3. number (%) of pregnancy lengths in each range (not pre-specified) 3a. 35-36 weeks 3b. 37-40 weeks 3c. 41 weeks	1. 436 (17.6%) vs 425 (16.9%), p=0.53 2. 2038 (82.3%) vs 2089 (83.1%), p=0.53 3a. 107 (4.3%) vs 99 (3.9%), p=0.54 3b. 1896 (76.5%) vs 1981 (78.8%), p=0.06 3c. 475 (19.2%) vs 435 (17.3%), p=0.09	1. number (%) of babies with Apgar score in each range 1 minute after birth (secondary) 1a. 0-2 1b. 3-4 1c. 5-6 1d. 7-8 1e. 9-10 2. number (%) of babies with Apgar score in each range 5 minutes after birth (secondary) 2a. 0-2 2b. 3-4 2c. 5-6 2d. 7-8 2e. 9-10 3. rate for the recorded indication of dystocia (pre-specified) 4. number (%) of	1a. 31 (1.3%) vs 27 (1.1%), p=0.65 1b. 63 (2.5%) vs 55 (2.2%), p=0.46 1c. 138 (5.6%) vs 126 (5.0%), p=0.41 1d. 607 (24.5%) vs 627 (25.0%), p=0.74 1e. 1639 (66.2%) vs 1671 (66.6%), p=0.83 2a. 7 (0.3%) vs 8 (0.3%), p=0.98 2b. 5 (0.2%) vs 4 (0.2%), p=0.98 2c. 37 (1.5%) vs 35 (1.4%), p=0.85 2d. 186 (7.5%) vs 201 (8.0%), p=0.55 2e. 2239 (90.5%) vs 2261 (90.1%), p=0.68 3. no data provided 4a. 67 (2.9%) vs 67 (2.8%), p=0.98 4b. 403 (17.4%) vs	0	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			babies with birth weight in each range (not pre-specified) 4a. ≤2500 g 4b. 2500-2999 g 4c. 3000 – 3499 g 4d. 3500 – 3999 g 4e. ≥ 4000 g 5. obstetrical and neonatal complications (not pre-specified)	361 (15.4%), p=0.06 4c. 887 (38.4%) vs 963 (41.0%), p=0.08 4d. 705 (30.5%) vs 743 (31.6%), p=0.44 4e. 249 (10.8%) vs 217 (9.2%), p=0.09 5. 0 vs 0		
Harari, 2008[63]	All outcomes reported as % (numbers) of self-reported behaviour/uptake of patients, intervention vs control, OR (95% CI); P value at 1 year follow-up. Article calls all of these outcomes primary. 1. Blood-pressure check in previous year 2. Cholesterol measurement in previous 5 years (younger than 75 years) 3. Blood glucose measurement in previous 3 years 4. Faecal occult blood test in previous year (younger than 80 years) 5. Influenza vaccination in previous year 6. Pneumococcal vaccination (ever) 7. Dental check in previous year	1. 83.5 (785/940) vs 84.8 (903/1066), 0.9 (0.7, 1.2); 0.40 2. 60.2 (312/518) vs 60.4 (389/643), 1.0 (0.8, 1.3); 0.95 3. 25.9 (243/940) vs 27.2 (302/1066), 0.9 (0.7, 1.1); 0.19 4. 6.1 (45/732) vs 5.7 (49/862), 1.1 (0.7, 1.6); 0.73 5. 83.9 (788/939) vs 85.8 (916/1066), 0.8 (0.6, 1.1); 0.12 6. 32.8 (308/939) vs 27.5 (291/1066), 1.2 (1.01, 1.5); 0.04 7. 74.9 (678/905) vs 72.0 (757/1051), 1.1 (0.9, 1.4); 0.23	All outcomes reported as % (numbers) of self-reported behaviour/uptake of patients, intervention vs control, OR (95% CI); P value at 1 year follow-up. Article calls all of these outcomes primary. 1. ≥3 times per week moderate or strenuous physical activity 2. ≥5 times per week moderate or strenuous physical activity 3. Consumption of ≤2 high fat food items per day 4. Consumption of ≥5 fruit/fibre items per	1. 16.4 (143/874) vs 13.8 (137/993), 1.2 (0.9, 1.6); 0.15 2. 10.8 (94/872) vs 7.8 (77/989), 1.4 (1.0, 2.0); 0.03 3. 25.2 (219/870) vs 21.8 (218/999), 1.2 (0.95, 1.5); 0.13 4. 37.2 (326/877) vs 36.7 (372/1015), 1.0 (0.8, 1.3); 0.86 5. 90.9 (779/857) vs 89.6 (897/1001), 1.2 (0.9, 1.6); 0.36 6. 80.2 (727/906) vs 79.7 (822/1032), 1.1 (0.8, 1.3); 0.63 7. 84.1 (755/898) vs 84.9 (883/1040), 1.0 (0.7, 1.2); 0.66	0	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	8. Vision check-up in previous year 9. Hearing check-up in previous year 10. Mammography in previous 2 years (younger than 70 years)	8. 68.3 (626/916) vs 69.6 (732/1052), 0.9 (0.8, 1.1); 0.53 9. 17.0 (155/912) vs 18.2 (191/1047), 0.9 (0.7, 1.2); 0.47 10. 35.9 (47/131) vs 32.3 (50/155), 1.2 (0.7, 1.9); 0.52	day 5. No current tobacco use 6. No or moderate alcohol use 7. Driving with use of seat belt			
Heidenreich, 2005[64]	Primary 1. Proportion prescribed ≥ moderate daily dose of ACE-I or appropriate alternative at 6 months (including patients on target doses at baseline). 2. Number (proportion) of patients prescribed ≥ moderate daily dose of ACE-I or appropriate alternative at 6 months (excluding randomised patients who were on ≥ moderate daily doses at baseline); adjusted OR (95% CI). Not prespecified 3. Proportion prescribed any dose of ACE-I or appropriate alternative at 6 months.	1. 125/221 (57%) vs. 114/235 (49%), P=.09 2. 52/137 (38%) vs. 37/140 (26%), P=.04; 1.70 (1.02 to 2.86), P<.05 3. 121/137 (88%) vs. 122/140 (87%), P=.77	Secondary 1. Mortality for n=251 with follow-up at 1 y; hazard ratio (95% CI). 2. Renal function at 6 months. 2a. Mean (SD) creatinine (mg/dL) for n=258 at 6 months. 2b. Number (proportion) of patients with creatinine >3 (mg/dL) at 6 months. 3. Mean (SD) systolic BP (mm Hg) at 6 months. 4. Mean (SD) diastolic BP (mm Hg) at 6 months.	1. 0.98 (0.78 to 1.23) 2a. 1.8 (1.8) vs 1.8 (1.9), p>0.2 2b. 15/124 (12%) vs 16/134 (12%), p>0.2 3. 126 (22) vs 126 (23), p>0.2 4. 68 (14) vs 68 (14), p>0.2	0	0
Heidenreich, 2007[65]	Primary 1. Number (proportion) of patients with prescriptions for any β - blocker over 9 months; adjusted	1. 458/621 (74%) vs 428/650 (66%), p=0.002; 1.30 (1.04 to 1.63) 2. 261/621 (42%) vs	Not prespecified 1. Survival free of heart failure hospitalization at 1y; hazard ratio	1. 0.99 (0.83 to 1.18)	1	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	OR (95% CI). Secondary 2. Number (proportion) of patients with prescriptions for specified β –blockers (carvedilol or metoprolol) over 9 months. Not prespecified 3. Number (proportion) of patients with prescriptions for any β -blocker over 9 months (excluding those on β–blockers at baseline). Subgroup analyses (not clearly prespecified) 4. Number (proportion) of patients with prescriptions for any β -blocker over 9 months by referral source. 4a. Inpatients. 4b. Outpatients. 4c. Cardiology clinic patients. 5. Interaction of reminder effect with patient history over 9 months. 5a. Prior heart failure. 5b. COPD. 5c. Prior β –blocker use. 5d. LVEF <35%. 6. Trend in reminder effect over time (2001-2005). Note: Inconsistency in data for	238/650 (37%), p=0.048 3. 163/292 (56%) vs 144/327 (44%), p=0.003 4. p=0.55 for interaction of referral source and reminder effect. 4a. 190/254 (75%) vs 171/266 (64%), p=NR 4b. 268/367 (73%) vs 257/284 (67%), p=NR 4c. 108/145 (74%) vs 86/111 (77%), p=NR 5a. P=0.07 for reminder effect in those without prior HF. 5b. P=0.09 (p=0.08 in figure 3) for reminder effect in those without COPD. 5c. P=0.32 5d. P=0.81 6. P>0.2	(95% CI).			

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	COPD. Text, p=0.09; figure 3, p=0.08 for reminder effect in those without COPD. No author response to query.					
Helder, 2008[66]	1.median number (95% CI) of days to regain birthweight (primary) 2. mean central body temperature during first 14 days (secondary) 3. mean incubator temperature (secondary) 4. mean amount of dexamethasone or indomethacin (secondary) 5. mean caloric intake (not prespecified) 6. mean incubator humidity setting (not prespecified)	1. 9 (8-10) vs 9 (7-11) 2. not significant 3. results not provided 4. did not differ significantly 5. did not differ significantly 6. did not differ significantly	1. proportion with intraventricular hemorrhage (absent, mild, severe) (secondary) 2. proportion of patients with sepsis 3. number (proportion) of patients who died	1. 47%,26%,1% vs 44%,24%,5% (p=0.26) 2. 46.5% vs 38.5% (p=0.34) 3. 4 (6.2%) vs 9 (12.7%) (p=0.20)	0	0
Hetlevik, 1999[67,68]	Prespecified 1. Proportion of hypertension patients (total N = 2239) without recorded data, difference (95% CI) 1a. BP over last 12 mo 1b. Serum cholesterol over last 12 mo 1c. BMI over 18 mo 1d. Smoking status over 18 mo 1e. CHD risk score over 18 mo 1f. CV inheritance over 18 mo 2. Proportion of diabetic patients (total N = 1034) without recorded data, difference (95% CI). 2a. BP over last 12 mo	1a. 14.3% vs 14.2%, 0.1 (-3.0 to 3.2) 1b. 62.3% vs 56.8%, 5.5 (1.2 to 9.8) 1c. 81.5% vs 89.2%, -7.7 (-10.8 to -4.6) 1d. 82.9% vs 87.1%, -4.2 (-7.4 to -1.0) 1e. 91.7% vs 91.9%, -0.2 (-2.6 vs 2.2) 1f. 79.5% vs 73.4%, 6.1 (2.4 to 9.8) 2a. 18.7% vs 18.5%, 0.2 (-5.2 to 5.6) 2b. 56.3% vs 62.7%, -6.4 (-	For hypertension patients at 18 mo (total N = 2239) Prespecified 1. Mean (SD) and change for SBP (mm Hg) in last 12 mo (n=1727). 2. Mean (SD) and change for DBP (mm Hg) in last 12 mo (n=1727). 3. Mean (SD) and change for serum cholesterol (mmol/L) in last 12 mo (n=821).	1. 156.7 (19.5) vs 155.5 (18.7), 1.2 (-0.6 to 3.0) 2. 88.6 (9.7) vs 89.6 (8.8), -1.0 (-1.9 to -0.2) 3. 6.6 (1.2) vs 6.7 (1.3), -0.1 (-0.3 to 0.1) 4. 28.9 (4.3) vs 28.6 (4.9), 0.3 (-0.9 to 1.3) 5. 23% vs 29%, -6 (-16 to 4) 6a. 18.3 (19.8) vs 25.2 (24.2), -6.9 (-16.3 to 2.5)	0	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	2b. Serum cholesterol over last 12 mo 2c. BMI over 18 mo 2d. Smoking status over 18 mo 2e. CHD risk score over 18 mo 2f. CV inheritance over 18 mo 2g. HbA1c over last 12 mo	13.2 to 0.4) 2c. 78.2% vs 93.0%, -14.8 (-19.5 to -9.9) 2d. 82.6% vs 94.5%, -11.9 (-16.3 to -7.5) 2e. 91.1% vs 98.3%, -7.2 (-10.3 vs -4.1) 2f. 78.7% vs 83.4%, -4.7 (-10.2 to 0.8) 2g. 20.5% vs 18.8%, 1.7 (-3.8 to 7.2)	4. Mean (SD) and change for BMI (kg/m2) in last 18 mo (n=286). 5. Proportion and change in proportion of smokers at 18 mo (n=297). 6. Mean (SD) and change in CHD risk score at 18 mo 6a. Women (n=89). 6b. Men (n=76). 7. Proportion and change in proportion of patients with CV inheritance at 18 mo (n=482). For hypertension patients at 21 mo (after feedback on missing data at 18 mo). 8. Mean (SD) and change for SBP (mm Hg) (n=1839). 9. Mean (SD) and change for DBP (mm Hg) (n=1839). 10. Mean (SD) and change for serum cholesterol (mmol/L)	6b. 56.0 (42.0) vs 65.1 (83.4), -9.1 (-40.7 to 22.6) 7. 76% vs 89%, -13.0 (-20.1 to 5.9) 8. 156.8 (19.4) vs 155.6 (19.0), 1.2 (-0.6 to 3.0) 9. 88.8 (9.7) vs 89.8 (8.9), -1.0 (-1.9 to -0.2) 10. 6.64 (1.2) vs 6.57 (1.3), 0.07 (-0.1 to 0.2) 11. 27.8 (4.5) vs 27.7 (4.8), 0.1 (-0.4 to 0.7) 12. 21% vs 19%, 2.0 (-2.6 to 6.6) 13a. 17.9 (17.9) vs 20.6 (23.5), -2.7 (-6.3 to 1.0) 13b. 67.9 (83.9) vs 66.8 (73.4), 1.1 (-14.6 to 6.9) 14. 62% vs 66%, -4.0 (-14.5 to 6.5) 15. 151.4 (22.2) vs 153.7 (20.5), -2.3 (-5.6 to 1.0) 16. 82.8 (10.7) vs 85.3 (9.9), -2.4 (-4.0 to -0.9) 17. 6.2 (1.5) vs 6.3		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			(n=1349). 11. Mean (SD) and change for BMI (kg/m2) (n=1053). 12. Proportion and change in proportion of smokers (n=1160). 13. Mean (SD) and change in CHD risk score 13a. Women (n=500). 13b. Men (n=391). 14. Proportion and change in proportion of patients with CV inheritance (n=1235). Note: Mean (SD) SBP higher in CCDSS group at baseline. 159.1 (20.3) vs 156.4 (19.7), difference 2.7 (1.0 to 4.5). Prespecified For diabetic patients at 18 mo (total N = 1034) 15. Mean (SD) and change (95% CI) for SBP (mm Hg) in last 12 mo (n=648). 16. Mean (SD) and change for DBP (mm	(1.2), -0.1 (-0.3 to 0.2) 18. 29.6 (5.0) vs 29.8 (5.7), -0.2 (-2.4 to 2.0) 19. 23% vs 30%, -7 (-28.3 to 14.3) 20a. 30.2 (32.8) vs 12.5 (9.3), 17.7 (-18.0 to 53.4) 20b. 39.8 (33.9) vs 68.7 (83.4), -28.9 (-229.1 to 171.3) 21. 84% vs 94%, -10.0 (-19.8 to -0.3) 22. 7.9 (1.6) vs 8.0 (1.6), -0.1 (-0.4 to 0.1) 23. 151.5 (22.1) vs 152.7 (19.0), -1.2 (-4.4 to 2.0) 24. 82.8 (10.6) vs 85.1 (10.1), -2.3 (-3.8 to -0.8) 25. 6.2 (1.3) vs 6.2 (1.3), 0 26. 28.6 (5.1) vs 28.3 (6.3), 0.3 (-0.8 to 1.4) 27. 19% vs 16%, 3.0 (-4.0 to 10.0) 28a. 14.3 (17.7) vs 14.2 (17.5), 0.1 (-5.1 to 5.2)		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			Hg) in last 12 mo (n=648). 17. Mean (SD) and change for serum cholesterol (mmol/L) in last 12 mo (n=321). 18. Mean (SD) and change for BMI (kg/m2) in last 18 mo (n=112). 19. Proportion and change in proportion of smokers at 18 mo (n=89). 20. Mean (SD) and change in CHD risk score at 18 mo 20a. Women (n=19). 20b. Men (n=22). 21. Proportion and change in proportion of patients with CV inheritance at 18 mo (n=150). 22. Mean (SD) and change in HbA1c level in last 12 mo (n=640). For diabetic patients at 21 mo (after feedback on missing data at 18 mo)	28b. 51.4 (53.5) vs 48.7 (44.1), 2.6 (-14.2 to 19.5) 29. 66% vs 63%, 3.0 (-5.8 to 11.8) 30. 7.8 (1.6) vs 7.9 (1.6), -0.1 (-0.4 to 0.1)		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			23. Mean (SD) and change (95% CI) for SBP (mm Hg) (n=697). 24. Mean (SD) and change for DBP (mm Hg) (n=697). 25. Mean (SD) and change for serum cholesterol (mmol/L) (n=535). 26. Mean (SD) and change for BMI (kg/m2) (n=427). 27. Proportion and change in proportion of smokers (n=460). 28. Mean (SD) and change in CHD risk score 28a. Women (n=184). 28b. Men (n=142). 29. Proportion and change in proportion of patients with CV inheritance (n=452). 30. Mean (SD) and change in HbA1c level (n=689). After 18 mo, CCDSS had been used in treatment of 104 hypertension patients			

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			(12%) and 52 of diabetic patients (14%).			
Hickling, 1989[69]	Prespecified 1. Number (proportion) of patients outside of therapeutic range (6-10 mg/L for peak and <2 mg/L for trough) at 48-72h (and who required dose change). 2. Mean (SEM) peak plasma aminoglycoside levels at 48-72 h (mg/L). 3. Mean (SEM) trough levels at 48-72 h (mg/L). 4. Number (proportion) of patients with 48-72 h peak plasma levels: 4a. >5 mg/L. 4b. >6 mg/L. 4c. >7 mg/L.	1. 5/13 (38%) vs 11/14 (78%), p<0.001 2. 7.45 (0.4) vs 5.14 (0.36), p=0.0004 3. 1.58 (0.27) vs 0.87 (0.155), p=0.02 4a. 13/13 (100%) vs 8/14 (57%), p=0.027 4b. 12/13 (92%) vs 3/14 (21%), p=0.0009 4c. 8/13 (61%) vs 0/14 (0%), p=0.002	Prespecified 1. Mean increase in estimated creatinine clearance during recovery. Not specified 2. Number (proportion} of patients with increase in creatinine clearance at end of treatment.	1. 17.5% vs 20.5%, p=NS 2. 7/13 (54%) vs 9/14 (64%), p=NS; Of 13 in intervention group: 1 = no change, 1 = 7% decrease, 3 = 25-50% decrease, 1 unaccounted for. Of 14 in control group: 1 = no change, 4 = 0-25% decrease	1	0
Hicks, 2008[70]	At 18 months. 1. n/N (%) patients with BP controlled; adjusted OR (95% CI). (primary) 2. Proportion of visits with triggered or suppressed reminders that had adherence to guideline medication prescribing within 1 week; adjusted OR (95% CI). (primary)	1. 410/859 (48%) vs 527/1168 (45%); 0.96 (0.78 to 1.19); p=NS Secondary analyses excluding patients without documented BP at index or outcome visit was consistent and analysis by race/ethnicity showed no difference in intervention effects (data not reported). 2. 7% vs 5%; 1.32 (1.09 to	1. Mean BP at 18 months (mm Hg). 1a. Systolic. 1b. Diastolic.	1a. 138 vs 137, p=0.67 1b. 77 vs 78, p=0.05 Secondary analysis: no difference in intervention effects by race/ethnicity.	1	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
		1.61); p=0.002 No interaction for intervention effect by race/ethnicity.				
Holbrook, 2009[71,72]	Median follow-up, 5.9 mo 1. 8-item process composite score (out of max 10, higher scores better). (primary); mean (SD) before/after intervention; mean difference (95%CI). Each individual component is also reported in the same way (range -2 to +2). 1a. Glycated hemoglobin, measured semiannually. 1b. Blood pressure, measured quarterly. 1c. LDL cholesterol, measured semiannually 1d. Albuminuria, measured semiannually. 1e. BMI, measured quarterly. 1f. Foot surveillance, measured semiannually. 1g. Exercise, measured quarterly. 1h. Smoking, measured quarterly. 1i. ABC (hemoglobin, blood pressure, and LDL cholesterol) composite (secondary).	1. 5.19 (2.14)/6.52 (2.30) vs 5.19 (2.16)/5.25 (2.52); 1.27 (0.79 to 1.75), p<0.001 1a. 0.60 (0.49)/0.88 (0.33) vs 0.62 (0.49)/0.70 (0.46); 0.19 (0.09 to 0.29) 1b. 1.03 (0.79)/1.52 (0.68) vs 1.12 (0.77)/1.27 (0.74); 0.34 (0.19 to 0.49) 1c. 0.49 (0.50)/0.78 (0.42) vs 0.45 (0.50)/0.56 (0.50); 0.18 (0.07 to 0.28) 1d. 0.29 (0.46)/0.70 (0.46) vs 0.30 (0.46)/0.43 (0.50); 0.27 (0.16 to 0.39) 1e. 0.49 (0.64)/0.75 (0.75) vs 0.45 (0.64)/0.54 (0.69); 0.17 (0.02 to 0.32) 1f. 0.28 (0.45)/0.51 (0.50) vs 0.28 (0.45)/0.36 (0.48); 0.16 (0.06 to 0.25) 1g. 1.00 (0.00)/0.69 (0.46) vs 1.00 (0.00)/0.69 (0.46); –0.01 (–0.09 to 0.07) 1h. 1.00 (0.06)/0.69 (0.46) vs 0.97 (0.17)/0.69 (0.46); –0.03 (–0.12 to 0.06)	Median follow-up, 5.9 mo 1. Clinical composite score; mean (SD) change from baseline;mean difference (95%CI) for 238 vs 241 patients. (secondary) Each individual component is also reported in the same way; mean (SD) before/after intervention; mean difference (95%CI). 1a. Systolic blood pressure, mm Hg, for 178/226 vs 195/213 patients. 1b. Diastolic blood pressure, mm Hg, for 178/226 vs 195/213 patients. 1c. LDL cholesterol, mmol/L, for 124/197 vs 115/144 patients.	1. 0.33 (1.64) vs -0.16 (1.48); 0.55 (0.04 to 1.07), p=0.036 1a. 135.2 (17.6)/130.5 (16.4) vs 134.8 (18.4)/135.1 (18.4); –3.95 (–7.64 to –0.26), p = 0.036 1b. 76.1 (11.1)/73.6 (9.9) vs 74.7 (10.3)/75.4 (10.5); –2.38 (–4.60 to 0.17), p = 0.049 1c. 2.41 (0.65)/2.43 (0.78) vs 2.59 (0.87)/2.54 (0.81); –0.002 (–0.14 to 0.14) 1d. 7.0% (1.4)/6.8% (1.2) vs 7.1% (1.6)/7.3% (1.6); –0.20 (–0.38 to –0.02), p = 0.029 1e. 5.80 (15.0)/6.89 (17.9) vs 5.13 (13.2)/5.95 (15.6); 0.65 (–1.11 to 2.41)1f. 32.1	1	1

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	2. Continuity of care (secondary). 3. Patients with improvement for total process composite score; n/N, %, mean % difference. 4. Patients with improvement of ≥ 3 points on total process composite score; n/N, %, mean % difference. 5. Difference (95% CI) in number of recommended visits to primary care provider.	1i. 1.80 (1.10)/2.55 (0.83) vs 1.82 (1.08)/2.08 (1.06); 0.49 (0.27 to 0.70) 2. no data shown, NS 3. 156/253, 61.7% vs 110/258, 42.6%; 19.1%, p<0.001 4. 88/253, 34.8% vs 46/258, 17.8%; 17.0%, p<0.001 5. 0.66 (0.37 to 1.02), p<0.001	1d. Glycated hemoglobin for 153/222 vs 159/180 patients 1e. Albuminuria, mg/mol, for 63/171 vs 67/101 patients. 1f. BMI for 101/140 vs 92/108 patients. 1g. Exercise, min/wk, median (IQR), for 170/170 vs 178/178 patients. 1h. Feet, no neuropathy for 70/128 vs 72/91 patients. 1i. Nonsmoker for 252/175 vs 250/179 patients. 2. Mean (SD) change in ABC (hemoglobin, blood pressure, LDL cholesterol) clinical composite score at 6 mo; difference (95% CI) for 201 vs 193 patients (secondary). 3. Change in quality of life (SF-12 and Diabetes-39 questionnaires) at 6	(8.2)/31.6 (7.5) vs 31.6 (7.0)/31.9 (7.0); 0.02 (–1.24 to 1.28) 1g. 60.0 (180.0)/127.5 (230.0) vs 90.0 (150.0)/122.5 (240.0); 5.18 (–43.50 to 53.86) 1h. 0.94 (0.23)/0.92 (0.27) vs 0.96 (0.20)/0.90 (0.30); 0.01 (–0.08 to 0.10) 1i. 0.88 (0.33)/ 0.87 (0.33) vs 0.84 (0.37)/0.85 (0.36); –0.02 (–0.09 to 0.04) 2. 0.01 (0.41) vs -0.39 (1.26); 0.34 (0.04 to 0.65), p = 0.028 3. no data shown, NS 4. 2.51 (1.44)/3.33 (1.66) vs 2.34 (1.45)/2.49 (1.56); 0.16 (–0.12 to 0.44), p=0.26 4a. 0.31 (0.47)/0.45 (0.50) vs 0.34 (0.47)/0.34 (0.48);		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			months (secondary). 4. Number of variables on target (maximum=8); mean (SD) before/after intervention; mean difference (95%CI) for 253/252 vs 258/248 patients (not prespecified). 4a. Systolic blood pressure on target for 178/226 vs 195/213 patients. 4b. Diastolic blood pressure on target for 178/226 vs 195/213 patients. 4c. LDL cholesterol on target for 124/197 vs 115/144 patients. 4d. Glycated hemoglobin on target for 153/222 vs 159/180 patients 4e. Albuminuria on target for 63/171 vs 67/101 patients 4f. BMI on target for 101/140 vs 92/108 patients	4b. 0.53 (0.50)/0.69 (0.47) vs 0.57 (0.50)/0.56 (0.50); 0.13 (0.02 to 0.25) for both systolic and diastolic blood pressure on target 4c. 0.66 (0.48)/0.61 (0.49) vs 0.57 (0.50)/0.60 (0.49); –0.02 (–0.14 to 0.10) 4d. 0.56 (0.50)/0.63 (0.48) vs 0.57 (0.50)/0.51 (0.50); 0.08 (–0.01 to 0.17) 4e. 0.83 (0.38)/0.71 (0.45) vs 0.64 (0.48)/0.69 (0.46); –0.01 (–0.11 to 0.09) 4f. 0.30 (0.46)/0.26 (0.44) vs 0.28 (0.45)/0.23 (0.42); –0.001(–0.11 to 0.11) 4g. 0.22 (0.42)/0.36 (0.48) vs 0.18 (0.39)/0.32 (0.47); –0.01 (–0.10 to 0.08) 4h. 0.94 (0.23)/0.92 (0.27) vs 0.96 (0.20)/0.90 (0.30); 0.01 (–0.08 to 0.10) 4i. 0.88 (0.33)/0.87 (0.33) vs 0.84		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			4g. Exercise on target for 253/170 vs 258/178 patients 4h. Feet, no neuropathy on target for 70/128 vs 72/91 patients 4i. Nonsmoker on target for 252/175 vs 250/179 patients 5.Number of ABC variables on target; mean (SD) before/after intervention; mean difference (95%CI) for 211/241 vs 218/227 patients (not prespecified).	(0.37)/0.85 (0.36); –0.02 (–0.09 to 0.04) 5. 0.99 (0.81)/1.44 (0.86) vs 0.96 (0.88)/1.02 (0.92); 0.19 (0.004 to 0.38), p = 0.049		
Hurley, 1986[73]	Prespecified 1. Patients with theophylline levels above therapeutic range (10-20 µg/mL) on d1 and d2. 2. Patients with theophylline levels below therapeutic range (10-20 µg/mL) on d1 and d2. 3. Patients with trough theophylline levels in therapeutic range during oral therapy. 4. Mean (SD) IV aminophylline loading dose (mg). 5. Mean (SD) serum theophylline levels (µg/mL)	1. d1, fewer intervention than control patients (data not reported), p=NS d2 18.9% vs 37.8%, p=0.04,(7/37 vs 14/37, calculated by RA) 2. d1 3/47 vs 4/41 patients, p=NS (RR 0.65, 95% CI 0.17 to 2.48, calculated by RA) d2 4/37 vs 1/37 patients, p=NS (RR 4, 95% CI 0.67 to 26, calculated by RA) 3. 71.1% vs 44.4%,	Prespecified N = 48 vs 43; Other than death, # pts NR for outcomes 2 and 3, only %. 1. Mean peak expiratory flow rate (d1, d2, and d3). 2. Patients with air flow obstruction symptoms (%, d2 and d3). 2a. Severe	1. Higher for intervention patients (data shown only in figure), d1 p=0.07; d2 p=0.01; d3 p=0.09 2a d2 31% vs 48.7%, p=0.045; d3 16.6% vs 50%, p=0.01 2b.All p=NS (no data reported). 3a.d2 31% vs 66.7%, p=0.0026; d3 16.6% vs 56.2%, p=0.001 3b. All p=NS (no data	0	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	d1 d2 6. Mean (SD) oral theophylline dose (mg/day). 7. Mean (SD) 1st serum level during oral therapy (µg/mL): 8. Mean (SD) trough levels during oral therapy (µg/mL). Not prespecified 9. Mean (SD) IV aminophylline infusion rate (mg/kg IBW/h). d1 d2 10. Mean (SD) IV aminophylline infusion duration (h) d1 d2 11. Mean (SD) hydrocortisone dose d1 12. n/N, proportion of patients given hydrocortisone + prednisolone during admission.	p=0.018 4. 250 (101) vs 227 (46), p=NS overall, p<0.01 for variance 5. d1 14.9 (3.5) vs 15.8 (6.1), p=NS overall, p<0.01 for variance d2 16.1 (5.2) vs 17.9 (7.0), p=NS overall, p<0.05 for variance. 6. 831 (210) vs. 698 (195), p=0.0023 7. 12.9 (4.7) vs 10.8 (4.6), p=0.029 8. 12.6 (3.9) vs 9.9 (4.1), p=0.009 Not specified 9. d1 0.70 (0.21) vs 0.68 (0.15), p=NS overall, p<0.05 for variance d2 0.78 (0.33) vs 0.67 (0.19), p=NS overall, p<0.01 for variance 10. d1 24.0 (3.0) vs 22.8 (4.4), p=NS overall, p<0.05 for variance d2 22.4 (5.4) vs 22.1 (5.5), p=NS overall, p<0.01 for variance	breathlessness. 2b. Wheeziness, night wheeze, or cough during hospitalization. 3. Patients with side effects, d2 & d3. 3a Severe palpitations. 3b. Nausea, tremulousness, agitation, blurred vision, or diarrhea during hospitalization, 3c. Deaths (n) during mean 6.3-8.7 days hospitalization. Not specified 4. Mean (SD) days in hospital.	reported). 3c. 0 vs 2 4. 6.3 (4.5) vs 8.7 (6.7), p=0.027		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
		11. 725 (339) vs 792 (292), p=NS 12. 36/48, 75% vs 33/43, 76.7%				
Javitt, 2005[74]	1. % physician compliance with recommendations over 12 months; relative (%) difference. (primary). 1a. Recommendations to add a drug. 1b. Recommendations to discontinue a medication. 1c. Diagnostic test ordering recommendations.	1a. 24% vs 17%; 42% (p=.007). 1b. unable to assess. 1c. unable to assess.	N = 19,739 vs 19,723 patients. 1. Hospital utilization over 12 mo (prespecified) 1a. Admissions per 1000 persons, mean ± SD; difference. 1b. Inpatient days per 1000 persons, mean ± SD; difference. 1c. Mean hospital length of stay in days ; % difference. 1d. Total number of hospital admissions. 2. Mortality (not prespecified). Subgroup analyses of patients who triggered recommendations (both intervention [n=961] and control [n=982]): 3. Hospital utilization over 12 mo	1a. 63.5 ± 3.4 vs 69.3 ± 3.4; -9.1% (P = 0.03). 1b. 247.7 ± 6.0 vs 273.0 ± 6.2; -9.3% (P = 0.001). 1c. 4.1 vs 4.1 1d. 1251 vs 1366; 115 2. Data NR; NS overall and for in-hospital mortality. 3a. 213.8 ± 5.7 vs 264.6 ± 5.7; -19.2% (P < .001). 3b. 1152.0 ± 45.0 vs 1252.3 ± 47.0; -8.0% (P = .004). 3c. 5.4 vs 4.7; 13.8% (NS). 3f. 106 vs 302 4. 133 vs 152. 5a. 49 (36.8%) vs 69 (45.4%), p=0.02 5b. 1.4 vs 2.2, p=0.003	...	1

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			3a. Admissions per 1000 persons, mean ± SD; difference. 3b. Inpatient days per 1000 persons, mean ± SD; difference. 3c. Mean hospital length of stay in days; % difference. 3f. Total number of hospital admissions. Subgroup analyses for patients with HOPE trial-consistent recommendation for ACE-I prescription (n=156 vs 155 patients). 4. Total hospital admissions over 12 mo. 5. HOPE-related hospital utilization over 12 mo. 5a. Hospital admissions, n (%). 5b. Inpatient days per person, mean. 6. Non-HOPE-related	6a. 84 (53.8%) vs 83 (53.5%), p=0.55 6b. 3.3 vs 3.8, p=0.34		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			hospital utilization over 12 mo. 6a. Hospital admissions, n (%). 6b. Inpatient days per person, mean.			
Javitt, 2008[75]	Not prespecified. 1. Resolution rate for problems identified by care considerations over 1 y: %, difference (% improvement). 1a. Add a drug (n=601 total). 1b. Do a test (n=1354 total) 1c. Stop a drug (n=592 total). 2. Resolution rate for 311 patients with a recommendation to use an ACE-I (based on HOPE trial; n=155 vs 156) over 1 y. Note: Number of care considerations issued differed between groups: 1299 vs 1519.	1a. 26.6% vs 18%, 8.6% (48%), p≤0.05 1b. 36.8% vs 31%, 5.8% (19%), p≤0.05 1c. 28% vs 34%, -6% (-18%), p=NS 2. 27% vs 14%, p<0.01	...	...	1	...
Judge, 2006[76]	1. Alerts followed by appropriate prescriber action during the 1 year study period. n/N, %; relative risk (95% CI) (pre-specified). 2. Alerts, within each category, followed-up by the prescriber during the 1 year study period. n/N, %; relative risk (95% CI) (pre-specified).	1. 606/1982, 31% vs 513/1861, 28%; 1.1 (1.00 to 1.2) 2a. 78/447, 17% vs 53/427, 12%; 1.4 (1.0 to 1.9) 2b. 60/271, 22% vs 75/307, 24%; 0.91 (0.67 to 1.2) 2c. 61/248, 25% vs	...	...	0	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	2a. CNS side effects. 2b. Constipation side effects. 2c. Related to orders for warfarin. 2d. Potential renal insufficiency or electrolyte imbalance. 2e. Hypokalemia. 2f. Dose recommendations. 2g. Hyperkalemia. 2h. Anticholinergic side effects. 2i.Related to orders for multiple antiplatelets. 2j.Drug interactions. 2k.Orders for phenytoin.	19/269, 7%; 3.5 (2.1 to 5.7) 2d. 146/288, 51% vs 133/221, 60%; 0.84 (0.72 to 0.99) 2e. 151/233, 65% vs 118/178, 66%; 0.98 (0.85 to 1.1) 2f. 20/189, 11% vs 17/206, 8%; 1.3 (0.69 to 2.4) 2g. 53/140, 38% vs 59/129, 46%; 0.83 (0.62 to 1.1) 2h. 18/75, 24% vs 13/53, 25%; 0.98 (0.53 to 1.8) 2i. 7/42, 17% vs 9/27, 33%; 0.50 (0.21 to 1.2) 2j. 10/42, 24% vs 4/30, 13%; 1.8 (0.62 to 5.2) 2k. 2/7, 29% vs 13/14, 93%; 0.31 (0.09 to 1.0)				
Kattan, 2006[77]	1. Number of weeks from the first scheduled provider visit after symptoms warranting a step-up in therapy to a step-up in medication use by percent of study participants. a. Entire 1 year period, p-value b. First 6 months hazard ratio, p-value (not pre-specified) 2. Actions within 2 months of medication step-up recommendation.	1a.See figure 2 for graph, faster with CCDSS, p=0.15 1b. 2.95; P = .04 2a. 17.1% vs 12.3%, p=0.005 2b. 46.0% vs 35.6%, p=0.03	All reported as mean (SE); p-value 1. Maximum symptom days per 2 weeks (primary) 2. Days limited in activities for more than half day per 2 weeks 3. School days missed per 2 weeks 4. Number of ED visits per year	1. 3.43 (0.11) vs 3.52 (0.11); .54 2. 1.42 (0.07) vs 1.60 (0.08); .09 3. 0.67 (0.04) vs 0.72 (0.04); .38 4. 0.87 (0.07) vs 1.14 (0.08); .013 5. 1.14 (0.08) vs 1.31 (0.08); .14 6. 0.22 (0.03) vs 0.24 (0.03); .56	1	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	2a. % scheduled visits. 2b. % of visits resulting in medication step-up.		5. Number of unscheduled clinic visits per year 6. Number of hospitalizations per year Note: Data available for subgroup of 226 children who needed and received medication step-up.			
Kenealy, 2005[78]	1. The primary pre-determined physician outcome was the percentage of patients who were eligible for diabetes screening and who visited an FP during the study were screened for diabetes in the computer reminder group, vs. patient reminder group, vs. group with both patient & computer reminders, vs. control group (usual care) over two months; OR (95% CI) patient reminders vs. usual care; OR (95% CI) computer reminders vs. usual care; OR (95% CI) both reminders vs. usual care; OR (95% CI) computer reminders vs. patient reminders. 2. Odd ratios for eligible patients being screened over two months, odds ratio, standard error, z, p>/z/, 95% confidence interval for	1. 31.8 % vs. 23.9% vs. 23.7% vs. 15.5%; 1.72 (1.21 to 2.43); 2.55 (1.68 to 3.88); 1.69 (1.11 to 2.59); 1.49 (1.07 to 2.07). 2a. 1.86, 0.39, 2.94, .003, 1.23 to 2.82 2b. 2.66, 0.72, 3.63, <.001, 1.57 to 4.53 2c. 1.95, 0.37, 3.53, <.001, 1.35 to 2.80 2d. 1.12, 0.17, 0.72, .47, 0.83 to 1.50 2e. 0.97, 0.02, -1.35, .18, 0.94 to 1.01 2f. 1.01, 0.01, 1.35, .18, 0.99 to 1.03 2g. 0.98, 0.03, -0.54, .59, 0.92 to 1.05 2h. 1.00, 0.001, -0.59, .56, 1.00 to 1.00	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	a. both reminders b. computer reminders c. patient reminders d. FP female e. FP number in practice f. FP year graduation g. FP tenths worked h. FP mean number patients per day i. FP proportion patients age 50+ j. FP prior screen rate k. FP fee to patient l. Patient age m. Patient "regular" n. Patient number of visits o. Patient non-European ethnicity	2i. 27.3, 1.83, 1.53, .13, 0.75 to 10.14 2j. 4.38, 2.46, 2.63, .01, 1.46 to 13.18 2k. 1.00, 0.01, -0.01, .99, 0.98 to 1.02 2l. 1.00, 0.004, -0.82, .41, 0.99 to 1.00 2m. 2.04, 0.27, 5.44, <.001, 1.58 to 2.64 2n. 1.23, 0.05, 5.44, <.001, 1.14 to 1.32 2o. 1.45, 0.20, 2.70, .007, 1.11 to 1.89				
Krall, 2004[79]	(no prespecified outcomes) 1. Number (proportion) of patients who were eligible for aspirin therapy at beginning of study who were no longer eligible after 1 month (i.e., practitioner had responded to alert in intervention group or acted similarly in control group). 1a. All patients. 1b. Patients of physicians and osteopaths. 1c. Patients of nurse practitioners and physician assistants.	1a. 315/580 (54.3%) vs 128/496 (25.8%), p<0.001 1b. 304/554 (54.9%) vs 113/416 (27.2%), p<0.001 1c. 11/26 (42.3%) vs 15/80 (18.8%), p=0.015	…	…	1	…
Kroth, 2006[80]	1. Proportion of low temperatures recorded by nursing personnel type (registered nurse / licensed	1. 1.9%/1.9%/3.0%/2.7%/2.8 % vs	…	…	1	…

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	practical nurse / nursing aide/ nursing student/total) (primary) Not prespecified 2. Proportion of temperatures recorded by group (intervention vs control) within temperature window (degrees F) 2a. < 80 2b. 80 to 90 2c. 90.1 to 95.0 2d. 95.1 to 96.4 2e. 96.5 to 98 2f. 98.1 to 99.0 2g. 99.1 to 100 2h. 100.1 to 102 2i. 102.1 to 104 2j. 104.1 to 106 2k. 106.1 to 110 2l. > 110 2m. 97.0 to 101.5 2n. < 95 or > 110 2o. < 96.4 3. Number of low body temperatures collected by each group on first attempt. 4. Most frequently stored temperature (number) 5. Average temperature recorded. 6. Number of instances of low	5.9%/5.0%/5.6%/7.3%/5.7 %, p<0.0001 2a. 0.02% vs 0.02% 2b. 0.01% vs 0.07% 2c. 0.46% vs 1.14% 2d. 2.28% vs 4.45% 2e. 32.20% vs 28.19% 2f. 37.44% vs 37.20% 2g. 18.03% vs 18.88% 2h. 8.50% vs 8.92% 2i. 0.97% vs 1.01% 2j. 0.03% vs 0.05% 2k. 0% vs 0% 2l. 0.05% vs 0.07% 2m. 91.23% vs 88.71% 2n. 0.05% vs 1.3% 2o. 2.8% vs 5.7% 3. 2451 vs 2516 4. 98.4’F (3214) vs 98.4’F (3158) 5. 97.7’% vs 96.4’F 6. 7.8 vs 14.5 7. 26%/13%/31%/30% vs 32%/14%/26%/28%				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	temperature measurement per patient 7. Proportion of patients treated by various types of nurses (registered nurse / licensed practical nurse / nursing aide/ nursing student)					
Kuilboer, 2006[81]	1. Median of paired differences of Delta values (the difference between the intervention and baseline periods) (P-value) for each age group: 0-11, 12-39, 40-59, ≥60. Not clearly pre-specified 1a. Number of contacts 1b. Number of peak total flow measurements 1c. Number of peak flow ratio measurements 1d. Number of FEV1 total measurements 1e. Number of FEV1 ratio measurements 1f. Number of antihistamines prescriptions 1g. Number of cromoglycate prescriptions 1h. Number of deptropine prescriptions 1i. Number of oral bronchodilators prescriptions 1j. Number of oral corticosteroids prescriptions	1a. -0.164 (0.255), +0.154 (0.034), +0.068 (0.756), +0.257 (0.134) 1b. +0.020 (0.016), +0.029 (0.020), +0.028 (0.096), +0.005 (0.133) 1c. +0.000 (0.071), +0.402 (0.004), +0.181 (0.009), +0.000 (0.108) 1d. +0.005 (0.028), +0.005 (0.062), +0.004 (0.009), 0.000 (0.108) 1e. +0.000 (0.046), +0.056 ((0.010), +0.250 (0.010), +0.000 (0.016) 1f. 0.000 (0.875), 0.000 (0.500), -0.004 (0.080), -0.000 (0.317) 1g. 0.000 (0.144), -0.0004 (0.033), 0.000 (0.051), 0.000 (0.893) 1h. -0.003 (0.753), N/A, N/A, N/A 1i. 0.001 (0.807), 0.000 (0.655), 0.000 (0.121), 0.000 (0.225)	...	...	0	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
		1j. -0.004 (0.050), -0.002 (0.836), -0.023 (0.109), -0.045 (0.679)				
Kuperman, 1999[82]	1. (primary outcome) length of time interval from filling alerting result to ordering of appropriate treatment (in hours) [median (IQR), mean (SD), range, p value] 1a. all 1b. when alerting situation satisfied laboratory's critical reporting criteria and a phone call was made 1c. when alerting situation did not satisfy laboratory's critical reporting criteria 2. (secondary outcome) interval between results filing time and resolution of critical condition (in hours) (for all cases, intervention vs. control cases given in median, mean, range, p value). 2a. all 2b. when alerting situation satisfied the laboratory's critical reporting criteria and a phone call was made 2c. when alerting situation did not satisfy laboratory's critical reporting criteria	1a. 1.0(0.2-2.6), 4.1(12.1), 0-100.5 vs. 1.6(0.6-4.2), 4.6(9.1), 0.1-66.1 median p=0.003, mean p=0.003 1b. 0.7(0.2-2.6), 3.4(8.0), 0-44.6) vs. 1.1(0.6-3.0), 3.3(7.4), 0.1-55.1, median p=0.06, mean p=0.59 1c. 1.2(0.2-2.9), 4.8(14.8), 0-100.5 vs. 2.5(0.9-6.5), 6.1(10.7), 0.1-66.1, median p=0.009, mean p=0.01 2a. 8.4(4.0-14.5), 14.4(18.7), 0.2-118.9 vs. 8.9(5.4-23.2), 20.2(28.5), 1.3-198.5, median p=0.11, mean p=0.11 2b. 7.0(3.4-14.1), 12.8(15.4), 0.2-68.1 vs. 8.1(4.0-18.9), 13.7(14.5), 1.4-64.7, median p=0.43, mean p=0.68 2c. 9.2(5.6-17.9), 15.8(21.1), 0.7-118.9 vs.	1. (prespecified) Number (%) of adverse events within 48 hours of alert, (/94 for intervention; /98 for control) p value 1a. death 1b. cardiopulmonary arrests 1c. an unexpected transfer to the ICU 1d. myocardial infarction 1e. delirium 1f. stroke 1g. new renal insufficiency 1h. new acute renal failure 1i. dialysis 1j. unexpected return to the operating room 1k. all	1a. 7 (7.4%) vs 13 (13.3%), p=0.19 1b. 2 vs 1, p=0.53 1c. 6 vs 1, p=0.05 1d. 1 vs 0, p=0.3 1e. 4 vs 3, p=0.66 1f. 0 vs 1, p=0.33 1g. 4 vs 1, p=0.16 1h. 1 vs 1, p=0.98 1i. 5 vs 3, p=0.43 1j. 1 vs 3, p=0.33 1k. 31 vs 27, p=0.41	1	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
		10.2(6.8-35.7), 28.8(38.7), 4.1-198.5, median p=0.05, mean p=0.06				
Lafata, 2007[83]	The primary pre-determined physician outcome was the 1. unadjusted rate of BMD testing for a 12-month period after the date of first mailing for mailed reminder in combination with physician prompt vs. mailed reminder vs. usual care arm, p-value. 2. Rate of abnormal findings (hip or spine t-score ≤ -2.0) mailed reminder in combination with physician prompt vs. mailed reminder vs. usual care, p-value (not prespecified). 3. Adjusted BMD testing rates (95% confidence intervals) among patient mailed reminder and physician prompt vs. patient mailed reminder vs. usual care (not prespecified). 3a. Screening at age 65 3b. Screening at age 75 3c. Screening at age 85 3d. Osteoporosis treatment rates 4. The secondary pre-determined physician outcome was the dispensing of an osteoporosis medication. (For 5877 receiving bone mineral density test)	1. 28.9%, vs. 21.4% vs. 10.8%, p<0.001. 2. 13.7% vs. 17.8% vs. 16.2%, p=0.104. 3a. 30.3 (27.8 to 32.9) vs. 23.2 (20.6 to 25.9) vs. 17.0 (13.8 to 20.9) 3b. 27.0 (24.7 to 29.4) vs. 18.7 (16.5 to 21.0) vs. 10.1 (8.0 to 12.6) 3c. 23.9 (21.8 to 26.2) vs. 14.8 (13.1 to 16.8) vs. 5.8 (4.5 to 7.3) 3d. 3.9 (3.0 to 5.1) vs. 4.0 (2.8 to 5.7) vs. 2.3 (1.6 to 3.3) 4. 3.9 (3.0 to 5.1) vs. 4.0 (2.8 to 5.7) vs. 2.3 (1.6 to 3.3), P equals significant for the two active treatments versus usual care.	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
Lee, 2009[84]	(Outcomes not prespecified) 1. n (%) of encounters with obesity-related diagnosis 2. n (%) of obesity -related diagnosis not screened and entered in CCDSS 3. of obesity-related diagnoses not screened and entered by nurse 3a. n(%) with correct diagnosis based on Body Mass Index (BMI) 3b. n(%) wrong diagnosis based on BMI 3c. n (%) height and/or weight not entered 4. n (%) encounters with missing obesity-related diagnosis (denominators are # of encounters including height and weight)	1. 91/807 (11.3%) vs 10/997 (1.0%), p<0.05 2. 12/91 (13.2%) vs 10/10 (100%), p=0.211 3a.3/12 (25%) vs 6/10 (60%), p=0.192 3b.1/12 (8.3) vs 1/10 (10%), p=1.00 3c.8/12 (66.7%) vs 3/10 (30%), p=0.198 4. 51/208 (24.5%) vs 440/662 (66.5%), p<0.05	...	...	1	...
Lesourd, 2002[85]	Follow-up period NR; outcomes not clearly prespecified. 1. Mean (SD) number of follicles (=> 18 mm). 2. Stimulation cycles cancelled, n/N (%). 2a. Overall. 2b. In poor responders. 2c. In normal responders. 2d. In high responders. 3. Mean (SD) duration of stimulation (d).	1. 1.2 (0.7) vs 1.3 (0.5), p=NS 2a. 16/82 (20%) vs 8/82 (10%) 2b. 6/14 (43%) vs 4/16 (25%) 2c. 9/60 (15%) vs 3/59 (5%) 2d. 1/8 (13%) vs 1/7 (14%) 3. 11.0 (3.3) vs 11.1 (2.6) 4. 860 (382) vs 938 (516) 5. 541 (276) vs 508 (243)	Follow-up period NR 1. Patient pregnancy rate (primary), n/N (%). 1a. Clinical pregnancies. 1b. Ongoing pregnancies. Subgroup analysis by expected response to FSH stimulation (response defined	1a. 15/82 (18%) vs 13/82 (16%), p=NS 1b. 13/82 (16%) vs 12/82 (15%), p=NS 2a. 4 (29%) vs 1 (6%) 2b. 9 (15%) vs 12 (20%) 2c. 2 (25%) vs 0%	...	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	4. Mean (SD) number of FSH units given. 5. Mean (SD) maximum E2 levels (pg/mL). 6. Number of gestational sacs. 6a. 1. 6b. 2.	6a. 13 vs 13 6b. 2 vs 0	p.457 of paper; number of patients in each subgroup NR). 2. Patient clinical pregnancy rate: n (% of cycles). 2a. Poor responders. 2b. Normal responders. 2c. High responders.			
Lester, 2006[86,87]	1. Patients with changes in statin prescriptions at 1 month (primary), n/N, %. 2. Patients with changes in statin prescriptions at 12 months (primary), n/N, %. 3. median interval (IQR) to first medication adjustment among patients with changes (months) (not pre-specified) NOTE: the preliminary data in the 2004 paper reports 15 PCPs and 256 pts randomized; 2006 publication only mentions 14 PCPs and 235 patients, Author indicated that 1 physician (centre) was lost during the study, hence different numbers. 2004 also reports 1 outcome not in 2006 paper – looks like 1 mo follow-up (but not explicit):	1. 18/118, 15.3% vs 2/117, 2%, p=0.001 2. 29/118, 24.6% vs 20/117, 17.1%, p=0.14 3. 0 (0 to 8.5) vs 7.1 (3.9 to 10.4), p=0.005	1. Patients with change in LDL levels of all patients with LDL results (primary), n/N, % 2. mean (SD) first LDL level after intervention (part of primary) 3. mean (SD) final LDL level (part of primary) 4. median (IQR) time to first measured LDL after study initiation Prespecified subgroup analysis. 5. Patients with LDL cholesterol level > 130mg/dL at baseline, n/N, %. 6. Of patients with LDL>130 mg/dL at baseline, mean (SD)	1. 81/118, 68.6% vs 82/117, 82%, p=0.8 2. 111.7 (30.2) vs 118.1 (32.1), p=0.2 3. 106.8 (26.8) vs 111.5 (30.0), p=0.3 4. 99 (48 to 171) vs 121 (45 to 208), p=0.48 5. 41/118, 34.7% vs 39/117, 33.3%, p=0.9 6. 119 (32.1) vs 138 (35.6), p=0.04 7. 111.4 (29.3) vs 128.3 (35.7), p=0.055	1	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	Patients with repeat fasting lipid profile ordered. 12.9% vs 7.6%, p=0.16		first LDL after intervention. 7. Of patients with LDL>130 mg/dL at baseline, mean (SD) final LDL level.			
Lewis, 1996[88]	Prespecified: PROQSY group vs GHQ only group vs usual care 1. Mean (SD) number of consultations over 6 months. 1a. Overall. 1b. Doctor initiated. 1c. Patient initiated. 1d. Physical consults. 1e. Psychological consults. 2. Proportion of patients (95%CI) with referrals to other professionals (?over 6 months). 2a. To psychological practitioners. 2b. To other practitioners. 2c. To other practitioners. PROQXY vs usual care difference (95% CI). 3. Mean (SD) number of prescriptions (?over 6 months) 3a. Psychotropic drugs. 3b. Non-psychotropic drugs.	1a. 3.31 (3.53) vs 3.33 (3.02) vs 2.99 (2.91), p=0.5 1b. 1.30 (1.95) vs 1.40 (1.98) vs 1.18 (1.87), p=0.4 1c. 1.91 (2.18) vs 1.92 (2.01) vs 1.79 (1.88), p=0.7 1d. 2.33 (2.41) vs 2.39 (2.40) vs 2.26 (2.26), p=0.9 1e. 0.79 (2.07) vs 0.84 (1.92) 0.65 (1.62), p=0.09 2a. 4.0% (1.8 to 7.4) vs 5.7% (3.1 to 9.6) vs 3.5%, (1.5 to 6.8), p=0.6 2b. 22.5% (17.2 to 28.4) vs 11.5% (9.1 to 18.3) vs 15.4% (11.0 to 20.8), p=0.03 2c. 6.7% (-0.6 to 13.8) 3a. 0.66 (2.33) vs 0.55 (1.43) vs 0.44 (1.58), p=0.6 3b. 2.93 (3.70) vs 3.43 (4.75) vs 2.89 (3.32), p=0.7	Main outcomes: PROQSY group vs GHQ only group vs usual care 1. Mean (95% CI) GHQ score. 1a. At 6wks. 1b. At 3 mo. 1c. At 6 mo. 2. Mean difference (95%CI) in GHQ score PROQSY vs 2 control groups. 2a. At 6 wks. 2b. At 3 mo. 2c. At 6 mo. Not prespecified. 3. Proportion of PROQSY-defined cases of mental disorder at 6 wks, difference (95% CI): PROQSY group vs usual care. Note: PROQSY score >11 indicates clinically significant level of	1a. 25.7 (24.8 to 26.5) vs 27.2 (26.3 to 28.1) vs 26.6 (25.7 to 27.5), p=0.04 in favor of PROQSY 1b. 25.5 (23.8 to 25.8) vs 27.0 (25.4 to 27.5) vs 26.4 (25.4 to 27.5), p=0.07 1c. 25.4 (24.2 to 26.3) vs 26.8 (25.7 to 27.9) vs 25.9 (24.2 to 26.6), p=0.12 2a. 0.92 (0.07 to 1.78) 2b. 0.86 (-0.04 to 1.76) 2c. NS 3. 69.2% vs 74.5%, 5.3% (-3 to 14)	0	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			distress.			
Lo, 2009[89]	Prespecified. Primary outcome. 1. Rate of ordering appropriate baseline laboratory tests within 14 days of clinical encounter, n/N, %; OR, 95% CI. 2. Association between non-interruptive alerts and number of lab tests ordered within 14 days of alert for 11 (of 23) medication classes with >32 orders placed); n/N for both groups combined; OR, 95% CI. 2a. Antimanic agents. 2b. HMG-CoA reductase inhibitors. 2c. Diuretics. 2d. ACE-Is. 2e. Hypoglycemics. 2f. Antifungal antibiotics, 2g. Anticonvulsants. 2h. Antiarthritics. 2i. Cardiotonic agents. 2j, Antituberculosis agents. 2k.Angiotensin II receptor antagonists. 3. Association between non-interruptive alerts and number of lab tests ordered within 14 days of alert for 5 of 12 lab tests with sufficient sample size; n/N for both	1. 689/1685, 41% vs 771/1988, 39%; 1.048, 0.753 to 1.457, p=0.782 2a. 24/71; 0.117, 0.016 to 0.858, p=0.035 2b. 295/1025; 0.654, 0.377 to 1.136, p=0.132 2c. 404/799; 1.324, 0.866 to 2.023, p=0.196 2d. 289/621; 1.184 , 0.660 to 2.124, p=0.571 2e. 82/177; 1.221, 0.662 to 2.252, p=0.524 2f. 65/106; 0.854, 0.275 to 2.649, p=0.785 2g. 44/255; 0.591, 0.127 to 2.756, p=0.503 2h. 25/103; 1.328, 0.564 to 3.129, p=0.517 2i. 35/56; 0.346, 0.024 to 4.977, p=0.435 2j. 62/115; 1.964, 0.506 to 7.617; p=0.329 2k. 53/130; 2.583, 0.821 to 8.131, p=0.105 3a, 18/82; 0.740, 0.223 to 2.456, p=0.623 3b, 483/1453; 0.789, 0.502 to 1.242, p=0.306 3c. 17/56; 0.811, 0.235 to	...	...	0	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	groups combined; OR, 95% CI. 3a. Alkaline phosphatase. 2b. Alanine aminotransferase 3c. Thyroid stimulating hormone. 3d. Creatinine. 3e. Potassium. 4. Association between non-interruptive alerts and number of lab tests ordered within 14 days of alert for 3 medications with significant associations (of 70 medications monitored); 95% CI for OR. 4a. Pravastatin. 4b. Atorvastatin. 4c. Lithium.	2.803, p=0.741 3d. 165/384; 1.267, 0.738 to 2.175, p=0.392 3e. 744/1526; 1.288, 0.852 to 1.947, p=0.229 4a. –ve association, OR CI 0.015 to 0.744, p=0.024 4b. –ve association, OR CI 0.299 to 0.952, p=0.034 4c. –ve association, OR CI 0.016 to 0.947, p=0.044				
Lobach, 1997[90,91]	1. Compliance with diabetes management recommendations (median % compliance; p-value) (Primary) a. Foot examination b. Complete physical examination c. Chronic glycemia monitoring d. Urine protein determination e. Cholesterol level f. Ophthalmologic examination g. Influenza vaccination h. Pneumococcal vaccination 2. Median rate (%) clinician adherence to guidelines; p-value.	1. 32.0 vs 15.6 (from abstract); P=.01 a. 55.6 vs 30.0; P>0.1 b. 33.3 vs 6.7; P=0.05 c. 57.4 vs 52.8; P>0.1 d. 73.3 vs 3.9; P=0.01 e. 43.7 vs 13.4; P<0.02 f. 18.8 vs 3.2; P>0.1 g. 29.2 vs 22.7; P>0.1 h. 19.8 vs 0.0; P>0.1 2. 65 vs 40 (from fig. 4); P=.01 3. no means reported; P > 0.1, 95% CI -5.9 to 8.8.	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	Not clear that 3&4 are comparative for CCDSS vs control – delete? 3. Mean encounter length in minutes (SD) when CCDSS was supplied vs when it was not supplied; p-value, 95% CI of difference. (secondary) 4. Difference in encounter length (minutes) when diabetes was assessed vs encounters in which diabetes was not assessed; Mean (SD) p-value, 95% CI of difference. (secondary)	4. 93 (58) vs 83 (62); P = 0.02, 95% CI 1.6 to 18.5.				
Locatelli, 2009[92]	1. Iron usage at 4 week follow-up (secondary) 1a. n (%) patients receiving iron 1b. % patients administered intravenous iron 1c. % patients administered oral iron 1d. % patients administered iv and oral iron 1e. % patients not given iron 2. Erythropoetic therapy (ESA) usage at 4 week follow-up (secondary) 2a. % patients receiving ESA 2b % patients administered intravenous ESA 2c. % patients administered subcutaneous ESA	1a. 182/289 (63%) vs 142/258 (55%) 1b. 52% vs 49% 1c. 8% vs 5% 1d. 3% vs 1% 1e. 37% vs 45% 2a. 96% vs 94% 2b. 46% vs 43% 2c. 54% vs 57% 2d. 8398 (n=127) vs 7431 (n=105) 2e. 8000 (n=147) vs 6406 (n=138) 3. 128 (21%) vs 134 (22%)	1. Mean (SD) Hb (g/dl): baseline / 6-8 mo follow-up (P value for comparison of follow-up values between groups) 1a. All patients (N=321 vs 278) 1b. Adherers only (N=128 vs 134) 1c. Western European countries (N=unstated) 1d. Eastern European countries (N=unstated) 2. Number (%) of patients achieving hematological targets: baseline / 6-8 mo	1a. 11.0 (1.3) / 11.6 (1.3) vs 11.2 (1.4) / 11.7 (1.3), p=0.134 1b. 11.4 (1.3) / 11.9 (1.1) vs 11.8 (1.3) / 12.1 (1.1), p=NR 1c. 11.6 (1.2) / 12.0 (1.3) vs 12.0 (1.2) / 12.2 (1.3), p=NR 1d. 10.6 (1.3) / 11.3 (1.2) vs 10.6 (1.2) / 11.3 (1.2), p=NR 2a. 157 (49%) / 193 (67%) vs 140 (50%) / 181 (70%), p=not applicable (NA) 2b. 91 (28%) / 88 (31%) vs 58 (21%) /	...	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	2d. Mean weekly combined i.v. dose 2e. Mean weekly combined s.c. dose 3. Number (%) of patients whose treatment followed guidelines at both study visits (secondary)		follow-up (N=321 vs 278) 2a. Hb >11 g/dL (primary) 2b. Hb 11-12 g/dL 2c. Hb >13 g/dL 2d. Serrum ferritin >100 ng/mL (primary) 2e hypochromic red cell count (HRC) <10% or transferrin saturation TSAT >20% (primary) 3. Number (%) of patients achieving hematological targets amongst adherers to the guidelines: baseline / 6-8 mo follow-up (N=128 vs 134) 3a. Hb >11 g/dL 3b. Hb 11-12 g/dL 3c. Hb >13 g/dL 3d. Serrum ferritin >100 ng/mL 3e. hypochromic red cell count (HRC) <10% or transferrin saturation TSAT >20% Subgroup analyses	82 (32%), p=NA 2c. 17 (5%) / 37 (13%) vs 29 (10%) / 35 (14%), p=NA 2d. 255 (84%) / 253 (90%) vs 221 (85%) / 237 (93%), p=0.359 2e. 206 (79%) / 253 (86%) vs 222 (86%) / 227 (85%), p=0.812 3a. 82 (64%) /95 (79%) vs 99 (74%) / 106 (84%), p=Not reported 3b. 48 (38%) / 41 (34%) vs 38 (28%) / 37 (29%), p=Not reported 3c. 10 (8%) / 15 (12%) vs 20 (15%) / 23 (18%), p=Not reported 3d. 105 (83%) / 99 (92%) vs 116 (89%) / 112 (93%), p=Not reported 3e. 87 (81%) / 104 (88%) vs 111 (84%) / 106 (85%), p=Not reported 4a. 98 (71%) / 98		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			(Outcomes not prespecified) 4. Number (%) of patients achieving hematological targets in Western European countries: baseline / 6-8 mo follow-up (N of patients in each group not reported)(secondary) 4a.Hb >11 g/dL, n (%) 4b. Serrum ferritin >100 ng/mL, n (%) 4c. Hypochromic red cell count (HRC) <10% or transferrin saturation TSAT >20%, n (%) (Outcomes not prespecified) 5. Number (%) of patients achieving hematological targets in Eastern European countries: baseline / 6-8 mo follow-up (N of patients in each group not reported.)(secondary) 5a. Hb >11 g/dL, n (%) 5b. Serrum ferritin	(82%) vs 103 (81%) / 103 (84%), p=NR 4b. 110 (86%) / 88 (98%) vs 122 (95%) / 116 (96%), p=NR 4c. 72 (69%) / 98 (85%) vs 107 (84%) / 103 (85%), p=NR 5a. 59 (32%) / 95 (57%) vs 37 (25%) / 78 (57%), p=NR 5b. 152 (84%) / 148 (89%) vs 105 (75%) / 108 (91%), p=NR 5c. 134 (85%) / 138 (87%) vs 126 (87%) / 113 (86%), p=NR		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			>100 ng/mL, n (%) 5c. Hypochromic red cell count (HRC) <10% or transferrin saturation TSAT >20%, n (%)			
Lowenstey n, 1998[93]	Main outcome (not specified as primary) 1. Ratio for high-risk/low-risk patients returning for reassessment at 3 months; intervention group (95% CI) vs control group (95% CI), difference (95% CI).	1. 1.23 (0.96 to 1.60) vs 0.77 (0.58 to 1.03), 0.46 (CI 0.08 to 0.87).	Prespecified: Intervention (Profile) group vs. Control 1. Mean (SD) change in total cholesterol (mmol/L) at 3 months. 2. Mean (SD) change in total /HDL cholesterol ratio at 3 months. 3. Mean (SD) change in body mass index (kg/m2) at 3 months. 4. Mean (SD) change in HDL cholesterol (mmol/L) at 3 months. 5. Mean (SD) change in LDL cholesterol (mmol/L) at 3 months. 6. Mean (SD) change in SBP (mm Hg) at 3 months. 7. Mean (SD) change in DBP (mm Hg) at 3 months. 8. Change in proportion of smokers	1. -0.49 (0.99) vs -0.09 (0.87), p<0.05 2. -0.6 (1.3) vs -0.2 (1.2), p<0.05 3. -0.2 (1.1) vs -0.3 (1.2), p=0.31 4. 0.02 (0.17) vs 0 (0.25), p=0.55 5. -0.40 (0.87) vs -0.01 (0.80), p<0.05 6. -2.0 (14.2) vs -1.2 (14.1) , p=0.61 7. -0.9 (8.1) vs 0.1 (9.8), p=0.99 8. -3 (-1.5%) vs -2(-2.3%), p=0.64 9. -1.8% (4.7) vs -0.3% (5.3), p<0.01 10. -0.6 (1.8) vs -0.1 (2.1), p<0.01	1	1

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			at 3 months. 9. Mean (SD) change in 8-year coronary risk (%) at 3 months. 10. Mean (SD) change in CV age (years) at 3 months.			
Maclean, 2009[94,95]	Mean of 32 months follow-up: 1. Proportion of tests that were timely according to guidelines (%); adjusted OR* (95% CI), (secondary). 1a. A1C (testing within 6 months if A1C<7% and 3 months otherwise). 1b. Lipids (yearly if LDL<100 mg/dl; 6 months if LDL 100-129 mg/dl; and 3 months otherwise). 1c. Serum creatinine (yearly). 1d. Urine microalbumin (yearly unless previous testing was abnormal). Subgroup of patients completed follow-up surveys within 6 months of study completion (not prespecified): Mean (measure not stated); adjusted effect*** (95% CI) 2a. Primary care visits/year 2b. Specialty visits/year *Adjusted for baseline patient	1a. 56% vs 55%; 1.17 (0.80 to 1.72), p=0.43 1b. 74% vs 71%; 1.39 (1.08 to 1.80), p=0.012 1c. 84% vs 80%; 1.40 (1.06 to 1.84), p=0.018 1d. 40% vs 32%; 1.74 (1.13 to 2.69), p=0.012 2a. 2.04 vs 2.86, -0.81 (-1.42 to -0.20), p=0.010 2b. 0.15 vs 0.23, -0.08 (-0.15 to -0.002), p=0.044	Mean of 32 months follow-up: Non-imputed data, n=4998 for A1C (Missing lab results 32% vs 34%, p=0.09); n=5,450 for LDL (Missing lab results 20% vs 23%, p<0.001). Imputed data, n=7412. 1. Mean A1C (%); adjusted absolute difference* (95% CI) (primary). 1a. non-imputed data 1b. imputed data 2. Proportion of patients with A1C <7% (%); adjusted OR* (95% CI) (primary). 2a. non-imputed data 2b. imputed data 3. Mean LDL (mg/dL);	1a. 7.16% vs 7.01%, +0.12 (-0.01 to +0.25), p=0.08 1b. 7.25% vs 7.10%, +0.10 (-0.05 to +0.24), p=0.17 2a. 54% vs 59%, 0.84 (0.66 to 1.08), p=0.18 2b. 54% vs 59%, 0.84 (0.66 to 1.08), p=0.18 3a. 93.5 vs 93.4, +0.4 (-2.2 to +3.1), p=0.74 3b. 95.0 vs 95.8, +0.2 (-2.5 to +3.0), p=0.86 4a. 64% vs 63%, 1.04 (0.87 to 1.23), p=0.68 4b. 64% vs 63%, 1.04 (0.88 to 1.23), p=0.65	1	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	value, baseline practice performance, and clustering within practices.		adjusted absolute difference* (95% CI) (secondary). 3a. non-imputed data 3b. imputed data 4. Proportion of patients with LDL <100 mg/dL (%); adjusted OR* (95% CI) (secondary). 4a. non-imputed data 4b. imputed data 5. Number, %, deaths (not prespecified). Subgroup of patients completed follow-up surveys within 6 months of study completion (not prespecified): 6. Physical status (n=672); Mean (measure not stated), adjusted effect** (95% CI) 6a. Systolic BP(mmHg) 6b. Diastolic BP(mmHg)	5. 301/3886 (7.7%) vs 222/3526 (6.3%), p=0.27 6a. 137.4 vs 138.4, -1.7 (-4.0 to +0.6), p=0.14 6b. 76.3 vs 76.4, 0.0 (-1.2 to +1.3), p=0.94 6c. 33.7 vs 33.7, -0.1 (-0.5 to +0.03), p=0.52 7a. 40.8 vs 40.6, +0.2 (-0.9 to +1.3), p=0.68 7b. 50.7 vs 50.5, -0.4 (-1.6 to +0.8), p=0.50 8a. 59.2 vs 61.0, -2.7 (-6.9 to +1.6), p=0.22 8b. 54.4 vs 51.9, +1.7 (-2.0 to +5.4), p=0.35 8c. 39.4 vs 33.5, +5.0 (+0.9 to +9.1), p=0.017 8d. 55.4 vs 63.4, -5.5 (-11.7 to +0.6), p=0.08 8e. 48.8 vs 52.9, -2.5 (-7.0 to +2.0), p=0.28 9. -1.2 vs -1.4, +0.12		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			6c. Body mass index (kg/m²) 7. Functional status (n=688) (Range 0-100); Mean (measure not stated), adjusted effect** (95% CI) 7a. SF-12 Physical 7b. SF-12 Mental 8. Self-care activity (n=564) (Range 0-100); Mean (measure not stated), adjusted effect** (95% CI) 8a. General diet 8b. Specific diet 8c. Exercise 8d. Blood testing 8e. Foot care 9. Audit of Diabetes Dependant Quality of Life (n=658) (range -9 to +9, lower scores = lower QOL); Mean (measure not stated); adjusted effect** (95% CI) 10. Patient's recall of healthcare utilization in past year (n=704); Mean (measure not	(-0.04 to +0.28), p=0.13 10a. 1.18 vs 1.89, -1.01 (-2.02 to -0.01), p=0.047 10b. 0.55 vs 0.72, -0.23 (-0.42 to -0.04), p=0.020 Note: there is a question out to the author as to whether or not these numbers are means and whether a higher number in the ranges is better.		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			stated); adjusted effect*** (95% CI) 10a. Hospital days/year 10b. Emergency room visits/year *Adjusted for baseline patient value, baseline practice performance, and clustering within practices. **Adjusted for baseline patient value, age, sex, marital status, education, health literacy, race, insulin use, comorbidity and clustering within practices. ***Adjusted for age, sex, marital status, education, health literacy, race, insulin use, comorbidity, hospital clustering within practices.			
Manotti, 2001[96]	Long term therapy group (on therapy for ≥ 3 months at enrollment and followed for 1 year) 1. percentage of time spent by the	Long term therapy group N = 458 vs 458 1ai. 71.2% vs 68.2%, p<0.001 1aii. 72.5% vs 70.5%,	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	single patient in the scheduled therapeutic range (primary outcome) over 1 year: high target INR, =>2.8; low target INR, <2.8. 1a. All INR targets. 1ai. Overall (744.7 pt/yrs follow-up). 1aii. Warfarin patients (519.0 pt/yrs follow-up). 1aiii. Acenocoumarol patients (255.7 pt/yrs follow-up). 1b. High target INR 1bi. Overall. 1bii. Warfarin patients. 1biii. Acenocoumarol patients. 1c. Low target INR 1ci. Overall. 1cii. Warfarin patients. 1ciii. Acenocoumarol patients. 2. percentage of time spent by the single patient below scheduled therapeutic range over 1 year: high target INR, =>2.8; low target INR, <2.8. 2a. All INR targets. 2ai. Overall. 2aii. Warfarin patients. 2aiii. Acenocoumarol patients. 2b. High target INR 2bi. Overall. 2bii. Warfarin patients. 2biii. Acenocoumarol patients.	p<0.001 1aiii. 68.7% vs 63.5%, p<0.001 1bi. 70.6% vs 68.2%, p<0.001 1bii. 73.9% vs 72.8%, p<0.001 1biii. 64.6% vs 61.0%, p<0.001 1ci. 71.6% vs 68.3%, p<0.001 1cii. 71.7% vs 69.5%, p<0.001 1ciii. 71.3% vs 65.3%, p<0.001 2. p-values NR 2ai. 19.0% vs 21.4% 2aii. 17.5% vs 19.3% 2aiii. 22.0% vs 25.8% 2bi. 22.7% vs 25.5% 2bii. 19.4% vs 21.6% 2biii. 28.5% vs 31.8% 2ci. 17.0% vs 19.1% 2cii. 16.6% vs 18.1% 2ciii. 17.8% vs 21.5% 3. p-values NR 3ai. 9.8% vs 10.4% 3aii. 10.0% vs 10.2% 3aiii. 9.3% vs 10.7% 3bi. 6.7% vs 6.3% 3bii.6.7% vs 5.6%				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	2c. Low target INR 2ci. Overall. 2cii. Warfarin patients. 2ciii. Acenocoumarol patients. 3. percentage of time spent by the single patient above scheduled therapeutic range over 1 year: high target INR, =>2.8; low target INR, <2.8. 3a. All INR targets. 3ai. Overall. 3aii. Warfarin patients. 3aiii. Acenocoumarol patients. 3b. High target INR 3bi. Overall. 3bii. Warfarin patients. 3biii. Acenocoumarol patients. 3c. Low target INR 3ci. Overall. 3cii. Warfarin patients. 3ciii. Acenocoumarol patients. Note: In the article, percentage time within, above, and below range is also reported by quarters of the year (separated by drug in Table 4 and by INR target in Table 5). 4. mean (SD) number of appointments per patient over 1 year; Number of appointments	3biii. 6.9% vs 7.2% 3ci. 11.4% vs 12.6% 3cii. 11.7% vs 12.4% 3ciii.10.9% vs 13.2% 4a. overall, high target INR: 18.6 (8.74) vs 19.5 (7.42) (p<0.001); 3,189 vs 3,257 4b.overall, low target INR: 15.7 (4.69) vs 16.8 (4.95) (p<0.001), 4,288 vs 4,505 4c. warfarin, high target INR: 18.4 (4.82) vs 19.4 (7.42), p<0.001; 1,982 vs 1,995 4d. warfarin, low target INR: 15.6 (4.71) vs 16.3 (4.76), p<0.001; 3, 192 vs 3,318 4e. acenocoumarol, high target INR: 19.1 (9.82) vs 19.6 (5.04), NS; 1,207 vs 1,262 4f. acenocoumarol, low target INR: 16.1 (4.63) vs 18.4 (4.82), p<0.001; 1,106 vs 1,187 5a. warfarin, high target INR 33.3 (15.7) vs 31.3 (12.8) (p<0.001) 5b. warfarin, low target				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	(secondary outcome) 4a. overall, high target INR 4b.overall, low target INR 4c. warfarin, high target INR 4d. warfarin, low target INR 4e. acenocoumarol, high target INR 4f. acenocoumarol, low target INR 5. mean (SD) dosage of anticoagulant drug (mg/week) over 1 year (secondary outcome) 5a. warfarin, high target INR 5b. warfarin, low target INR 5c. acenocoumarol, high target INR 5d. acenocoumarol, low target INR 6. mean INR value over 1 year (secondary outcome) 6a. overall, high target INR 6b.overall, low target INR 6c. warfarin, high target INR 6d. warfarin, low target INR 6e. acenocoumarol, high target INR 6f. acenocoumarol, low target INR Starting treatment group (enrolled before 2nd visit and followed for ≥ 3 months) 1. percentage of patients reaching stable condition (primary outcome). [Stable = 3 consecutive INRs within therapeutic range at least 1 week from each other].	INR 29.7 (12.9) vs 29.7 (14.4) (not significant) 5c. acenocoumarol, high target INR 19.2 (9.82) vs 17.8 (10.4) (p<0.01) 5d. acenocoumarol, low target INR 14.7 (6.70) vs 14.8 (6.81) (not significant) 6a. overall, high target INR: 3.07 (1.01) vs 2.95 (0.84) (p<0.001) 6b. Overall, low target INR: 2.51 (0.82) vs 2.55 (0.76) (not significant) 6c. warfarin, high target INR: 3.10 (0.93) vs 2.90 (0.69), p<0.001 6d. warfarin, low target INR: 2.50 (0.76) vs 2.51 (0.75), NS 6e. acenocoumarol, high target INR: 3.03 (1.05) vs 2.99 (0.99), NS 6f. acenocoumarol, low target INR. 2.51 (0.85) vs 2.59 (0.81), NS Starting treatment group N = 145 vs 190 1. 1-31 days: 39% vs 27% (p<0.01) 1-60 days: 73% vs 57%				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
		(p<0.05)				
	2.percentage of time spent within the therapeutic range limit (secondary outcome)	1-90 days: 93% vs 87% (not significant)				
	2a. All months.	1 to >90 days: 100% vs 100% (not significant)				
	2ai. Overall (71.3 pt/yrs follow-up)					
	2aii. Warfarin patients (44.5 pt/yrs follow-up)	2ai, 51.9% vs 48.1%, p<0.001				
	2aiii. Acenocoumarol patients (26.8 pt/yrs follow-up).	2aii. 52,2% vs 49.6%, p<0.001				
	2b. 1st month.	2aiii. 51.4% vs 45.3%,				
	2bi. Overall.	p<0.001				
	2bii. Warfarin patients.	2bi. 47.4% vs 44.0%,				
	2biii. Acenocoumarol patients.	p<0.001				
	2c. 2nd month.	2bii. 46.5% vs 45.4%, NS				
	2ci. Overall.	2biii. 48.9% vs 41.1%,				
	2cii. Warfarin patients.	p<0.001				
	2ciii. Acenocoumarol patients.	2ci. 51.1% vs 45.2%,				
	2d. 3rd month.	p<0.001				
	2di. Overall.	2cii. 51.5% vs 47.3%,				
	2dii. Warfarin patients.	p<0.01				
	2diii. Acenocoumarol patients.	2ciii. 50.5% vs 41.3%, p<0.001				
	3.percentage of time spent below the therapeutic range (secondary outcome)	2di. 57.8% vs 56.4%, NS 2dii. 60.2% vs 57.7%, NS 2diii. 54.7% vs 54.2%, NS				
	3a. All months.					
	3ai. Overall (71.3 pt/yrs follow-up)	3. p-values NR				
	3aii. Warfarin patients (44.5 pt/yrs follow-up)	3ai. 40.8% vs 43.3% 3aii. 41.6% vs 42.2%				
	3aiii. Acenocoumarol patients (36.8 pt/yrs follow-up).	3aiii. 39.6% vs 45.3% 3bi. 43.0% vs 43.2%				
	3b. 1st month.	3bii. 45.8% vs 43.0%				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	3bi. Overall.	3biii. 38.7% vs 43.8%				
	3bii. Warfarin patients.	3ci. 42.8% vs 48.7%				
	3biii. Acenocoumarol patients.	3cii. 43.9% vs 47.2%				
	3c. 2nd month.	3ciii. 41.3% vs 51.6%				
	3ci. Overall.	3di. 36.0% vs 37.0%				
	3cii. Warfarin patients.	3dii. 33.9% vs 35.2%				
	3ciii. Acenocoumarol patients.	3diii. 38.7% vs 40.1%				
	3d. 3rd month.					
	3di. Overall.	4. p-values NR				
	3dii. Warfarin patients.	4ai. 7.3% vs 8.6%				
	3diii. Acenocoumarol patients.	4aii. 6.2% vs 8.2%				
		4aiii. 9,0% vs 9.4%				
	4.percentage of time spent above the therapeutic range (secondary outcome)	4bi. 9.6% vs 12.8%				
		4bii. 7.7% vs 11.6%				
		4biii. 12.4% vs 15.1%				
	4a. All months.	4ci. 6.1% vs 6.1%				
	4ai. Overall (71.3 pt/yrs follow-up)	4cii. 4.6% vs 5.5%				
	4aii. Warfarin patients (44.5 pt/yrs follow-up)	4ciii. 8.2% vs 7.1%				
		4di. 6.2% vs 6.6%				
	4aiii. Acenocoumarol patients (46.8 pt/yrs follow-up).	4dii. 5.9% vs 7.1%				
		4diii. 6.6% vs 5.7%				
	4b. 1st month.					
	4bi. Overall.					
	4bii. Warfarin patients.					
	4biii. Acenocoumarol patients.					
	4c. 4nd month.					
	4ci. Overall.					
	4cii. Warfarin patients.					
	4ciii. Acenocoumarol patients.					
	4d. 3rd month.					
	4di. Overall.					
	4dii. Warfarin patients.					
	4diii. Acenocoumarol patients.					

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	Note: Time spent in range for 'starting treatment' group also shown in figure 2. Note: Low target INR 2.0 to 3.0; high target INR 3.0 to 4.5.					
Martens, 2007[97,98]	All measured during 12 month intervention period. 1. Appropriate prescribing when no prescribing of a particular drug was advised: % not prescribing [in accordance with recommendation] (95% CI) 1a. no antibiotics for acute sore throat divided by all patients with acute sore throat considered for prescription. 1b. no antibiotics except after 5 days, feneticilline, azitromycin, fenoxymethylpenicilline for acute sore throat divided by all prescriptions for sore throat. 1c. no antibiotics for acute sinusitis divided by all patients with acute sinusitis considered for prescription. 1d. no prescribing indicated, only prescriptions doxycyclin for acute sinusitis divided by all prescriptions for acute sinusitis. 2. Appropriate prescribing of antibiotics when no prescribing of	1a. 74% (33 to 94) vs 75% (59 to 90): NS 1b. 66% (23 to 100) vs 46% (16 to 74): NS 1c. 67% (59 to 73) vs 61% (51 to 70): NS 1d. 39% (31 to 49) vs 42% (32 to 58): NS 2a. 4.4 (2.8 to 8.6) vs 5.1 (2.8 to 10.6) 2b. 0.2 (0.0 to 0.6) vs 0.3 (0.1 to 0.7) 2c. 0.2 (0.0 to 0.4) vs 0.8 (0.3 to 2.4), p=0.03 2d. 4.5 (2.9 to 6.4) vs 6.1 (4.4 to 8.6) 2e. 7.6 (5.0 to 10.4) vs 10.6 (7.5 to 18.1) 2f. 4.6 (2.5 to 13.7) vs 5.6 (3.8 to 8.1) 2g. 5.3 (2.9 to 12.5) vs 6.5 (4.5 to 10.3) 2h. 1.5 (0.8 to 2.2) vs 4.6 (2.8 to 8.1), p=0.03 2i. 28.2 (20.8 to 44.5) vs	...	...	0	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	a particular drug was advised: volume per GP per 1000 enlisted patients. (95% CI) 2a. Doxycyclin and amoxicillin for acute bronchitis. 2b. Antibacterial antibiotics (for systemic use) for sore throat. 2c. Feneticilline, azitromycin, fenoxymethylpencilline for acute sore throat. 2d. Antibacterial antibiotics (for systemic use) without doxycyclin for acute sinusitis. 2e. Doxycyclin for acute sinusitis. 2f. Amoxicillin and azitromycin for otitis media acuta. 2g. Antibacterial antibiotics (for systemic use) for otitis media acuta. 2h. Quinolones for cystitis in women >12 years of age. 2i. Sum score for antibiotic prescription (primary). 3. Appropriate prescribing for asthma/COPD when no prescribing of a particular drug was advised: volume per GP per 1000 enlisted patients. (95% CI). 3a. Prescriptions for intermittent asthma and maintenance treatment. 3b. Inhaled corticosteroids for	39.7 (29.7 to 64.1), NS 3a. 1.1 (0.5 to 2.3) vs 1.7 (0.8 to 3.3) 3b. 0 (0.0 to 0.1) vs 0.5 (0.3 to 0.9), p=0.00 3c. 1.1 (0.6 to 2.6) vs 2.2 (1.4 o 4.3), NS 5a. 19% (7 to 38) vs 24% (9 to 49): NS 5b. 59% (42 to 72) vs 68% (56 to 77): NS 5c. 50% (32 to 73) vs 35% (17 to 52): NS 5d. 29% (21 to 38) vs 28% (16 to 37): NS 5e. 64% (49 to 76) vs 57% (40 to 65): NS 5f. 30% (16 to 42) vs 26% (14 to 46): NS 5g. 47% (23 to 65) vs 53% (24 to 81): NS 5h. 73% (69 to 80) vs 57% (52 to 63); p=0.01 5i. 47% (38 to 54) vs 51% (39 to 65): NS 5j. 44% (30 to 56) vs 27% (14 to 47): NS 5k. 36% (20 to 53) vs 51% (26 to 78): NS				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	newly diagnosed COPD in patients >40 years. 3c. Sum score for asthma/COPD prescriptions (primary). 5. Appropriate prescribing when prescribing of a particular drug was advised: % prescribing [in accordance with recommendation] (95% CI) 5a. benzolyperoxi and salicylacid for acne vulgaris divided by all prescriptions for acne vulgaris. 5b. erythromycin, minocyclin, cyproteronacetate for acne vulgaris divided by all prescriptions for acne vulgaris. 5c. minocyclin, benzoylperoxi, salicyl acid for acne vulgaris (comedones with inflammation, symptoms) divided by all prescriptions for acne. 5d. Fenoxymethyl penicillin, feneticillin, erytromycin for erysipelas divided by all prescriptions for erysipelias. 5e. Fusedine acid, zinc preparation with an desinfectant for impetigo divided by all prescriptions for impetigo. 5f. flucloxacillin, azitromycin for	5l. 15% (9 to 29) vs 15% (8 to 23): NS 6a. 0.3 (0.1 to 1.2) vs 0.3 (0.1 to 0.5) 6b. 1.9 (1.1 to 2.8) vs 2.0 (1.3 to 3.1) 6c. 0.6 (0.3 to 1.1) vs 0.4 (0.1 to 1.1) 6d. 1.1 (0.6 to 2.5) vs 1.2 (0.6 to 2.2). 6e. 5.0 (3.5 to 8.6) vs 4.4 (2.6 to 7.0) 6f. 0.7 (0.3 to 1.5) vs 0.5 (0.2 to 0.8) 6g. 0.8 (0.4 to 1.9) vs 0.4 (0.2 to 0.9) 6h. 10.1 (7.6 to 14.0) vs 11.5 (6.9 to 19.3) 6i. 20.7 (17.1 to 26.1) vs 20.5 (14.2 to 27.4), NS 7a. 3.3 (2.1 to 4.6) vs 4.8 (3.3 to 6.9) 7b. 1.7 (1.0 to 2.6) vs 1.4 (0.7 to 4.1) 7c. 0.3 (0.1 to 0.7) vs 0.5 (0.3 to 1.0) 7d. 0.7 (0.3 to 1.1) vs 1.0 (0.6 to 1.7) 7e. 5.9 (3.8 to 7.9) vs 7.7 (5.6 to 11.8), NS				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	impetigo divided by all prescriptions for antibacterial antibiotics for impetigo. 5g. co-trimoxazol, ciprofloxacin and norfloxacin for chronical and recurrent symptoms on prostatitis divided by all antibacterial antiobiotic prescriptions for same condition. 5h. trimethoprim, nitrofurantoin for acute and recurrent cystitis among female patients >12 years divided by all prescriptions for same population. 5i. Terbutalin turbohaler/salbutamol diskus/salbutamoldosis-aerosol for intermittent/mildly persistent and moderate persistent asthma with acute complaints among patients >7 years divided by all asthma prescriptions for same population. 5j. Budesonide turbuhaler/fluticason discus/fluticasondosis-aerosol for mildly persistent asthma with maintenance treatment among patients >7 years divided by all asthma prescriptions for same population. 5k. Budesonide turbuhaler/fluticason diskus/fluticason dosis-aerosol					

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	AND: salmeterol discus/salmeterol dosis-aerosol/formoterol dosis-aerosol for severe persistent asthma with maintenance treatment among patients >7 years divided by all asthma prescriptions for same population. 5l. ipratropiumbromid powder inhaler, ipratropiumbromid dosis-aerosol, salbutamol discus, salbutamol dosis-aerosol for newly diagnosed COPD patients >40 years divided by all prescriptions for COPD patients >40 years of age. 6. Appropriate prescribing of particular antibiotics: volume per GP per 1000 enlisted patients. (95% CI) 6a. benzolyperoxi and salicylacid for acne vulgaris (mainly comedones). 6b. erythromycin, minocyclin, cyproteronacetate for acne vulgaris (mainly inflammation, symptoms). 6c. minocyclin, benzoylperoxi, salicyl acid for acne vulgaris (comedones with inflammation, symptoms). 6d. Fenoxymethyl penicillin, feneticillin, erytromycin for erysipelas. 6e. Fusedine acid, zinc preparation					

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	combined with an desinfectant for impetigo. 6f. flucloxacillin, azitromycin for impetigo. 6g. co-trimoxazol, ciprofloxacin and norfloxacin for chronical and recurrent symptoms on prostatitis. 6h. trimethoprim, nitrofurantoin for acute and recurrent cystitis among female patients >12 years. 6i. Sum score for antiobiotic prescriptions (primary). 7. Appropriate prescribing of particular drugs for asthma/COPD treatment: volume per GP per 1000 enlisted patients. (95% CI). 7a. Terbutalin turbohaler/salbutamol diskus/salbutamol dosis-aerosol for intermittent/mildly persistent and moderate persistent asthma with acute symptoms among patients >7 years. 7b. Budesonide turbuhaler/fluticason discus/fluticason dosis-aerosol for mildly persistent asthma with maintenance treatment among patients >7 years. 7c. Budesonide turbuhaler/fluticason diskus/fluticason dosis-aerosol					

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	AND: salmeterol discus/salmeterol dosis-aerosol/formoterol dosis-aerosol for severe persistent asthma with maintenance treatment among patients >7 years. 7d. ipratropiumbromid powder inhaler, ipratropiumbromid dosis-aerosol, salbutamol discus, salbutamol dosis-aerosol for newly diagnosed COPD patients >40 years 7e. Sum score for asthma/COPD drug prescriptions (primary). Note: also reports volume of prescriptions for all antibiotics, % of prescriptions for inhaled corticosteroids in asthma patients, and volume of prescriptions for inhaled corticosteroids in asthma patients; however, only reports data for 'clinically meaningful' results.					
Martens, 2007c2[97,98]	All measured during 12 month intervention period. 1. Appropriate prescribing when no prescribing of a particular drug was advised: % not prescribing [in accordance with recommendation] (95% CI) 1e. No statins for newly diagnosed	1e. 100% (0) vs 98% (94–100): NS 4. 0 vs 0.1 (0.0 to 0.2), NS 5m. 88% (71 to 100) vs 72% (52 to 81): NS	...	...	0	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	patients with diabetes or CVD between 18 and 70 years with cholesterol <3.5mmol divided by all same population considered for prescription. 4. Appropriate prescribing of statins for patients with newly diagnosed DM or CVD, 18-70 years of age, and cholesterol <3.5mmol, when no prescribing of a particular drug was advised: volume per GP per 1000 enlisted patients. (95% CI) (primary). 5m. statins for newly diagnosed patients with diabetes or CVD between 18 and 70 years and cholesterol >5.5mmol divided by all statin prescriptions for newly diagnosed DM or CVD 8. Appropriate prescribing of particular cholesterol-lowering drugs: volume per GP per 1000 enlisted patients. (95% CI) (primary). Note: also reports volume of prescriptions for all antibiotics, % of prescriptions for inhaled corticosteroids in asthma patients, and volume of prescriptions for	8. 1.0 (0.5 to 2.2) vs 1.2 (0.7 to 1.8), NS				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	inhaled corticosteroids in asthma patients; however, only reports data for 'clinically meaningful' results.					
Martin, 2004[99]	1. Self-reported patient satisfaction with health plan (change from baseline to 18 months); score range 0=worst, 10=best) (primary). 2. Disenrollment from plan (secondary).	1. 0.32 vs 0.12; p<0.01 2. No differences (no data reported).	Primary outcomes over 18 months. 1. SF-36 domains (change from baseline to 18 months) 1a. General health. 1b. Bodily pain. 1c. Mental health. 1d. Physical function. 1e. Role limitation — emotional. 1f. Role limitation — physical. 1g. Social function. 1h. Vitality. 1i. Mental component — summary score. 1j. Physical component — summary score. 2. Inpatient admissions per 1000 per year. 3. Inpatient days per 1000 per year. 4. Skilled nursing facility admissions per 1000 per year. Secondary 5. Skilled nursing facility days per 1000	1a. -1.50 vs -2.29; p=0.09 1b. -0.78 vs -1.42; p=0.35 1c. -0.13 vs 0.01; p=0.74 1d. -4.29 vs -4.04; p=0.67 1e. -2.73 vs -2.24; p=0.66 1f. -3.09 vs -4.45; p=0.28 1g. -1.42 vs -2.77; p=0.04 1h. -1.53 vs -2.28; p=0.14 1i. -0.16 vs -0.23; p=0.79 1j. -1.25 vs -1.56; p=0.21 2. 430 vs 421; p=0.89 3. 1929 vs 1989; p=0.46 4. 36 vs 37; p=0.73 5. 616.3 vs 747.7; p=0.02 6. 191/4257 (4.5%) vs 211/4247 (5.0%),	1	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			per year . 6. Number (proportion) of deaths over 18 months.	p=0.18		
Matheny, 2004[100]	Primary 1. Proportion of appropriate laboratory tests within 14 days of the clinical encounter (Medication–lab reminder): number of visits with overdue tests ordered/number of visits with overdue tests, %; adjusted odds ratio (95% CI). 1a. NSAID-Creatinine (8487 vs 9307 visits). 1b. ARB-Creatinine (751 vs 832 visits). 1c. Metformin-Creatinine (856 vs 781 visits) 1d. Potassium supplement – Potassium (579 vs 751 visits). 1e. Potassium sparing diuretic – Potassium (761 vs 875 visits). 1f. Thiazide diuretic- Potassium (1997 vs 2508 visits). 1g. ACE inhibitor – Potassium (2279 vs 2790 visits). 1h. Statin – ALT (9441 vs 10935 visits). 1i. Thyroxine – TSH (897 vs 1233 visits). 1j. Therapeutic levels of carbamazapine, cyclosporine,	1a. 150/442, 33.9% vs 136/428, 31.8%; 1.24 (0.71 to 2.15), p=0.457 1b. 17/31, 54.8% vs 17/27, 63.0%; 0.24 (0.04 to 1.34), p=0.104 1c. 7/20, 35.0% vs 6/16, 37.5%; 0.53 (0.05 to 5.34), p=0.594 1d. 7/12, 58.3% vs 5/9, 55.5%; 0.91 (0.03 to 24.44), p=0.956 1e. 13/19, 68.4% vs 17/28, 60.7%; 0.82 (0.12 to 5.60), p=0.836 1f. 40/62, 64.5% vs 46/89, 51.7%; 1.30 (0.63 to 2.67), p=0.473 1g. 57/119, 47.9% vs 40/80, 50.0%; 1.00 (0.43 to 2.30), p=0.993 1h. 291/613, 47.5% vs 358/674, 53.1%; 0.89 (0.43 to 1.81), p=0.740 1i. 22/38, 57.9% vs 25/44, 56.8%; 1.19 (0.40 to 3.53), p=0.747 1j. 2/16, 12.5% vs 4/26, 15.4%; 0.55 (0.03 to 8.94),	...	...	0	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	Phenobarbital, phenytoin, Proc-NAPA, valproate (514 vs 755 visits).	p=0.677				
Mazzuca, 1990[101]	Pre-specified. 3 treatment groups (B - CCDSS reminder + seminar; C = B + seminar-related clinical materials; D = C + diabetes patient education service) vs control (seminar only). 1. Adherence to 5 recommendations for care of non-insulin dependent diabetes (11 months follow up): number of physicians/number of eligible patients; mean (SE) for B vs C vs D vs A. 1a. Lab order for glycosylated hemoglobin. 1b. Lab order for fasting blood sugar. 1c. Initiation of home-monitored blood glucose. 1d. Diet clinic referral. 1e. Initiation of oral hypoglycemic therapy.	1a. 114/1591; 0.24 (0.04) vs 0.37 (0.04) vs 0.25 (0.03) vs 0.21 (0.04); p<0.05 overall, p<0.05 C vs B, p<0.05 D vs C 1b. 47/125; 0.80 (0.08) vs 0.69 (0.10) vs 0.70 (0.11) vs 0.68 (0.10), p=NS overall 1c. 114/1454; 0.11 (0.03) vs 0.16 (0.03) vs 0.14 (0.03) vs 0.06 (0.02), p<0.05 overall but NS for individual comparisons 1d. 111/707; 0.18 (0.03) vs 0.15 (0.03) vs 0.22 (0.04) vs 0.14 (0.03); p=NS overall 1e. 99/292; 0.24 (0.07) vs 0.26 (0.06) vs 0.31 (0.07) vs 0.20 (0.06); p=NS overall	...	...	0	...
McAlister, 1986[102]	No outcomes clearly prespecified. 1. Mean length of follow up (# of days) by physicians with patients from first to last visit (95% CI) (16 Month Follow Up) a.All patients b.Moderate hypertension c.Mild hypertension	1a.199.3 (173.0-225.6) vs 167.0 (148.8 -193.2); p<0.09 (not significant at p=0.05 but significant at p<0.1) 1b.168.0 (141.0-195.0) vs 152.7 (121.1-184.3) ; NS 1c.190.9 (163.6 – 218.1) vs	No outcomes clearly prespecified. 1.Mean % of patients with diastolic pressure ≤90 mmHg on last visit at 16 Months (95% CI) 1a.All patients 1b.Moderate	1a. 88.9 (76.5-100) vs 87.5 (74.5-100); NS 1b. 86.0 (72.4-99.6) vs 76.2 (59.5-92.9); NS 1c. 87.9 (75.1-100) vs 88.3 (75.7-100);	0	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	d.Newly diagnosed 2. Mean % of patients treated for hypertension (95% CI) (16 Month Follow Up) a.All patients b.Moderate hypertension c.Mild hypertension d.Newly diagnosed 3.Mean no. of office visits per patient-year (95% CI) (16 Month follow up) a.All patients b.Moderate hypertension c.Mild hypertension d.Newly diagnosed All patients: baseline DBP > 90 mmHg or prescribed antihypertensive medication. Moderate hypertension: baseline DBP >104 mmHg Mild hypertension: baseline DBP >90 to <105 mmHg	169.3 (137.7-209.9); NS 1d.162.0 (137.5-186.5) vs 132.1 (108.0-156.2); p<0.1 2a.95.4 (87.1-100*) vs 95.7 (87.7 -100) ; NS 2b.95.1 (86.6-100) vs 84.5 (70.3-98.7) ; NS 2c.91.4 (80.4-100) vs 90.2 (78.5-100) ; NS 2d.79.4 (63.5-95.3) vs 76.1 (59.4 -92.8) ; NS 3a.10.8 (9.2-12.4) vs 12.4 (9.8 – 15.0); NS 3b.13.3 (11.0-15.6) vs 17.4 (13.9-20.9); p<0.09 3c.11.6 (11.2-12.0) vs 12.7 (12.1-13.3; NS 3d.13.1 (11.5-14.7) vs 14.7 (11.7-17.7); NS *Upper 95% CI truncated at 100%	hypertension 1c.Mild hypertension 1d.Newly diagnosed 2.Mean no. of days with diastolic pressure ≤90 mmHg per patient-year at 16 months (95% CI) 2a.All patients 2b.Moderate hypertension 2c.Mild hypertension 2d.Newly diagnosed 3.Mean change in median diastolic pressure (mmHg) from baseline to last visit (95% CI) 3a.All patients 3b.Moderate hypertension 3c.Mild hypertension 3d.Newly diagnosed	NS 1d. 92.4 (82.0-100) vs 91.5 (80.6-100); NS 2a. 215.6 (175.1-256.1) vs 202.6 (160.8-244.4); NS 2b. 191.7 (136.6-246.8) vs 175.7 (119.1-232.3); NS 2c. 251.0 (205.7-296.3) vs 274.0 (229.5-318.5); NS 2d. 323.2 (299.7-346.7) vs 258.5 (212.8-304.2); p<0.03 3a. -4.9 (-6.6 to -3.2) vs -4.1 (-6.1 to -2.1); NS 3b. -21.7 (-25.1 to -18.3) vs -16.7 (-19.9 to -13.5); p<0.06 3c. -9.8 (-11.9 to -7.7) vs -8.5 (-10.8 to -6.2); NS 3d. -15.1 (-18.2 to -12.0) vs -11.3 (14.2 to -8.4); NS		
McCowan,	N = 147 vs 330 patients; 6 month	1a. 49 (33%) vs 139 (42%);	N=147 vs 330 patients;	1. 12 (8%) vs 57	0	1

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
2001[103]	follow-up Main outcomes 1. Primary care consultations: number (proportion) of patients; OR (95% CI) 1a. Practice initiated review 1b. Issued peak flow meter 1c. Used a self-management plan 2. Number (proportion) of patients who received each assessment; OR (95% CI). (symptom outcome prespecified; rest not clearly prespecified) 2a. symptoms 2b. Night time symptoms 2c. Symptoms on waking 2d. Symptoms on exercise 2e. Inhaler technique checked 2f. Compliance checked. 2g. Peak flow measured. Prespecified 3. Number (proportion) of patients for whom each of the British asthma guidelines steps was taken for maintenance prescribing (analysis not provided) 3a. step 0 3b. step 1 3c. step 2 3d. step 3 3e. step 4	0.69 (0.21 to 2.21) 1b. 77 (52%) vs 158 (48%); 1.52 (0.58 to 4.01) 1c. 75 (50%) vs 173 (52%); 1.32 (0.42 to 4.16) OR for 1c (1.32) seems incorrect since intervention rate < control rate. No response from author when requested confirmation. 2a. 8 (5%) vs 44 (13%); 0.31 (0.03 to 3.32) 2b. 7 (5%) vs 52 (16%); 0.27 (0.01 to 6.98) 2c. 12 (11%) vs 60 (18%); 0.40 (0.06 to 2.78) 2d. 45 (31%) vs 133 (40%); 0.65 (0.14 to 3.16) 2e. 45 (31%) vs 133 (40%); 0.65 (0.14 to 3.16) 2f. 47 (32%) vs 155 (47%); 0.53 (0.11 to 2.50) 2g. data missing Note: rows may be offset (i.e "symptoms" as a header for 'night time', 'on waking', and 'on exercise', rather than an item on its own. No response from author when requested confirmation. 3. p=0.51 for trend across	6 month follow-up. 1 Number (proportion) of patients with acute exacerbation of asthma; OR (95% CI) (primary) 2. Primary care consultations: number (proportion) of patients; OR (95% CI) 2a. Patient initiated consultation 3. Number (proportion) of patients with hospital contacts for asthma; OR (95% CI) (prespecified) 3a. Admissions. 3b. Accident and emergency. 3c. Outpatients.	(17%); 0.43 (0.21 to 0.85) 2a. 34 (22%) vs 111 (34%); 0.59 (0.37 to 0.95) 3a. 0% vs 4 (1%); 0 (0 to 3.44) 3b. 0% vs 2 (1%); 0 (0 to 9.16) 3c. 2 (1%) vs 7 (2%); 0.64 (0.09 to 3.38)		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	3f. step 5 4. Prescriptions for acute asthma exacerbations; number (proportion) of patients; OR (95% CI) (prespecified). 4a. Received oral corticosteroids. 4b. Received emergency nebulisations.	3a-3f. 3a. 53 (36%) vs 116 (35%) 3b. 20 (14%) vs 45 (15%) 3c. 50 (34%) vs 127 (38%) 3d. 6 (4%) vs 21 (6%) 3e. 18 (12%) vs 15 (5%) 3f. 0% vs 3 (1%) 4a. 7 (5%) vs 35 (11%); 0.42 (0.14 to 1.29) 4b. 1 (1%) vs 17 (5%); 0.13 (0.01 to 0.91)				
McDonald, 1976[104]	1. n/N, %, of events to which provider responded by ordering the required tests to monitor drug effects over 8 months (prespecified) 1a. Overall. 1b. Renal function (blood urea nitrogen or creatinine). 1c. Serum potassium. 1d. Serum uric acid. 1e. Liver function (serum glutamic oxalacetic transaminase, alkaline phosphatase, or bilirubin) 1f. Hemoglobin or hematocrit. 1g. Leukocyte count. 1h. Serum sodium. 2. n/N, %, of events (abnormal measures) to which provider responded by changing therapy appropriately over 8 months	1a. 144/390, 36% vs 45/402, 11%, p<0.0001 1b. 76/204, 37% vs 28/220, 14% 1c. 27/73, 36% vs 7/68, 10% 1d. 22/65, 33% vs 6/67, 9% 1e. 13/34, 38% vs 2/25, 8% 1f. 2/9, 22% vs 2/12, 16% 1g. 3/4,75% vs ?/6 (NR) 1h. 1/1, 100% vs ?/4 (NR) 2a. 31/110, 28% vs 9/68, 13%, p<0.026 2b. 13/52 vs 7/34 2c. 0/13 vs 1/3 2d. 0/7 vs 0/4 2e. 13/72, 18% vs 8/41, 19%	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	(prespecified) 2a. Overall Medication / Abnormality / Suggested response. 2b. Oral hypoglycemics, triamterene, potassium chloride, digoxin, thiazide, tetracycline, aspirin, phenobarbitol, macrodantin, or phenothiazine / Last blood urea nitrogen >25 mg/dL, or last creatinine >2mg/dL / Reduce because of risk of overtreatment. 2c. Methyldopa / As 2b / As 2b. 2d. Digitoxin / As 2b / As 2b. 2e. Subtotal for renal protocols. 2f. Aspirin-containing compounds / Last hemoglobin <12g/dL, or last hematocrit <36% / Reduce because possible cause of bleeding. 2g. Triamterene, potassium chloride /Last potassium >5 meq/L / Reduce because cause of metabolic toxicity. 2h. Cardiac glycosides, potassium-wasting diuretics / Last potassium <3.5 meq/L / Change regimen because of metabolic toxicity. 2i. Furosemide / Last sodium <135 meq/L / Reduce because cause of metabolic toxicity. 2j. Antihyprtensives / Last DBP >110 mmHg / Increase regimen	2f. 2/5 vs 1/5 2g. 2/3 vs 0/6 2h. 4/8 vs 0/6 2i. NR vs 0/2 2j. 8/14 vs 0/7 2k. 0/1 vs 0/1 2l. 2/7 vs NR 2m. 18/38, 47% vs 1/27, 4%, p<0.0004 3. 63/110, 57% vs 16/68, 23%, p<0.0001				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	because of undertreatment. 2k. Methyldopa / Last alkaline phosphatase >160 IU/L / Reduce because cause of hepatic toxicity. 2l. Thiazides / Last uric acid >9 mg/dL / Reduce because cause of metabolic toxicity. 2m. Subtotals for nonrenal protocols. 3. n/N, %, of events (abnormal measures) to which provider responded by changing therapy appropriately or repeating index measure over 8 months (not clearly prespecified).					
McDonald, 1980[105]	Prespecified 1. Mean provider response rate for reminders over 5 weeks. With references (R1) vs without references (R2) vs no reminders (C). Specific reminders not prespecified for analysis. All data R1/R2 vs C 2. Number of events detected / mean adherence response rate for reminders by 17 residents over 5 weeks. 2a. Overall.	1. 40.9% vs 35.9% (p=0.154 for R1 vs R2) vs 19.8% (p<0.001 vs R1 /R2 combined [38.4%]) 2a. 1503, 40% vs 758, 20%, p<0.001 2b. 420, 23% vs 200, 13%, p<0.015 2c. 725, 49% vs 374, 20%, p<0.001 2d. 201, 43% vs 114, 29%, p<0.037 2e. 129, 36% vs 70, 20%, p<0.058	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	2b. Record a finding. 2c Order a test. 2d. Change a treatment. 2e. Miscellaneous. 3. Number of events detected / Mean adherence response rate for reminders by 9 interns over 5 weeks. 3a. Overall. 3b. Record a finding. 3c Order a test. 3d. Change a treatment. 3e. Miscellaneous. 4. Number of events detected / mean adherence response rate for reminders over 5 weeks by nurse clinicians. 4a. Overall. 4b. Record a finding. 4c Order a test. 4d. Change a treatment. 4e. Miscellaneous.	3a. 422, 41% vs 204, 17%, p<0.006 3b. 101, 29% vs 49, 15%, p=NS 3c. 226, 38% vs 108, 9%, p<0.017 3d. 45, 62% vs 21, 28%, p<0.008 3e. 19, 0% vs 16, 0% 4a. 608, 30% vs 196, 25%, p=NS 4b. 166, 36% vs 64, 31%, p=NS 4c. 289, 24% vs 89, 15%, p=NS 4d. 104, 37% vs 28, 29%, p=NS 4e. 44, 32% vs 15, 22%, p<0.058				
McDonald, 1984[106]	Main outcome 1. Mean per-patient response to reminders over 2 years (%). 1a. For 115 residents. 1b. For 11 faculty. 1c. For 4 nurse-clinicians. Not clearly prespecified 2. Residents per-patient response	1a. 49% vs 29%, p<0.0001 1b. 44% vs 29%, p<0.01 1c. 50% vs 36%, p<0.03 paired t-test, p<0.06 Wilcoxon signed rank test) 2. No data reported; figure 2 shows higher rates in study group for all	Prespecified interest in patient outcomes but not which outcomes. Follow-up at 2 years. 1. Number of hospitalizations, emergency room visits, and clinic visits.	1. Data not reported, p=NS 2. Data not reported, p=NS 3. Data not reported, p<0.02 in favor of CCDSS group	1	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	to reminders over 2 years. 2a. Digitalis usage 2b. Occult blood 2c. Cervical smear 2d. Hematocrit 2e. Chest roentgenogram 2f. Pneumococcal vaccine 2g. TB skin test 2h. Serum potassium 2i. Mammography 2j. Influenza vaccine 2k. Diet 2l. Reticulocytes 2m. Iron/Iron binding 2n. Liver enzymes 2o. Antacids 2p. Other. Note: physicians with <100 reminder messages during study were excluded from analysis, and for the 15 most frequent reminders, physicians with <6 eligible patients for an action were excluded from analysis (p.132 of article). Note: Data inconsistencies. a. P-value for digitalis reminder = 0.015 in figure 2 and 0.15 in text (p. 134). b. p-values reported for 15 actions on p.134 but only 14 actions listed.	reminders. All in favor of CDSS group. 2a. p=0.015 (not significant at Bonferroni correction level, 0.0033) 2b. p<0.0001 2c. p<0.0005 2d. p<0.0001 2e. p<0.0005 2f. p<0.0001 2g. p<0.0001 2h. p<0.0005 2i. p<0.0005 2j. p<0.0001 2k. p<0.0001 2l. p<0.0001 2m. p<0.0001 2n. p<0.0001 2o. p<0.0005 2p. p<0.0001 3. p<0.0001 in favor of CCDSS. No data reported, but article specifies large CCDSS effects for the less common reminders listed 4a. 0.55 vs 0.22 4b. 0.38 vs 0.23 4c. 0.43 vs 0.30 4d. 0.51 vs 0.14 4e. 0.26 vs 0.03	2. Time averaged values for diastolic/systolic blood pressure, weight, serum glucose, serum hemoglobin, serum potassium, and blood urea nitrogen. 3. Winter hospitalizations and emergency room visits in patient subgroup eligible for influenza or pneumococcal vaccine.			

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
		4f. 0.84 vs 0.75				
	3. For less common reminders:	4g. 0.08 vs 0.02				
	3a. serum amylase for abdominal pain	4h. 0.46 vs 0.20				
		4i. 0.49 vs 0.37				
	3b. colon roentgenograms for hemoglobin-positive stools	4j. 0.49 vs 0.37				
		4k. 0.50 vs 0.37				
	3c. urine cultures for pyurea	4l. 0.15 vs 0.14				
	3d. serum fluorescent treponemal antibody tests to follow-up positive VDRL tests					
	3e. median cell volumes to detect anemia					
	3f. metronidazole to treat trichomonas					
	3g. multivitamins for alcoholic patients					
	3h. vitamin K for unexplained prothrombin time elevations					
	3i. prothrombin time after Coumadin treatment					
	3j. T4 index to work up findings suspicious of hypo- or hyperthyroidism					
	4. Response rate (group mean response to an indication for a clinical action) amongst residents					
	4a. Occult blood					
	4b. Cervical smear					
	4c. Chest roentgenogram					
	4d. Pneumococcal vaccine					
	4e. TB skin test					
	4f. Serum potassium					

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	4g. Mammography 4h. Influenza vaccine 4i. Diet 4j. Digitalic 4k. Antacids 4l. Beta blockers					
McDonald, 2005[107]	The pre-determined nurse practitioner outcome measures for intervention (adjusted probability, difference from control (p-value)) vs. augmented intervention (adjusted probability, difference from control (p-value)) vs. control (adjusted probability) for 1. Nurse assessment practices including a. presence of pain b. presence of pain at every visit c. Pain intensity (using numeric scale) d. location of pain e. Other assessments of pain f. Medication assessment g. Mood assessment h. Bowel movement assessment 2. Nurse instruction practices including a. medication management b. Side effects of medications c. Other pain management instructions d. Instruction on contacting MD	1a. 89.3, 2.4(0.57) vs. 88.0, 1.1(0.81) vs. 86.9 1b. 39.0, 4.0(0.63) vs. 38.1, 3.1(0.53) vs. 35.0 1c. 31.9, 5.7(0.39) vs. 27.9, 1.7(0.80), vs. 26.2 1d. 76.8, -5.5(0.35) vs. 82.4, 0.1(0.99) vs. 82.3 1e. 60.6, 6.3(0.38) vs. 54.8, -0.5(0.94) vs. 54.3 1f. 45.6, 1.1(0.86) vs. 50.4, 5.9(0.39), vs. 44.5 1g. 92.7, 7.2(0.08) vs. 88.9, 3.4(0.48) vs. 85.5 1h. 89.0, -5.7(0.02) vs. 92.0, -2.7(0.26) vs. 94.7 2a.. 34.7, 4.0(0.50) vs. 31.9, 1.2(0.84) vs. 30.7 2b. 10.3, -1.4(0.74) vs. 21.4, 9.7(0.07) vs. 11.7 2c. 16.1, 2.2(0.64) vs. 8.5, -5.4(0.21) vs. 13.9 2d. 7.3, -1.3(0.73) vs. 10.8, 2.2(0.61) vs. 8.6 2e. 2.4, 1.1(0.59) vs. 7.3,	The pre-determined patient outcome measures for intervention (adjusted probability/score, difference from control (p-value)) vs. augmented intervention (adjusted probability/score, difference from control (p-value)) vs. control (adjusted probability/score) for 1. pain a. pain at its worst (range 0 -10) b. Pain on average (range 0-10) c. Pain interference scale (range 0-10) 2. EORTC (European Organization for Research and Treatment of Cancer questionnaire (higher	1a. 3.6, -0.9(0.13) vs. 3.3,-1.2(0.05) vs. 4.5 1b. 2.2, -1.5(0.03) vs. 3.1, -0.6(0.42) vs. 3.7 1c. 5.8, 0.5(0.11) vs. 5.2,-0.1(0.86) vs. 5.3 2a. 16.9%, 0.8(0.79) vs. 15.2%, -0.9(0.81) vs. 16.1% 2b. 32.0%, 3.6(0.44) vs. 25.8%, -2.6(0.57) vs. 28.4% 2c. 39.5%, -1.4(0.79) vs. 32.8%, -8.1 (0.15) vs. 40.9% 2d. 14.8%, -4.1(0.27) vs. 12.0%, -6.9 (0.08) vs. 18.9% 3a. 69.9%, 1.4(0.70) vs. 64.0%, -4.5(0.29) vs. 68.5% 3b. 37.6, -0.1(0.98) vs. 39.0, 1.3(0.81) vs. 37.7 3c. 22.6%, -4.3(0.22)	0	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	e. Education materials	6.0(0.07) vs. 1.3	values = better overall outcome but worse outcome on symptom scales). a. Best quality of life (scale >74) b. Severe pain (scale >74) c. Severe insomnia (scale >74) d. Severe constipation (scale >74) 3. Symptom management a. Inadequate pain management b. Barriers summary score c. Use of alternative treatments 4. Cost effectiveness for home care-related cost of a 10% reduction in (US$) for basic intervention; augmented intervention for 4a. Pain at its worst. 4b. Pain on average. 4c. Probability of hospitalization.	vs. 15.9%, -11.0 (0.02) vs. 26.9%		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
McPhee, 1989[108]	Prespecified. CCDSS vs control; audit + feedback vs control 1. Compliance with American Cancer Society recommendations over 9 month intervention (Mean compliance score shown in figure 2 of article but data not provided; only p-value for the comparison is provided). 1a. Stool occult blood test. 1b. Rectal exam. 1c. Sigmoidoscopy. 1d. Pap smear test. 1e. Pelvic exam. 1f. Breast exam. 1g. Mammography. 2. Multiple regression analysis for compliance over 9 months, controlling for preintervention compliance (unstandardized regression coefficient β, p-value). 2a. Stool occult blood test. 2b. Rectal exam. 2c. Sigmoidoscopy. 2d. Pap smear test. 2e. Pelvic exam. 2f. Breast exam. 2g. Mammography. 3. Multiple regression analysis for provider performance over 9	For outcomes 1-3, significant p-values are all in favor of CCDSS (i.e. compliance higher with CCDSS) 1a. P<0.01; p=NS 1b. P<0.001; p=NS 1c. P<0.01; p=NS 1d. P=NS; p=NS 1e. P<0.01; p=NS 1f. P<0.01; p<0.01 1g. P<0.05; p<0.01 2a. 19.0, p=0.002; 12.3, p=0.048 2b. 22.6, p<0.001; 14.0, p=0.02 2c. 31.3, p=0.002; -1.2, p=0.899 2d. 34.8, p=0.122; 29.5, p=0.198 2e. 20.5, p=0.004; 10.4, p=0.140 2f. 24.3, p=0.001; 25.3, p=0.001 2g. 15.7, p=0.04; 20.6, p=0.008 3a. 14.8, p=0.002; 6.7, p=0.148 3b. 17.6, p<0.001; 8.0, p=0.059 3c. 6.9, p=0.002; 0.5, p=0.813 3d. 8.5, p=0.112; 5.1,	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	months, controlling for physician case mix (unstandardized regression coefficient β, p-value). 3a. Stool occult blood test. 3b. Rectal exam. 3c. Sigmoidoscopy. 3d. Pap smear test. 3e. Pelvic exam. 3f. Breast exam. 3g. Mammography. Note: Data for patient reminders are not reported here because they were not presented by CCDSS vs no CCDSS	p=0.353 3e. 14.8, p=0.003; 6.5, p=0.195 3f. 18.5, p<0.001; 14.1, p=0.006 3g. 11.0, p=0.031; 10.0, p=0.05				
McPhee, 1991[109]	Prespecified. 1. Compliance with American Cancer Society and/or National Cancer Institute recommendations over 12 months (Mean %, SD). 1a. Stool occult blood test. 1b. Rectal exam. 1c. Sigmoidoscopy. 1d. Pap smear test (>100% means test done more frequently than recommended). 1e. Pelvic exam. 1f. Breast exam. 1g. Mammography. 1h. Smoking assessment. 1i. Smoking counseling. 1j. Diet assessment. 1k. Diet counseling.	1a. 50.4% (17.3) vs 34.2% (13.0), p=0.002 1b. 49.6% (15.7) vs 40.3% (12.4), p=0.047 1c. 39.5% (41.9) vs 31.4% (27.1), p=0.480 1d. 154.7% (44.8) vs 120.9% (48.4), p=0.029 1e. 54.8% (14.1) vs 41.4% (14.4), p=0.006 1f. 57.3% (17.6) vs 48.7% (15.8), p=0.118 1g. 40.1% (14.2) vs 34.9% (13.7), p=0.245 1h. 45% (16.6) vs 32.4% (13.9), p=0.014 1i. 58.8% (23.0) vs 41.8% (22.2), p=0.027	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
		1j. 23% (23.8) vs 7% (11.4), p=0.011				
	2. Multiple regression analysis for effect of reminders over 12 months, controlling for preintervention activity scores (unstandardized regression coefficient β, p-value).	1k. 17.5% (14.0) vs 0.6% (1.4), p=0.003 2. Significant p-values are all in favor of the CCDSS.				
	2a. Stool occult blood test.	2a. 14.5, p=0.001				
	2b. Rectal exam.	2b. 10.5, p=0.004				
	2c. Sigmoidoscopy.	2c. 11.4, p=0.270				
	2d. Pap smear test.	2d. 30.7, p=0.014				
	2e. Pelvic exam.	2e. 11.8, p=0.002				
	2f. Breast exam.	2f. 8.7, p=0.032				
	2g. Mammography.	2g. 4.7, p=0.26				
	2h. Smoking assessment.	2h. 10.2, p=0.021				
	2i. Smoking counseling.	2i. 17.3, p=0.027				
	2j. Diet assessment.	2j. 12.3, p=0.011				
	2k. Diet counseling.	2k. 13.9, p=0.001				
Meigs, 2003[110]	N = 307 vs 291 patients. All secondary 1. Glycemic control outcomes 1a. Patients with ≥ 1 HbA1c test in the last 12 months; baseline n (%), % change from baseline. 1b. Mean (SE) number of preintervention HbA1c tests/year, change from baseline. 2. Cholesterol control outcomes 2a. Patients with ≥ 1 LDL cholesterol test in the last 12 months; baseline n (%), % change from baseline.	1a. 264 (86.0%), +1.6% vs 256 (88.0%), -1.0%; p=0.3 1b. 1.7 (0.1), +0.3 vs 1.8 (0.1), -0.04; p=0.008 2a. 177 (57.7%) ,+7.2% vs 167 (57.4%), +3.4%; p=0.5 2b. 0.8 (0.1), +0.2 vs 0.9 (0.1), +0.01; p=0.02 3. 299 (97.4%), +1.0% vs 287 (98.6%), -1.4% p=0.3 4. 90 (29.3%), +5.5% vs 120 (41.2%), +1.7%; p=0.5	N = 307 vs 291 patients. 1. Patients with HbA1c <7%; baseline n (%), % change from baseline (primary). 2. Mean (SE) preintervention HbA1c (% of hemoglobin), change from baseline (primary). All others are secondary 3. Patients with LDL	1. 51 (21.7%), +1.7% vs 61 (26.6%), -2.8%; p=0.2 2. 8.4 (0.1), -0.23 vs 8.1 (0.1), +0.14; p=0.09 3. 62 (54.8%), +20.3% vs 78 (63.5%), +10.5%; p=0.5 4. 126.7 (3.1), -14.7 vs 122.1 (3.2), -9.4; p=0.3 5. 76 (25.4%), +1.4% vs 79 (29.6%), -2.2%;	0	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	2b. Mean (SE) number of preintervention LDL cholesterol tests/year, change from baseline. 3. Patients with ≥ 1 blood pressure measurement in the last 12 months; baseline n (%), % change from baseline. 4. Patients with ≥ 1 eye examination by an eye-care professional in the last 12 months; baseline n (%), % change from baseline. 5. Patients with ≥ 1 foot examination in the last 12 months; baseline n (%), % change from baseline.	5. 201 (65.5%), +9.8% vs 231 (82.1%), -0.7%; p=0.003 Note: proportions, means, and comparison of changes were adjusted for clustering and weighted by number of patients per provider.	cholesterol <130 mg/dL; baseline n (%), % change from baseline. 4. Mean (SE) preintervention LDL cholesterol (mg/dL), change from baseline. 5. Patients with blood pressure <130/85 mmHg; baseline n (%), % change from baseline. 6. Mean (SE) preintervention systolic blood pressure (mmHg), change from baseline. 7. Mean (SE) preintervention diastolic blood pressure (mmHg), change from baseline. Not prespecified. 8. Increase in proportion of patients taking lipid-lowering drugs who had LDL cholesterol < 130mg/dL.	p=0.8 6. 138.1 (1.2), +0.8 vs 136.9 (1.2), -2.2; p=0.03 7. 78.3 (0.6), -1.8 vs 76.4 (0.6), -0.8; p=0.8 8. 30% vs 10%, p=0.008 Note: proportions, means, and comparison of changes were adjusted for clustering and weighted by number of patients per provider.		
Mitchell, 2004[111]	No specific outcomes pre-specified All outcomes: (A) pre/post vs (S)	1a. 39.0%/47.0% vs 54.3%/63.0% vs	No specific outcomes prespecified	1a. 152.3 vs 150.8; 1.51, -0.57 to 4.41,	0	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	pre/post vs (C) pre/post unless otherwise stated. 1. Mean percentage of patients identified with bp identified. 1a. bp < 160/90 1b. bp ≥160/≥90 1c. no record of bp 1d. hypertensive 2. Among known hypertensives, mean percentage 2a. with a bp recorded 2b. with bp < 160/90 2c. with bp ≥160/≥90 2d. treated 2e. no record of bp 3. Among patients treated for hypertension, mean percentage 3a. with no record of bp 3b. with recorded bp ≥160/≥90 3c. with bp controlled	47.5%/58.0% 1b. 26.8%/26.7% vs 26.9%/22.8% vs 30.1%/24.1% 1c. 34.2%/26.3% vs 18.8%/14.2% vs 22.4%/17.9% 1d. 22.4%/27.7% vs 23.9%/26.9% vs 24.8%/32.9% Between group differences not significant. 2a. 80.4%/86.0% vs 96.1%/96.6% vs 89.6%/92.3% 2b. 33.6%/45.1% vs 53.9%/62.1% vs 40.5%/56.5% 2c. 46.8%/40.9% vs 42.1%/34.5% vs 49.1%/35.8% 2d. 87.5%/92.3% vs 84.3%/93.7% vs 84.3%/91.4% 2e. 19.6%/14.0% vs 3.9%/3.4% vs 10.4%/7.7% Between group differences not significant. 3a. 15.9%/12.9% vs 3.0%/3.2% vs 9.2%/6.6% 3b. 41.3%/38.3% vs	1. Mean final systolic bp (adjusted values*); difference, 95% CI 1a. audit (A) vs control (C) 1b audit plus strategic (S) vs control (C) 1c.audit (A) vs audit plus strategic (S) 2. Final proportion of patients with hypertension controlled; RR adjusted for initial hypertension control*, 95% CI. 2a. audit (A) vs control (C) 2b. audit plus strategic (S) vs control (C) *Adjusted for gender, smoking, and social deprivation and practice level factors, training status, practice nurse, hypertension register, and recall system.	p=0.707 1b. 149.2 vs 150.8; -1.54, -4.06 to.0.49, p=0.555 1c. 152.3 vs 149.2; 3.05, 1.26 to 5.81, p=0.026 2a. 35.4% vs 46.5%; 0.93, 0.57 to 1.53, p=0.770 2b. 49.4% vs 46.5%; 1.72, 1.06 to 2.79, p=0.028 **In outcome 2, adjusted RRs do not appear consistent with the reported data.		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
		36.1%/32.6% vs 41.5%/32.3% 3c. 30.3%/41.1% vs 45.2%/57.9% vs 33.6%/52.5% 4a. 152.3 vs 150.8; 1.51, -0.57 to 4.41, p=0.707 4b. 149.2 vs 150.8; -1.54, -4.06 to.0.49, p=0.555 4c. 152.3 vs 149.2; 3.05, 1.26 to 5.81, p=0.026 5a. 35.4% vs 46.5%; 0.93, 0.57 to 1.53, p=0.770 5b. 49.4% vs 46.5%; 1.72, 1.06 to 2.79, p=0.028 **In outcome 5, adjusted RRs do not appear consistent with the reported data.				
Mitra, 2005[112]	1. Proportion of time in a therapeutic anticoagulation range (INR 2.0 to 3.0) during hospitalization (d) (primary outcome) 2. Proportion of time at INR <2.0 during hospitalization (days) (not prespecified). 3. Proportion of time at INR >3.0 during hospitalization (days) (not prespecified).	1. 61.7% vs 44.1%, p<0.05 2. 20% vs 40% 3. 18% vs 16% 4. 23.3 (7.5) vs 19.5 (10.9), p=0.170	Not prespecified 1. Number of incident deep vein thrombosis or pulmonary embolism. during hospitalization. 2. Mean (SD) length of hospital stay (d).	n/N patients. 1. 0/14 vs 0/16 2. 38.7 (15.6) vs 31.7 (16.5)	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	4. Number (SD) of blood draws (not stated if mean or median) during hospitalization (primary outcome).					
Montgomery, 2000[113]	1. Number (%) patients prescribed cardiovascular drugs (secondary outcome although primary follow-up period is 12 months): baseline (%) / 6 months (%). CCDSS + chart (n=207) vs chart only (n=208) vs usual care (n=137). 1a. 0-1 drug classes prescribed. 1b. 2 drug classes prescribed. 1c. ≥3 drug classes prescribed.	1. chi square (4 df)=5.46; p=0.24. 1a. 88 (43%)/81 (39%) vs 98 (47%)/68 (33%) vs 58 (42%)/50 (37%) 1b. 75 (36%)/74 (36%) vs 58 (28%)/67 (32%) vs 45 (33%)/47 (34%) 1c. 44 (21%)/52 (25%) vs 52 (25%)/73 (35%) vs 34 (25%)/40 (29%)	1. Number (%) of patients with 5-year cardiovascular risk ≥10% (secondary): Baseline/ 12 months; adjusted OR (95% CI). 1a. CCDSS + chart vs chart only. 1b. CCDSS + chart vs usual care. 1c. Chart only vs usual care. 2. Number (%) of patients with 5-year cardiovascular risk by group: Baseline / 12 months. CCDSS + chart vs Chart only vs Usual care. 2a. <10% cardiovascular risk. 2b. 10-19.9% cardiovascular risk. 2c. ≥20% cardiovascular risk. 3. Cardiovascular risk score: Mean (SD) baseline / 12 months;	1. Number (%) calculated by RA from data in article. 1a. 189/229 (83%) / 179/202 (89%) vs 198/228 (87%) / 169/199 (85%); 2.3 (1.1 to 4.8), p=0.02 1b. 189/229 (83%) / 179/202 (89%) vs 138/157 (88%) / 114/130 (88%); 1.7 (0.7 to 3.9), p=0.22 1c. 198/228 (87%) / 169/199 (85%) vs 138/157 (88%) / 114/130 (88%); 0.7 (0.3 to 1.6), p=0.43 2a. 40 (17%) / 23 (11%) vs 30 (13%) / 30 (15%) vs 19 (12%) / 16 (12%) 2b. 112 (49%) / 114 (56%) vs 107 (47%) / 91 (46%) vs 82 (52%) / 60 (46%) 2c. 77 (34%) / 65 (32%) vs 91 (40%) / 78 (39%) vs 56 (36%)	0	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			mean difference [SE]. CCDSS + chart vs chart only vs usual care. 4. Mean (SD) systolic blood pressure (secondary): baseline / 12 months; difference [SE]. CCDSS + chart vs chart only vs usual care 5. Mean (SD) diastolic blood pressure (secondary): baseline / 12 months; difference [SE]. CCDSS + chart vs chart only vs usual care. Not prespecified 6. Change in mean absolute risk at 12 months. CCDSS + chart vs chart only vs usual care. 6a. Baseline risk <10%. 6b. Baseline risk 10-19.9%. 6c. Baseline risk ≥ 20%. 6d. All.	/ 54 (46%). 3. 16.0 (8.3) / 16.7 (7.8); 0.65 [0.39] vs 17.9 (8.4) / 17.5 (8.2); -0.48 [0.35] vs 17.3 (8.6) / 17.8 (9.3); 0.77 [0.37] 4. 153 (19) / 153 (17); -0.04 [1.4] vs 156 (19) / 153 (19); -2.66 [1.4] vs 158 (21) / 159 (22); 0.25 [1.7] Chart only vs usual care mean difference 4.6 mm Hg; 95% CI = 0.8 to 8.4 mm Hg, p=0.02 5. 85 (9) / 85 (9); 0.36 [0.74] vs 87 (9) / 86 (10); -1.1 [0.78] vs 86 (11) / 84 (11); -1.64 [1.03] 6. Test for interaction between trial arm and baseline risk: F(2, 524)=4.88, p<0.01 6a. 3.8 vs 2.3 vs 0.9 6b. 1.5 vs 0.7 vs 1.8		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
				6c. -1.7 vs -1.7 vs -0.3 6d. 0.7 vs -0.5 vs 0.8		
Murray, 2004[114]	All reported as pharmacist vs physician vs pharmacist + physician vs control groups at 12 months (n=180 vs 181 vs 180 vs 171 patients): 1. Compliance with treatment suggestions (secondary): n (%) patients with suggestions; mean (SD) adherence rate. a. All antihypertensive drug suggestions. b. Start or increase ACE inhibitor. c. Start diuretic. d. Start or increase calcium channel blocker. e. Start or increase beta-blocker. 2. Patient satisfaction with physicians and pharmacists (secondary). Not prespecified 3. Total number of antihypertensive drug suggestions/mean (SD) per patient.	1a. 117 (65%) vs 123 (68%) vs 125 (69%) vs 114 (67%); 25 (33) vs 29 (36) vs 35 (39) vs 26 (33); p=0.13 1b. 89 (42%) vs 92 (51%) vs 96 (53%) vs 91 (53%); 33 (47) vs 44 (50) vs 41 (49) vs 30 (46); p=NS 1c. 54 (30%) vs 55 (30%) vs 52 (29%) vs 58 (34%); 22 (42) vs 22 (42) vs 25 (44) vs 31 (47); p=NS 1d. 38 (21%) vs 56 (31%) vs 46 (26%) vs 51 (30%); 47 (51) vs 34 (48) vs 39 (49) vs 49 (51); p=NS 1e. 35 (14%) vs 31 (17%) vs 34 (19%) vs 20 (12%); 29 (46) vs 45 (51) vs 47 (51) vs 45 (51); p=NS 2. No data reported. 3. 234/2.0 (1.1) vs 255/2.1 (1.1) vs 243/1.9 (1.0) vs 245/2.1 (1.1)	All reported as pharmacist vs physician vs pharmacist + physician vs control groups at 12 months. 1. Mean (SD) overall composite quality of life score (primary). (n=116 vs 124 vs 116 vs 127 patients) All other outcomes were secondary. 2. Mean (SD) short-form 36 subscale scores (n=116 vs 124 vs 116 vs 127 patients). 2a. Physical function. 2b. Role physical. 2c. Pain. 2d. General health. 2e. Vitality. 2f. Social function. 2g. Role emotional. 2h. Mental health. 3. Bulpitt subscales (%) (n=116 vs 124 vs 116 vs 127 patients).	1. 37 (21) vs 35 (20) vs 38 (22) vs 36 (21); p=NS 2a. 48 (29) vs 52 (28) vs 45 (30) vs 49 (28), p=NS 2b. 53 (41) vs 49 (42) vs 46 (44) vs 44 (44), p=NS 2c. 51 (29) vs 53 (27) vs 45 (28) vs 48 (27), p=NS 2d. 46 (23) vs 51 (24) vs 45 (24) vs 46 (24), p=NS 2e. 46 (21) vs 48 (23) vs 43 (24) vs 45 (23), p=NS 2f. 72 (29) vs 75 (27) vs 68 (32) vs 70 (29), p=NS 2g. 66 (43) vs 70 (41) vs 64 (44) vs 66 (43), p=NS 2h. 66 (23) vs 70 (21) vs 62 (24) vs 65 (22), p=NS 3a. 42% vs 43% vs	0	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			3a. Faint.	47% vs 42%, p=NS		
			3b. Faint on standing.	3b. 17% vs 19% vs		
			3c. Faint in the	23% vs 23%, p=NS		
			morning.	3c. 22% vs 12% vs		
			3d. Sleepy.	14% vs 18%, p=NS		
			3e. Weak.	3d. 72% vs 71% vs		
			3f. Blurry vision.	73% vs 75%, p=NS		
			3g. Short of breath.	3e. 52% vs 59% vs		
			3h. Swollen ankles.	61% vs 54%, p=NS		
			3i. Walk slowly.	3f. 38% vs 40% vs		
			3j. Loose bowel	44% vs 38%, p=NS		
			movements.	3g. 49% vs 36% vs		
			3k. Dry mouth	45% vs 44%, p=NS		
			3l. Dysphagia.	3h. 51% vs 46% vs		
			3m. Bad taste in	49% vs 43%, p=NS		
			mouth.	3i. 45% vs 42% vs		
			3n. Runny nose.	47% vs 39%, p=NS		
			3o. Poor	3j. 46% vs 40% vs		
			concentration.	44% vs 38%, p=NS		
			3p. Flushing of face or	3k. 49% vs 49% vs		
			neck.	59% vs 50%, p=NS		
			3q. Nightmares.	3l. 24% vs 20% vs		
			3r. Nausea or vomiting.	29% vs 28%, p=NS		
			3s. Rash.	3m. 45% vs 40% vs		
			3t. Itching.	43% vs 48%, p=NS		
			3u. White fingers.	3n. 53% vs 53% vs		
			3v. Finger pain.	58% vs 54%, p=NS		
			3w. Headache.	3o. 22% vs 18% vs		
			3x. Dry cough.	21% vs 23%, p=NS		
			3y. Libido decreased.	3p. 20% vs 20% vs		
			3z. Erectile	23% vs 22%, p=NS		
			dysfunction.	3q. 31% vs 30% vs		
				34% vs 35%, p=NS		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			4. Mean (SD) number of emergency department visits per patient (n=180 vs 181 vs 180 vs 171 patients). 4a. All. 4b. Heart disease specific. 5. Mean (SD) number of hospitalizations per patient (n=180 vs 181 vs 180 vs 171 patients). 5a. All. 5b. Heart disease specific. 6. Mean (SD) systolic BP (mm Hg) (n=128 vs 126 vs 129 vs 124 patients). 6a. Baseline. 6b. Last 6 months. 7. Mean (SD) diastolic BP (mm Hg) (n=128 vs 126 vs 129 vs 124 patients). 7a. Baseline. 7b. Last 6 months. Not prespecified 8. Deaths (n=180 vs	3r. 32% vs 26% vs 26% vs 25%, p=NS 3s. 15% vs 16% vs 18% vs 16%, p=NS 3t. 30% vs 36% vs 44% vs 37%, p=NS 3u. 25% vs 17% vs 22% vs 17%, p=NS 3v. 13% vs 13% vs 15% vs 13%, p=NS 3w. 52% vs 46% vs 49% vs 51%, p=NS 3x. 37% vs 37% vs 37% vs 34%, p=NS 3y. 34% vs 40% vs 29% vs 28%, p=NS 3z. 33% vs 41% vs 42% vs 42%, p=NS 4a. 1.11 (1.94) vs 1.02 (1.67) vs 1.01 (3.03) vs 1.21 (2.04); p=NS 4b. 0.02 (0.13) vs 0.01 (0.07) vs 0.01 (0.07) vs 0.04 (0.20); p=0.02 for intervention groups vs control group 5a. 0.25 (0.62) vs 0.25 (0.69) vs 0.19 (0.74) vs 0.25 (0.89);		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			181 vs 180 vs 171 patients).	p=NS 5b. 0.01 (0.07) vs 0.01 (0.10) vs 0.01 (0.11) vs 0.02 (0.13); p=NS 6a. 144 (18) vs 143 (20) vs 143 (17) vs 142 (16); p=NS 6b. 144 (21) vs 144 (18) vs 142 (23) vs 143 (18); p=NS 7a. 78 (10) vs 75 (12) vs 76 (11) vs 78 (10); p=NS 7b. 77 (11) vs 75 (12) vs 77 (14) vs 78 (11); p=NS 8. 1% vs 2% vs 1% vs 1%		
Nilasena, 1995[115]	1. Change in overall compliance scores. (very generally specified in methods section)	1. 16.9% vs 16.4% (Not significant)	...	...	0	...
Ornstein, 1991[116]	1. Change (95% CI) in proportion of patients who received each of the five preventive services over 1 year (prespecified). Physician reminders vs patient reminders vs both vs neither (control). 1a. Cholesterol measurement. 1b. Fecal occult blood test. 1c. Mammography.	1a. 12.3% (11.3 to 13.2) vs 13.6% (13.0 to 14.3) vs 18.6% (17.8 to 19.5) vs 9.1% (8.0 to 10.1) Combined reminder group showed significantly greater improvement than other groups by pairwise comparisons.	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	1d. Papanicolaou smear. 1e. Tetanus vaccine. ** data also available by quarter	1b. 5.1% (1.8 to 8.5) vs 8.7% (5.8 to 11.6) vs 17.7% (14.9 to 20.4) vs 8.1% (4.7 to 11.5) Combined reminder group showed significantly greater improvement than other groups by pairwise comparisons. 1c. 10.7% (4.7 to 16.8) vs 2.8% (-3.0 to 8.5) vs 15.7% (11.1 to 20.2) vs 15.7% (10.7 to 20.9) 1d. -4.5% (-7.1 to -1.9) vs -2.1% (-4.7 to 0.5) vs -0.8% (-3.7 to 2.1) vs -0.9% (-4.0 to 2.1) 1e. 10.5% (9.8 to 11.3) vs 9.5% (8.9 to 10.1) vs 12.0% (11.2 to 12.8) vs 3.8% (3.1 to 4.4) Each of the 3 intervention groups showed significantly greater improvements than the control group.				
Overhage, 1996[117]	Primary outcomes 1. Compliance with preventive care guidelines over 6 months: No. of eligible patients (% compliance). 1a. Overall.	1a. 23% vs 24%, p=0.78 1b. 323 (2.8%) vs 329 (2.8%), p=0.41 1c. 271 (2.6%) vs 243 (2.1%), p=0.69	...	...	0	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	1b. Cervical cytology study. 1c. Pneumococcal vaccination. 1d. Aspirin. 1e. Estrogen treatment. 1f. Calcium treatment. 1g. Opthalmologic referral. 1h. Mammography. 1i. TSH screen. 1j. Hepatitis B screen. 1k. Rubella screen. 1l. Screening urinalysis. 1m. Cholesterol test. 1n. Pregnancy test. 1o. HIV screen. 1p. ACE inhibitor. 1q. Heparin prophylaxis. 1r. 24h urine protein screen. 1s. Sickle cell screen. 1t. Cholesterol treatment. 1u. Screening electrocardiogram. 1v. Beta-blocker. 1w. STD screen. 2. Attitude towards providing preventive care to hospitalized patients at 6 months (pre-defined).	1d. 246 (9.4%) vs 247 (9.7%), p=0.89 1e. 243 (0.8%) vs 232 0.3%), p=0.62 1f. 243 (5.4%) vs 232 (3.9%), p=0.45 1g. 217 (2.3%) vs 200 (1.5%), p=0.55 1h. 125 (5.6%) vs 131 (1.5%), p=0.08 1i. 112 (16.1%) vs 118 (9.3%), p=0.12 1j. 88 (8.0%) vs 92 (2.2%), p=0.08 1k. 80 (1.2%) vs 86 (0.3%), p=0.30 1l. 68 (32.4%) vs 75 (34.7%), p=0.77 1m. 70 (14.3%) vs 58 (13.8%), p=0.94 1n. 60 (13.3%) vs 66 (13.6%), p=0.96 1o. 44 (4.6%) vs 43 (9.3%), p=0.38 1p. 35 (29.0%) vs 45 (56.0%), p=0.02 1q. 30 (43.3%) vs 28 (35.7%), p=0.55 1r. 24 (25.0%) vs 23 (4.4%), p=0.05 1s. 22 (9.0%) vs 14 (0%), p=0.25 1t. 11 (9.1%) vs 16 (6.2%),				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
		p=0.78 1u. 13 (0%) vs 14 (21.4%), p=0.08 1v. 14 (14.3%) vs 10 (20.0%), p=0.71 1w. 2 (50%) vs 6 (16.7%), p=0.35 2. No difference (data not reported)				
Overhage, 1997[118]	Prespecified unless otherwise indicated: 1. % corollary orders with immediate compliance. 1a. Overall. 1b. Excluding saline lock orders (not prespecified). 1c. At 1st order suggestion (not prespecified). 2. % corollary orders with compliance within 24 hours. 2a. Overall. 2b. Excluding saline lock orders (not prespecified). 3. % corollary orders with compliance during hospital stay. 3a. Overall. 3b. Excluding saline lock orders (not prespecified). 4. Number of times pharmacists intervened with physicians for significant errors over 6 months. 5. Compliance with corollary orders	1a. 46.3% vs 21.9%, p<0.0001 1b. 46.4% vs 27.6%, p<0.0001 1c. 48% vs 23%, p<0.0001 2a. 50.4% vs 29.0%, p<0.0001 2b. 50.9% vs 35.3%, p<0.0001 3a. 55.9% vs 37.1%,p<0.0001 3b. 56.0% vs 43.5%, p<0.0001 4. 105 vs 156, p=0.003 5a. 1476; 77.42% vs 40.24% (37.18%) 5b. 1061; 64.66% vs 0%, (64.66%) 5c. 1055; 12.66% vs 5.18% (7.48%) 5d. 542; 22.90% vs 14.64% (8.26%) 5e. 518; 40.00% vs 31.01%	Not clearly prespecified 1. Mean hospital length of stay (days). 2. Maximum serum creatinine level during hospital stay (units not reported).	1. 7.62 vs 8.12 (difference -0.5, 95% CI -0.17 to 1.19, p=0.94) 2. 1.51 (1.25) vs 1.42 (0.88), p=0.28	1	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	within 24 hours for the following 25 most common triggering orders. Total number of orders; % compliance (% increase). 5a. Heparin infusion 5b. IV fluid orders 5c. cimetidine po 5d. Type and cross. 5e. Insulin lente humulin 5f. Furosemide po 5g. Ferrous sulfate 5h. Furosemide IV 5i. Warfarin. 5j. Ventilator settings. 5k. Insulin NPH humulin 5l. Vancomycin IV 5m. Sustained release theophyllin 5n. Gentamicin IV 5o. Insulin reg humulin 5p. Digoxin po 5q. Glyburide po 5r. Meperidine IM/IV 5s. Captopril po 5t. Enteral feeding 5u.Enalapril po 5v.Kayexalate suspension 5w.Timentin IV 5x.Spironolactone po 5y.Glipizide po	(8.99%) 5f. 410; 75.38% vs 62.09% (13.29%) 5g. 394; 21,43% vs 16,47% (4.96%) 5h. 360; 60.88% vs 51.85% (-0.98%) 5i. 303; 68,18% vs 35.09% (33.09%) 5j. 242; 80.14% vs 21.78% (58.36%) 5k. 241; 52.17% vs 26.19% (25.98%) 5l. 224; 60.44% vs 44.36% (16.08%) 5m. 215; 73.33% vs 45.46% (27.88%) 5n. 197; 78.35% vs 61.00% (17.35%) 5o. 197; 53.33% vs 35.87% (17.46%) 5p. 178; 96.88% vs 84.15% (12.73%) 5q. 177; 51.28% vs 43.43% (7.85%) 5r. 177; 24.24% vs 5.41% (18.84%) 5s. 177; 74.42% vs 55.06% (19.36%) 5t. 170; 23.08% vs 7.60% (15.48%)				
	6. Compliance with the following 25 most common corollary orders within 24 hours. Total number of	5u. 161; 73.68% vs 70.59% (3.10%)				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	orders; % compliance (% increase). 6a. Serum creatinine 6b. Saline lock 6c. Serum electrolytes 6d. Glycosylated HgbA1. 6e. Activated partial thromboplastin time 6f. SGPT (ALT) 6g. Sodium docusate 6h. SGOT (AST) 6i. Capillary glucose. 6j. Blood cell profile. 6k. Stool occult blood test 6l. Prothrombin time 6m. Theophylline level 6n. Diphenhydramine 6o. Platelet count 6p. Acetominophen 6q. Reticulocyte count 6r. NG feeding tube 6s. Fe-TIBC 6t. Vancomycin 6u. Phenytoin level 6v. Portable AP CXR 6w. A-V blood gas 6x. Simplate bleed time 6y. Gentamicin level	5v. 161; 26.09% vs 18.48% (7.61%) Article reports difference % as 18.48 (repeat of control group %) – revised to 7.61% - could not confirm with author (no response). 5w. 161; 45.24% s 14.29% (30.95%) 5x. 158; 42.25% vs 20.69% (21.56%) 5y. 147; 47.22% vs 36.00% (11.22%) 6a. 1209; 48.28% vs 41.18% (7.10%) 6b. 1065; 64.73% vs 0% (64.73%) 6c. 1034; 87.03% vs 70.86% (16.18%) 6d. 821; 23.71% vs 7.39% (16.32%) 6e. 615; 89.21% vs 59.56% (29.65%) 6f. 569; 12.63% vs 1.87% (10.76%) 6g. 506; 79.35% vs 79.26% (0.09%) 6h. 467; 7.14% vs 0% (7.14%) 6i. 446; 30.77% vs 4.41% (26.36%) 6j. 382; 80.46% vs 51.44%				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
		(29.02%) 6k. 374; 60.94% vs 12.09% (48.85%) 6l. 320; 64.57% vs 45.52% (19.05%) 6m. 270; 75.89% vs 46.51% (29.38%) 6n. 267; 16.41% vs 7.19% (9.21%) 6o. 236; 70% vs 15.09% (54.91%) 6p. 232; 19.66% vs 14.78% (4.88%) 6q. 205; 19.66% vs 11.36% (8.29%) 6r. 170; 23.08% vs 7.60% (15.48%) 6s. 149; 12.64% vs 0% (12.64%) 6t. 143; 90.74% vs 65.17% (25.57%) 6u. 140; 73.13% vs 38.36% (34.78%) 6v. 127; 81.69% vs 33.93% (47.76%) 6w. 123; 72.60% vs 0% (72.60%) 6x. 123; 26.23% vs 0% (26.23%) 6y. 118; 90% vs 75.86% (14.14%)				
Palen, 2006[119]	Prespecified 1. Rate of compliance with	1a. 10,494/18556 (56.6%) vs 8957/15686 (57.1%),	...	...	0	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	ordering the recommended laboratory monitoring* for patients prescribed study medications. 1a. Overall, n/N dispsensings (%). 1b. ACE-Is, N dispensings (% compliance).. 1c. Allopurinol, N dispensings (% compliance). 1d. Carbamazepine, N dispensings (% compliance). 1e. Colchicine, N dispensings (% compliance). 1f. Digoxin, N dispensings (% compliance). 1g. Diuretic, N dispensings (% compliance). 1h. Gemfibrozil, N dispensings (% compliance). 1i. Isoniazid, N dispensings (% compliance). 1j.Losartan potassium, N dispensings (% compliance). 1k. Metformin hydrocholoride, N dispensings (% compliance). 1l. Methotrexate, N dispensings (% compliance) 1m. Niacin, N dispensings (% compliance). 1n. Phenytoin sodium, N dispensings (% compliance). 1o. Pioglitazone hydrochloride, N dispensings (% compliance). 1p. Potassium chloride, N	p=0.31 1b. 3099 (47.0%) vs 2729 (47.5%), p=0.681 1c. 429 (57.6%) vs 355 (61.1%), p=0.31 1d. 153 (34.6%) vs 119 (35.3%), p=0.91 1e. 411 (52.8%) vs 400 (46.0%), p=0.05 1f. 242 (55.0%) vs 178 (48.9%), p=0.22 1g. 5384 (44.0%) vs 4270 (45.6%), p=0.11 1h. 569 (71.2%) vs 454 (62.3%), p=0.003 1i. 33 (15.2%) vs 36 (19.4%), p=0.64 1j. 506 (52.0%) vs 433 (52.7%), p=0.84 1k. 1098 (67.6%) vs 940 (7.6%), p=0.14 1l. 7 (42.9%) vs 9 (0.0%), p=0.03 1m. 34 (67.7%) vs 36 (47.2%), p=0.084 1n. 83 (32.5%) vs 52 (25.0%), p=0.35 1o. 76 (92.1%) vs 63 (93.7%), p=0.73 1p. 1623 (54.3%) vs 1291 (57.8%), p=0.06 1q. 7 (14.3%) vs 6 (50.0%), p=0.20				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	dispensings (% compliance). 1q. Rifampin, N dispensings (% compliance) 1r. Statins, N dispensings (% compliance). 1s. Valproic acid, N dispensings (% compliance). Subgroup analysis (not prespecified). 2. Rate of compliance with ordering the recommended laboratory monitoring for patients prescribed study medications, %. 2a. Male patients. 2b. Female patients. *Compliance = test completed from 180 d before to 14 d after the time of the medication order.	1r. 4717 (75.7%) vs 4245 (73.9%), p=0.05 1s. 85 (36.5%) vs 70 (38.6%), p=0.79 2a. 57.5% vs 58.5%, p=0.18 2b. 55.7% vs 55.9%, p=0.82				
Paul, 2006[120]	1. Rate of appropriate antibiotic treatment, intervention intention-to-treat OR (95% CI) p value; (primary outcome): 1a. Israel 1b. Germany 1c. Italy 1d. Overall 2. Rate of appropriate antibiotic treatment, intervention per protocol, OR (95% CI) p value per site (n/N(%)) (primary outcome):	1a. 140/203 (69.0%) vs 131/206 (63.6%), 1.27 (0.84 to 1.92) p=0.251 1b. 38/44 (86.4%) vs 32/43 (74.4%), 2.18 (0.72 to 6.54) p=0.160 1c. 38/50 (76.0%) vs 13/4 (54.2%), 2.68 (0.95 to 7.52) p=0.057 1d. 216/297 (72.7%) vs 176/273 (64.5%), 1.48 (1.03 to 2.11) p=0.033	1. Mean/median (SD) duration of hospital stay (prespecified) 1a. Israel 1b. German 1c. Italy 1d. Overall 2. Mean/median (SD) duration of hospital stay among patients surviving 30 days (N=1837) 2a. Israel	1a. 4/7.21(9.7) vs 5/8.04(11.1), p=0.014 1b. 10/13.6(11.2) vs 14/16.3(12.0), p=0.016 1c. 8/12.13(15.7) vs 7/11.3(10.7), p=0.600 1d. 6/8.83(11.29) vs 6/9.45(11.52), p= 0.055 2a. 4/7.1(10.2) vs	1	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	2a. Israel 2b. Germany 2c. Italy 2d. Overall 3. Number (%) of antibiotics prescribed in Israel / Germany / Italy): (secondary outcome) 3a. no antibiotic 3b. narrow-spectrum penicillins 3c. piperacillin/tazobactam or sulbactam 3d. first-generation cephalosporin 3e. broad-spectrum cephalosporins 3f. Flouroquinolones 3g. aminoglycosides 3h. glycopeptides 3i. carbapanems	2a. 74/87 (85.1%) vs 131/206 (63.6%), 3.26(1.69 to 6.27) p≤0.001 2b. 18/19 (94.7%) vs 32/43 (74.4%), 6.19 (0.74 to 51.91) p=0.062 2c. 22/28 (78.6%) vs 13/4 (54.2%), 3.10 (0.93 to 10.39), p=0.061 2d. 114/134 (85.1%) vs 176/273 (64.5%), 3.42 (1.97 to 5.96), p=0.001 3a. 173(20%) vs 172 (21%) / 4(2%) vs 3(2%) / 28(16%) vs 8(9%) 3b. 92(11%) vs 85(10%) / 36(17%) vs 26(15%) / 44(25%) vs 8(9%) 3c. 26(3%) vs 17(2%) / 14(7%) vs 13(8%) / 11(6%) vs 3(3%) 3d. 29(3%) vs 11(1%) / 0 vs 0 / 0 vs 0 3e. 333(39%) vs 405(49%) / 108(52%) vs 84(49%) / 23(18%) vs 37(43%) 3f. 144(17%) vs 98(12%) / 29(14%) vs 29(17%) / 68(38%) vs 28(32%) 3g. 33(4%) vs 15(2%) / 6(3%) vs 8(5%) / 3(2%) vs 1(1%)	2b. German 2c. Italy 2d. Overall 3. Mean/median (SD) duration of fever (prespecified). 3a. Israel 3b. German 3c. Italy 3d. Overall 4. Overall 30 day mortality intention to treat, n/N(%) 4a. Israel 4b. German 4c. Italy 4d. Overall 5. Overall 30 day mortality per protocol, n/N(%) 5a. Israel 5b. German 5c. Italy 5d. Overall	5/7.9(11.6), p=0.032 2b. 11/16.4(13.2) vs 16/19.9(13.8), p=0.040 2c. 8/12.2(15.9) vs 7/11.4(10.7), p=0.586 2d. 5/8.8(11.9) vs 5/9.4(12.2), p=0.128 3a. 1/2.2(4.1) vs 1/2.5(4.7), p=0.014 3b. 1/1.9 (2.7) vs 1/2.1(3.0), p=0.487 3c. 3/4.0(3.4) vs 3/3.8(4.3), p=0.024 3d. 1/2.4(3.9) vs 1/2.5(4.5), p=0.253 4a. 113/860(13.1) vs 128/823(15.6), p=0.158 4b. 26/208(12.5) vs 16/172(9.3), p=0.322 4c. 10/177(5.6) vs 1/86(1.2), p=0.109 4d. 149/1153(12.9) vs 145/1012(14.3), p=0.611 5a. 35/344(10.2) vs 38/301(12.6), p=0.327 5b. 9/69(13.0) vs 6/53(11.3), p=0.774 5c. 5/120(4.2) vs		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
		3h. 26(3%) vs 21(3%) / 9(4%) vs 8(5%) / 5(3%) vs 6(7%) 3i. 5(0.6%) vs 3(0.4%) / 9(4%) vs 6(3%) / 6(3%) vs 3(3%)		0/42(0), p=0.328 5d. 49/503(9.7) vs 44/371(11.9), p=0.719		
Peck, 1973[121]	Results unclear but prespecified at mean 3.4 wks 1. Mean (SD) prediction error (measured minus predicted serum digoxin level)/correlations coefficient. 2. Mean between-group difference in absolute prediction error for serum digoxin level. Note: the following results were not prespecified and do not maintain randomization: intervention group split into 2 - experiment followed and experiment not followed groups. 3. Mean (SD) achievement error (measured minus desired serum digoxin level): Followed vs not followed vs control. 4. Correlation between desired and measured digoxin level. Note: -ve predication error indicates overprediction; -ve achievement error indicates underachievement.	1. -0.12 (0.53) p<0.05/0.42, p<0.01 vs -0.03 (0.63)/0.14, p=NS. P-values for comparison of CCDSS vs control outcomes, NR 2. 0.06 ng/mL greater error in control group, p<0.025 3. -0.04 (0.55) vs -0.23 (0.44), p<0.05 vs 0.02 (0.63) 4. 0.38, p<0.05 vs -0.16 vs 0.25, p<0.05	Prespecified at mean 3.4 wks 1. Digoxin toxicity (12-lead ECG assessed). 2. Congestive heart failure index.	1. No digoxin-related toxicity detected (N rand: 21 vs 21). 2. No between-group differences in mean changes. [Note: authors only report data for all patients as a single group.]	1	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
Peterson, 2007[122]	1. median (IQR) ratio of overall prescribed to recommended doses (primary) 2. median (IQR) ratio of prescribed to recommended doses by type (not prespecified) 2a. antihistamine/anti-emetic 2b. benzodiazepines 2c. neuroleptics 2d. antihypertensives 2e. NSAIDS 2f. antispasmodics 2g. opiates 2h. sulfonylureas 2i. other anticholinergic 2j. other 2k. beers criteria medications 2l. scheduled 2m. PRN 2n. single dose 2o. multiple dose 2p. non-critical care unit 2q. critical care unit and procedure suites 2r. emergency room 2s. subacute unit 3. median (IQR) ratio of overall prescribed to recommended doses by physicians in the intervention group only vs physicians in the control group only (not prespecified)	1. 2.5 (1.0,4.0) vs 3.0 (1.5, 5.0) (p<0.001) 2a. 4.0 [2.0 , 4.0] vs 4.0 [2.0 , 6.0] 2b. 2.0 [1.0 , 4.0] vs 2.5 [1.2 , 4.2] 2c. 4.0 [1.0 , 10] vs 4.0 [1.0 , 10] 2d. 2.0 [1.0 , 4.0] vs 2.0 [1.0 , 4.0] 2e. 4.0 [1.5 , 4.0] vs 4.0 [2.0 , 4.0] 2f. 2.0 [1.0 , 4.0] vs 3.0 [1.1 , 6.0] 2g. 1.0 [0.5 , 1.5] vs 1.0 [0.4 , 1.5] 2h. 4.0 [2.0 , 6.5] vs 4.0 [2.0 , 8.0] 2i. 2.5 [2.0 , 5.0] vs 2.5 [1.0 , 5.0] 2j. 1.0 [1.0 , 1.6] vs 1.3 [1.0 , 2.0] 2k. 2.0 [1.0 , 4.0] vs 2.0 [1.0 , 4.0] 2l. 2.0 [1.0 , 4.0] vs 2.0 [1.0 , 4.0] 2m. 4.0 [3.0 , 6.0] vs 4.0 [3.0 , 7.5] 2n. 1.0 [1.0 , 2.0] vs 1.25 [1.0 , 2.0] 2o. 4.0 [2.0 , 6.0] vs 4.0 [2.0 , 6.0] 2p. 2.5 [1.0 , 4.0] vs 3.0	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	4. percentage of recommended doses selected (not prespecified)	[1.3 , 5.0] 2q. 3.0 [1.5 , 6.0] vs 3.0 [2.0 , 6.0] 2r. 2.0 [1.0 , 4.0] vs 2.0 [1.0 , 4.0] 2s. 3.0 [1.5 , 6.0] vs 4.0 [2.0 , 4.0] 3. 2.0 [1.0,4.0] vs 4.0[2.0,6.0] (p<0.001) 4. 28.6% vs 24.1% (p<0.001)				
Peterson, 2008[123]	Pre-specified 1. Mean (SEM) change in proportion of patients having foot exams over 12 months. 2. Mean (SEM) change in proportion of patients having eye exams over 12 months. 3. Mean (SEM) change in proportion of patients having renal testing over 12 months. 4. Mean (SEM) change in proportion of patients having BP monitoring over 12 months. 5. Mean (SEM) change in proportion of patients having HbA1c testing over 12 months. 6. Mean (SEM) change in proportion of patients having LDL-C testing over 12 months. Not pre-specified 7. Mean (SEM) improvement in	1. 29.4% (5.6) vs -5.6% (5.4), p<0.001 2. 27% (2.9) vs 1.2% (2.3), p<0.001 3. 23.2% (5.0) vs -5.3% (4.6), p<0.001 4. 1.3% (0.9) vs -2.1% (1.4), p=0.05 5. 2.8% (0.9) vs -5.3% (1.2), p<0.001 6. 8.9% (1.3) vs 0.3% (1.6), p<0.001 7. 1.29 (0.042) vs 0.22 (0.038), p<0.001	1. Proportion of patients with target composite clinical outcome at 12 months. (primary outcome) Not specified 2. Proportion of patients with target HbA1c (<7.0%) at 12 months. 3. Proportion of patients with target SBP (<130 mm Hg) at 12 months. 4. Proportion of patients with target LDL-C (<100 mg/dL) at 12 months. Composite clinical outcome = SBP <130	1. 12.6% vs 8.5%, p<0.001 2. 49% vs 43.8%, p<0.001 3. 45% vs 40.6%, p<0.001 4. 43% vs 35.5%, p<0.001	1	1

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	process of care index (PCI) at 12 months. PCI = annual BP monitoring; eye and foot exams; renal, HbA1c, and LDL cholesterol testing.		mm Hg, HbA1c <7.0%, and LDL-C <100 mg/dL.			
Petrucci, 1991[124]	1. (pre-specified) Nurses' knowledge of caring for patients with urinary incontinence. 2. Nurses' knowledge of caring for patients with urinary incontinency – group by time interaction	1. F.001(2,157)=19.46 (significant) 2. "knowledge of nurses on the treatment group improved gradually over the first 5 weeks of the study and accelerated during the second 5 weeks of the study" F.001(6,157)=45.29 (significant)	1. (pre-specified) Mean number of wet occurrences per week for 10 weeks by group. 2. Mean number of wet occurrence per week for 10 weeks – group by time interaction. (data provided in figure)	1. (figure indicates that treatment groups were drier than control group) F.001(2,81)=34.67 (significant) 2. F.001(18,81)=28.6 (significant) 3. state that the above (#2) was the only significant interaction but do not report others)	1	1
Plaza, 2005[125]	Prespecified; 12-mo follow-up. Use of the following health resources: 1. Spirometry 2. Conventional blood tests 3. Total immunoglobulin E 4. Skin allergy tests 5. Thorax radiography Prescriptions of the following medications: 6. Oral glucocorticoids 7. Inhaled steroids 8. Budesonide 9. Long-acting Beta2-adrenergic	1. 79 vs 70, p>0.10 2. 30 vs 18, p>0.10 3. 21 vs 2, p=0.0996 4. 17 vs 7, p>0.10 5. 23 vs 15, p>0.10 6. 130 vs 727, p=0.0135 7. 1021 vs 923, p>0.10 8. 700 vs 584, p>0.10 9. 1297 vs 983, p=0.0029 10. 1165 vs 481, p=0.0006 11. 71 vs 141, p>0.10 12. 82 vs 251, p>0.10 13. 2 vs 72, p=0.0795 14. 51 vs 265, p=0.0473 15. 0 vs 49, p>0.10	12-mo follow-up Primary prespecified outcome. 1. Estimated increment of the cost-effectiveness coefficient (primary) 1a. From the social perspective. 1b. From the perspective of the one who pays. 2. St. George Respiratory	1a. 27.3 (2.0) vs 34.1 (1.9), p=0.002; 6.8 (2.5 to 11.1) 1b. 35.6 (2.9) vs 44.4 (2.9), p=0.005; 8.8 (2.7 to 14.8) 1c. 32.9 (1.9) vs 39.7 (1.8), p=0.003; 6.8 (2.3 to 1.3) 1d. 20.7 (2.0) vs 26.3 (1.9), p=0.001; 5.6 (1.2 to 10.1) 2. 314 vs 367, p>0.10 3. 42 vs 17, p>0.10, 4. 96 vs 147, p>0.10	0	1

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	10. Formoterol 11. Short-acting Beta2-adrenergic 12. Anticholinergic 13. Xantinas 14. Leucotrenic receptor adrenergic 15. Cromonas 16. Other anti-asthmatics 17. Number of medical visits during the study. 18. Number of home visits. 19. Number of visits to other physicians.	16. 0 vs 96, p=0.0325 17. 314 vs. 367, p>0.10 18. 42 vs. 17, p>0.10 19. 96 vs. 147, p>0.10	Questionnaire score (component of primary; score range 0 [no impairment] to 100 [maximum impairment]): 2a. Score (SE); difference (95% CI) 2b. Activity (SE); difference (95% CI) 2c. Symptoms (SE); difference (95% CI) 2d. Impact (SE); difference (95% CI) Prespecified 3. Number of emergency room visits. 4. Number of hospitalizations. 5. Days spent in ICU. 6. Days hospitalized. 7. Days on rescue medication. 8. Number of short cycles of oral steroid use. 9. Number of patients symptom-free at the end of the study.	5. 49 vs 115, p=0.0888 6. 12 vs 15, p>0.10 7. 8 vs 2, p>0.10 8. 37 vs 166, p>0.10 9. 3,478 vs 9,318, p=0.0257 10. 53 vs 95, p>0.10 11. 49 vs 22		
Poels, 2009[126]	1. Proportion (95% CI) of diagnoses that changed after intervention; Odds ratio (95% CI), p-value, for CCDSS vs usual care(primary)	CCDSS vs Chest Physician Support vs. Usual care 1. 45.0% (39.5 to 50.6) vs 47.8% (41.8 to 53.9) vs	...	...	0	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
		53.3% (47.2 to 59.4); 0.72 (0.45 to 1.15), p=0.16				
	2. Proportion of patients who were referred to a specialist; Odds ratio (95% CI), p-value, for CCDSS vs usual care (secondary)	2. 5.7% vs 7.6% vs 5.2%; 1.09 (0.53 to 2.36), p=0.82				
	3. Proportion of additional diagnostic tests ordered; Odds ratio (95% CI), p-value, for CCDSS vs usual care (secondary)	3. 18.1% vs. 8.7% vs 12.5%; 1.61 (0.76 to 3.41), p=0.21				
	4. Proportion of patients who had their medication changed; Odds ratio (95% CI), p-value, for CCDSS vs usual care (secondary)	4. 38.9% vs 32.7% vs 39.0%; 0.99 (0.65 to 1.52), p=0.97 5. 0.88 (0.48 to 1.61) 6. 0.55 (0.27 to 1.12)				
	5. Shift in diagnosis from COPD to another diagnosis. Odds Ratio (95% CI) for CCDSS vs Usual Care (not pre-specified)	7. 0.85 (0.34 to 2.13)				
		8. 2.4 (1.2) vs 2.2 (1.7)				
	6. Shift in diagnosis from asthma to another diagnosis. Odds Ratio (95% CI) for CCDSS vs Usual Care (not pre-specified)	9. 19 vs 25 vs 43 10a. 26.3% vs 16% vs 39.5% 10b. 15.8% vs 16% vs 9.3%				
	7. Shift in diagnosis from “no respiratory disease” to another diagnosis. Odds Ratio (95% CI) for CCDSS vs Usual Care (not pre-specified)	10c. 5.3% vs 8% vs 4.7% 10d. 0% vs 16% vs 7% 10e. 0% vs 12% vs 18.6% 10f. 19% vs 32% vs 43%				
	8. Mean (SD) family practitioners’	11a. 0.83 (0.48 to 1.43) 11b. 0.52 (0.27 to 1.01)				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	perception of the influence of expert support on their interpretation of spirometry results (self-scored on a 5 point scale [1=no influence at all, 5=very strong influence]). (not pre-specified) 9. Number of patients with no diagnosis after interpretation. (Not pre-specified) 10. Of all patients for whom practitioner reported no diagnosis after interpretation, proportion with each reason (not pre-specified) 10a. Standard assessment form was lost 10b. Patients had left the practice 10c. Patients had died 10d. Patients were under treatment from a chest physician 10e. Practitioners could not interpret the spirometry results 10f. Other reasons 11. Odds ratio (95% CI) for change in diagnosis after intervention (CCDSS vs Usual Care) (not pre-specified) 11a.respiratory disease 11b. apparent respiratory disease					
Poller,	1. n/N (%) visits spent in or out of	Charles vs Coventry vs	Prespecified (follow-up	1. 0/57 vs 0/53 vs	0	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
1993[127]	target range ("INR" was prespecified) 1a. All patients - in range. 1b. All patients - below range. 1c. All patients - above range. 1d. New patients (n=116) – in range. 1e. New patients – below range. 1f. New patients – above range. 1g. Long-term warfarin patients (n=58) – in range. 1h. Long-term warfarin patients – below range. 1i. Long-term warfarin patients – above range. 2. percentage of visits within or outside of range for INR target range 2.0 to 3.0 ("INR" was prespecified) 2a. In range. 2b. Below range. 2c. Above range 3. percentage of visits within or outside of range for INR target range 3.0 to 4.5 ("INR" was prespecified) 3a. In range. 3b. Below range. 3c. Above range. 4. mean time between visits (in	Usual dosing 1a. 96/170 (56.5%) vs 68/128 (53.1%) vs 118/234 (50.4%) (not sig) 1b. 47/170 (27.6%) vs 32/128 (25%) vs 75/234 (32.1%) 1c. 27/170 (15.9%) vs 28/128 (21.9%) vs 41/234 (17.5%) 1d. 55.7% vs 54.3% vs 50.8% 1e. 29.0% vs 29.6% vs 35.9% 1f. 15.3% vs 16.0% vs 13.3% 1g. 59.0% vs 51.1% vs 49.1% 1h. 23.1% vs 17.0% vs 18.9% 1i. 17.9% vs 31.9% vs 32.1% 2a. 56.8% vs 51.5% vs 59.7% (p=0.62) 2b. 27.4% vs 28.3% vs 20.9% 2c. 15.8% vs 20.2% vs 19.4% 3a. 56.0% vs 58.6% vs 36.8% (Charles and Coventry significantly diff	period unclear) Number of patients with event/number randomized: Charles vs Coventry vs Traditional dosing. 1. major bleeding events 2. other clinical events 3. death	0/64 2. 0/57 vs 0/53 vs 0/64 3. 0/57 vs 1/53 vs 0/64 (no analyses done)		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	weeks) (suggested interval was prespecified) 4a. Overall. 4b. For 116 new patients. 4c. For 58 patients on long-term warfarin. 5. Percentage of visits in different INR ranges. 5a. INR <2.0 5b. INR 2.0 to 4.0 5c. INR 2.0 to 4.5 5d. INR >4.5 Note: Hillingdon system was discontinued during the study and is not included in this review.	from traditional dosing, p=0.044) 3b. 28.0% vs 13.8% vs 48.4% 3c. 16.0% vs 27.6% vs 14.7% 4a. 2.9 vs 3.2 vs 3.1 (not sig) 4b. 2.6 vs 3.1 vs 2.6 4c. 3.9 vs 3.4 vs 4.9 5a. 15.3% vs 22.7% vs 17.7% 5b. 68.2% vs 68.8% vs 69.6% 5c. 75.9% vs 71.7% vs 74.0% 5d. 8.8% vs 6.3% vs 8.1%				
Poller, 1998[128]	6-mo study with ≥ 3 mo follow-up Data also reported by patient subgroups (below), study weeks (1-3, 4-9, 10-21, >22), and by each of 5 participating centres. a) Stable on long-term anticoagulant therapy (most >22 wks therapy) b) Stabilization group who were discharged from hospital within 6 wks of starting anticoagulation therapy.	1a. 63.3% (28.0) vs 53.2% (27.7), p=0.004 1b. 61.8% (27.1) vs 54.0% (27.5), p=0.06 1c. 66.4% (29.9) vs 51.2% (28.4), p=0.02 2a. 40 vs 195 2b. 42% vs 45% 2c. 7 vs 7 2d. 55% vs 65% 2e. 35% vs 0% 2f. 28% vs 36%	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
		2g. 38% vs 28%				
	Data also reported by study weeks (1-3, 4-9, 10-21, >22) and the 2 subgroups above.	2h. 3.0 vs 2.7				
		3a. 619 vs 693				
	Prespecified: proportion of time in range	3b. 68% vs 55%				
		3c. 17 vs 16				
	1. Mean (SD) time within target INR range for all patients and all ranges (3 ranges used in study: 2-3, 2.5-3.5, and 3-4.5) (days).	3d. 39% vs 57%				
		3e. 23% vs 0				
		3f. 29% vs 36%				
		3g. 11% vs 16%				
	1a. All patients	3h. 2.6 (0.8) vs 2.6 (1.1)				
	1b. Stabilization patients					
	1c. Stable patients	4a. 314 vs 387				
		4b. 72% vs 59%				
	2. Stabilization patients – first 3 weeks	4c. 20 vs 18				
		4d. 36% vs 46%				
	2a. Number of INRs.	4e. 21% vs 0%				
	2b. Proportion of time in target range.	4f. 25% vs 27%				
		4g. 18% vs 19%				
	2c. Mean time between visits (days).	4h. 2.7 (0.9) vs 2.7 (0.8)				
	2d. Proportion dose changes.	5a. 933 vs 1080				
	2e. Proportion traditional interventions.	5b. 70% vs 56%				
		5c. 18 vs 17				
	2f. Proportion low INRs.	5d. 38% vs 53%				
	2g. Proportion high INRs.	5e. 22% vs 0%				
	2h. Mean INR.	5f. 28% vs 33%				
		5g. 15% vs 17%				
	3. Stabilization patients (83 vs 92 patients) – weeks 4 to >22	5h. 2.6 (0.9) vs 2.6 (1.0)				
	3a. Number of INRs.	6a. 22.8% vs 32.2%				
	3b. Proportion of time in target range.	6b. 34.5% vs 44.3%				
		6c. 35.4% vs 44.7%				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	3c. Mean time between visits (days). 3d. Proportion dose changes. 3e. Proportion traditional interventions. 3f. Proportion low INRs. 3g. Proportion high INRs. 3h. Mean (SD) INR. 4. Stable patients (39 vs 40 patients) – overall 4a. Number of INRs. 4b. Proportion of time in target range. 4c. Mean time between visits (days). 4d. Proportion dose changes. 4e. Proportion traditional interventions. 4f. Proportion low INRs. 4g. Proportion high INRs. 4h. Mean (SD) INR. 5. Total (122 vs 132 patients) 5a. Number of INRs. 5b. Proportion of time in target range. 5c. Mean time between visits (days). 5d. Proportion dose changes. 5e. Proportion traditional interventions. 5f. Proportion low INRs.	6d. 19.7% vs 23.0% 6e. 32.2% vs 23.3% 6f. 42.1% vs 46.4% 7a. 15.7% vs 17.7% 7b. 9.1% vs 19.7% 7c. 9.4% vs 10.5% 7d. 16.2% vs 19.4% 7e. 25.3% vs 18.3% 7f. 5.3% vs 7.1% 8a. 72.3% vs 59.3% 8b. 80.0% vs 59.9% 8c. 51.6% vs 72.5% 8d. 76.1% vs 46.3%				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	5g. Proportion high INRs. 5h. Mean (SD) INR. 6. Proportion low INRs 6a. Stabilization, INR target 2.0 to 3.0. 6b. Stabilization, INR target 2.5 to 3.5. 6c. Stabilization, INR target 3.0 to 4.5. 6d. Stable, INR target 2.0 to 3.0. 6e. Stable, INR target 2.5 to 3.5. 6f. Stable, INR target 3.0 to 4.5. 7. Proportion high INRs 7a. Stabilization, INR target 2.0 to 3.0. 7b. Stabilization, INR target 2.5 to 3.5. 7c. Stabilization, INR target 3.0 to 4.5. 7d. Stable, INR target 2.0 to 3.0. 7e. Stable, INR target 2.5 to 3.5. 7f. Stable, INR target 3.0 to 4.5. 8. Proportion time in INR ranges. 8a. Stable, All ranges 8b. Stable, INR target 2.0 to 3.0. 8c. Stable, INR target 2.5 to 3.5. 8d. Stable, INR target 3.0 to 4.5. Note: data also reported for stabilization patients by INR target range but this is provided					

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	separately by weeks (4-9, 10-21, and >22), not overall.					
Poller, 2008[129-131]	Secondary 1. Mean (SD) % time INR in range during 4.5 y study (difference, 95% CI, adjusted for computer program, gender, age, clinical indication, and target INR difference). 1a. All weeks. 1b. Weeks 1-3. 1c. Weeks 4-9. 1d. Weeks 10-21. 1e. Weeks 22+. Planned subgroup analysis by clinical indication 2. Mean (SD) % time INR in range during 4.5 y study: 2a. Atrial fibrillation. 2b. Deep vein thrombosis/pulmonary embolism. 2c. Mechanical heart valves. 2d. Other indication. Supplementary article reported data for subgroup PARMA vs control (study duration 4.5y): 3. Mean (SD) % time INR in range (difference, 95% CI, adjusted for computer program, gender, age, clinical indication, and target INR difference). 3a. All weeks.	1a. 65.9% (16.5) vs 64.7% (17.0), (1.2%, 0.7 to 1.8, p<0.001) 1b. 49.3% vs 49.3% 1c. 56.5% vs 55.9% 1d. 63.2% vs 62.0% 1e. 68.9% vs 67.4% 2a. 67.6 (15.7) vs 66.2 (16.1), p=NR 2b. 66.0 (17.7) vs 64.9 (17.6), p=NR 2c. 62.5 (16.0) vs 62.6 (16.9), p=NR 2d. 63.7 (17.1) vs 61.5 (18.7), p=NR 3a. 65,7% (16.5) vs 65.0% (16.9), (0.7%, 0.1 to 1.3, p=0.021) 3b. 48.6% (32.6) vs 48.9% (32.0) 3c. 55.5% (33.8) vs 55.5% (32.7) 3d. 62.5% (28.3) vs 61.6% (28.5) 3e. 68.8% (15.7) vs 67.7% (16.7) 4a. 22.3% vs 22.9% 4b. 35.9% vs 36.7% 4c. 34.0% vs 33.1%	Patients/patient-years analyzed: 6605/9353 vs 6447/9264; Primary outcome: 1. Number of adjudicated clinical events / events per 100 patient-years (adjusted incidence rate ratio, 95% CI) 1a. Overall. 1b. In patients 1st 3 weeks of study. 2. Number of minor bleeds / events per 100 patient-years. 3. Number of major bleeds / events per 100 patient-years. 4. Number of thrombotic events / events per 100 patient-years. 5. Number of deaths: n/N; n per 100 patient-years. 6. Number of fatal bleeds during 4.5y study: n/N. 7. Number of fatal	1a. 513 vs 555; 5.5 vs 6.0 (0.90, 0.80 to 1.02, p=0.10) 1b. NR; 8.6 vs 12.3 (0.7, 0.48 to 1.04), p=0.06 2. 253 vs 288;2.7 vs 3.1, p=NR 3. 93 vs 99; 1.0 vs 1.1, p=NR 4. 97 vs 106; 1.0 vs 1.1, p=NR 5. 70/6716 vs 62/6503; 0.7 vs 0.7, p=NR 6. 9/6716 vs 12/6503, p=NR 7. 8/6716 vs 14/6503, p=NR 8a. 228 vs 251; 4.9 vs 5.3 (0.93, 0.78 to 1.12) 8b. 115 vs 152; 6.1 vs 9.1 (0.67, 0.52 to 0.85), p=0.001 8c. 87 vs 83; 6.5 vs 6.1 (1.04, 0.77 to 1.40) 8d. 83 vs 69; 5.5 vs 4.6 (1.20, 0.87 to 1.65)	1	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	3b. Weeks 1-3.	4d. 26.8% vs 26.9%	thrombotic events	8e. p=0.02		
	3c. Weeks 4-9.	4e. 19.1% vs 20.1%	during 4.5y study: n/N.	9a. 402 vs 455; 5.1		
	3d. Weeks 10-21.			vs 5.8		
	3e. Weeks 22+.	5a. 11.9% vs 12.1%	Planned subgroup	9b. 111 vs 100; 7.6		
		5b. 15.5% vs 14.5%	analysis by clinical	vs 7.0		
	4. Mean % time INR below range.	5c. 10.5% vs 11.5%	indication:			
	4a. All weeks.	5d. 10.7% vs 11.5%	8. Number of	10a. 361 vs 397; 5.6		
	4b. Weeks 1-3.	5e. 12.0% vs 12.1%	adjudicated clinical	vs 6.4		
	4c. Weeks 4-9.		events / events per	10b. 152 vs 158; 5.1		
	4d. Weeks 10-21.	6a. 80.0% vs 79.9%	100 patient-years:	vs 5.6		
	4e. Weeks 22+.	6b. 65.5% vs 64.7%	(incidence rate ratio			
		6c. 68.8% vs 69.7%	(95% CI) adjusted for	11.420 vs 463; 5.5 vs		
	5. Mean % time INR above range.	6d. 75.8% vs 76.1%	gender, age at entry,	6.0 (0.89, 0.78 to		
	5a. All weeks.	6e. 83.1% vs 82.8%	clinical indication, and	1.01)		
	5b. Weeks 1-3.		target INR range (<1	12. 211 vs 245; 2.7		
	5c. Weeks 4-9.	7a. 2.48 (0.88) vs 2.47	favors treatment):	vs 3.2, p=NR		
	5d. Weeks 10-21.	(0.85)	8a. Atrial fibrillation.	13. 73 vs 85; 0.9 vs		
	5e. Weeks 22+.	7b. 2.36 (1.17) vs 2.35	8b. Deep vein	1.1, p=NR		
		(1.10)	thrombosis/pulmonary	14. 84 vs 85; 1.1 vs		
	6. Mean % time INR at 2-4.5.	7c. 2.36 (0.87) vs 2.36	embolism.	1.1, p=NR		
	6a. All weeks.	(0.85)	8c. Mechanical heart	15. 52/5377 vs		
	6b. Weeks 1-3.	7d. 2.43 (0.81) vs 2.44	valves.	48/5175; 0.7 vs 0.6,		
	6c. Weeks 4-9.	(0.84)	8d. Other indication.	p=NR		
	6d. Weeks 10-21.	7e. 2.52 (0.82) vs 2.52	8e. Overall interaction.	16a. 172 vs 199; 4.6		
	6e. Weeks 22+.	(0.79)	Subgroup analysis (not	vs 5.1, p=NS		
			clear preplanned)	16b. 106 vs 134; 6.7		
	7. Mean (SD) INR.	8a. 66.8% (16.4) vs 63.4%	9. Number of clinical	vs 9.7 (0.69, 0.53 to		
	7a. All weeks.	(17.7) (3.5%, 2.3 to 4.9,	events / events per	0.89, p=0.005)		
	7b. Weeks 1-3.	p<0.001)	100 patient years by	16c. 78 vs 75; 6.5 vs		
	7c. Weeks 4-9.	8b. 51.7% (34.6) vs 51.1%	INR target range:	6.2, p=NS		
	7d. Weeks 10-21.	(33.6)	9a. Target 2-3 or lower	16d. 64 vs 55; 5.4 vs		
	7e. Weeks 22+.	8c. 60.7% (31.8) vs 58.4%	range.	4.6, p=NS		
		(33.7)	9b. Target 2.5-3.5 or	16e. p=0.05		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	Supplementary article reported data for subgroup DAWN-AC vs control during 4.5y study: 8. Mean (SD) % time INR in range (difference, 95% CI, adjusted for computer program, gender, age, clinical indication, and target INR difference). 8a. All weeks. 8b. Weeks 1-3. 8c. Weeks 4-9. 8d. Weeks 10-21. 8e. Weeks 22+. 9. Mean % time INR below range. 9a. All weeks. 9b. Weeks 1-3. 9c. Weeks 4-9. 9d. Weeks 10-21. 9e. Weeks 22+. 10. Mean % time INR above range. 10a. All weeks. 10b. Weeks 1-3. 10c. Weeks 4-9. 10d. Weeks 10-21. 10e. Weeks 22+. 11. Mean % time INR at 2-4.5. 11a. All weeks. 11b. Weeks 1-3. 11c. Weeks 4-9.	8d. 66.2% (27.6) vs 62.9% (29.5) 8e. 69.6% (16.2) vs 64.4% (17.2) 9a. 19.7% vs 21.1% 9b. 32.7% vs 32.5% 9c. 25.3% vs 27.3% 9d. 20.4% vs 22.3% 9e. 17.7% vs 21.4% 10a. 13.5% vs 15.5% 10b. 15.5% vs 16.4% 10c. 14.0% vs 14.3% 10d. 13.4% vs 14.7% 10e. 12.7% vs 14.2% 11a. 82.4% vs 79.2% 11b. 68.1% vs 68.5% 11c. 76.7% vs 74.1% 11d. 81.7% vs 78.6% 11e. 84.7% vs 81.2% 12a. 2.49 (0.94) vs 2.48 (1.00) 12b. 2.29 (1.15) vs 2.30 (1.22) 12c. 2.45 (1.27) vs 2.44 (0.88) 12d. 2.49 (0.89) vs 2.51 (0.89) 12e. 2.54 (0.81) vs 2.53 (0.99)	higher range Subgroup analysis (not clear preplanned). 10. Number of events / events per 100 patient years by patient type. 10a. New patients. 10b. Patients established on oral anticoagulants. Supplementary article reported data for subgroup PARMA vs control: 11. Number of adjudicated clinical events (bleeding or thrombosis) / events per 100 patient-years (adjusted incidence rate ratio, 95% CI). 12. Number of minor bleeds / events per 100 patient-years. 13. Number of major bleeds / events per 100 patient-years. 14. Number of thrombotic events /events per 100 patient-years.	17a. 321 vs 376; 4.9 vs 5.9 17b. 99 vs 87; 8.2 vs 7.0 18a. 292 vs 321; 5.6 vs 6.1 18b. 128 vs 142; 5.1 vs 5.8 19a. 9 vs 10 19b. 1 vs 1 19c. 1 vs 0 19d. 7 vs 9 19e. 11 vs 27 19f. 55 vs 66 19g. 31 vs 31 19h. 15 vs 26 19i. 91 vs 108 19j. 115 vs 152 20. 93 vs 92; 5.6, 4.6 to 6.9 vs 5.8, 4.6 to 7.0 21. 42 vs 43; 2.5 vs 2.7 22. 23 vs 14; 1.4 vs 0.9 23. 15 vs 23; 0.9 vs 1.4 24. 13/1399 vs 12/1328; 0.8 vs 0.8		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	11d. Weeks 10-21. 11e. Weeks 22+. 12. Mean (SD) INR. 12a. All weeks. 12b. Weeks 1-3. 12c. Weeks 4-9. 12d. Weeks 10-21. 12e. Weeks 22+. Note: Figure 3 in main and supplementary papers show results by clinical centre.		15. Number of deaths: number per 100 patient-years. Planned subgroup analysis by clinical indication: 16. Number of clinical events / events per 100 patient-years (incidence rate ratio, 95% CI; <1 favors treatment): 16a. Atrial fibrillation. 16b. Deep vein thrombosis/pulmonary embolism. 16c. Mechanical heart valves. 16d. Other indication. 16e. Overall interaction. Subgroup analysis (not clear preplanned) 17. Number of clinical events / events per 100 patient years by INR target range: 17a. Target 2-3 or lower range. 17b. Target 2.5-3.5 or higher range	25a. 53 vs 51; 6.1 vs 5.9 25b. 9 vs 18; 3.1 vs 6.4 25c. 11 vs 9; 7.3 vs 5.9 25d. 20 vs 14; 6.0 vs 4.6 26a. 81 vs 79; 5.8 vs 5.7 26b. 12 vs 13; 4.8 vs 6.4 27a. 69 vs 76; 5.7 vs 6.2 27b. 24 vs 16; 5.4 vs 4.3		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			Subgroup analysis (not clear preplanned). 18. Number of events / events per 100 patient years by patient type. 18a. New patients. 18b. Patients established on oral anticoagulants. 19. Number of events in 2542 patients (1322 vs 1220) with deep vein thrombosis/pulmonary embolism. 19a. All deaths. 19b. Fatal bleeds. 19c. Fatal thrombosis. 19d. Other deaths. 19e. Major bleeds. 19f. Minor bleeds. 19g. Thrombotic events. 19h. During 1st 3 weeks. 19i. After week 3. 19j. Total. Supplementary article reported data for subgroup DAWN-AC vs			

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			control: 20. Number of adjudicated clinical events (bleeding or thrombosis) / events per 100 patient-years, 95% CI 21. Number of minor bleeds / events per 100 patient-years. 22. Number of major bleeds / events per 100 patient-years. 23. Number of thrombotic events / events per 100 patient-years. 24. Number of deaths: number per 100 patient-years. Planned subgroup analysis by clinical indication: 25. Number of clinical events / events per 100 patient-years: 25a. Atrial fibrillation. 25b. Deep vein thrombosis/pulmonary embolism. 25c. Mechanical heart valves.			

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			25d. Other indication. Subgroup analysis (not clear preplanned) 26. Number of clinical events / events per 100 patient years by INR target range: 26a. Target 2-3 or lower range. 26b. Target 2.5-3.5 or higher range Subgroup analysis (not clear preplanned). 27. Number of events / events per 100 patient years by patient type. 27a. New patients. 27b. Patients established on oral anticoagulants. Note: Event rates are reported by other subgroups (gender, age) in Table 2 and text in main and supplementary papers, but not analyzed or indicated as			

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			preplanned.			
Quinn, 2008[132]	Secondary 1. Medications intensified at 3 months (% patients). 2. Medication errors identified at 3 months (% patients). Not prespecified 3. Physician received patient logbooks at 3 months.	1. 84.62% vs 23.08%, p=0.002 2. 53.38% v 0%, p=0.002 3. 100% vs 7.69%, p<0.001	Primary 1. Mean HbA1c levels; Baseline/follow-up at 3 months; difference. Prespecified 2. Diet self-care (mean days/week); Baseline/follow-up at 3 months. 3. Medications self-care (mean days/week); Baseline/follow-up at 3 months. 4. Exercise self-care (mean days/week); Baseline/follow-up at 3 months. 5. Patients reporting improved knowledge of food choices at 3 months. 6. Patients reporting provider diabetes management improved at 3 months by receipt of blood sugars. 7. Patients reporting improved confidence about diabetes control	1. 9.51%/7.48% vs 9.05%/8.37%; 2.03% vs 0.68%, p<0.04 2. 3.15/5.5 vs 3.15/3.86, p=0.036 3. 5.92/6.64 vs 6.3/6.75, p=0.495 4. 2.08/2.92 vs 1.23/1.57, p=0.657 5. 90.91% vs 50%, p=0.062 6. 100% vs 37.5%, p=0.004 7. 100% vs 75%, p=0.167 8. 9.09% vs 20%, p=0.37	1	1

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			at 3 months. Not specified 8. New depression diagnosis at 3 months (% patients).			
Raebel, 2005[133]	1. Percentage (95% CI) of drug dispensings with baseline laboratory monitoring (from 180 days prior to dispensing until 14 days after) (primary outcome) 2. n/N, percentage (95% CI) of drug dispensings with baseline laboratory monitoring (from 180 days prior to dispensing until 14 days after) for each drug; difference(comparison by drug not pre-specified) 2a. allopurinol 2b. amiodarone 2c. azathioprine 2d. carbamazepine 2e. divalproex sodium 2f. isotretinoin 2g. lithium 2h. metformin 2i. methotrexate 2j. nefazodone hydrochloride 2k. pioglitazone hydrochloride 2l. statin + gemfibrozil Note: The number of patients started on felbamate (0 vs 2) or	1. 79.1% (78.0 to 80.2) vs 70.2 (68.9 to 71.5), p<0.001 2a 575/701, 82.0% (79.9 to 84.8) vs 484/692, 69.9% (66.4 to 73.3); 12.1%; p<0.001 2b. 202/257, 78.6% (73.1 to 83.5) vs 107/208, 51.4% (44.4 to 58.4); 27.2%; p<0.001 2c. 97/108, 89.8% (82.5 to 94.8) vs 94/112, 83.9% (75.8 to 90.2); 5.9% p=0.20 2d. 356/499, 71.3% (67.2 to 75.3) vs 273/484, 56.4% (51.6 to 60.7); 15.9%; p<0.001 2e. 343/517, 66.3% (62.1 to 70.4) vs 306/514, 59.5% (55.1 to 63.8); 6.8%; p=0.02 2f. 105/117, 89.7% (82.8 to 94.6) vs 141/148, 95.3% (90.5 to 98.1); 5.6%; p=0.83 2g. 152/285, 53.3% (47.6	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	ticlopidine (5 vs 7) during the study was low and data on lab monitoring were not presented. 3. percentage (95% CI) of drug dispensings with baseline laboratory monitoring (from 180 days prior to dispensing until 14 days after) broken down by age subgroup (18-39y, 40-49y, 50-59y, 60-69y, 70-79y, ≥80y) (not pre-specified) **there are other descriptions of findings in intervention group, but these do not compare CDSS vs control	to 59.2) vs 117/272, 43.0% (37.1 to 49.1); 10.3%; p=0.02 2h. 1538/1855, 82.9% (81.1 to -84.5) vs 1333/1759, 75.8% (73.7 to 77.8); 7.1%; p<0.001 2i. 235/259, 90.7% (86.5 to 94.0) vs 218/246, 88.6% (84.0 to 92.3); 2.1%; p=0.43 2j. 54/93, 58.1% (47.4 to 68.2) vs 54/112, 48.2% (38.7 to 57.9); 9.9%; p=0.16 2k. 122/131, 93.1% (87.4 to 96.8) vs 103/115, 89.6% (82.5 to 94.5); 3.5%; p=0.32 2l. 295/326, 90.5% (86.8 to 93.4) vs 288/345, 83.5% (79.1 to 87.2); 7.0%; p=0.01 3. values not provided but p<0.001 in favor of CCDSS.				
Raebel, 2007a[134]	1y study period. Primary outcomes. 1. Rate of all first dispensings of targeted potentially inappropriate medications, n/N (%). 1a. ≥ 1 medication. 1b. 1 medication.	1a. 543/29840 (1.8%) vs 644/29840 (2.2%) (P=0.002) 1b. 535/29840 vs 632/29840 1c. 8/29840 vs 11/29840 1d. 0 vs 1/29840, p=0.90	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	1c. 2 different medications. 1d. 3 different nedications. 2. Rate of dispensings of specific targeted potentially inappropriate medications, n/N (%). 2a. Amitriptyline. 2b.Chlordiazepoxide. 2c. Diazepam. 2d. Doxepin. 2e. Flurazepam. 2f. Ketorolac. 2g. Meperidine (oral). 2h.Oxycodone/aspirin. 2i. Total. 3. Rate of dispensings of specific targeted medications for indications considered inappropriate, n/N (%). 3a. Amitriptyline. 3b.Chlordiazepoxide. 3c. Diazepam. 3d. Doxepin. 3e. Flurazepam. 3f. Ketorolac. 3g. Meperidine (oral). 3h.Oxycodone/aspirin. 3i. Total.	for 1b-1d 2a. 114/29840 (0.38%) vs 183/29840 (0.61%), p<0.001 2b. 11/29840 (0.04%) vs 14/29840 (0.05%), p=0.55 2c. 383/29840 (1.28%) vs 411/29840 (1.38%), p=0.32 2d. 32/29840 (0.11%) vs 42/29840 (0.14%), p=0.24 2e. 4/29480 (0.01%) vs 2/29840 (0.01%), p=0.69 2f. 2/29840 (0.01%) vs 0 (0%), p=0.50 2g. 4/29840 (0.01%) vs 4/29840 (0.01%), p=NA 2h. 1/29840 (0%) vs 1/29840 (0%), p=NA 2i. 551/29840 (1.85%) vs 657/29840 (2.20%), p=0.002 3a. 111/29840 (0.37%) vs 175/29840 (0.59%), p<0.001, relative risk reduction 37% 3b. 11/29840 (0.04%) vs 14/29840 (0.05%), p=0.55 3c. 167/29840 (0.56%) vs 213/29840 (0.71%), p=0.02, relative risk				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
		reduction 21% 3d. 27/29840 (0.09%) vs 38/29840 (0.13%), p=0.17 3e. 4/29480 (0.01%) vs 2/29840 (0.01%), p=0.69 3f. 2/29840 (0.01%) vs 0 (0%), p=0.50 3g. 4/29840 (0.01%) vs 4/29840 (0.01%), p=NA 3h. 1/29840 (0%) vs 1/29840 (0%), p=NA 3i.. 327/29840 (1.10%) vs 447/29840 (1.50%), p<0.001				
Raebel, 2007b[134]	4-mo data collection (stopped early for planned 12-month follow-up). 1. Patients dispensed targeted drugs (primary): n/N (%). 1a. Category D drug. 1b. Category X drug. 1c. Category D and X drugs. 1d. Category D or X drugs. 2. First dispensings of targeted drugs (secondary). 2a. Number from category D or X/number first dispensings of unique drugs (%). 2b. Number (%) of category D/category X drugs dispensed. 3. Of patients who received a	1a. 108/6075 (1.8%) vs 198/5025 (3.9%) 1b. 54/6075 (0.9%) vs 58/5025 (1.2%) 1c. 15/6075 (0.2%) vs 20/5025 (0.4%), p=0.05 for 1a-1c. 1d. 177/6075 (2.9%) vs 276/5025 (5.5%), p<0.001 2a. 238/593 (40.2%) vs 361/848 (42.6%), p=0.36 2b. 166(69.8%)/72(30.3%) vs 280 (77.6%)/81(22.4%), p=0.03 for difference in proportions. 3a. 133/177 (75.1%) vs 211/276 (76.5%)	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	targeted drug, number (%) given: 3a. 1 category D or X drug. 3b. 2 different category D or X drugs. 3c. ≥3 different category D or X drugs. 4. Number (%) of first dispensings of specific category D/category X drugs. 4a. ACE-I. 4b. Antidepressant. 4c. Antineoplastic. 4d. Barbiturate. 4e. Benzodiazepine. 4f. Beta-blocker. 4g. Clomiphene citrate. 4h. Codeine. 4i. Estrogens (not oral contraceptives). 4j. Lithium carbonate. 4k. Misoprostol. 4l. Nonsteroidal anti-inflammatory agent. 4m. Narcotic analgesic (not codeine). 4n. Oral contraceptive. 4o. Phenytoin. 4p. Propylthiouracil. 4q. Progesterone (not oral contraceptives). 4r. Sulfamethoxazole-trimethoprim.	3b. 31/177 (17.5%) vs 51/276 (18.4%) 3c. 13/177 (7.3%) vs 14/276 (5.1%),p=0.60 over 3a-3c. 4a. 0 vs 1 (0.2%), p>0.05 4b. 1 (0.4%) vs 2 (0.6%), p>0.05 4c. 0 vs 3 (0.8%), p>0.05 4d. 8 (3.4%) vs 16 (4.4%), p>0.05 4e. 8 (3.4%) vs 15 (4.2%), p>0.05 4f. 4 (1.7%) vs 8 (2.2%), p>0.05 4g. 5 (2.1%) vs 11 (3.1%), p>0.05 4h. 29 (12.2%) vs 54 (15.0%), p>0.05 4i. 6 (2.5%) vs 6 (1.7%), p>0.05 4j. 0 vs 3 (0.8%), p>0.05 4k. 5 (2.1%) vs 6 (1.7%), p>0.05 4l. 22 (9.2%) vs 36 (10.0%), p>0.05 4m. 66 (27.7%) vs 94 (26.0%), p>0.05 4n. 53 (22.3%) vs 53 (14.7%), p=0.02 4o. 0 vs 1 (0.3%), p>0.05 4p. 0 vs 2 (0.6%), p>0.05				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	4s. Tretinoin. 4t. Tetracycline derivatives. 4u. Warfarin. 4v. Total	4q. 2 (0.8%) vs 6 (1.7%), p>0.05 4r. 9 (3.8%) vs 28 (7.8%), p>0.05 4s. 1 (0.4%) vs 1 (0.3%), p>0.05 4t. 18 (7.6%) vs 15 (4.2%), p>0.05 4u. 1 (0.4%) vs 0, p>0.05 4v. 238 (100%) vs 361 (100%)				
Rodman, 1984[135]	Main outcome: plasma lidocaine levels in middle of therapeutic range (1.5 to 5.0 µg/mL). 1. Mean plasma lidocaine level (µg/mL) at intervals after initiation of therapy: 1a. min 0 to 30 1ai. min 0 to 10 1aii min 11-30 1b. min 31 to 60 1c. min 61 to 120 1d. hours 4 to 8 Not prespecified 2. mean (SE) observation time (hours) 3. mean (SE) overall lidocaine infusion rate (µg/kg/min) 4. mean (SEM) final infusion rate (µg/kg/min) 5. mean (SEM) first-hour infusion rate (µg/kg/min)	1a. 2.34 vs 1.44 (p<0.02) 1ai. p< 0.3 1aii. p<0.01 1b. 3.2 vs 1.60 (p<0.01) 1c. 3.7 vs 2.1 (p<0.01) 1d. 4.5 vs 3.0 (p<0.01) 2. 10.1 (2.0) vs 11.3 (1.75) (NS) 3. 39.68 (7.03) vs 35.63 (4.22) (NS) 4. 29.24 (5.31) vs 31.24 (2.29) (NS) 5. 82.68 (6.05) vs 42.27 (3.86) (p<0.01) 6. 4/11 (36%) vs 1/9 (11%) (NS)	*No outcomes were specifically prespecified. 1. number of patients with a toxic response requiring lidocaine discontinuation or dosage reduction.	(N rand = 9 vs 11) 1. 0 vs 0	1	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	6. number (proportion) of patients requiring upward adjustment of lidocaine to control arrhythmia in the first six hours of therapy					
Rogers, 1984[136-138]	Prespecified 1. Proportion of hypertension patients with medical care event at 1 y / 2 y / both y / not done. 1a. Renal function exam. 1b. Potassium exam. 1c. Fundoscopic exam. 1d. Intravenous pyelogram. 2. Proportion of obesity patients with medical care event at 1 y / 2 y / both y / not done. 2a. Number of diets given or reviewed overall. 2b. Number of diets given or reviewed for men. 2c. Number of diets given or reviewed for women. 3. Proportion of patients with renal disease and medical care events at 1 y / 2 y / both y / not done. 3a. Renal function exam (blood urea nitrogen, creatinine or creatinine clearance). 3b. Urine analysis. 3c. Urine culture. 4. Mean perceived quality of	1a. 22.3% vs 20.5% / 9.1% vs 14.1% / 60.9% vs 50.3% / 7.6% vs 15.1%, p=0.03 1b. 23.3% vs 20.5% / 10.2% vs 13.0% / 60.4% vs 52.5% / 6.1% vs 14.1%, p=0.042 1c. 9.5% vs 3.2% / 59.8% vs 52.6% / 7.0% vs 4.7% / 27.9% vs 37.8%, p>0.05 1d. 6.5% vs 6.8% / 22.6% vs 31.6% / 39.2% vs 31.1% / 31.0% vs 28.6%, p>0.05 2a. 16.2% vs 11.4% / 29.4% vs 20.3% / 33.8% vs 20.3% / 20.6% vs 48.1%, p=0.007 2b. 15.0% vs 6.7% / 45.0% vs 6.7% / 30.0% vs 46.7% / 10.0% vs 40.0%, p>0.05 2c. 16.7% vs 12.5% / 22.9% vs 23.4% / 35.4% vs 14.1% / 25.0% vs 50.0%, p=0.018 3a. 18.8% vs 13.3% / 3.1% vs 13.3% / 70.3% vs 55.6% / 7.8% vs 17.8%, p>0.05	Prespecified 1. Mean perceived health status over 1 year adjusted for financial status, chart weight, prior clinic attendance length, and age (high scores better). Not clearly prespecified. Data collected by retro chart review using a standardized evaluation form. Not clear which data were intended as outcomes for analysis or if some analyses were post-hoc decisions. 2. Proportion of deaths by study end. 2a. Hypertension patients. 2b. Obesity patients. 2c. Renal disease patients.	1. No data reported (figure 2b in article), p<0.05 in favor of CCDSS. 2a. 14.2% vs 17.8%, p>0.05 2b. 1.5% vs 8.6%, p>0.05 2c. 15.6% vs 22.2%, p>0.05 3a. 147.7 / 91.5 vs 151.8 / 91.4, p=NS 3b. 148.6 / 91.7 vs 146.5 / 91.3, p=NS 3c. 144.5 / 90.1 vs 146.8 / 94.0, p=NS 3d. 146.9 / 91.3 vs147.0 vs 90.1, p=NS 4a. 45.6 / 52.3 vs 48.6 / 55.3, p=0.12 4b. 39.3 / 51.5 vs 52.2 / 55.8, p=0.023 5a. 36.2% / 63.8% vs 22.6% / 77.4%,	1	1

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	communication score over 1 year adjusted for financial status, chart weight, prior clinic attendance length, and age (high scores better). Not clearly prespecified: 5. Mean (±95% CI) number of events in subgroup of patients with hospitalization data at year 1 / year 2 / combined. (p value for years 1 and 2 combined) 5a. Procedures and referrals carried out. 5b. Diets by Cardiac, Pulmonary, and Renal (CPR) Clinics. 5c. New problems indicated by CPR. 5d. Resolved problems. 5e. New abnormal lab results. 5f. Worse abnormal lab results. Note: Data inconsistency. Text (p.67, 1982 paper) indicates urine analysis significant and urine culture not significant. Table 3 states the opposite. Data checked and the text appears to be correct. 6. Proportion of times a diagnostic intervention result was recorded for patients with length of hospitalization available (year 1 /	3b. 32.8% vs 20.0% / 10.9% vs 20.0% / 46.9% vs 31.1% / 9.4% vs 28.9%, p=0.015 3c. 48.4% vs 60.0% / 9.4% vs 11.1% / 25.0% vs 20.0% / 17.2% vs 8.9%, p>0.05 4. No data reported (figure 2b in article), p<0.05 in favor of CCDSS. 5a. 31.8 (5.8) / 40.9 (11.3) / 35.5 (5.7) vs 17.2 (5.3) / 32.4 (11.2) / 24.0 (5.9), p<0.005 5b. 0.3 (0.2) / 0.3 (0.2) / 0.3 (0.1) vs 0.1 (0.1) / 0.1 (0.1) / 0.1 (0.1), p<0.03 5c. 1.0 (0.4) / 0.9 (0.3) / 1.0 (0.3) vs 0.6 (0.3) / 0.4 (0.3) / 0.5 (0.2), p<0.007 5d. 0.2 (0.1) / 0.3 (0.2) / 0.2 (0.1) vs 0.0 (0.1) / 0.0 (0.1) / 0.0 (0.1), p=NS 5e. 3.9 (1.0) / 5.4 (1.8) / 4.5 (0.9) vs 2.0 (0.9) / 5.0 (1.9) / 3.4 (1.0), p=NS 5f. 1.5 (0.6) / 1.6 (1.3) / 2.0 (0.6) vs 1.4 (0.9) / 1.7 (1.0) / 1.6 (0.6), p=NS 6a. 82.1% / 84.6% vs 54.3% / 55.6%	3. Mean adjusted systolic / diastolic blood pressure in hypertension patients. Adjusted for BP at start of study, age, and previous time in cardiac-pulmonary-renal clinics. Unadjusted data with 95% CIs was also reported in 1982 paper. 3a. Men after 10-15 months. 3b. Women after 10-15 months. 3c. Men after 22-24 months. 3d. Women after 22-24 months. 4. Mean adjusted pounds overweight in obesity patients. Adjusted for pounds overweight at baseline, ideal weight, time in cardiac-pulmonary-renal clinics, concomitant diabetes, and total number of other concomitant	p=0.10 5b. 45.9% / 54.1% vs 4.3% / 95.7%, p=0.0003 5c. 68.2% /31.8% vs 35.7% /64.3%, p=0.028 6. 48/40 vs 41/40, p>0.05 7a. 20.0 / 9.7 vs 16.5 / 20.7, p>0.05 (p<0.01 for interaction of CDSS and year). 7b. 17.8 / 13.5 vs 19.0 / 20.9 8a. 5.8% vs 4.2%, p>0.05 8b. 5.4% vs 8.4%, p>0.05 8c. 0% vs 0% 9a. 0.05 / 0.04 / 0.51 / 0.24 / 0.12 / 0.02 / 49 vs 0.10 / 0.00 / 0.37 / 0.20 / 0.32 / 0.02 / 41 (NS) 9b. 0.10 / 0.00 / 0.51 / 0.18 / 0.18 / 0.03 / 61 vs 0.05 / 0.00 /		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	year 2). 6a. chest x-ray 6b. electrocardiogram 6c. urine analysis 6d. red blood cells 6e. hemoglobin 6f. HTC (cell pack) 6g. WBC 6h. blood smear 6i. VDRL 6j. BUN 6k. uric acid 6l. creatinine 6m. FBS 6n. PCS (2 hr) 6o. cholesterol 6p. sodium 6q. potassium 6r. chlorides 6s. carbon dioxide 6t. pap smear 6u. all tests	6b. 84.6% / 80.8% vs 57.1% / 63.0% 6c. 81.6% / 80.8% vs 48.6% / 66.7% 6d. 71.8% / 73.1% vs 42.9% / 59.3% 6e. 82.1% / 73.1% vs 51.4% / 70.4% 6f. 82.1% / 73.1% vs 57.1% / 66.7% 6g. 87.2% / 73.1% vs 51.4% / 70.4% 6h. 69.2% / --- vs 28.6% / --- 6i. 25.6% / 38.5% vs 20.0% / 22.2% 6j. 87.2% / 88.5% vs 57.1% / 77.8% 6k. 84.6% / 84.6% vs 37.1% / 63.0% 6l. 87.2% / 84.6% vs 42.9% / 63.0% 6m. 84.6% / 88.5% vs 42.9% / 81.5% 6n. 18.4% / 23.1% vs 08.6% / 18.5% 6o. 87.2% / 84.6% vs 45.7% / 63.0% 6p. 82.1% / 88.5% vs 54.3% / 74.1% 6q. 82.1% / 88.5% vs 65.7% / 77.8% 6r. 82.1% / 88.5% vs 54.3%	diseases. Unadjusted data with 95% CIs was also reported in 1982 paper. 4a. Men / women at 10-15 months. 4b. Men / women at 22-24 months. 5. Proportion of patients with normal/abnormal renal test during year 2 (excluding those that did not have test). 5a. Renal function exam (blood urea nitrogen, creatinine or creatinine clearance). 5b. Urine analysis. 5c. Urine culture. 6. Number of patients hospitalized at 1 y / 2 y (adjusted for previous cardiac-pulmonary-renal clinic attendance, diabetes, and sex.). 7. Mean adjusted length of hospital stay (days) for y1 / y2. 7a. Outliers included	0.39 / 0.18 / 0.34 / 0.05 / 44 (NS)		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
		/ 74.1% 6s. 82.1% / 88.5% vs 51.4% / 74.1% 6t. 61.9% / 62.5% vs 40.0% / 22.7% 6u. 75.3% / 76.2% vs 45.6% / 61.3% p=NR	7b. outliers excluded Not prespecified. 8. Proportion of patients newly diagnosed during study. 8a. Hypertension. 8b. Obesity. 8c. Renal disease. Note: results for newly diagnosed hypertension and obesity patients generally consistent with those for all patients (4 and 5 above), although at 10-15 months CDSS patient less overweight (22.1-28.2 lbs vs 36.7-42.6, p<0.04). 9. Proportion of admitted patients with various admission diagnoses – tests / pregnancy, cosmetic surgery / acute illness or surgery with no evidence of complications due to chronic disease /			

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			evidence of chronic disease with mild impairment of function / evidence of chronic disease with severe impairment of function / condition critical, evidence of life-endangering disease / total number of patients admitted 9a. year one 9b. year 2			
Rood, 2005[139]	1. Deviation between advised and actual glucose measurement times over 10 weeks; (prespecified); N for samples 2352 vs 2597 1a. For late measurements: Mean minutes (SD); proportion of time (SD); difference in proportion of time (95% CI). 1b. For early measurements: proportion of time (SD); difference in proportion of time (95% CI). 2. Proportion of time that patients' glucose levels were within specified range over 10 weeks; observed difference (95% CI). 2a. Target range, 4.0 to 7.0 mmol/L (prespecified). 2b. <2.5 mmol/L (not clearly prespecified).	1a. 27.95 (118.3) vs 42.49 (139.5); 28.1% (103.3) vs 41.9% (99.1); 14% (11 to 16) 1b. 27.8% (28.8) vs 28.95% (29.3) 2a. 54.2% vs 52.9%; 1.3% (1.0 to 1.56) 2b. 0.09% vs 0.05% (diff NR) 2c. 1.28% vs 1.32% (diff NR) 2d. 26.64% vs 27.53% (diff NR) 2e. 17.79% vs 18.21% (diff NR)	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	2c. 2.5 to 4 mmol/L (not clearly prespecified). 2d. 7 to 8.5 mmol/L (not clearly prespecified). 2e. >8.5 mmol/L (not clearly prespecified). 3. Proportion of dosing recommendations followed over 10 weeks; observed difference (95% CI) (not prespecified). 4. % adherence to guideline for timing of glucose measurement over 10 weeks; observed difference (95% CI). 4a. % samples taken on time (prespecified). 4b. % samples taken too late (not clearly prespecified). 4c. % samples taken too early (not clearly prespecified). Pre- and post-intervention periods are available in article.	3. 77.3% vs 64.2%; 13.1% (11 to 16): total N of samples: 2352 vs 2597 4. total N of samples: 2352 vs 2597 4a. 40.18% vs 35.54%; 4.6% (2.0 to 7.4) 4b. 25.51% vs 31%; 5.5% (3.0 to 8.0) 4c. 34.31% vs 33.46% (difference NR) Other details regarding pre- and post-intervention periods available.				
Rosser, 1991[140]	1. (pre-specified) Percentage of patients for whom the recommended procedure was performed (physician reminder, letter reminder, telephone reminder, control). 1a. administration of influenza	1 (physician reminder, letter reminder, telephone reminder, control) 1a. 22.9, 35.2, 37.0, 9.8 (p value not indicated) 1b. 30.7, 40.5, 37.2, 21.1 (p value not indicated)	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	vaccine 1b. measure of blood pressure 1c. assess smoking status 1d. obtain Papanicolaou smear 1e. administer tetanus vaccine 1f. male, 15-34 years 1g. male, 35-64 years 1h. male, ≥65 years 1i. male, all 1j. female, 15-34 years 1k. female, 35-64 years 1l. female, ≥65 years 1m. female, all 1n. overall 1o. men 15-44 years 1p. men ≥45 years 1q. women 15-64 years 1r. women => 65 years	1c. 37.9, 49.4, 55.8, 11.9 (p value not indicated) 1d. 16.5, 29.7, 30.0, 13.7 (p value not indicated) 1e. 22.8, 30.6, 24.0, 3.2 (p value not indicated) 1f. 20.5*, 31.3*†, 37.7*†‡, 8.3 1g. 34.7, 49.4*†, 43.4*†‡, 14.9 1h. 44.7, 52.1*†, 43.0*†‡, 13.7 1i. 30.3*, 43.0*†, 41.2*†‡, 12.3 1j 26.7*, 35.8*†, 39.9*, 13.6 1k. 38.8*, 45.8*†, 45.1*†, 14.5 1l. 38.4, 47.1*†, 42.7*†‡, 10.7 1m. 33.7*, 42.0*†, 42.0*†, 13.5 * Significantly greater than proportion in control group (p<0.01) †Significantly greater than proportion in physician reminder group (p<0.05) ‡Significantly different from proportion in letter reminder group (p<0.05) 1n. 33.3, 42.0, 42.0, 14.1,				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
		p<0.05 for telephone or letter reminder vs physician reminder; p<0.001 for intervention groups vs control. 1o. telephone reminder more effective than letter (p<0.05) 1p. letter reminder more effective than telephone reminder (p<0.05) 1q. letter similarly effective to telephone reminder 1r. letter reminder more effective than telephone reminder (p<0.05)				
Rossi, 1997[141]	Main outcome for 6-month study. 1. Prescription changes from a calcium channel blocker to another antihypertensive agent: n/N of patients (%). 1a. Overall. 1b. Changed to beta-blockers. 1c. Changed to diuretics. 1d. Increased ACE-I dose. 1e. Changed to both beta-blockers and diuretics. 1f. No other medication substituted.	1a. 39/346 (11.3%) vs 1/373 (<1%), p<0.0001 1b. 26/346 vs 1/373 1c. 7/346 vs 0/373 1d. 3/346 vs 0/373 1e. 2/346 vs 0/373 1f. 1/346 vs 0/373	Note: these data are not reported for randomized treatment vs control and are not included in any of the applications. Outcome after 6 mo intervention and 6 mo follow-up. Data presented in subgroups as: intervention group with vs without drug change; intervention	1. 155/81 ± 24/15 vs 151/75 ± 21/12, p=0.317; 155/81 ± 24/15 vs 149/78 ± 23/13, p=0.484 2. 4±2 vs 4±3, p=0.260; 4±2 vs 4±3, p=0.585 3. 0.2±0.5 vs 0.3±0.6, p=0.419; 0.2±0.5 vs 0.4± 1.1, p=0.190 4. 1.0±1.3 vs 0.6±1.0, p=0.179; 1.0±1.3 vs	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			group with drug change vs control. 1. Mean ± SD blood pressure. 2. Mean ± SD number of follow up clinic visits per patient. 3. Mean ± SD number of emergency department visits per patient. 4. Mean ± SD number of lab tests ordered (creatinine). 5. Mean ± SD number of lab tests ordered (total cholesterol).	1.9±4.1, p=0.179 5. 0.5±1.0 vs 2.0±4.6, p=0.567; 0.5±1.0 vs 0.6±1.1, p=0.918		
Rothschild, 2007[142]	The pre-specified primary outcomes were transfusion guideline adherence of junior house staff at DS intervention (4 months). 1. Appropriateness of transfusion orders. Number (%). 1a. chart review confirms DS-agree (appropriate order) 1b. chart review changes to DS-disagree (inappropriate order) 1c. chart review changes to DS-agree (appropriate order) 1d. chart review confirms DS-disagree (inappropriate order)	1a. 305 vs 349 1b. 106 vs 121 1c. 108 (11.5%) vs 154 (14.4%) 1d 698 (74.3%) vs 922 (85.7%) 2a. 546 (40.4%) vs 503 (32.5%) p<0.0001 2b. 804 (59.6%) vs 1043(67.5%)p<0.0001	1. Number of severely undertransfused patients. (primary outcome)	No evidence of severely undertransfused patients found	1	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	2. Final total appropriateness ratings of DS interventions. Number (%), 2 sided p value 2a. Appropriate transfusion decision 2b. Inappropriate transfusion decision					
Rotman, 1996[143]	1 y study period. Prespecified 1. Rate of clinically relevant drug interactions.	1. No difference Note: CCDSS was used to write only 2.8% of prescriptions (75 of 2570).	1. Health outcomes (details not specified).	1. NS	0	0
Roukema, 2008[144]	1. number (proportion) of patients for whom tests were ordered (for intervention group, proportion out of cases in which CCDSS advised to order lab tests)(not clearly pre-specified)	1. 61 (82%) vs 40 (44%) (p value not provided but reported as significant)	1. median (interquartile range) time (min) spent at ED (pre-specified) 2. median (interquartile range) time (min) spent at ED for patients who had lab tests ordered (not prespecified)	1. ITT - 138 (104-181) vs 123 (83 vs 179) p=0.16 Per protocol 140 (116-184) vs 123 (83-179) p=0.06 2. 149 (116-184) vs 160 (15-213) p=0.43	1	0
Rubenstein, 1995[145]	1. Mean (SD) and difference (95%CI) for number of clinical problems per patient in medical records during 6 mo follow-up that were listed in the visit (prespecified). 2. Mean (SD) and difference (95%CI) for number of functional status interventions per patient	1. 4.9 (3.4) vs 4.1 (2.9); 0.8 (0.2 to 1.5), p<0.01 2. 3.3 (3.7) vs 2.5 (3.3); 0.8 (0.1 to 1.6), p=0.05 3a. 231 vs 95 3b. 81% vs 71%; 10% (1 to 19), p<0.02 4. Data not reported.	1. Mean change (difference, 95% CI) in patient functional status during 6 mo follow-up (scale 0-100, 100=highest performance). (predefined) 1a. Basic activities of	1a. 0.5 vs 0.1; 0.44 (-3.2 to 4.1), p=0.81 1b. 0.9 vs 1.1; -0.2 (-4.6 to 4.2), p=0.92 1c. 1.3 vs -3.2; 4.5 (0.5 to 8.3), p=0.03 1d. 3.3 vs -1.5; 4.8 (-0.8 to 10.4), p=0.09 1e. 0.2 vs -0.8; 1.0 (-	...	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	with functional status problems during 6 mo follow-up (prespecified). 3. Functional status interventions during 6 mo follow-up (prespecified). 3a. Total number. 3b. Proportion of interventions recommended in study materials. 4. Physician attitudes toward managing functional status at end of study (prespecified).		daily living. 1b. Intermediate activities of daily living. 1c. Mental health. 1d. Social activities. 1e. Work performance. 2. % patients (difference, 95%CI)identified as having specific mpairments during 6 mo follow-up (prespecified). 2a. Physical, psychological, or social function impairment. 2b. Depression or anxiety. 2c. Depression. 2d. Anxiety. 2e. Social problems. 2f. Physical function impairments. 3. Mean change adjusted by baseline scores (difference, 95% CI) in social activities scores by age group over 6 mo follow-up (unclear if analysis by age groups was preplanned). 3a. <50y of age.	4.4 to 6.6), p=0.70 2a. 37% vs 25%; 12% (2 to 2.1) CIs are not consistent with data and author did not respond to request for confirmation. However, no significant p-value reported for this comparison. 2b. 30% vs 21%; 9% (1 to 20), p<0.05 2c. 23% vs 20%, 3% (-5 to 12), p=NS 2d. 13% vs 4%; 9% (3 to 15), p<0.01 2e. 17% vs 10%; 7% (0 to 15), p<0.10 2f. 6% vs 5%; 1% (-4 to 5), p=NS 3a. 1.13 (n=83) vs 4.49 (n=79); -3.36 (-9.0 to 2.3), p=0.24 3b. 1.96 (n=47) vs -8.31 (n=42); 10.27 (-1.8 to 22.3), p=0.10 3c. 9.50 (n = 40) vs -10.09 (n = 22); 19.59 (1.96 to 36), p=0.03 Interaction for		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			3b. 50-69y of age. 3c. >69y of age.	intervention by age, p<0.01		
Saager, 2008[146]	Primary outcome=decrease in blood glucose. 1 Operating room outcomes: 1a. Blood glucose in range (90 to 150 mg/dL), %. 1b. Time in range (minutes)(?mean, SD). 2 Intensive care unit outcomes: 1 Operating room outcomes: 2a. Blood glucose in range (90 to 150 mg/dL), %. 2b. Time in range (minutes)(?mean, SD).	1a. 49% vs 27%; p<0.001 1b. 121 (67) vs 64 (85): p=0.02 2a. 84% vs 60%; p<0.001 2b. 536 (135) vs 377 (214); p=0.01	Primary o/c = decrease in blood glucose. 1 Operating room outcomes: 1a. Mean (?SD) blood glucose (BG) (mg/dL). 1b. Mean (?SD) time to BG<150 mg/dL (min). 2 Intensive care unit outcomes: 2a. Mean (?SD) BG (mg/dL). 2b. Mean (?SD) time to BG<150 mg/dL (min). (Outcomes not prespecified) 3. Number of episodes of hypoglycemia (BG<60 mg/dL). 3a. Operating room. 3b. Intensive care unit: 4. Length of surgery, minutes (unclear if mean and SD) 5. Length of cross-clamp, minutes (unclear if mean and SD) 6. Cardiopulmonary	1a. 147 (19) vs 177 (36); p<0.001 1b. 62 (92) vs 91 (121); p=0.55 2a. 126 (18) vs 147 (27); p=0.01 2b. 40 (97) vs 171 (238); p=0.02 3a. 1 vs 0; p=1.00 3b. 4 vs 1; p=0.60 Note: 3 of 4 episodes of hypoglycemia in the ICU occurred within the same patient. 4. 290 (67) vs 281 (82); p=0.69 5. 85 (34) vs 77 (29); p=0.44 6. 135 (33) vs 123 (43); p=0.36 7. 2.5 (2 to 6) vs 2.5 (2 to 4.75); p=0.825 8. 9.5 (6 to 11.75) vs 7.0 (6 to 11.75); p=0.183 9. No differences, data not reported 10. No differences at any time point, data	1	1

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			bypass times, minutes (unclear if mean and SD) 7. Median ICU length of stay, days (IQR) 8. Hospital length of stay, days (IQR) 9. Postoperative complications (arrhythmias, prolonged intubation, infection, stroke or myocardial infarction). 10. Troponin 1, brain natriuteric peptide and ketones, measured at baseline, after removal of cross-clamp, and at 6 and 12 hours after surgery.	not reported. (Author has not responded to multiple queries about results being means and SDs)		
Schriger, 2001[147]	Primary Outcome 1. Proportion of patients assigned a psychiatric diagnosis by CCDSS over 18 months (n/N, %, difference, 95% CI) who received: 1a. psychiatric diagnosis in ED. 1b. psychiatric consultation or referral in ED. 1c. Psychiatric diagnosis, consultation or referral in ED. Prespecified. 2. Proportion of patients with PRIME-MD (computerized	1a. 3/34, 9% vs 4/45, 9%; 0% (-13 to 14) 1b. 3/34, 9% vs 3/45, 7%; 2% (-11 to 16) 1c. 6/34, 18% vs 4/45, 9%; 9% (-8 to 26) 2. N=92 vs 98 2a. 37% vs 46% (difference 9%, 95% CI -5 to 23) 2b. 18% vs 28% 2c. 12% vs 8% 2d. 2% vs 7% 2e. 5% vs 3%	...	...	0	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	interview) or psychiatric diagnosis in ED over 18 months. 2a. Any PRIME-MD diagnosis. 2b. 1 PRIME-MD diagnosis. 2c. 2 PRIME-MD diagnoses. 2d. 3 PRIME-MD diagnoses. 2e. >3 PRIME-MD diagnoses. 2f. Any mood diagnosis. 2g. Major depressive diagnosis. 2h. Partial remission of major depressive diagnosis. 2i. Dysthymia. 2j. Minor depressive disorder. 2k. Rule out bipolar disorder. 2l. Any anxiety diagnosis. 2m. Panic disorder. 2n. Generalized anxiety disorder. 2o. Anxiety disorder (not otherwise speficied). 2p. Any alcohol abuse/dependence. 2q. Any eating disorder. 2r. Any OCD diagnosis. 2s. Any phobia diagnosis. 3. Items documented in medical encounter over 18 months (% patients). 3a. Psychiatric history. 3b. Notation of alcohol use. 3c. General physical exam. 3d. Eye, ears, nose, throat exam. 3e. Physical exam: cardiovascular. 3f. Physical exam: respiratory.	2f. 22% vs 30% 2g. 16% vs 16% 2h. 2% vs 4% 2i. 8% vs 9% 2j. 4% vs 8% 2k. 3% vs 4% 2l. 24% vs 23% 2m. 10% vs 3% 2n. 9% vs 6% 2o. 15% vs 14% 2p. 9% vs 15% 2q. 2% vs 2% 2r. 12% vs 5% 2s. 3% vs 4% 3. N=92 vs 98 3a. 30% vs 34% 3b. 62% vs 62% 3c. 94% vs 97% 3d. 83% vs 85% 3e. 82% vs 84% 3f. 86% vs 84% 3g. 67% vs 70% 3h. 73% vs 75% 3i. 67% vs 67% 3j. 78% vs 84% 3k. 38% vs 33% 3l. 5% vs 7% 3m. 3% vs 4%				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	3g. Physical exam: gastrointestinal. 3h. Physical exam: muscular. 3i. Physical exam: neurologic. 3j. Evaluation of orientation and level of consciousness. 3k. Checked 'mood normal' box on chart. 3l. Detailed assessment of affect. 3m. Evaluation of memory, cognition, or reasoning.					
Selker, 2002[148]	No clearly pre-specified outcomes – subgroup analyses not pre-specified. 1a. Number of patients who had ST-segment elevation detected but did not have AMI. 1b. Number (%) of patients in 1a who received thrombolytic therapy 1c. Number (%) of patients who received thrombolytic therapy and had contraindications 2. The effect of the CCDSS (TPI) on treatment of patients with acute myocardial infarction: % of patients, Relative Risk (95% CI) (adjusted), P-value 2a. all patients; thrombolytic therapy within 1 hour 2b. all patients; thrombolytic therapy 2c. all patients, thrombolytic	1a. 208 vs 191 1b. 3 (1.4%) vs 1 (0.5%), p>0.2 1c. 1 (0.3%) vs 2 (0.6%), p>0.2 2a. 53.3% vs 52.5%, 1.0 (0.9 to 1.2), p>0.2 2b. 62.1% vs 60.5%, 1.1 (0.96 to 1.1), p=0.2 2c. 70.3% vs 67.6%, 1.0 (0.97 to 1.1), p=0.2 2d. 58.6% vs 53.2%, 1.1 (0.9 to 1.3), p=0.08 2e. 67.6% vs 61.1%, 1.1 (1.01 to 1.2), p=0.03 2f. 74.7% vs 67.7%, 1.1 (1.01 to 1.2), p=0.03 2g. 45.3% vs 51.4%, 0.9 (0.8 to 1.1), p>0.2 2h. 53.9% vs 59.5%, 0.9 (0.8 to 1.1), p>0.2 2i. 63.8% vs 67.6%, 1.0	1. Proportion of patients who died within 30 day follow-up (P-value) 2. Number (%) of strokes within 30 day follow-up (P-value). 3. Number (%) of thrombolysis-related bleeding events that required transfusion during the 30 day follow-up (P-value).	1. 5.0 vs 3.4 (p = 0.15) 2. 3 (0.5%) vs 3 (0.5%) (p > 0.2) 3. 22 (5.8%) vs 16 (4.5%) (p > 0.2)	0	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	therapy or PTCA	(0.8 to 1.1), p>0.2				
	2d. patients with inferior AMI; thrombolytic therapy within 1 hour	3a. 48.4% vs 40.5%, 1.2				
	2e. patients with inferior AMI; thrombolytic therapy	(0.96 to 1.5), p=0.10 3b. 58.2% vs 48.1%, 1.2				
	2f. patients with inferior AMI, thrombolytic therapy or PTCA	(1.01 to 1.5), p=0.03 3c. 65.7% vs 55.7%, 1.2				
	2g. patients with anterior AMI; thrombolytic therapy within 1 hour	(1.0 to 1.4), p=0.04 3d. 55.9% vs 58.0%, 1.0				
	2h. patients with anterior AMI; thrombolytic therapy	(0.9 to 1.1), p>0.2 3e. 64.2% vs 66.2%, 1.0				
	2i. patients with anterior AMI, thrombolytic therapy or PTCA	(0.9 to 1.1), p>0.2 3f. 72.8% vs 73.1%, 1.0				
		(0.9 to 1.1), p>0.2				
	3. The effect of the CCDSS (TPI) on treatment of patients with acute myocardial infarction: % of patients, Relative Risk (95% CI) (adjusted), P-value	4a. 53.6% vs 41.1%, 1.3				
		(1.01 to 1.7), p=0.04 4b. 63.2% vs 47.3%, 1.3				
		(1.2 to 3.1), p=0.01				
	3a. women; thrombolytic therapy within 1 hour	4c. 66.4% vs 50.7%, 1.3 (1.1 to 1.6), p=0.01				
	3b. women; thrombolytic therapy					
	3c. women; thrombolytic therapy or PTCA	5a. 58.8% vs 40.9%, 1.4 (0.8 to 2.6), p=0.19				
	3d. men; thrombolytic therapy within 1 hour	5b. 76.5% vs 50.0%, 1.5 (0.97 to 2.4), p=0.04				
	3e. men; thrombolytic therapy	5c. 79.4% vs 54.6%, 1.5				
	3f. men; thrombolytic therapy or PTCA	(0.96 to 2.2), p=0.05				
	4. The effect of the CCDSS (TPI) on treatment of patients with acute myocardial infarction for whom					

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	physician consultation was entirely by telephone: % of patients, Relative Risk (95% CI) (adjusted), P-value 4a. thrombolytic therapy within 1 hour 4b. thrombolytic therapy 4c. thrombolytic therapy or PTCA 5. The effect of the CCDSS (TPI) on treatment of patients with acute myocardial infarction who presented to hospitals without an on-site emergency department physician: % of patients, Relative Risk (95% CI) (adjusted), P-value 5a. thrombolytic therapy within 1 hour 5b. thrombolytic therapy 5c. thrombolytic therapy or PTCA					
Sequist, 2005[149]	1. Receipt of recommended care for diabetes using the 5-item composite outcome during the 6 mo study, % patients; OR (95% CI). (Primary) 2. Receipt of recommended care for CAD using the 4-item composite outcome during the 6 mo study, %; OR (95% CI). (Primary) 3. Receipt of recommended	1. 19% vs 14%; 1.30 (1.01 to 1.67) 2. 22% vs 17%; 1.25 (1.01 to 1.55) 3a. 1.41 (1.15 to 1.72), p=0.001 3b. 1.14 (0.89 to 1.46), p=0.29 3c. 1.38 (0.81 to 2.32), p=0.23	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	components of diabetes care during the 6 mo study; hazard Ratio (95% CI)(components of primary): 3a. Annual cholesterol exam. 3b. Biennial hemoglobin Alc exam 3c. Annual dilated eye exam 3d. Hypertension/ACE inhibitor use 3e. Statin use for LDL cholesterol ≥ 130 mg/dL 4. Receipt of recommended components of CAD care during the 6 mo study; hazard Ratio (95% CI) (components of primary): 4a. Annual cholesterol exam 4b. Aspirin use 4c. Beta-blocker use 4d. Statin use for LDL cholesterol ≥130 mg/dL Not prespecified 5. Mean number of diabetes reminders per patient. 6. Mean number of CAD reminders per patient. Note: HR>1 = benefit for CCDSS	3d. 1.42 (0.94 to 2.14), p=0.10 3e. 1.10 (0.65 to 1.85), p=0.73 4a. 0.99 (0.75 to 1.29), p=0.92 4b. 2.36 (1.37 to 4.07), p=0.002 4c. 1.09 (0.72 to 1.63), p=0.69 4d. 1.51 (1.05 to 2.17), p=0.03 5. 6.1 vs 6.7, p=0.004 6. 4.3 vs 5.4, p<0.001				
Sequist, 2009[150]	Patient mailed reminder vs control (regardless of physician intervention) (N=10930 vs N=10930) 1. N(%) of individual tests	1a. 2779 (25.4%) vs 2225 (20.4%), 5.1% (3.8 to 6.3), p<.001 1b. 47/2779 (1.7%) vs 12/2225 (0.5%) 1.2% (0.6	1. N (%) of pathologic findings, % difference, (95% CI), p value (secondary) 1a. Colonic adenoma	1a. 622 (5.7%) vs 568 (5.2%) 0.5% (-0.1 to 1.1), p=0.10 1b. 19 (0.2%) vs 15 (0.2%) 0.0% (-0.1 to	0	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	performed, % difference, (95% CI), p value 1a. FOBT (primary) 1b. Positive FOBT result (among FOBT) 1c. Follow-up colonoscopy (among positive FOBT result) 1d. Flexible sigmoidoscopy (primary) 1e. Colonoscopy (primary) 1f. % order for colonoscopy placed during the study Physician reminder vs control (regardless of patient reminder) (N=10912 vs N=10948) 2. N(%) of individual tests performed, % difference, (95% CI), p value 2a. FOBT (primary) 2b. Positive FOBT result(among FOBT) 2c. Follow-up colonoscopy (among positive FOBT result) 2d. Flexible sigmoidoscopy (primary) 2e. Colonoscopy (primary) 2f. % order for colonoscopy placed during the study Patient mailing (with vs without patient mailing, regardless of physician intervention or not)	to 1.7), p<.001 1c. 33/47 (70.2%) vs 10/12 (83.3%), -11.9% (-37.9 to 14.1), p=0.36 1d. 11 (0.1%) vs 9 (<0.1%), 0.0% (-0.1 to 0.1), p=0.66 1e. 2014 (18.4%) vs 1933 (17.7%), 0.7% (-0.3 to 1.8), p=0.17 1f. 31.8% vs 30.9%, p=0.12 2a. 2505 (23.0%) vs 2499 (22.8%), 0.1% (-5.5 to 5.7), p=0.96 2b. 27/2505 (1.1%) vs 32/2499 (1.3%), -0.2% (-0.8 to 0.4), p=0.52 2c. 21/27 (77.8%) vs 22/32 (68.8%), 7.8% (-15.4 to 31.0), p=0.50 2d. 10 (<0.1%) vs 10 (<0.1%), 0.0% (-0.1 to 0.1), p=0.99 2e. 2056 (18.8%) vs 1891 (17.3%), 1.6% (-0.7 to 3.9), p=0.18 2f. 33.1% vs 29.6%, p=.004 3a. 44% vs 38.1%, 5.8% (4.5 to 7.1), p<.001 3b. 42.1% vs 38.4%, 3.7% (2.0 to 5.5), p<.001	1b. Colorectal cancer 2. N (%) of pathologic findings, % difference, (95% CI), p value (secondary) 2a. Colonic adenoma 2b. Colorectal cancer	0.1), p=0.43 2a. 650 (6.0%) vs 540 (4.9%) 1.0% (-0.1 to 2.2), p=0.09 2b. 17 (0.2%) vs 17 (0.2%) 0.0% (-0.1 to 0.1), p=0.99		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	(N=10930 vs N=10930) (Subgroup analyses not prespecified.) 3. % of patients who completed screening by grouping, % difference, (95% CI), p value 3a. All patients 3b. Patients aged 50-59 3c. Patients aged 60-69 3d. Patients aged 70-80 3e. Trend towards effectiveness in older patients 3f. Females 3g. Males 3h. 0 primary care visits i. 1-2 primary care visits 3j. ≥3 primary care visits	3c. 45.4% vs 38.0%, 7.3% (4.5 to 10.1), p<.001 3d. 47.4% vs 37.3%, 10.1% (7.0 to 13.2), p<.001 3e. p=.01 3f. 44.3% vs 38.6%, 5.7% (4.0 to 7.4), p<.001 3g. 43.5% vs 37.5%, 6.0% (4.1 to 7.9), p<.001 3h. 19.6% vs 15.6%, 3.9% (2.2 to 5.6), p<.001 3i. 55.6% vs 49.0%, 6.6% (4.7 to 8.4), p<.001 3j. 59.5% vs 52.3%, 7.1% (4.4 to 9.8), p<.001				
	Physician Reminder (with vs without physician reminder, regardless of patient intervention of not) (Subgroup analyses not prespecified.) 4. % of patients who completed screening by grouping, % difference, (95% CI), p value 4a. All patients 4b. Patients aged 50-59 4c. Patients aged 60-69 4d. Patients aged 70-80 4e. Females 4f. Males	4a. 41.9% vs 40.2%, 1.6% (-2.7 to 5.9), p=0.47 4b. 40.9% vs 39.7%, 1.0% (-3.2 to 5.1), p=0.64 4c. 43.2% vs 40.4%, 2.7% (-2.4 to 7.8), p=0.29 4d. 43.4% vs 41.5 %, 2.0% (-3.8 to 7.8), p=0.50 4e. 42.8% vs 40.2%, 2.2% (-2.6 to 7.1), p=0.36 4f. 40.8% vs 40.1%, 0.7% (-4.7 to 6.2), p=0.79 4g. 19.1% vs 16.0%, 3.0% (-1.1 to 7.2), p=0.15 4h. 53.2% vs 51.5%, 1.6% (-3.8 to 7.1), p=0.56 4i. 59.5% vs 52.7%, 6.0% (-				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	4g. 0 primary care visits 4h. 1-2 primary care visits 4i. ≥3 primary care visits 5a. Screening rates by physician reminder and patient mailing vs patient mailing vs physician reminder vs neither reminder nor mailing 5b. Interaction between patient intervention and physician intervention, % difference between combined intervention and sum of individual intervention, (95% CI), p value	0.5 to 12.5), p=0.07 5a. 44.2% vs 43.7% vs 39.6% vs 36.7% 5b. -0.6% (-1.2% to 0.1%), p=0.08				
Stengel, 2004[151]	1a. Median (IQR) number of diagnoses per patient (primary outcome) 1b. Number (proportion) of ICD codes that were false or redundant 1c. Number of diagnoses per patient after correction for quasi-false-positives 2. Mean (95% CI) coding quality of patient records during the study period (pre-specified secondary outcome) 2a. regularly performed data entry 2b. detailed depiction of clinical findings 2c. correct assessment of patient's	1a. 9 (6 to 14) vs 4 (3 to 5) (p<0.0001) 1b. 48(11.7%) vs 7(4.5%); risk diff 7.2%, 95%CI 2.0% to 11.4% 1c. p<0.0001 2a. 1.90 (1.63 to 2.17) vs 2.71 (2.38 to 3.08) (p<0.0004) 2b. 1.59 (1.38 to 1.86) vs 2.08 (1.84 to 2.33) (p<0.0045) 2c. 1.87 (1.64 to 2.10) vs 2.53 (2.34 to 2.83) (p<0.0026) 3. 411 vs 157	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	progress and translation into ICD diagnoses 3. Total number of ICD diagnoses generated by each documentation method (not pre-specified)					
Sundaram, 2009[152]	1. Proportion of change in HIV testing rates (primary) 2. Number (%) of patients tested for HIV, baseline (6 mo preintervention) / follow-up (6 mo during intervention) 3. Among tested patients, number (%) of tests: baseline (6 mo preintervention) / follow-up(6 mo during intervention) (secondary) 3a. with documented risk behaviour* (incl. alcohol use only) 3b. with documented risk behaviour* (excl. alcohol use only) 3c. patient requested test 3d. reason for test unclear 3e. guideline concordant testing 4. Among untested patients, number (%) of tests: baseline (6 mo preintervention) / follow-up(6 mo during intervention), % (secondary) 4a. risk assessment done 4b. with documented risk	1. 0.29% vs 0.52%, p=0.75 2. 98/5484 (1.78%) / 114/6207 (1.84%), p=0.57 vs 67/6976 (0.96%) / 106/7375 (1.44%), p=0.3 3a. 64/98 (65%) / 91/114 (80%) vs 43/67 (64%) / 81/106 (76%) 3b. 54/98 (55%) / 87/114 (76%) vs 37/67 (55%) / 70/106 (66%) 3c. 36/98 (37%) / 39/114 (34%) vs 29/67 (43%) / 44/106 (42%) 3d. 14/98 (14%)/7/114 (6%) vs 11/67 (16%) / 11/106 (10%) 3e. 84/98 (86%) / 107/114 (94%) vs 56/67 (84%) / 94/106 (89%) 4a. 11/154 (7%) / 27/200 (14%) vs 8/199 (4%) / 8/200 (4%)	...	...	0	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	behaviour* (incl. alcohol use) 4c. with documented risk behaviour* (excl. alcohol use) 4d. test offered 4e. provider action guideline concordant * risk behaviour defined in article using CDC guidelines	4b. 62/154 (40%) / 68/200 (34%) vs 73/199 (37%) / 71/200 (36%) 4c. 47/154 (31%) / 52/200 (26%) vs 52/199 (26%) / 53/200 (27%) 4d. 2/154 (1%) / 0/200 (0%) vs 0/199 (0%) / 2/200 (1%) 4e. 56/154 (36%) / 62/200 (31%) vs 54/199 (27%) / 67/200 (34%)				
Tamblyn, 2003[153]	Primary outcomes (initiation and discontinuation rates) over 13-mo study. 1. Number of inappropriate prescriptions started per 1000 visits; Number (%) of patients given an inappropriate prescription; RR (95% CI). 2. Number of pre-existing inappropriate prescriptions discontinued per 1000 visits; Number (%) of patients with pre-existing inappropriate prescriptions discontinued; RR (95% CI). 2a. Any prescriptions. 2b. All prescriptions. Secondary outcomes over 13-mo study. 3. Number of inappropriate	1. 43.8 vs 52.2; 755/4767, 15.8% vs 909/4603, 19.7%; 0.82 (0.69 to 0.98) 2a. 71.4 vs 67.4; 1002/1578, 63.5% vs 1045/1670, 62.6%; 1.06 (0.89 to 1.26) 2b. 35.5 vs 32.1; 47.5% vs 44.5%; 1.14 (0.98 to 1.33). 3a. 16.6 vs 18.4; 0.89 (0.72 to 1.10) 3b. 10.7 vs 13.7; 0.77 (0.59 to 1.00) 3c. 13.3 vs 17.1; 0.78 (0.61 to 0.99) 3d. 6.1 vs 6.8; 0.87 (0.69 to 1.11) 3e. 1.6 vs 1.5; 1.12 (0.68 to 1.87)	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	prescriptions started per 1000 visits by type of prescribing problem; RR (95% CI). 3a. Drug–disease contraindication. 3b. Drug–age contraindication. 3c. Excessive duration of therapy. 3d. Therapeutic duplication. 3e. Drug interaction. 4. Number of patients starting an inappropriate prescription by type of prescribing problem, n/N, %. 4a. Drug–disease contraindication. 4b. Drug–age contraindication. 4c. Excessive duration of therapy. 4d. Therapeutic duplication. 4e. Drug interaction. 5. Number of pre-existing inappropriate prescriptions discontinued per 1000 visits, by type of prescribing problem; RR (95% CI). 5a. Drug–disease contraindication. 5b. Drug–age contraindication. 5c. Excessive duration of therapy. 5d. Therapeutic duplication 5e. Drug interaction. 6. Number of patients with pre-existing inappropriate prescriptions discontinued, by type of prescribing problem, n/N, %. 6a. Drug–disease contraindication.	4a. 396/5520, 7.2% vs 470/5469, 8.6% 4b. 283/5727, 4.9% vs 375/5516, 6.8% 4c. 361/5791, 6.2% vs 499/5768, 8.7% 4d. 179/6193, 2.9% vs 217/6188, 3.5% 4e. 49/6221, 0.79% vs 51/6212, 0.82% 5a. 62.6 vs 57.9; 1.08 (0.85 to 1.36) 5b. 40.7 vs 42.9; 0.94 (0.79 to 1.13) 5c. 32.3 vs 32.6; 1.00 (0.77 to 1.29) 5d. 317.1 vs 334.0; 0.94 (0.59 to 1.51) 5e. 68.6 vs 51.5; 1.33 (0.90 to 1.95) 6a. 552/933, 59.2% vs 522/881, 59.3% 6b. 330/636, 51.9% vs 401/812, 49.4% 6c. 196/506, 38.7% vs 208/548, 40.0% 6d. 146/150, 97.3% vs 170/176, 96.6% 6e. 106/148, 71.6% vs 89/134, 66.4%			

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	6b. Drug–age contraindication. 6c. Excessive duration of therapy. 6d. Therapeutic duplication. 6e. Drug interaction. 7. Inappropriate prescriptions discontinued for excessive duration of therapy, by source of prescription. 7a. Total number of pre-existing inappropriate prescriptions. 7b. Study physician as prescriber: % prescriptions, number of discontinuations per 1000 visits; RR (95% CI). 7c. Study physician + another physician as prescribers: % prescriptions, number of discontinuations per 1000 visits; RR (95% CI). 7d. Another physician as prescriber: % prescriptions, number of discontinuations per 1000 visits; RR (95% CI). 8. Inappropriate prescriptions discontinued for therapeutic duplication, by source of prescription. 8a. Total number of pre-existing inappropriate prescriptions. 8b. Study physician as prescriber: % prescriptions, number of discontinuations per 1000 visits; RR	7a. 506 vs 548 7b. 63.6%, 63.7 vs 65.5%, 59.7; 1.06 (0.8 to 1.5) 7c. 13.4%, 16.3 vs 13.0%, 11.4; 1.43 (0.7 to 3.1) 7d. 22.9%, 46.4 vs 21.5%, 42.3; 1.09 (0.63 to 1.89) 8a. 148 vs 174 8b. 21.6%, 388.1 vs 17.8%, 495.7; 0.78 (0.3 to 2.2) 8c. 35.8%, 519.6 vs 40.2%, 312.1; 1.66 (0.99 to 2.79) 8d. 42.5%, 662.5 vs 42.0%, 585.6; 1.10 (0.65 to 1.85) 9a. 148 vs 133 9b. 29.7%, 165.1 vs 35.3%, 76.5; 2.15 (0.98 to 4.70) 9c. 36.5%, 74.6 vs 36.8%, 56.1; 1.33 (0.74 to 2.54) 9d. 33.8%, 81.8 vs 27.8%, 122.0; 0.75 (0.35 to 1.59) 10a. 0.70 (0.55 to 0.89) 10b. 1.03 (0.82 to 1.29) 11. 1.17 vs 0.93, P=.32 for study group/computer experience interaction. Note: Non-CCDSS factors affecting prescribing				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	(95% CI). 8c. Study physician + another physician as prescribers: % prescriptions, number of discontinuations per 1000 visits; RR (95% CI). 8d. Another physician as prescriber: % prescriptions, number of discontinuations per 1000 visits; RR (95% CI). 9. Inappropriate prescriptions discontinued for drug interaction, by source of prescription. 9a. Total number of pre-existing inappropriate prescriptions. 9b. Study physician as prescriber: % prescriptions, number of discontinuations per 1000 visits; RR (95% CI). 9c. Study physician + another physician as prescribers: % prescriptions, number of discontinuations per 1000 visits; RR (95% CI). 9d. Another physician as prescriber: % prescriptions, number of discontinuations per 1000 visits; RR (95% CI). Unspecified subgroup analyses. 10. Rate of inappropriate prescriptions: CCDSS vs control	included increased copayments for prescriptions when study started, and frequent hardware and software problems early in study (affecting 22% of physicians).				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	group; RR (95% CI). 10a. Experienced computer users (those who had used computers for recreational or work-related activities). 10b. Inexperienced computer users. 11. Rate of discontinuation of inappropriate prescriptions: RR (CCDSS vs control) for experienced and inexperienced users.					
Terrell, 2009[154]	Pre-specified primary 1. Number (%) of ED visits by older adults that resulted in prescriptions for one of more of the nine targeted inappropriate medications; odds ratio (95% CI), P-value. Pre-specified secondary 2. Number (%) of all prescribed medications that were potentially inappropriate; odds ratio (95% CI), P-value. Pre-specified 3. Number of times that each potentially inappropriate medication was initially prescribed (n)/ changed to an alternate treatment (n, %) in the CCDSS group vs prescribed in the control	1. 69 (2.6%) vs 99 (3.9%); 0.55 (0.34 to 0.89), p=0.02 2. 69 (3.4%) vs 103 (5.4%); 0.59 (0.41 to 0.85), p=0.006 3a. 32 / 19 (59%) vs 40 3b. 22 / 8 (36%) vs 15 3c. 18 / 5 (28%) vs 10 3d. 8 / 2 (25%) vs 9 3e. 15 / 6 (40%) vs 9 3f. 1 / 0 (0%) vs 8 3g. 5 / 2 (40%) vs 7 3h. 3 / 2 (67%) vs 4 3i. 10 / 5 (50%) vs 1 3j. 114 / 49 (43%) vs 103	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	group (n). 3a. Promethazine 3b.Diphenhydramine 3c. Diazepam 3d. Propoxyphene with acetaminophen 3e. Hydroxyzine 3f. Amitriptyline 3g. Cyclobenzaprine 3h. Clonidine 3i. Indomethacin 3j. All inappropriate medications					
Thomas, 1983[155]	Prespecified 1. Mean (?SD or SE) number of visits to diabetic clinic in 1 yr. Not clearly prespecified. 2. n/N, % suggestions followed for 58 vs 75 patients over 1 yr. Note: This is a preliminary study report. The full report does not appear to have been published.	1. 4.6 (1.5) vs 4.8 (2.05), p=NS 2. 394/784, 50.25% vs 482/1291, 37.5%, p<0.001	Prespecified 1. Number of ED visits. 2. n/N, %, of patients hospitalized at 1 yr. 3. Number of hospitalizations at 1 yr. 4. Total days hospitalized. 5. Mean (SD) days hospitalized. 6. Change in BP at 1 yr. 7. Change in obesity at 1 yr. 8. Change in glucose at 1 yr.	1. Data NR, p=NS 2. 12/58, 20.7% vs 20/75, 26.7% 3. 20 vs 41 4. 196 vs 594, p=0.005 5. 9.8 (11.6) vs. 14.5 (16.7) 6. Data NR, p=NS 7. Data NR, p=NS 8. Data NR, p=NS	0	...
Thomas, 2004[156]	1. % patients satisfied with GP (prespecified) 1a. at 6 weeks 1b. at 6 months	1a. 75% vs 72%, P=0.56 1b. No data reported, NS	1. General Health Questionnaire score (lower is better), (95% CI), p-value (primary). a. at 6 weeks b. at 6 months	1a. 14.8 (14.0 to 15.6) vs 16.0 (15.2 to 16.8), p=0.04 1b. 14.2 (13.2 to 15.2)vs 14.5 (13.6 to 15.4), p=0.61	0	1

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			2. Mean QoL score (95% CI), p-value (prespecified) a. at 6 weeks b. at 6 months 3. Recovery rate (%), (95% CI), p-value (prespecified) a. at 6 weeks b. at 6 months	2a. 5.9 (5.5 to 6.2) vs 5.8 (5.4 to 6.1), P = 0.73 2b. 6.4 (6.0 to 6.9) vs 6.2 (5.8 to 6.6), P = 0.52 3a. 38 (33 to 43) vs 35 (30 to 40), P = 0.38 3b. 35 (30 to 40) vs 39 (34 to 44), P = 0.20		
Thomas, 2006[157]	1. Median {IQR} number of targeted tests requested per 10,000 patients per practice during 12 month period (primary); OR (95% CI) for reminders with or without feedback vs feedback without reminders or control*; OR (95% CI) for feedback with or without reminders vs reminders without feedback or control*. OR<1 indicates intervention group better (i.e., less likely to order targeted test). 1a. Total. 1b. Autoantibody screen. 1c. Carbohydrate antigen-125. 1d. Carcino-embryonic antigen.	1. Reminders vs feedback + reminders vs feedback vs control 1a. 1317 {719 to 1590} vs 1041 {362 to 1515} vs 1079 {575 to 1818} vs 1226 {726 to 2057}; 0.89 (0.83 to 0.93), p=0.003; 0.87 (0.81 to 0.94), p=0.0004 1b. 36 {18 to 63} vs 31 {10 to 66} vs 33 {20 to 49} vs 41 {13 to 64}; 0.96 (0.82 to 1.12), p=0.599; 0.78 (0.67 to 0.91); p=0.002 1c. 12 {4 to 23} vs 11 {4 to 19} vs 11 {3 to 19} vs 16 {9 to 25}; 0.89 (0.61 to 1.30), p=0.537; 0.94 (0.65 to 1.36), p=0.726	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	1e. Ferritin.	1d. 10 {3 to 25} vs 6 {2 to 19} vs 9 {2 to 15} vs 11 {4 to 33}; 0.66 (0.44 to 0.98), p=0.041; 0.76 (0.52 to 1.13), p=0.177				
	1f. Follicle stimulating hormone.					
	1g. Helicobacter pylori serum.	1e. 85 {45 to 132} vs 58 {16 to 87} vs 60 {23 to 106} vs 79 {49 to 137}; 1.04 (0.81 to 1.34), p=0.746; 0.91 (0.71 to 1.18), p=0.489				
	1h. IgE.					
	1i. Thyroid stimulating hormone.					
	1j. Vitamin B12.	1f. 55 {30 to 92} vs 49 {30 to 85} vs 57 {23 to 96} vs 77 {27 to 122}; 0.96 (0.85 to 1.09), p=0.559; 0.86 (0.75 to 0.98), p=0.02				
	2. Interaction between interventions overall; OR (95% CI).					
	3. Combined intervention effect (reminder + feedback) for total targeted test requests; OR (95% CI).	1g. 76 {38 to 98} vs 63 {20 to 117} vs 66 {21 to 104} vs 56 {36 to 98}; 0.91 (0.76 to 1.09), p=0.293; 0.95 (0.74 to 1.14); p=0.589				
	4. Interaction between interventions for autoantibody screen, carbohydrate antigen-125, carcino-embryonic antigen, follicle stimulating hormone, helicobacter pylori serum, IgE, thyroid stimulating hormone, and vitamin B12; median interaction OR {IQR}.	1h. 21 {13 to 25} vs 23 {7 to 38} vs 23 {10 to 36} vs 24 {9 to 34}; 0.99 (0.79 to 1.24), p=0.909; 0.92 (0.73 to 1.16), p=0.471				
	5. For ferritin reminder; OR (95% CI)	1i. 891 {490 to 1250} vs 800 {287 to 1077} vs 802 {432 to 1359} vs 795 {552 to 1466}; 0.82 (0.83 to 0.95), p=0.001; 0.90 (0.84 to 0.97), p=0.005				
	5a. Interaction effect.					
	5b. Reminder effect.					
	5c. Feedback + reminder effect.	1j. 29 {15 to 45} vs 19 {10				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	5d. Feedback effect. 6. Prespecified subgroup analysis of possible effect moderation by pre-intervention number of test requests; OR (95% CI) for feedback / reminders.	to 40} vs 23 {15 to 48} vs 34 {13 to 52}; 0.81 (0.66 to 0.99), p=0.043; 0.81 (0.66 to 0.99), p=0.041 2. 0.98 (0.84 to 1.14) 3. 0.78 (0.71 to 0.85) 4. 0.99 {0.87 to 1.23} 5a. 0.60 (0.42 to 0.87) 5b. NS 5c. 0.58 (0.36 to 0.92) in favor of combined intervention. 5d. NS 6. 1.05 (0.95 to 1.15) / 0.96 (0.87 to 1.05)				
Thomson, 2007[158]	1. Mean (95% CI) difference in decision conflict scale score (negative difference represents lower decision conflict in CCDSS group) 1a. pre-clinic 1b. (primary) immediately post-clinic 1c. 3 month follow-up 2. (secondary) knowledge scale 2a. knowledge of aspirin pre-clinic 2b. knowledge of aspirin post-clinic 2c. knowledge of aspirin 3 month follow-up 2d. knowledge of warfarin pre-clinic 2e. knowledge of warfarin post-	1a. 0.02 (-0.22 to 0.26) 1b. -0.18 (-0.34 to -0.01), p=0.036 1c. -0.15 (-0.37 to 0.06) 2a. Not significant 2b. Not significant 2c. Not significant 2d. Not significant 2e. Not significant 2f. Not significant 3. No results provided 4a. 39/53, 73.6% vs 50/56, 81.7% (0.82, 0.68 to 0.99) 4b. 4/16, 25.0% vs 15/16, 93.8% (0.27, 0.11 to 0.63)	Secondary; 3-month follow-up 1. Number of patients admitted to hospital. 2. Adverse events. 2a. TIA 2b. Bleed with GP consultation. 2c. Stroke. 2d. Bleed requiring hospital admission. 3. (secondary) State Trait Anxiety Inventory – mean change in anxiety from pre-clinic	1. 3/53 vs 4/56 2a. 0/53 vs 1/56 2b. 0/53 vs 1/56 2c. 0/53 vs 0/56 2d. 0/53 vs 0/56 3. no difference between groups, p=0.98; -4.57 (95% CI -6.30 to -2.84) for all patients	1	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	clinic 2f. knowledge of warfarin 3 month follow-up 3. (secondary) Degner's decision-making preference scale 4. (secondary) Number (proportion) of patients who decided to start or continue warfarin (RR, 95% CI) 4a. all patients 4b. patients not already on warfarin 4c. patients already on warfarin 5. Number of consultations with GPs (secondary). 6. Number of hospital appointments (secondary).	4c. 35/37, 94.6% vs 35/40, 87.5% (1.08, 0.94 to 1.24) 5. 39 vs 32 (p=0.35) 6. 29 vs 10, p=0.06	to post-clinic			
Tierney, 1986[159]	Primary outcomes 1. Percent physician compliance with Group A and Group B preventive care protocols over 7 months (4 groups: monthly feedback + reminders at patient visit vs monthly feedback only vs reminders only vs no feedback or reminders (control)). (Limited data reported.) Group A Protocols: 1a. Fecal blood testing (n=2991).	1a. p<0.01 in favor of monthly feedback or reminders vs control* 1b. p<0.01 in favor of monthly feedback or reminders vs control* 1c. p=NS across all groups. 1d. p=NS across all groups. 1e. p=NS across all groups. 1f. p=NS across all groups. 1g. p=NS across all groups. 1h. p<0.01 in favor of	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	1b. Pneumococcal vaccination (n=1759). 1c. Antacids (n=1343). 1d. TB skin testing (n=1383). 1e. Beta blockers (n=621). 1f. Nitrates (n=518). 1g. Antidepressants (n=339) 1h. All group A protocols (n=8909). Group B Protocols: 1i. Calcium supplements (n=2713). 1j. Cervical cytology (n=1636). 1k. Mammography (n=1539). 1l. Metronidazole (n=686). 1m. Digitalis (n=678). 1n. Salicylates (n=97). 1o. Combined group B protocols (n=7349).	monthly feedback or reminders vs control* 1i. p<0.01 in favor of reminders vs control, regardless of monthly feedback 1j. p < 0.05 in favor of control vs reminders, regardless of monthly feedback 1k. p < 0.01 in favor of monthly feedback or reminders vs control* 1l. p < 0.01 in favor of reminders (without monthly feedback) vs control. 1m. p=NS across all groups. 1n. p=NS across all groups. 1o. p < 0.01 in favor of monthly feedback or reminders vs control* *Effects of monthly feedback and reminders were not additive.				
Tierney, 1988[160]	Not prespecified 1. Mean (SEM) probability of abnormal study test over 6 months.	1. 0.24 (0.006) vs 0.18 (0.005), p<0.0001	...	...	1	...
Tierney, 1993[161]	Prespecified 1. Mean reduction in time for	1. 63, p=NR 2. 34, p=NR	Predefined. 1. Mean (SE) / median	1. 7.60 (0.20) / 5 vs 8.49 (0.24) / 6,	...	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	admitting drug orders to be filled (minutes). 2. Mean reduction in time for daily drug orders to be filled (minutes).		length of hospital stay (days, % reduction). 2. Resources used 1 and 3 months after discharge (limited data). 2a. Number of primary care visits. 2b. Number of emergency department visits. 2c. Number of outpatient visits. 2d. Number of hospital readmissions.	10.5%, p=0.11 2a. P>0.20 2b. P>0.20 2c. P>0.20 2d. p>0.20		
Tierney, 2003[162]	Primary outcome (Physician intervention vs pharmacist intervention vs both intervention vs control) 1. Adherence with care suggestions over 12 months. 1a. All cardiac care suggestions. 1b. Start or increase an ACE inhibitor. 1c. Pneumococcal vaccination. 1d. Start or increase a beta-blocker. 1e. Start low-dose aspirin. 1f. Start or increase a diuretic. 1g. Start or increase a long-acting nitrate. 1h. Start an antihyperlipidemic drug.	1a. n/N suggestions (%). 152/648 (23%) vs 125/535 (23%) vs 134/514 (23%) vs 130/589 (22%), p>0.2 1b-1i. n/N patients (%) 1b. 41/109 (38%) vs 40/92 (44%) vs 39/94 (42%) vs 39/107 (36%), p>0.2 1c. 10/104 (10%) vs 7/82 (9%) vs 7/87 (8%) vs 1/82 (1%), p=0.09 1d. 15/96 (16%) vs 11/76 (14%) vs 18/91 (20%) vs 10/83 (12%), p>0.2 1e. 18/74 (24%) vs 17/72 (24%) vs 13/68 (19%) vs 23/81 (28%), p>0.2	Physician intervention vs pharmacist intervention vs both intervention vs control 1. Mean (SD) quality of life (score SF-36) at 12 mo (primary). 1a. Physical function 1b. Role physical 1c. Pain 1d. General health 1e. Vitality 1f. Social function 1g. Role emotional 1h. Mental health 2. Mean (SD) quality of	1a. 36 (27) vs 38 (26) vs 39 (27) vs 42 (26), p=NS 1b. 35 (40) vs 37 (41) vs 40 (42) vs 43 (42), p=NS 1c. 47 (28) vs 53 (29) vs 52 (27) vs 53 (28), p=NS 1d. 38 (22) vs 41 (24) vs 39 (22) vs 42 (24), p=NS 1e. 40 (23) vs 40 (25) vs 44 (24) vs 44 (25), p=NS 1f. 65 (30) vs 66 (31) vs 64 (32) vs 69 (28), p=NS	0	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	1i. Start or increase a calcium blocker. 2. Medication compliance over 12 months (secondary). 3. Patient satisfaction with physicians over 12 months(secondary). 4. Patient satisfaction with pharmacist over 12 months(secondary).	1f. 17/71 (24%) vs 11/53 (21%) vs 13/62 (21%) vs 20/73 (27%), p>0.2 1g. 6/30 (20%) vs 8/34 (24%) vs 8/44 (18%) vs 3/25 (12%), p>0.2 1h. 7/22 (32%) vs 5/15 (33%) vs 11/22 (50%) vs 8/22 (36%), p>0.2 1i. 7/21 (33%) vs 5/13 (39%) vs 6/23 (26%) vs 10/17 (59%), p>0.2 2. Data not reported, p>0.69 3. Data not reported, p>0.5 4. Data not reported, p>0.4	life (Chronic heart disease questionnaire subscale scores) at 12 months (primary). 2a. Overall health status 2b. Dyspnea 2c. Fatigue 2d. Emotion 3. Mean (SD) number of emergency department visits over 12 months (secondary). 3a. All. 3b. Heart disease specific. 4. Mean (SD) number of hospitalizations over 12 months (secondary). a. All. b. Heart disease specific. 5. Mortality over 12 months (not prespecified).	1g. 61 (46) vs 64 (44) vs 71 (43) vs 61 (44), p=NS 1h. 64 (22) vs 64 (23) vs 65 (24) vs 63 (25), p=NS 2a. 4.5 (1.2) vs 4.6 (1.2) vs 4.6 (1.3) vs 4.6 (1.2), p=NS 2b. 5.0 (1.5) vs 5.3 (1.5) vs 5.2 (1.6) vs 5.2 (1.4), p=NS 2c. 3.8 (1.4) vs 3.8 (1.5) vs 4.0 (1.5) vs 4.0 (1.3), p=NS 2d. 4.5 (1.3) vs 4.6 (1.4) vs 4.7 (1.4) vs 4.6 (1.4), p=NS 3a. 1.1 (1.9) vs 1.1 (1.8) vs 1.1 (1.4) vs 1.0 (1.7), p=NS 3b. 0.2 (0.4) vs 0.2 (0.6) vs 0.1 (0.4) vs 0.2 (0.5), p=NS 4a. 0.4 (1.0) vs 0.5 (1.0) vs 0.5 (1.1) vs 0.5 (1.1), p=NS 4b. 0.2 (0.6) vs 0.2 (0.7) vs 0.2 (0.6) vs 0.2 (0.5), p=NS 5. Data not reported		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
				(2% overall), p>0.9		
Tierney, 2005[163]	Physician intervention vs pharmacist intervention vs both interventions vs control: Number of patients/grp, 194 vs 161 vs 182 vs 169 Primary outcome 1. Number of suggestions adhered to/Number of patients with suggestions, %, of care suggestions adhered to over 3 yrs. 1a. Overall. 1b. Influenza vaccination. 1c. Pneumococcal vaccination. 1d. Obtain pulmonary function test. 1e. Start ipratropium. 1f. Start inhaled β-agonist. 1g. Switch to cheaper β-agonist. 1h. Increase/decrease theophylline dose. 1i. Stop ipratropium. 1j. Start inhaled corticosteroid. 1k. Start oral corticosteroid. Prespecified with follow-up at 12 mo 2. Medication compliance measures. 2a. Mean Inui score (%). 2b. Mean (SD) Morisky score. 2c. N, %, of patients with ≥2 prescription refills.	1a. 161/498, 32% vs 123/382, 32% vs 173/471, 37% vs 135/416, 32%, p=NS 1b. 37/92, 40% vs 34/80, 43% vs 37/100, 37% vs 36/85, 42%, p=NS 1c. 7/89, 8% vs 6/76, 8% vs 15/95, 16% vs 7/78, 9%, p=NS 1d. 6/97, 6% vs 4/65, 6% vs 9/75, 12% vs 4/66, 6%, p=NS 1e. 30/71, 42% vs 15/59, 25% vs 23/65, 35% vs 17/67, 25%, p=NS 1f. 18/30, 60% vs 13/25, 52% vs 16/24, 67% vs 23/33, 70%, p=NS 1g. 23/30, 77% vs 13/20, 65% vs 30/33, 91% vs 17/24, 71%, p=NS 1h. 26/39, 67% vs 18/25, 72% vs 20/31, 65% vs 16/24, 67%, p=NS 1i. 7/22, 32% vs 10/18, 56% vs 16/28, 57% vs 12/21, 57%, p=NS 1j. 2/18, 11% vs 3/10, 30% vs 3/11, 27% vs 1/9, 11%, p=NS 1k. 5/10, 50% vs 2/4, 50%	Physician intervention vs pharmacist intervention vs both interventions vs control All prespecified with follow-up at 12 mo. 1. Mean (SD) SF-36 subscale scores (N/grp: 135 vs 110 vs 118 vs 111). Higher scores better. 1a. Physical function. 1b. Role physical. 1c. Pain. 1d. General health. 1e. Vitality. 1f. Social function. 1g. Role emotional. 1h. Mental health. 2. Mean (SD) McMaster Asthma Quality of Life Questionnaire subscale scores (N/grp: 38 vs 31 vs 27 vs 20). Higher scores better. 2a. Overall health status. 2b. Activity.	All p=NS unless noted otherwise. 1a. 38 (23) vs 38 (27) vs 36 (24) vs 37 (26) 1b. 32 (40) vs 33 (40) vs 38 (41) vs 32 (40), p<0.05 in favor of both interventions 1c. 49 (25) vs 47 (27) 48 (26) vs 44 (26) 1d. 37 (24) vs 29 (25) vs 35 (20) vs 34 (22) 1e. 37 (21) vs 39 (23) vs 36 (23) vs 36 (20) 1f. 69 (27) vs 63 (30) vs 61 (29) vs 63 (29) 1g. 65 (43) vs 60 (44) vs 59 (43) vs 60 (45) 1h. 62 (23) vs 62 (23) vs 50 (25) vs 61 (24) 2a. 4.0 (1.5) vs 4.2 (1.4) vs 4.2 (1.1) vs 3.7 (1.3) 2b. 4.5 (1.5) vs 4.6 (1.3) vs 4.4 (1.2) vs 3.9 (1.2) 2c. 4.0 (1.5) vs 4.0 (1.5) vs 4.2 (1.2) vs 3.6 (1.4) 2d. 3.8 (2.0) vs 4.3 (1.6) vs 4.4 (1.2) vs	0	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	2d. Mean (SD) medication possession ratio (measure referenced but not described). 3. Mean (SD) score for patient satisfaction with physician (American Board of Internal Medicine questionnaire; score range/direction not described). 4. Mean (SD) score for patient satisfaction with pharmacist (American Board of Internal Medicine questionnaire; score range/direction not described).	vs 3/9, 33% vs 2/9, 22%, p=NS 2a. 81% vs 80% vs 82% vs 80%, p=NS 2b. 0.95 (1.1) vs 0.85 (1.0) vs 0.89 (1.1) vs 0.88 (1.0), p=NS 2c. 128, 95% vs 89, 81% vs 109, 92% vs 96, 87%, p=NS 2d. 0.98 (0.8) vs 1.00 (2.7) vs 1.1 (2.0) vs 0.92 (1.0), p=NS 3. 1.9 (0.9) vs 2.0 (0.9) vs 2.1 (0.6) vs 2.1 (0.7), p=NS 4. 2.1 (0.7) vs 2.1 (0.8) 2.0 (0.6) vs 2.1 (0.7), p=NS	2c. Symptoms. 2d. Emotion. 2e. Environment. 3. Mean (SD) McMaster Chronic Respiratory Disease Questionnaire subscale scores (N/grp: 72 vs 104 vs 91 vs 91). Higher scores better. 3a. Overall health status. 3b. Dyspnea. 3c. Fatigue. 3d. Emotion. 3e. Mastery. 4. Mean (SD) number of emergency department visits. 4a. For any reason. 4b. For reactive airways disease. 5. Mean (SD) number of hospitalizations. 5a. For any reason. 5b. For reactive airways disease.	3.6 (1.5), p<0.05 in favor of pharmacist intervention 2e. 3.9 (1.6) vs 4.2 (1.5) vs 4.0 (1.4) vs 3.7 (1.4) 3a. 4.4 (1.2) vs 4.3 (1.3) vs 4.1 (1.1) vs 4.2 (1.1) 3b. 4.2 (1.6) vs 4.2 (1.7) vs 4.0 (1.6) vs 4.0 (1.5) 3c. 3.8 (1.3) vs 3.7 (1.5) vs 3.4 (1.2) vs 3.6 (1.2) 3d. 4.6 (1.3) vs 4.5 (1.4) vs 4.2 (1.2) vs 4.4 (1.3) 3e. 4.8 (1.4) vs 4.8 (1.5) vs 4.5 (1.4) vs 4.6 (1.4) 4a. 1.4 (1.7) vs 1.5 (2.3) vs 1.4 (2.1) vs 1.4 (1.9) 4b. 0.3 (0.7) vs 0.4 (0.8) vs 0.4 (0.8) vs 0.3 (0.8) 5a. 0.5 (1.6) vs 0.5 (1.1) vs 0.4 (1.1) vs 0.4 (0.8) 5b. 0.1 (0.5) vs 0.1		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
				(0.5) vs 0.1 (0.5) vs 0.1 (0.3)		
Turner, 1994[164]	Primary outcome 1. % performance of health maintenance activities over 1 y: Baseline/follow-up; difference. 1a. Influenza vaccinations. 1b. Stool for occult blood test. 1c. Pap smears. 1d. Breast examinations performed by the physicians. 1e. mammograms.	1a. 20%/26% vs 17%/24%; +6% vs +7%, p=0.51 1b. 30%/31% vs 28%/23%; +1% vs -5%, p=0.70 1c. 23%/26% vs 26%/15%; +3% vs -11%, p=0.10 1d. 30%/33% vs 35%/33%; +3% vs -2%, p=0.64 1e. 15%/26% vs 22%/25%, +11% vs +3%, p=0.41	...	...	0	...
Unrod, 2007[165]	Primary Assessed by patients after visits) intervention; intervention vs control (%) OR (if reported); 95% CI (if reported), was whether the physician 1. Asked whether the patient smoked 2. Assessed the willingness to quit 3. Provided quitting advice 4. Helped the patient set goals 5. Provided written materials 6. Referred patient to quit-smoking program 7. Discussed quit-smoking medications 8. Arranged a follow-up appointment Cost-effectiveness was evaluated from perspective of individual	1. 61.2 vs. 47.4, 2. 76 vs. 36.8, OR 5.06; 95%CI 3.22, 7.95. 3. 76.8 vs. 53, OR 2.79; 95%CI 1.70, 4.59. 4. 55.1 vs. 20.2, OR 4.31; 95%CI 2.59, 7.16. 5. 32.3 vs. 6.9, OR 5.14; 95%CI 2.60, 10.14. 6. 23.2 vs. 4.5, OR 4.72; 95%CI 2.90, 7.68. 7. 61.6 vs. 24.7, OR 6.48; 95%CI 3.11, 13.49. 8. 47.5 vs. 9.7, OR 8.14; 95%CI 3.98, 16.68. 9a. $1,174 9b. $869 10a. $4,757 10b. $735 10c. $1,715	The pre-specified primary patient outcome at 6-month post-intervention was 1. The 7-day point-prevalence abstinence for intervention vs. control, p-value. The pre-specified secondary patient outcome was 2. The longest quit attempt in days M (appears to be 'mean' but not explicit) (SD) for intervention vs. control, p-value. 3. total number of 24-hour quit attempts M(SD) for intervention	1. 12% vs. 8%, 0.078 2. 18.4 (36.7) vs. 12.4 (29.6), 0.05 3. 2.1 (3.4) vs. 2.1 (3.5), 0.91 4. F=3.84, df=465, p<0.05	1	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	physician practices (not prespecified in main paper). 9. Overall incremental cost-effectiveness (US $) 9a. Per life-year saved. 9b. Per quality-adjusted life-year saved. 10. Incremental cost-effectiveness per net quitter. (US $) 10a. Prepreparation stage. 10b. Preparation stage. 10c. Overall		vs. control, p-value. 4. Stage-of-change-progression change score variable calculated as the difference between baseline and 6-month stage scores.			
Vadher, 1997[166,167]	Main outcomes 1. Median (SE) time to reach therapeutic range (INR ≥2) (days). 2. Median (SE) time to reach stable dose (INR 2-3 for 3 consecutive days) (days). 3. Median time to first pseudoevent (INR ≤1.5 or ≥5 after therapeutic range is reached). Not prespecified 4. n/N patients below therapeutic range at hospital discharge. 5. n/N patients who did not reach a stable dose before study endpoint. Prespecified For inpatient treatment (n=60 vs 62) 6. Days (per 100 patient days of treatment) at INR <1.5 (relative rate, 95% CI); excess days in	RRs are inverse of those reported in the article to be consistent with presentation of data as intervention vs control. 1. 3 (0.34) vs 3 (0.29), p=0.24 2. 7 (0.43) vs 9 (1.8), p=0.01 3. Rates not reported, p=0.06 4. 4/72 vs 8/76 5. 11/72 vs 14/76 6. 1.3 vs 5.6 (0.24, 0.13 to 0.45);4.3, 0 to 1.2 7. 18.3 vs 21.4 (0.83, 0.59 to 1.25); 3.1, -4.2 to 10.4 8. 59.4 vs 52.2 (1.11, 1 to 1.43); -7.2, -16.3 to 1.9 9. 22.3 vs 26.4 (0.83, 0.59 to 1.25). 4.1, -4.3 to 12.6	Prespecified with median follow-up of 93 vs 88 days. 1. n/N deaths. 2. n/N patients with hemorrhage events. 3. n/N patients with thromboembolism events.	1. 2/72 vs 2/76 2. 2/72 vs 4/76 3. 4/72 vs 1/76	0	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	control group, 95% CI. 7. Days (per 100 patient days of treatment) at INR <2.0 (relative rate, 95% CI); excess days in control group, 95% CI. 8. (main outcome) Days (per 100 patient days of treatment) at INR 2-3 (relative rate, 95% CI); excess days in control group, 95% CI. 9. Days (per 100 patient days of treatment) at INR >3.0 (relative rate, 95% CI); excess days in control group, 95% CI. 10. Days (per 100 patient days of treatment) at INR >5.0 (relative rate, 95% CI); excess days in control group, 95% CI. For outpatient treatment (n=53 vs 64) 11. Days (per 100 patient days of treatment) at INR <1.5 (relative rate, 95% CI); excess days in control group, 95% CI. 12. Days (per 100 patient days of treatment) at INR <2.0 (relative rate, 95% CI); excess days in control group, 95% CI. 13. (main outcome) Days (per 100 patient days of treatment) at INR 2-3 (relative rate, 95% CI); excess days in control group, 95% CI. 14. Days (per 100 patient days of treatment) at INR >3.0 (relative	10. 1.2 vs 2.8 (0.42, 0.10 to 1.67); 1.6, -0.6 to 4.1 11. 1.3 vs 4.2 (0.30, 0.11 to 0.77); 2.9, 0.3 to 5.5 12. 21.1 vs 31.8 (0.67, 0.48 to 0.91); 10.7, 2.1 to 19.2 13. 63.7 vs 51.0 (1.25, 1.11 to 1.42) ; -12.7, -21.6 to -3.8 14. 15.1 vs 17.2 (0.91, 0.56 to 1.43); 2.1, -5.6 to 9.7. 15. 0.8 vs 1.1 (0.67, 0.07 to 5); 0.3, -1.5 to 2.2 16. 2 (1 to 22) vs 2 (1 to 30), p=0.07. 17. 14 (2 to 63) vs 14 (1 to 91), p=0.2. 18. 8.7 (2.32) vs 7 (2.64), p=0.03 19. 25 vs 41 20. 12 vs 18				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	rate, 95% CI); excess days in control group, 95% CI. 15. Days (per 100 patient days of treatment) at INR >5.0 (relative rate, 95% CI); excess days in control group, 95% CI. 16. Median (range) INR test interval in inpatients (days). 17. Median (range) INR test interval in outpatients (days). Not prespecified 18. Median (SE) days to 1st pseudoevent among inpatients. 19. Number of pseudoevents at median 88-93 days. 20. Number of pseudoevents due to overtreatment.					
van Wyk, 2008[168]	2 primary outcomes, 12-mo follow-up (auto alerting vs on-demand vs control) 1. Patients requiring screening who were screened. 1a. n/N (%) patients. 1b. RR (95% CI) adjusted for individual visits and practice size 1bi. Auto alerting vs control. 1bii. On-demand vs control. 1biii. Auto alerting vs on-demand. 2. Patients requiring treatment	1a. 701/1079 (65%) vs 438/1249 (35.1%) vs 225/882 (25.5%) 1bi. 1.76 (1.41 to 2.20) 1bii. 1.28 (0.98 to 1.68) 1biii. 1.40 (1.08 to 1.81) 2a. 801/1218 (65.7%) vs 385/969 (39.7%) vs 275/766 (35.9%) 2bi. 1.40 (1.15 to 1.70) 2bii. 1.19 (0.94 to 1.50) 2biii. 1.18 (0.96 to 1.45)	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	were who treated. 2a. n/N (%) patients. 2b. RR (95% CI) adjusted for number of individual visits, CVD, diabetes mellitus and practice size 2bi. Auto alerting vs control. 2bii. On-demand vs control. 2biii. Auto alerting vs on-demand.					
Verstappen, 2007[169]	1. mean (95%CI) methotrexate dose for completers (mg/week) (not pre-specified) 2. mean (SD) maximum methotrexate dose for patients except those who withdrew shortly after inclusion (mg/week) (not pre-specified) 3. mean (SD) methotrexate dose (mg/week) for those who fulfilled criteria of remission among completers vs those who did not remit, over 2 years (not pre-specified) 4. mean (SD) cumulative dose (mg) of methotrexate until the start of the first remission period (not pre-specified) 5. number of patients that converted to subcutaneous methotrexate administration (not pre-specified) 6.number of patients treated with cyclosporine at start of first remission period (not pre-	1. 16.1 (14.8 to 17.3) vs 14.0 (13.1 to 14.8), p=0.008 2. 24.9 (6.5) vs 18.2 (6.5), p value not indicated 3. (remission) 15.3 (6.1) vs 11.8 (4.3) (no remission) 19.7 (4.7) vs 16.1 (4.1) 4. 892 (588) vs 776 (506), p=0.243 5. 55 vs 12 6. 38 vs 4 7. 6 vs 0 8. 79% vs 93%, p=0.002 9. 46% vs 71%, p<0.001 10. 41 (27%) vs 37 (25%), p=0.8	1. number (%) of patients in remission for ≥ 3 months 1a. in first year 1b. in first two years (primary) 2. area under the curve (IQR) standardized to time (lower = better outcome for CCDSS) (secondary) 2a. morning stiffness 2b. ESR 2c. tender joint count 2d. swollen joint count 2e. VAS general well-being 2f. VAS pain 2g. functional disability 3. Number (%) of patients meeting modified ACR50 criteria (pre-specified) 3a. at one year 3b. at two years	1a. 53 (35%) vs 21 (14%), p<0.001 1b. 76 (50%) vs 55 (37%), p=0.029 2a. 17.0 (7.5 to 41.2) vs 23.7 (12.3 to 56.7), p=0.009 2b. 17.7 (10.2 to 27.6) vs 21.6 (13.0 to 33.6), p=0.007 2c. 3.6 (1.9 to 6.0) vs 5.5 (2.8 to 9.2), p<0.001 2d. 2.7 (1.5 to 5.2) vs 4.7 (2.8 to 7.6), p<0.001 2e. 19.0 (11.5 to 35.4) vs 31.2 (16.2 vs 44.6), p<0.001 2f. 12.0 (5.0 to 24.3) vs 19.0 (9.5 to 34.1), p=0.001 2g. 0.64 (0.3 to 1.3) vs 0.80 (0.3 to 1.2), p=0.8	...	1

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	specified) 7. number of patients who used cyclosporine at start of the first remission period (not pre-specified) 8. proportion of patients who used NSAIDS at 6 months (not pre-specified) 9. proportion of patients who used NSAIDS at 2 years (not pre-specified) 10. number (%) of patients with ≥ 1 intra-articular injection (not pre-specified)		4. mean (95% CI) time (months) until the first period of remission (not pre-specified) 5. duration (CI) (months) of all periods of remission together (not pre-specified) 6. median (IQR)/mean (95%CI) annual radiographic progression over 2 years (units/year) (not pre-specified) Adverse events were evaluated at each visit according to a predefined protocol. 7. percentage of patients with AE 8. number of adverse events/number of protocol visits after methotrexate initiated 9. percentage of total number of adverse events 9a. gastrointestinal 9b. mucocutaneous	3a. 87 (58%) vs 64 (43%), p=0.018 3b. 69 (46%) vs 67 (45%), p=1.00 4. 10.4 (9.1 to 11.7) vs 14.3 (12.6 to 16.1), p<0.001 5. 11.6 (10.1 to 13.1) vs 9.1 (7.6 to 10.6), p=0.025 6. 0 (0 to 2.0) / 1.9 (1.0 to 2.7) vs 0 (0 to 2.5) / 2.1 (1.3 to 2.8), p=0.9 7. 94% vs 87% 8. 2378/3190 vs 873/1132 9a. 24.6% vs 25.2% 9b. 14.8% vs 18.2% 9c. 18.8% vs 18.8% 9d. 2.4% vs 2.8% 9e. 23.2% vs 18.6% 9f. 7.1% vs 4.2% 9g. 2.0% vs 5.3% 9h. 1.8% vs 2.1% 9i. 5.2% vs 4.8% 10a. -18 (27) vs -15 (24), -3 (-9 to 2) 10b. -24 (27) vs -16 (24), -7 (-15 to -0.4) 10c. -63 (61) vs -56 (59), -7 (-21 to 6)		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			reaction 9c. neurological disorders 9d. renal events 9e. liver toxicity 9f. haematological abnormalities 9g. pulmonary symptoms 9h. post-dosing reactions of methotrexate 9i. other 10. mean (SD) change from baseline after 1 year (prespecified) CDSS vs Control, Mean (95%CI) difference; 10a. ESR, mm/h1st – all patients 10b. ESR, mm/hlst - completers 10c. Morning stiffness, min. - all patients 10d. Morning stiffness, min. - completers 10e. Number of swollen joints – all patients 10f. Number of swollen joints - completers 10g. Number of tender joints - all patients	10d. -73 (56) vs -64 (57), -9 (-25 to 7) 10e. -11 (8) vs -9 (7), -2 (-4 to -1) 10f. -14 (7) vs -10 (8), -3 (-5 to -1) 10g. -11 (7) vs -8 (8), -3 (-6 to -1) 10h. -13 (8) vs -9 (8), -4 (-6 to -1) 10i. -32 (29) vs -21 (29), -11 (-17 to -4) 10j. -38 (27) vs -24 (29), -14 (-22 to -6) 10k. -36 (31) vs -24 (30), -11 (-18 to -4) 10l. -42 (27) vs -27 (30), -15 (-23 to -7) 10m. -0.44 (0.59) vs -0.39 (0.66), -0.05 (-0.19 to 0.09) 10n. -0.56 (0.53) vs -0.49 (0.67), -0.07 (-0.24 to 0.10) 11a. -16 (27) vs -16 (24), -0.3 (-6 to 5) 11b. -22 (27) vs -19 (24), -3 (-10 to 4) 11c. -56 (68) vs -57 (63), 1 (-13 to 16) 11d. -60 (70) vs -69 (60), 8 (-10 to 26)		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			10h. Number of tender joints - completers	11e. -11 (8) vs -11 (8), -0.3 (-2; 2)		
			10i. VAS general well-being, mm – all patients	11f. -13 (7) vs -13 (7), -0.4 (-2; 2)		
			10j. VAS general well-being, mm - completers	11g. -10 (9) vs -9 (8), -1 (-3 to 1)		
			10k VAS pain, mm - all patients	11h. -12 (9) vs -11 (8), -1 (-4 to 1)		
			10l. VAS pain, mm - completers	11i. -30 (31) vs -22 (28), -8 (-15 to -1)		
			10m. Functional disability, HAQ - all patients	11j. -37 (29) vs -28 (27), -9 (-16 to -1)		
			10n. Functional disability, HAQ - completers	11k. -34 (31) vs -26 (31), -9 (-16 to -1)		
				11l. -40 (28) vs -30 (28), -10 (-18 to -2)		
			11. mean (SD) change from baseline after 2 years (prespecified) CDSS vs Control, Mean (95%CI) difference	11m. -0.41 (0.64) vs -0.42 (0.76), 0.01 (-0.15 to 0.17)		
				11n. -0.55 (0.62) vs -0.54 (0.79), -0.01 (-0.20 to 0.19)		
			11a. ESR, mm/h1st – all patients			
			11b. ESR, mm/hlst - completers			
			11c. Morning stiffness, min. - all patients			
			11d. Morning stiffness, min. - completers			
			11e. Number of			

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			swollen joints – all patients 11f. Number of swollen joints - completers 11g. Number of tender joints - all patients 11h. Number of tender joints - completers 11i. VAS general well-being, mm – all patients 11j. VAS general well-being, mm - completers 11k VAS pain, mm - all patients 11l. VAS pain, mm - completers 11m. Functional disability, Health Assessment Questionnaire - all patients 11n. Functional disability, Health Assessment Questionnaire - completers			
Weir, 2003[170]	1a. (secondary) Number (%) of "optimal" treatments (the treatment that would provide the lowest estimated event rates according to CCDSS).	1a. 56 (30%) vs 140 (34%), P=NS 1b. 2 (1 to 3) vs 2 (1 to 3) 1c. 1.32 (0.83 to 1.80)	(primary) 1. Median (IQR) relative risk reduction in ischemic and hemorrhagic vascular	1. 16.7 (13.5 to 22.9) vs 16.3 (13.1 to 23.8), p=NS	0	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	1b. (secondary) Median (IQR) rank of therapy prescribed. 1c. Odds ratio for optimal therapy being prescribed (95% CI) in multilevel model 2. (secondary) Number (%) of patients receiving each anticoagulant or antiplatelet therapy. 2a. No therapy 2b. Aspirin 2c. Dipyridamole 2d. Clopidogril 2e. Aspirin and dipyridamole 2f. Warfarin 2g. Warfarin and aspirin 2h. Other	2a. 5 (3%) vs 14 (3%) 2b. 106 (53%) vs 236 (54%) 2c. 3 (2%) vs 5 (1%) 2d. 15 (8%) vs 16 (4%) 2e. 41 (21%) vs 104 (24%) 2f. 28 (14%) vs 53 (12%) 2g. 2 (1%) vs 6 (1%) 2h 0 (0%) vs 2 (0%)	events that is achieved by actual prescribed therapy vs no therapy.			
White, 1984[171]	Prespecified 1. Number of physician actions related to alerts at 3 months; ratio for alert/nonalert group weighted by number of alerts days (ratio >1 indicates benefit for CCDSS group). 1a. Any action. 1b. Serum digoxin determination ordered. 1c. Digoxin withheld. 1d. Digoxin discontinued. 1e. Digoxin dose reduced. 1f. Quinidine changed. 1g. Beta-blocking agent changed. 1h. Potassium supplement	1a. 175 vs 136 (1.22, p<0.003) 1b. 48 vs 17 (2.67, p<0.0001) 1c. 27 vs 9 (2.84, p<0.002) 1d. 5 vs 2 (2.37, p<0.14) 1e. 5 vs 1 (4.73, p<0.06) 1f. 2 vs 1 (1.89, p<0.30) 1g. 4 vs 0 (NR, p<0.03) 1h. 69 vs 48 (1.33, p<0.04) 1i. 117 vs 89 (1.24, p<0.02) 1j. 42 vs 32 (1.24, p<0.16) 1k. 5 vs 1 (4.73, p<0.06) 1l. 36 vs 29 (1.17, p<0.25)	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	ordered. 1i. Serum potassium determination ordered. 1j. Oxygen delivery increased. 1k. Concern of toxicity in note. 1l. Electrocardiogram ordered. 2. Number of alerts (%) by alert reason for 211 vs 185 patients (prespecified). 2a. Any alert. 2b. Low weight. 2c. Old age. 2d. High serum digoxin level. 2e. Low serum potassium level. 2f. Renal insufficiency. 2g. No serum potassium. 2h. Concurrent beta-blocker. 2i. Concurrent quinidine. 2j. Concurrent calcium channel blocker. 2k. Acid-base disorder. 2l. Hypoxemia. 2m. Atrial tachycardia with block. 2n. Junctional arrhythmia. 2o. Ventricula arrhythmia. 2p. Sinoatrial block. 2q. Atrioventricular block. 2r. Acute infarction. Not specified. 3. Number of alert days at 3	2a. 150 (71%) vs 134 (72%), p=NS 2b. 0 (0%) vs 1 (0.5%), p=NS 2c. 8 (4%) vs 12 (6%), p=NS 2d. 8 (4%) vs 8 (4%), p=NS 2e. 21 (10%) vs 34 (18%), p=significant 2f. 15 (7%) vs 9 (5%), p=NS 2g. 2 (1%) vs 3 (2%), p=NS 2h. 19 (9%) vs 16 (9%), p=NS 2i. 12 (6%) vs 6 (3%), p=NS 2j. 2 (1%) vs 1 (0.5%), p=NS 2k. 7 (3%) vs 4 (2%) ,p=NS 2l. 45 (20%) vs 37 (20%), p=NS 2m. 1 (0.5%) vs 0 (0%), p=NS 2n. 0 (0%) vs 2 (1%), p=NS 2o. 15 (7%) vs 10 (5%), p=NS 2p. 1 (0.5%) vs 9 (5%), p=NS 2q. 6 (3%) vs 8 (4%), p=NS 2r. 3 (1%) vs 2 (1%), p=NS 3. 260 vs 246 Note: For 2p (sinoatrial block) - article reports 9 alerts but 0%. Corrected to				

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	months.	5% (9 alerts/185 patients) but could not confirm with author (no response).				
White, 1987[172]	Prespecified 1. Mean (not clear if SD or SE) time to reach a stable therapeutic dose (days). 2. Mean time to reach a therapeutic PR ratio (days). 3. n/N patients with PR above therapeutic range during hospital stay. 4. Mean predicted/observed PR. 5. Mean absolute error (absolute value of absolute PR – predicted PR). Not prespecified 6. % mean absolute error. 7. Mean days on warfarin with PR in therapeutic range during hospital stay. 8. Mean days on warfarin with PR above therapeutic range during hospital stay. 9. Mean days on warfarin with PR below therapeutic range during hospital stay 10. n/N patients reaching PR therapeutic range after 6 days. 11. n/N patients reaching a stable therapeutic dose after 10 days. 12. Mean warfarin dose at discharge	1. 5.7 (1.7) vs 9.4 (5.2), p=0.002 2. 3.2 (1.6) vs 4.5 (3.4), p=0.05* 3. 2/39 vs 6/36, p=0.11 4. 1.75 (0.2)/ 1.76 (0.3) vs 1.67 (0.1)/ 1.94 (0.9), p=NS 5. 0.20 (0.2) vs 0.62 (0.7), p=0.05* 6. 13% (14) vs 30% (19), p=0.05* 7. 58% (23) vs 42% (27), p=0.001 8. 3.0% (9) vs 5.9% (14), p=NS 9. 39% (24) vs 51% (31), p=NS 10. 1/39 vs 6/36 11. 0/39 vs 11/36 12. 5.9 mg/d vs 7.1 mg/d 13. 28/33 (85%) vs 11/26 (42%), p=0.002 14. 2/33 vs 8/26 [Note: text and table data reversed for this outcome] 15. 3/33 vs 7/26 [Note: text and table data reversed for this outcome] 16. 8.9 (6.8) vs 11.3 (8), p=NS	Prespecified 1. Mean (not clear if SD or SE) length of hospital stay (days). 2. n/N patients with in-hospital bleeding complications (major/minor) during hospital stay. Not prespecified. 3. n/N deaths. 4. n/N patients with thromboembolic complications on warfarin therapy.	1. 13 (8) vs 20 (15), p=0.01 2. 0/39 vs 1(2)/36, p=NS 3. 0/39 vs 0/36 4. 0/33 vs 0/26	1	1

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	13. n/N (%) patients with PR in therapeutic range 10-14 days after start of maintenance dose. 14. n/N patients with PR above therapeutic range 10-14 d after start of maintenance dose. 15. n/N patients with PR below therapeutic range 10-14 d after start of maintenance dose 16. Mean time on warfarin (d). 17. n/N (%) patients discharged on warfarin <5.0 mg/d.	17. 12/33 (36%) vs 4/26 (15%) *Author indicates p<0.05 as significant but reports this comparison as significant. Unable to confirm with author.				
White, 1991[173]	Not clearly prespecified. 1. Mean (SD) absolute difference between achieved and target PTs at median 14 day follow-up (seconds) ; 95% CI for difference. 2. Mean (SD) % difference between achieved and target PTs at median 14 day follow-up. 3. n/N, proportion of patients with final PT within 2 seconds of target at median 14 day follow-up. 4. Mean (SD) % change in warfarin dose at median 14 day follow-up. 5. Mean (SD)/Median {range} follow-up interval (days)	1. 2.3 (1.37) vs 2.6 (2.20); -1.0 to 1.6, p=NS 2. 14% (10) vs 13% (10), p=NS 3. 10/23, 43% vs 12/24, 50%, p=NS 4. 20% (17) vs 15% (11), p=NS 5. 18.7 (13) vs 17.5 (10)/14 (7 to 42) vs 14 (7 to 37), p=NS	...	...	0	...
Wilson, 2005[174]	The pre-determined primary physician outcome was confidence in management of patient with family history of breast cancer concerns as measured by (intervention N=151, n (%) vs.	1. 91(60) vs. 56(61), 0.93 2. 60(40) vs. 30(33), 0.27 3. 85(57) vs. 48(52), 0.46 4. 35(23) vs. 20(22), 0.77 5. 49/85(58) vs. 14/29(48), 1.18(0.88-1.37)	The pre-determined secondary patient outcomes were changes in 1. Perception of risk in post-intervention as	1a. 12 (19.4%) vs. 4 (22.2%) 1b. 50 (80.6%) vs. 14 (77.8%), 1.04(0.79 to 1.37), 0.79 1c. 11 (17.7%) vs. 2	0	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	control N=92, n (%), p) 1. taking appropriate family history, 2. Knowing which patients need to be referred 3. Reassuring low-risk patients 4. Being able to answer questions The pre-determined secondary physician outcomes were changes in 5. Proportion (%) of referred patients with elevated genetic risk for post-intervention period. (Intervention n/N (%) vs. control n/N (%), risk ratio (95% CI) as probability that patients referred by intervention practices were at elevated risk. 6. Completeness of family history information in referral letters in the post-intervention period for intervention n/N (%) vs. control n/N (%).	6. 102/108 (94%) vs. 37/37 (100%) 7a. 27(11.7%) 7b. 64(42.4%) 7c. 22(34.4%) 8a.i. 11(50) 8a.ii. 7(31.8) 8a.iii. 4(18.2) 8b.i. 7(31.8) 8b.ii. 3(13.6) 8b.iii. 12(54.5) 8c.i. 14(63.8) 8c.ii.8(36.4) 8d.i. 22(100) 8d.ii. 7(31.8) 8d.iii. 7(31.8) 8d.iv. 1(4.5) 8d.v. 0	assessed by self-completion of questionnaire responses for intervention n(%) vs. control n(%),). Post-intervention period n=62 vs. n=18. 1a. low perceived risk 1b. elevated perceived risk RR (95% CI), p-value adjusted for clustering of patients within practice. 1c. High perceived risk 1d. moderate perceived risk 2. Understanding of incorrect breast cancer risk factors, intervention n=74 vs. control n=22, as measured by answers to the following questions: 2a. Stress is a major cause of breast cancer. i. Agree/strongly agree ii. Disagree/strongly disagree iii. Not sure 2b. Having one relative with breast cancer	(11.1%) 1d. 39 (62.9%) vs. 12 (66.7%) 2a. p=0.57 2a.i. 23% vs. 22.7% 2a.ii. 29.7% vs. 40.9% 2a.iii. 47.3% vs. 36.4% 2b. p=0.74 2b.i. 88% vs. 90.9% 2b.ii. 2.7% vs. 05 2b.iii. 9.3% vs. 9.1% 2c. p=0.32 2c.i. 42.7% vs. 27.3% 2c.ii. 16% vs. 59.1% 2c.iii. 41.3% vs. 13.6% 2d. p=0.35 2d.i. 32% vs. 45.5% 2d.ii. 5.3% vs. 9.1% 2d.iii. 62.7% vs. 45.5% 2e. p=0.96 2e.i. 20% vs.22.7% 2e.ii.38.7%% vs. 36.3% 2e.iii. 41.3% vs.40.9%		

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
			always increases your risk considerably. i. Agree/strongly agree ii. Disagree/strongly disagree iii. Not sure 2c. A healthy diet can prevent breast cancer. i. Agree/strongly agree ii. Disagree/strongly disagree iii. Not sure 2d. Oral contraceptives can significantly increase the risk of breast cancer. i. Agree/strongly agree ii. Disagree/strongly disagree iii. Not sure 2e. Minor injury to the breast can cause breast cancer. i. Agree/strongly agree ii. Disagree/strongly disagree iii. Not sure			
Wolfende n, 2005[175]	6-mo trial Primary outcome. 1. Receipt of elements of cessation care: n/N patients, %; OR (95% CI). 1a. Computerized cessation counseling.	1a. 119/124, 96% (CCDSS group only). 1b. 83/105, 79% vs 35/75, 47%; 4.3 (2.2 to 8.3), p<0.01 1c. 114/123, 93% vs	...	...	1	...

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
	1b. Nurse brief advice: self-report. 1c. Nurse brief advice: medical audit. 1d. Anesthetist brief advice: self-report. 1e. Preoperative NRT offered: self-report. 1f. Preoperative NRT offered: medical audit. 1g. Postoperative NRT prescribed: medical audit. 1h. Tailored self-help material. Ii. All elements of care. 1j. No elements of care. 2. Annual incremental cost of sustaining comprehensive cessation care: Australian dollars (prespecified).	57/85, 67%; 6.2 (2.8 to 14.1), p<0.01 1d. 61/102, 60% vs 27/69, 39%; 2.3 (1.2 to 4.3) p<0.01 1e.60/73, 82% vs 4/50, 8%; 53.1 (16.2 to 173.5) p<0.01 1f. 79/89, 89% vs 0/56, 0%; 855.6 (49.1 to infinity) p<0.01 1g. 61/71, 86% vs 0/37, 0%; 439.2 (25.0 to infinity), p<0.01 1h. 119/124, 96% (CCDSS group only). 1i. 50% vs 13% 1j. 1% vs 11% 2. Australian $14,681 or $35/smoking patient.				
Zanetti, 2003[176]	1. Number (proportion) of patients given an intraoperative redose of antibiotics, n (%); adjusted OR (95% CI). (primary outcome)	1. 93/137 (68%) vs 55/136 (40%); 3.31 (1.97 to 5.61), p < 0.0001. Note: 227 vs 222 randomized; 168 vs 163 could have reminders activated (i.e. surgery documented as >225 mins and patient given antibiotics); and 137 vs 136 were documented as	1. Number (proportion) with surgical-site infection. (secondary outcome)	1. 5/137 (4%) vs 8 /136 (6%); P = 0.4.	1	0

Study	Process of Care Outcome Measures	Process of Care Results CCDSS vs control	Patient Outcome Measures	Patient Results CCDSS vs control	PoC Effect	Patient Effect
		eligible for intraoperative redosing according to guidelines and were included in primary analysis.				

Abbreviations: ACE –I, angiotensin converting enzyme inhibitor; ARB, angiotensin receptor blockers; BMI, body mass index; BP, blood pressure; CAD, coronary artery disease; CCDSS, computerised clinical decision support system; CHD, coronary heart disease; CI, confidence interval; COPD, chronic obstructive pulmonary disease; CV(D), cardiovascular (disease); DBP, diastolic blood pressure; Hb, haemoglobin; HDL-C, high-density lipoprotein cholesterol; HR, hazard ratio; I*QR, interquartile range; ITT, intention to treat; LDL-C, low-density lipoprotein cholesterol; NR, not reported; NS, not significant; NSAID, non-steroidal anti-inflammatory drug; OR, odds ratio; RR, risk ratio;* SBP, systolic blood pressure; SD, standard deviation; SE(M), standard error (of the mean); SF-36, Short-form 36 questionnaire; VAS, visual analogue scale.

[a]Ellipses (…) indicate item was not assessed or could not be evaluated. [b]Outcomes were evaluated for effect as positive (1) or no effect (0) for CCDSS based on the following hierarchy. No outcomes we. An effect is defined as ≥ 50% of relevant outcomes showing a statistically significant difference (2*P* < .05):

- If a single primary outcome is reported, *in which all components are applicable*, this is the only outcome evaluated (see Methods section of manuscript for definition of primary outcome). If > 1 primary outcome is reported, the ≥ 50% rule applies and only the primary outcomes are evaluated.
- If no primary outcomes are reported (or only some of the primary outcome components are relevant) but overall analyses are provided, the overall analyses are evaluated as primary outcomes. Subgroup analyses are not considered.
- If no primary outcomes or overall analyses are reported, or only some components of the primary outcome are relevant for the application, any reported prespecified outcomes are evaluated.
- If no clearly prespecified outcomes are reported, any available outcomes are considered.
- If statistical comparisons are not reported, 'Outcome is designated as not evaluated (…).

"Flottorp, 2002" and "Martens, 2007" represent the first of two comparisons from the original studies. "Flottorp, 2002c2" and "Martens, 2007c2" represent the second of two comparisons in those studies.

Statistical appendix

Logistic models

Each comparison in our dataset represents an independent experiment, or *Bernoulli trial*, with only two possible outcomes: CCDSS success and CCDSS failure. Each has probability *p* of demonstrating a successful CCDSS (Kleinbaum & Klein, 2010). The logistic function that describes the relationship between a set of determinants (*z*) and the probability of CCDSS success can be expressed as:

$$p = \Pr(success \mid z) = \frac{1}{1+e^{-z}}$$, where

$$z = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + ... + \beta_k x_k$$

X's represent the individual determinants and β's their associated coefficients of association (Kleinbaum & Klein, 2010). We generally expect there to be some relationship among determinants of success. Failing to take into account the independent relationship between inter-related determinants will produce biased estimates of associations between any given determinant and CCDSS success. Multiple logistic regression allows us to adjust our estimates of independent association between determinant X_1 and success accounting for the relationship between other potentially linked factors (X_2, X_3, X_4 …) and CCDSS success. This is not possible with univariable methods and leaves us open to bias by confounding. We can express the logistic model as a linear equation using its logit form:

$$\text{logit}(p_i) = \ln(\frac{p_i}{1-p_i}) = \beta_0 + \beta_1 x_1 + \ldots + \beta_k x_k$$

A logistic model coefficients β represents the log of odds ratio (OR) and can be exponentiated to yield the OR.

$$odds \text{ of success} = \frac{\text{probability of success with determinant X}}{1 - \text{probability of success with determinant X}}$$

$$OR = \frac{\dfrac{\text{probability of success with determinant X}}{1 - \text{probability of success with determinant X}}}{\dfrac{\text{probability of success without determinant X}}{1 - \text{probability of success without determinant X}}}$$

An OR of 2 means that having determinant X doubles odds of CCDSS success over systems that do not have determinant X. Conversely, an OR of 0.5 means that having determinant X halves the odds of CCDSS success compared to systems that do not have determinant X.

Confidence intervals and tests of significance

The Wald method for testing the statistical significance of logistic model coefficients is the default approach in most statistical software packages. It is simple to compute; all parameter estimates can be derived by fitting only the full model. The likelihood ratio and the Wald statistic are equivalent in very large samples. In small to moderate size samples, however, the likelihood ratio has been shown to be more efficient and accurate than the Wald test (L. D. Brown et al., 2002; Heinze & Schemper, 2002). The likelihood ratio can be calculated using the equation below:

$$\chi^2 = -2[\ln L(\text{model containing determinant X}) - \ln L(\text{model not containing determinant X})]$$

We first calculate the log-likelihood of a model involving a number of potential determinants of success, one of which is determinant X. We then remove X and calculate the log-likelihood of the resultant model. We can then find a ratio of the log likelihood in the model with X compared to the model without X. This is the likelihood ratio, and it can tell us the independent magnitude of effect that X exerts on the probability of a CCDSS succeeding. The likelihood ratio has a distribution which closely approximates that of chi-squared with 1 degree of freedom (if we only test a single determinant at a time), making the likelihood ratio test similar to a chi-squared test. If significant, the model that contains X is different enough from the model that omits X to rule out chance as a reasonable cause of that difference, and we have good reason to

believe that X matters to CCDSS success.

Wald's is the most common method of constructing confidence intervals around point estimates of logistic model coefficients.

$$100(1-\alpha)\%\ \text{CI for}\ \beta = \beta \pm \exp(Z_{1-\frac{\alpha}{2}} S_\beta)$$

These confidence intervals are based on the standard errors associated with the parameter estimates. We can exponentiate the upper and lower limits of the confidence interval to convert the coefficients to odds ratios (Kleinbaum & Klein, 2010).

The Wald method can also be used to construct confidence intervals around point estimates of determinant prevalence using the equation:

$$\hat{p} \pm z_{1-\alpha/2}\sqrt{\frac{\hat{p}\,(1-\hat{p})}{n}}$$

Unfortunately, it is severely deficient (L. Brown et al., 2001). The performance of a confidence interval estimation method can be judged by the *coverage probability* of the estimated confidence interval. The coverage probability is the probability that the true parameter estimate (a proportion or regression coefficient) lies inside the confidence interval. Ideally, the actual coverage probability should equal the nominal (or intended) coverage: 95% for a 95% confidence interval. A lower-than-nominal coverage probability means that parameter estimate is found inside the confidence interval less often than 95% of the time. If the actual coverage is smaller than the intended coverage,

hypothesis tests based on such intervals are prone to higher rates of type I error. Because the Wald interval is based on an approximation of the normal distribution, its coverage probability for any given *p* value should approach the nominal probability as the sample size increases. For small sample sizes, Wald interval coverage probabilities will be far from their nominal level. It is almost universally assumed that Wald's method will yield correct coverage when *p* is not very near to 0 or 1 and when n is large. Brown, Cai, and DasGupta (L. Brown et al., 2001) show that, in reality, Wald interval coverage oscillates substantially when *p* is fixed and n increases, or vice versa. The authors expose the phenomenon of "lucky n and lucky *p* pairs", where certain sample size and *p* value combinations yield intervals with exact nominal coverage but changing sample size by just 1 causes tremendous drops in coverage probability. This readily occurs in situations previously assumed safe: large samples and *p* not near 0 or 1.

Exact confidence intervals (also known as Clopper-Pearson intervals) provide a popular alternative to Wald. While Wald suffers from lower-than-nominal coverage, exact intervals tend to suffer from greater-than-nominal coverage and, therefore, overly conservative (L. D. Brown et al., 2002; L. Brown et al., 2001; Heinze & Schemper, 2002).

Confounding and effect-modification

In the context of our study, a confounder must be an independent determinant of success and it must be associated with another potential determinant of success. Ignoring the independent effect of a confounder distorts the *observed* relationship between another potential determinant and success. This may mean finding a positive relationship where none exists (positive confounding), a negative relationships where none exists (negative confounding), or no relationship where one exists. Confounders only affect the relationship we observe but have no impact on the true relationship between the determinant of interest and CCDSS success.

Effect modifiers, on the other hand, change the real relationship between a determinant and system success, that is, the real relationship is dependent on the effect modifier. In the context of this study on determinants of CCDSS effectiveness, every potential determinant of effectiveness may also confound the relationship between other potential determinants and effectiveness. All determinants may also act as effect modifiers by creating (or hindering) conditions under which other determinants can improve chances of success.

Let us take the *inpatient hospital setting* as an example:

1) *Inpatient hospital setting* may be an independent determinant of success

through direct or indirect mechanisms. For example, practitioners working in an inpatient service may face more challenging diagnostic or therapeutic choices and may benefit from the advice of a CCDSS more often than practitioners working in outpatient care.

2) *Inpatient hospital setting* may distort the apparent impact of *CCDSS integration with an electronic charting or order entry system* on CCDSS success if integrated systems are easier to construct (and therefore tend to be more common) in inpatient care. Therefore, much of the perceived benefit derived from such systems may simply come from the nature of the inpatient setting. In this situation, *inpatient hospital setting* is a confounding factor.

3) *Inpatient hospital setting* may enable or enhance the impact of *CCDSS integration with an electronic charting or order entry system* on CCDSS success if inpatient care affords practitioners more time to interact with the system or more obvious benefits from the system than in outpatient encounters. Therefore, *inpatient hospital setting* is an effect-modifying factor.

Success factors can generally be categorized as necessary but not sufficient. At the individual study level, all success factors may be independent contributors to success but also interact and modify each other's impact on probability of success. Any one factor alone is very unlikely to cause a computerized decision support system to succeed without the help of other factors. For example, integration with electronic health

records or order entry systems is in itself not capable of producing success. Presentation of evidence-based advice may produce some benefits, but one would expect that integration with electronic health records and order entry systems would help realize the potential benefits of evidence-based advice. Indeed, a number of success factors are necessary to achieve a given level of success but not sufficient on their own. They may have some independent effect but are also likely to augment the effects of other features.

Both confounding and effect-modification can be modeled using multiple logistic regression; confounders enter the model directly and effect-modifiers enter the model in interaction terms along with the individual determinant of interest. This method adjusts for the effect of other variables by holding them constant. All models constructed in our analysis, however, were main effects models. We ignored effect-modification among the potential determinants of success in order to avoid overfitting our data and detecting spurious associations. Further, we have insufficient statistical power to reliably detect interactions.

It is debatable whether characteristics like system deployment in a *major informatics research setting* can be an independent determinant of CCDSS success. It is difficult to conceive that setting alone causes success directly. However, it is likely that other, more difficult to extract factors are functions of the care setting. For example, the level of expertise of healthcare personnel may be higher in academic medical settings than in community settings, the problems faced in inpatient settings may be more

amenable to decision support than those faced in outpatient settings (or vice versa), or the personnel implementing CCDSS in academic settings may be more experienced with such work. The advantage of using surrogate factors like setting is that we can adjust our analyses for a number of characteristics which are very difficult or impossible to extract by means of systematic review. The disadvantage, however, is important: interpretation of any associations we discover between surrogate factors and CCDSS success is at best an exercise in creative hypothesis generation. This problem is compounded when we don't know which of these difficult–to–measure factors is associated with the surrogate factor and to what extent.

Sample size and events per variable

There are numerous general guidelines—*rules-of-thumb*—regarding the minimum sample size to yield precise and reliable findings from multivariable statistical models. In linear regression models with a continuous response variable, samples containing 10 to 20 observations per independent variable should allow for reliable estimates. However, many more observations may be necessary if the independent variables are highly correlated with one another or the magnitude of their association with the response variable is small.

Logistic models are primarily limited by the number of *events* (or non-events, whichever is smaller) per independent variable, or the EPV ratio. We defined *event* as one of the two possible outcomes from a Bernoulli trial (a single experiment with a binary outcome). Simulation studies conducted by Peduzzi and colleages (Peduzzi et al., 1996) demonstrated that EPVs greater than 10 produce reliable estimates. EPV lower than 10 yielded less reliable estimates, and estimates made with EPV≤5 proved to be highly problematic. Specifically, as EPV ratio progressed downward from 10:1, estimates of association became biased in both positive and negative directions, variance estimates overestimated and underestimated the true variance of the associations, confidence intervals became wider than their intended coverage, and the rate of Type III error—discovery of associations significant in the opposite direction of the true effect—

rose.

Model specification procedures

To guard against false findings, we put significant looked for a valid procedure for selecting and entering potential determinants of success into our regression models. One might reasonably wonder why we went through this trouble instead of relying on one of the widely used automatic model fitting procedures (forward, backward, or stepwise selection). These procedures use simple statistical rules to decide whether a factor makes a significant contribution to a model's explanatory performance and keep the contributors in the model specification while removing the 'freeloaders'(Babyak, 2004). They should perform well, identifying only true associations, if the researchers have done due-diligence and tested only factors potentially linked to the outcome by a plausible mechanism. Austin and colleagues (Austin and Tu 2004; Austin, Mamdani, Juurlink, and Hux 2006) showed that models selected using automated procedures often find associations that have no relationship with the outcome and may omit variables that really matter.

Another common way of selecting factors for inclusion in a multivariable model involves assessing the univariable association between each factor and the outcome of interest and including in the multivariable model only those factors that cross some *p* value threshold. This was the method was used in previous influential CCDSS reviews (Garg et al., 2005; Kawamoto et al., 2005). However, it is just another automated

selection approach that increases the risk of overfitting the data because each 'look' at the associations expends degrees of freedom, regardless of how many variables are eventually included in the multivariable model (Babyak, 2004). Therefore, the safest way to select factors for inclusion in a model is to consider their relative importance based on domain knowledge.

When faced with many viable hypotheses, however, relying entirely on theory to select factors can be very challenging and poses a risk of being overly restrictive and committing Type I error—failing to identify real associations. This would be wasteful, given the time and effort invested in creating the CCDSS dataset. In an effort to draw valid inferences and use our dataset to its full potential, we partitioned our factors of interest into 3 sets: primary, secondary, and exploratory.

We were most confident in associations discovered from the primary factor set. These analyses were carefully pre-specified, obey empirically-derived EPV rules-of-thumb (10:1 EPV ratio) (Peduzzi et al., 1996), and most demonstrated significant associations in previous reviews.

The secondary factor set is larger (10 factors) and breaks the 10:1 EPV ratio. However, selection of these factors was guided by our expert panel on the grounds of plausible mechanisms. We surveyed the corresponding authors of all studies in our review to rank the top 10 factors in terms of importance and used this ranking to modify our pre-specified list. Still, we must point out that there is significant risk of finding spurious associations in the secondary factor set: even if no true associations exist, there

is an 89% chance that at least one of the 10 factors will cross the p-value threshold of 0.2 in univariable screening and a 40% chance that at least one will cross p=0.05.

The exploratory factor set contains the remaining 7 factors. Potential associations between these factors and success are theoretically plausible, although less likely than factors in the other sets, but all reasonable EPV ratios were broken. Even if no true associations exist, there is a 79% chance that at least one of these 7 factors will cross the p-value threshold of 0.2 in univariable screening and a 30% chance that at least one will cross p=0.05. Therefore, we interpret any findings from this factor set as strictly hypothesis generating.

For the 17 factors outside the primary factor set, there is a 98% chance that at least one will cross the p-value threshold of 0.2 in univariable screening and a 58% chance that at least one will cross p=0.05. Failing to split separate these factors from the primary set would guarantee that at least one spurious association would receive unreasonable attention.

Maximum likelihood estimation

Discriminant function analysis was previously used to estimate the parameters of logistic models. This method is very similar to the least squares approach used in ordinary linear regression but would restrict us to using normally distributed independent variables. In the context of our CCDSS review, where independent variables are binary (present or not present), discriminant function analysis is likely to estimate coefficients biased away from the null (Kleinbaum & Klein, 2010).

A more recent method--*maximum likelihood estimation* (MLE)—does not restrict us to normally distributed independent variables and allows for any kind of variable, or a mix of different types, to be used in the same model (Kleinbaum & Klein, 2010). This flexibility makes MLE a more appropriate approach for the binary variables in our dataset.

We first use the logistic model to predict the probability for each comparison to demonstrate an effective system. We then compare that estimate to the observed 'probability' (0 if the system was not effective; 1 if effective). The *likelihood function* compares the overall predicted probability of success to the overall observed success probability (Kleinbaum & Klein, 2010).

$$L = \prod_i \hat{p}_i \prod_j (1 - p_i)$$

The mathematical question becomes: what is the most likely value of each parameter β that will give us the observed probability of CCDSS success given the values of the potential determinants entered into our model? Because the most likely parameter values are those that maximize the likelihood function, we can estimate the β's if we find the maximum of the likelihood function.

Maximizing the likelihood function is equivalent to maximizing the log-likelihood function or natural logarithm of the likelihood function. The latter is computationally simpler and often preferred. It can be maximized by solving partial derivatives in the set of equations

$$\frac{\partial \ln L(\Theta)}{\partial \theta_j} = 0, j = 1,2,....,q$$

Each equation in this set is the partial derivative of the log of the likelihood function with respect to θ_j. θ_j is one of the parameters being estimated, or more specifically, the *j*th parameter. The number of parameters being estimated (q) determines the number of equations that need to be solved. In *unconditional* logistic regression, the number of parameters to estimate is equal to the number of independent variables + intercepts. Multiple equations must be solved when there are multiple unknown parameters. This is typically done in software packages like Stata using the iterative Newton-Raphson method.

The separation problem

Unfortunately, when the maximum of the likelihood (or log-likelihood) function cannot be identified, parameter estimates are undefined (Albert and Anderson 1984; Jacobsen 1989). Situations in which the log-likelihood function has no maximum occur when the responses (Y) can be *separated* (or predicted) by a single independent variable X or a linear combination of several independent variables.

Separation can be characterized as *complete separation* and *quasi-complete.* Complete separation occurs when determinant X predicts CCDSS success perfectly by means of some linear function. In other words, all successful systems feature determinant X, but none of the unsuccessful systems do.

Determinant X	**CCDSS Success?**	
	Yes	**No**
Present	0	25
Absent	0	15

Quasi-complete separation occurs under the more common condition where just one cell equals to zero. For example, determinant X is present in every successful CCDSS, but there are unsuccessful CCDSSs that also feature determinant X:

Determinant X	**CCDSS Success?**	
	Yes	**No**
Present	35	25
Absent	0	15

The parameter estimator $\hat{\beta}$ becomes undefined when a zero appears in the denominator or in the numerator. In the case of complete separation, zeros appear in both the denominator and numerator, while a zero appears in just the denominator or numerator during quasi-complete separation.

Complete separation: $\hat{b} = \ln \frac{\text{product of concordant cells}}{\text{product of discordant cells}} = \ln \frac{35 \text{ x } 15}{0 \text{ x } 25}$

Quasi-complete separation: $\hat{b} = \ln \frac{\text{product of concordant cells}}{\text{product of discordant cells}} = \ln \frac{0 \text{ x } 15}{0 \text{ x } 25}$

Therefore, in univariable and multivariable logistic models using MLE, a dichotomous independent variable that forms the 2 x 2 table containing any cells with size 0 with the dichotomous dependent variable will preclude finding a finite estimate of the relationship between those two variables because the log-likelihood function cannot be maximized.

This problem is most likely to occur with small sample sizes or when the prevalence of an independent variable is low.

There are some potential solutions to the problem of separation (Heinze &

Schemper, 2002):

1. Omit the determinant causing separation. If, however, this potential determintant is truly associated with the outcome, omitting it would result in a misspecified model with incorrect parameter estimates for other factors.

2. Choose a different kind of model instead of logistic. Our binary summary-level estimate of effect for each study precludes us from choosing another type of model.

3. Adjust the data ad-hoc so as to avoid separation. Some authors have suggested adding extra observations to the dataset to increase cell counts. But what should the value of the new observations be? We did not have adequate information to introduce new observations and would risk biasing other parameter estimates with this practice.

4. Use exact logistic regression based on Median Unbiased Estimation. Kawamoto and colleagues (Kawamoto et al., 2005) used this method and we have also employed it to allow for direct comparison with their results.

5. Set the parameter estimate β to an arbitrary high value. There is no consensus as to what the arbitrary value should be and this method has performed worse than alternative approaches in comparative studies.

6. Use a bias-corrected approach such as Firth's Profile-Penalized Likelihood Estimation. We based our primary inferences on this method.

Firth's bias-corrected logistic regression

We based our primary inferences on multiple logistic regression using *Firth's second order bias-corrected method* (Firth, 1993). This method has not been applied in previous CCDSS reviews but provides significant advantages. In a comparative study conducted in small to moderate sized samples, this method produced the least biased results compared to data manipulation, exact logistic regression, and maximum likelihood estimation logistic regression (Heinze, 2006).

The approach is based on a *profile-penalized likelihood estimation* (PPLE) method. It converts the original likelihood function (1) into (2) by adding a penalty function which, with low sample sizes, removes the bias associated with MLE.

$$\frac{\partial \ln L(\Theta)}{\partial \beta_j} = 0, j = 1,2,....,q \quad (1)$$

$$\frac{\partial \ln L(\Theta)}{\partial \beta_j} + \frac{1}{2} trace[I(\beta)^{-1}\{\frac{\partial I(\beta)}{\partial \beta_j}\}] = 0, j = 1,2,....,q \quad (2)$$

The magnitude of the penalization decreases asymptotically as sample size increases. This is appropriate because bias also decreases with increasing sample size.

Effective bias correction in small to moderate samples is only one of the reasons we chose Firth's method. The second reason is that it solves the separation problem[1] because it always finds a finite estimate. This means that we do not have to resort to

exact logistic regression and MUE, which provides overly optimistic estimates under conditions of separation (Heinze, 2006).

Heinze and Schemper (Heinze & Schemper, 2002)[1] also show that the profile-penalized likelihood ratio (PPLR) is a superior method for significance testing and construction of confidence intervals for several reasons:

1. The actual significance level is equal to the intended (0.05) significance level even in datasets with small sample sizes and unbalanced structures.

2. The actual coverage probability of the confidence intervals is equal to the intended (95%) coverage of the confidence intervals.

3. It is more statistically efficient than exact logistic regression with median unbiased estimates and MLE based on Wald-type tests of significance.

The more common Wald method is underpowered in conditions approaching separation where it constructs confidence intervals that have greater coverage probabilities than intended. This occurs because the likelihood function is often not symmetric under such conditions but Wald assumes a symmetric, normal distribution. At the time of writing this thesis, there was no functional software available to compute confidence intervals by the PPLR method. Neither the retail Stata package nor user-written extensions could provide this functionality. Therefore, we reported only Wald – based confidence intervals, noting that these are expected to be slightly conservative for variables that exhibit separation behaviour in MLE logistic regression.

Exact logistic regression

Logistic regression by *Exact Conditional Maximum Likelihood Estimation* is preferred to logistic regression by maximal likelihood estimation when expected cell sizes for any of the covariates are <5 or when the total sample is small <100 subjects. In exact logistic regression, inference about β is conditional on the permutational distribution of β's sufficient statistics conditional on the observed values of other sufficient statistics (Mehta and Patel 1995). Briefly, a *sufficient statistic* is any statistic for a parameter that contains all information needed to make inferences about that parameter from the sample data. Take, for example, the probability *p* that an event Y occurs. We can calculate *p* from the data, but we do not need to if we already know the number of times Y=1 in the sample. Therefore, the number of times that Y=1 in the sample is *sufficient* to infer the value of parameter *p*.

Exact logistic regression addresses the separation problem by computing *median unbiased estimates (MUE)* instead of maximum likelihood estimates (Hirji, Tsiatis, and Mehta 1989). In small samples and in samples where the prevalence of some independent variable is low—an unbalanced covariate structure—MUE is consistently more accurate than MLE. In our case, the sample was relatively small (162 comparisons or fewer, depending on missing data) and some 2x2 tables had an expected cell of size <5 observations. While MLE is highly dependent on sample size and covariate structure,

MUE provides accurate estimates regardless of how these conditions vary(Hirji, Tsiatis, and Mehta 1989). Kawamoto and colleagues (Kawamoto et al., 2005) used exact logistic regression to estimate associations between potential determinants and system success so we tested our models using this method as well. However, conditions of separation pose a problem for MUE. The procedure will provide an estimate, but comparative work has shown that results can be strongly biased away from the null (Heinze, 2006).

Handling correlated data

Previous reviews have mentioned that much of the evidence regarding health information technology comes from a few institutions which made early strides in the field of medical informatics (Shojania et al., 2010). Some famous ones include Vanderbilt University, Veterans Administration hospitals, the Regenstrief Institute and Wishard Memorial hospital in Indiana, Kaiser Permanente, the LDS Hospital, Massachusetts General Hospital, and Brigham and Women's Hospital. Early investment in research and development at these institutions attracted pioneers who produced the first electronic charting and order entry systems, enhancing them with reminders and alerts to improve the quality of care. These institutions became the setting of many randomized trials contained in our review.

Systems, people, culture, investment, and expertise, potentially differ between institutions and may affect the success of computerized systems in each setting. While we were unable to measure these factors through our systematic review, it is reasonable to suspect that there exist important similarities within, and differences between, institutions.

The scientific community is indebted to these pioneering groups who elected to test their systems rigorously so that we may all learn from their work. However, two challenges arise when assessing the evidence base of decision support:

1. Generalizability: we are not sure to what extent the results from these

institutions will generalize the less technologically endowed settings.

2. Clustering: the similarities between studies defy assumptions of independence in our statistical methods.

The first challenge can only be addressed through more primary studies in settings representative of those hospitals and clinics expected to implement computer systems today, but which have no previous experience doing so. The second challenge we can address in our analysis. Previous reviews have been analyzed as cross-sectional studies, but we can also treat the CCDSS review is a longitudinal study in which some study institutions have contributed multiple studies over time while others have contributed only one. Due to similarities amongst studies from the same institution, we can suspect that the observed success rates among such studies will be correlated. Our statistical analysis has so far assumed that each study is independent, but this new observation suggests that this is not true for studies conducted in the same institution. This means that each individual study contributes less information to the analysis than we previously thought. Failing to account for this fact inflates our confidence in the findings and falsely reduces variance estimates, narrows confidence intervals, and spuriously inflates the precision of our findings. As a result, the type I error rate in our analysis would be inflated, leaving us prone to discovering associations that do not really exist in the population of decision-support implementations.

We can use the intra-class correlation coefficient (ICC) to quantify and account for the degree of correlation between studies conducted at the same institution.

$$ICC = \frac{\sigma^2 \, between \; institution}{\sigma^2 \, between \; institution + \sigma^2 \, within \; institution}$$

Truly independent observations, or in our context, individual comparisons which are independent of other studies conducted in the same institution, will increase the within-institution variance in relation to the between-institution variance and will result in a low average ICC. As the strength of the relationship between studies conducted within the same institution increases, within-institution variance decreases and the ICC grows from 0 toward 1 (Zeger, Liang, & P. S. Albert, n d).

Because an ICC of 0 indicates that each observation within the same setting is independent of the others in that setting, each individual study contributes a maximum amount of information, regardless of whether it is part of a cluster or not. Therefore, if the ICC is 0, adding to our review another study conducted at the same institution as several previous studies increases the effective sample size by 1, as it would in a naïve analysis. However, if the ICC is greater than 0, adding another such study to the review increases the effective sample size by less than 1 and a naïve cross-sectional analysis would not be appropriate. If the average ICC reaches 1, adding to our systematic review another study conducted at an institution from which we already have previous studies will not provide any new information and therefore does not increase the effective sample size for our analysis. In this scenario, we can only increase our review's sample size by including a new study conducted at an institution that we have not seen before (i.e., an institution that has not already contributed studies to our review). In this

extreme scenario, our effective sample size would only be as large as the number of unique institutions represented by the studies in our review. In reality, we can reasonably expect that the ICC lies somewhere between 0 and 1 and that adding studies from institutions that are already represented in our review will give us additional information and is worthwhile.

Response feature analysis provides a simple way to tackle the analysis of studies in our review so as to prevent artificially inflating our effective sample size. In this approach, we would look at all unique institutions represented in our review and, for each institution, calculate some measure to summarize the success its studies as a whole. For example, we may choose to represent the successful studies conducted at Wishard Memorial Hospital as a proportion of all studies conducted there. We can use this simple method to calculate a probability of success at each institution in our review, with each institution contributing 1 observation to our analysis.

Unfortunately, this method is also very statistically inefficient, ignoring the information provided by individual studies at each institution and greatly reducing our effective sample size(Pendergast et al., 1996). To maximize the information we can glean from each individual study in every centre without assuming that these studies are completely unique relative to one another or that, just because they share an institution, added nothing new to a dataset, we fit logistic models incorporating random-effects in the form of random intercepts corresponding to the institutions at which studies were conducted. The random intercept was assumed to be normally distributed,

with a mean 0 and some variance corresponding to the between-institution variance in success (Pendergast et al., 1996). We chose an *Adaptive Gaussian Quadrature log-likelihood Approximation* method (AGQA) (Pinheiro and Bates 1995; Pinheiro 2006) to estimate parameters in Stata 11.2.

Parameter estimates in models incorporating random effects differ from those in typical models in that they do not estimate an average association between factor and outcome, but a cluster-specific association (Larsen, Petersen, Budtz-Jørgensen, & Endahl, 2000). Consider the determinant *integration with an electronic charting or order entry system*. In models not incorporating random effects, the odds ratio represents the average odds of success in the group of CCDSSs *integrated with an electronic charting or order entry system* compared to the group of CCDSSs not integrated with such systems. In random effects models, the odds ratio for *integration with an electronic charting or order entry system* is adjusted for unobserved characteristics of the institution in which the CCDSS was tested. It represents the odds of success for a CCDSS *integrated with an electronic charting or order entry system* compared to CCDSSs studied in the same institution but not integrated with such systems.

Finding the log-likelihood in models that incorporate random effects cannot be done by simple MLE (Pinheiro and Bates 1995). In these circumstances, the log-likelihood function can be approximated by one of several methods. AGQA is a popular method for approximating the log-likelihood function but a detailed account of AGQA is beyond the scope of this thesis. Pinheiro and Bates (Pinheiro and Bates 1995) compared

several different methods of log-likelihood approximation in the context of non-linear random-effects or mixed models and found the AGQA to offer the best combination of accuracy and statistical efficiency. This method is also the default approach in many software packages, including Stata 11.

Model diagnostics

Checking for collinearity

The main effect of collinearity or multicollinearity is to inflate variance and to make it more difficult to detect important associations (increased risk of Type 1 error). We can quantify the degree of collinearity or multicollinearity by calculating the squared multiple correlation (R^2) and deriving from it a variance inflation factor (VIF), defined as:

$$\text{VIF} = \frac{1}{1-R^2}$$

VIF values higher than 10 generally indicate a collinearity or multicollinearity problem, but there is no certain rule about when a VIF is too large. Our sample was relatively small and we expected significant noise in the data (due to poor reporting and difficult extraction) so we would have been concerned if a VIF approached 5. In such a case, we would have considered either combining variables or removing from the analysis variables that were not modifiable during the design or implementation of decision support systems.

Goodness-of-fit statistics

Goodness-of-fit measures compare the observed success or failure with the outcome that our model predicts. The model provides perfect *individual prediction* if

there is no difference between the observed probability of success (what really happened) and the predicted probability of success in every comparison.

It isn't practical for a logistic model to fit the data perfectly. The dependent variable in our study always had an observed probability of 1 (succeeded) or 0 (failed) with no other possible values. Logistic models, however, produce predicted probabilities of success that range between 1 and 0 but rarely equal to exactly 1 or 0. We can achieve a model that fits the data perfectly by *saturating* it with independent variables (k) to the point that the number of variables approaches the sample size (n) (Kleinbaum & Klein, 2010). Unfortunately, this is true even when the independent variables are not truly related to the outcome: the definition of 'overfitting' the data.

$$k+1 = n$$

There is a better way to assess how well a logistic model fits the data. Instead of comparing the fit of a model to that of a saturated model, we can compare our model to a *fully parametrized* model: a model in which the number of parameters is equal to the number of covariate patterns that can be defined from its independent variables. We can create groups of observations that share the same values of the covariates (i.e., have the same covariate pattern) and use these groups in place of individual observations.

The concept of a fully parametrized model is the same as a saturated model, except that that number of independent variables (k) and the intercept together equal

the number of observed covariate patterns (G), not the number of observations. Therefore, a fully parametrized model is a *group-saturated* model. Such a model predicts the probability of success perfectly for groups of observations (defined by covariate patterns) even if it does not predict success perfectly for individual observations (Kleinbaum & Klein, 2010).

$$k+1 = G$$

Unlike the observed probability of success for individual observations, the observed probability of success for a group is typically not equal to exactly 1 or 0. This appealing property makes the fully parameterized model (and therefore the use of groups of observations instead of individual observations) the preferred gold standard model for assessing goodness-of-fit in logistic regression.

We examined goodness-of-fit using Pearson's Chi-square test, comparing the predicted probability of success in subgroups defined by covariate patterns with the observed probability. This is a valid approach when the number of covariate patterns (and therefore the groups of observations) is much smaller than the total sample size. We planned to use the Hosmer and Lemeshow statistic if we encountered situations where the number of covariate patterns is large and approaches the number of individual observations, meaning that most covariate patterns have only 1 observation. We did not encounter this situation.

Influential observations

We planned to look for observations (comparisons, in our case) or groups of observations that clearly have more influence on the logistic model than other observations using a number of measures:

1) Standardized Pearson residuals are the standardized differences between the observed and the predicted probability of success in subgroups of observations defined by covariate patterns.

2) Deviance residuals represent the difference between the maximums of the observed and predicted log-likelihood functions in subgroups of observations defined by covariate patterns.

3) Pregibon's leverage is the influence exerted by subgroups of observations defined by covariate patterns.

4) DF Beta is the change in the parameter estimate caused by omitting a given observation. This measure is unique among the measures we used because it is calculated at the level of the individual observation instead of at the level of groups defined by covariate patterns. It can be particularly useful for detecting observations that cause instability in the parameter estimates.

Validation procedures

Despite using statistical tests to determine if factors are associated with system effectiveness, it remains possible that some of our findings occurred due to random peculiarities specific to our sample of RCTs and will disappear if tested in a new sample. Findings should be validated in two general ways: internal validation and external validation. However, several years will need to pass before enough RCTs are available for us to test our findings again. We took extra care to avoid overfitting the data with our primary model and we also conducted internal validation procedures to ensure that our findings are stable. We focus here on validating our findings internally.

One simple and popular approach to internal validation is to split the dataset randomly into halves and use one half to develop the model (often with automated selection procedures) and the other half to assess its performance (Steyerberg et al. 2001). This approach allows development and validation in similar but independent samples. However, it is not appropriate with our data because splitting the already small sample would significantly reduce our ability to identify important associations.

Cross-validation is a similar but more rigorous approach. The data can be split in half with one half again used to develop the model and the other used to test its performance but the role of the halves is reversed in a second step and model performance is averaged between the two validations. Variations of this method include

splitting the sample into two unequal parts (80% and 20%, for example) and using the larger part to develop the model and the smaller part to test its performance, repeating the procedure until all observations have fallen into the validation sample once (Steyerberg et al. 2001).

A computer-intensive simulation technique called bootstrap resampling, or bootstrapping, has also been used to validate models. It involves drawing a number of random samples with replacement from the original sample. We assume that the original sample is representative of a larger population, but we anticipate that another random sample drawn from the same population would look slightly different. In the context of our systematic review, that may mean a somewhat different success rate in CCDSS trials and somewhat different distributions of system and study characteristics. In other words, there exists some uncertainty as to the true population characteristics of CCDSS implementations. Classical statistical methods account for this uncertainty by referring to various theoretical distributions such as the Gaussian (normal) distribution and Chi-square distribution. However, small samples and sparse data may provide poor approximations of these theoretical distributions and this has implications on the validity of our parameter estimates. Bootstrap procedures are often used to form an *observed* distribution of parameter estimates, such as means, and to estimate the variance around those point-estimates using the observed distribution instead of a theoretical distribution. This method allows researchers to derive more accurate variance estimates by minimizing the impact of idiosyncrasies in their original sample.

However, the performance of the bootstrap at estimating confidence intervals in small samples or samples with sparse data is debatable. A variety of bootstrap methods intended for this purpose exist but applying them is beyond the scope of this thesis. Instead, we used bootstrap resampling to test the stability of our findings.

The bootstrap has been shown to be superior to split-sample and cross validation in studies by Steyerberg and colleages (Steyerberg, Eijkemans, & Habbema, 1999) and Beyene and colleageus (Beyene, Atenafu, Hamid, To, & Sung, 2009). Their methods included drawing a number of random samples from the original sample, developing a (potentially different) model in each of these datasets using automated procedures (forward, backward, or stepwise selection), and testing the predictive performance of the model(s) with the original data. Beyene and colleagues (Beyene et al., 2009) determined the number of bootstrapped models in which each candidate predictor was selected for inclusion by the automated procedures. A higher frequency of selection suggests that a given candidate is consistently important and is, therefore, stable.

We applied the bootstrap somewhat differently than these previous studies(Austin & Tu, 2004; Beyene et al., 2009; Steyerberg et al., 2001). Instead of using forward, backward, or stepwise selection on randomly drawn “training” samples and testing the resulting models in the original sample, we executed our logistic regression using all pre-specified factors in each of 10,000 randomly drawn samples. We then determined the proportion of samples in which each adjusted parameter estimate was found statistically significant at the $p \leq 0.05$ level using the Wald test statistic. Likelihood ratio tests were

not possible for this simulation because some samples suffered from separation problems and Stata dropped all observations including the problematic variable. The log-likelihood estimates were based on samples of different sizes and the likelihood ratio could not be calculated correctly.

Etiologic and prognostic models, and assessing predictive performance

We set out to discover etiologic (causal) associations between the potential determinants of success in our analysis and the probability of CCDSS success at improving the process of care or patient outcomes. It is important to make the distinction between statistical models constructed for predictive purposes and those constructed to provide etiologic information.

Suppose we had asked, "What do we have to look for in a decision support implementation to predict whether it will succeed or fail at improving the process of care or patient outcomes?" To answer this question, we would be looking to assemble the minimal number of items, each associated with the outcome of interest, which together predict that outcome with a high degree of accuracy. Multiple regression modeling is necessary to investigate causal and prognostic factors but the goals of the resultant models differ (Tripepi, Jager, Dekker, & Zoccali, 2008). Items included in an effective prognostic model may not necessarily have a causal relationship with the outcome of interest (effectiveness, in our case); mere associations will do. Therefore, prognostic models are not used to detect causal relationships and formulating such models does not require us to carefully select potentially causative items.

While this isn't necessary, prognostic factors can be causative (or etiologic). However, to have high predictive value, a prognostic factor should be strongly associated with the outcome of interest. Wald, Hackshaw, and Frost (Wald et al., 1999)

explain that for an item with etiologic value to function as a useful screening test (for a successful system, in our case) it needs to exhibit a very strong association with the outcome of interest. In fact, what one might consider a strong association, say, relative risk of 5, will not yield good performance in predicting the outcome of interest.

It is very common for risk factors in medicine to be used inappropriately in screening and diagnosis. Some examples include serum cholesterol levels for ischemic heart disease and smoking for lung cancer; both may be valid etiologic factors but perform quite poorly in predicting outcomes[35].

To assess predictive performance, we can use our models to predict which comparisons will yield success and which will yield failure and compare these predictions with the outcome we really observed in the dataset. However, our models usually do not predict exact 1 or 0 probabilities, but rather some value in between. To overcome this problem, we considered a model to give a prediction of 'success' if the predicted probability of success for a given observation exceeded a cut point of 0.5 and failure if it did not.

Calculating the predicted probability for each observation necessitates that we remove from the dataset the observation being classified. Otherwise, the resulting error-rate would be biased because we used the same data to predict the probability and to test the prediction. Instead of removing one observation at a time, refitting the model, and classifying that observation using the new parameter estimates, software packages like Stata perform a one-step approximation of the predicted value. This is

important to note because the parameter estimates, while quite accurate, are not exactly what one would compute by removing each observation and refitting the model through iterative maximum likelihood estimation.

As measures of predictive performance, we estimated models' sensitivity and specificity for a predicted probability cut point of 0.5. Sensitivity refers the proportion of true successes that the model predicted correctly; specificity refers to the proportion of true failures that the model predicted correctly. Because these values are likely to vary with the selection of a different predicted probability cut point, we plotted a Receiver Operating Characteristics (ROC) curve and estimated the area under it as a measure of discrimination performance. We also calculated corresponding 95% confidence intervals around each of the measures discussed here.

The ROC curve plots, at several predicted probability cut points, the proportion of correctly predicted success against the proportion of incorrectly predicted successes (i.e. those that turned out to be failures). The area under this curve is large when the model is very accurate at predicting CCDSS successes and failures. The maximum area is 1; 0.9 to 1 indicates excellent predictive performance; 0.8 to 0.9, good performance; 0.7 to 0.8, fair performance; 0.6 to 0.7, poor performance; and 0.5 to 0.6 indicates virtually no ability to discriminate between effective and ineffective systems.

While ideal in practice, AUROCs that approach a value of 1 signify conditions of complete separations and result in no (or highly biased or unstable) parameter

estimates for typical MLE logistic regression. Please refer to the “Maximum likelihood estimation” section of the appendix for a discussion of the separation problem.

Missing data

The validity of all methods for handling missing data rests on assumptions about the way in which data came to be missing—the *mechanism of missingness*. Little and Rubin (Little & Rubin, 1987) characterize mechanisms of missingness in 3 ways:

1. Missing Completely at Random (MCAR): this is the strongest assumption we can make about how the data came to be missing. The probability that observations on a given variable are missing depends on neither observations on any other variable nor on the true value of the missing observation itself. Unfortunately, we cannot test the second condition and have no way of verifying the validity of the MCAR assumption.

2. Missing at Random (MAR): this is a more plausible assumption, but it too is not testable. The probability that a value is missing on a given variable does not depend on the true value of the missing observation. It can, however, depend on any other variable.

3. Not Missing at Random (NMAR): the situation arises when the missing at random mechanism cannot be assumed. Here, the probability of a missing observation on some variable depends on the true value of the observation. Valid statistical inference can only take place if we explicitly modeled the exact mechanism that gave rise to the missing data. This is also called *informative missingness*.

The NMAR mechanism is very plausible for some of the variables in the CCDSS

review. It would arise due to reporting bias, where authors, pressured by space constraints, do not mention in their manuscript features that their systems do not have. We addressed this situation by inferring that, for certain factors, not reported meant not present. We then contacted all corresponding authors with an opportunity to confirm this and discovered that we were universally correct in our inferences.

We could not, however, make such inferences about all missing data. Whether the authors of the study also developed the system, whether the feedback was delivered at the care, or whether the system was a commercial product could not be inferred in this simple way. We assumed that such data were missing at random and moved on to statistical imputation methods.

There are various choices of statistical imputation methods. One way of handling missing data is to impute a single value for each missing observation. Single imputations are easy to compute and simple to understand. However, they do not capture the uncertainty associated with the imputed values, but instead assume no uncertainty. As a result, inferences drawn based on the imputed data tend to be to over-confident and may produce spurious findings (inflated type I error risk).

Multiple imputation

Multiple imputation (MI) was proposed by Donald Rubin in the context of survey non-response (Rubin, 1987). The primary purpose of MI is not to guess the true value of the missing data but to allow for valid statistical inference (Schafer, 1999). It generates

new data only as a means of estimating the uncertainty associated with the missing values. The premise behind MI is that instead of creating a single imputed value for every missing observation (and therefore one imputed data set) we can conduct the imputation procedure multiple times resulting in multiple (m) new datasets.

MI has three basic steps: impute, analyze, and combine. We first use our original dataset to create some number (m) of datasets in which the missing values of the original have been imputed. We then conduct our analyses on each imputed dataset separately as we would with the original dataset. Finally, we combine the results into a point estimate and a variance measure that captures the uncertainty of our imputation procedure, instead of ignoring this uncertainty altogether. The combination procedure captures within-imputation variance and between-imputation variance. Without multiple imputed data sets, we can only capture within-imputation variance. It is the variance in results between imputed datasets that reflects uncertainty introduced by the missing data. The result should be a full dataset that allows for valid inference.

We conducted multiple imputation by the method of *chained equations* (Van Buuren & Oudshoorn, 2010; White, Royston, & Wood, 2011). This iterative imputation technique allowed us to impute data in comparisons with observations on multiple variables. For example, if *integration with charting or order entry system* and *critiquing function* were missing from a given study, the method of chained equations imputed the first factor and used it to impute the second factor, turning that study into a complete-case.

The optimal number of imputed datasets is not well defined in the literature. Historically, it has been suggested that 5 imputed datasets are adequate. Recent empirical work, however, suggests 20 datasets may be required for many common scenarios (Graham, Olchowski, & Gilreath, 2007). We carried out the same analyses across 20 imputed datasets as we had conducted in the complete-case dataset. One exception was that we could not conduct exact logistic regression analysis in the imputed datasets due to computational limitations.

Comparing complete-case analysis and multiple imputation

Complete-case analysis (CCA) may intuitively appear to be a safer approach than multiple imputation because it does not involve creating new data. Indeed, we ought to make every effort to maximize the proportion of complete-cases in our dataset, as we have strived to do in the CCDSS review. An obvious downside of CCA in the context of a multiple logistic model is that if an observation on just one of the multiple covariates in the model is missing, the entire case (entire comparison, in our case) is removed from the analysis. This can be particularly troubling if several of the factors of interest have missing values. For example, if 10 observations are missing across each of 5 variables in a non-overlapping pattern, CCA will drop 50 cases—nearly 1/3 of our dataset—from the analysis. This would lower the statistical efficiency of our analysis and may prevent us from identifying important associations. Further, because our sample is already relatively small, asymptotic estimation methods like maximum likelihood estimation

depend on large sample sizes and may be biased, potentially resulting in spurious associations, and will fail to estimate some parameters altogether under conditions of separation. Please refer to the "Maximum likelihood estimation" section in the appendix.

Consider a very plausible MAR situation where the probability of a variable A being missing from the dataset is related to the value of binary variable B (with no missing values) in the dataset so that a missing observation in A often corresponds to a value of 1 in B. If we include both variables in a multiple logistic model, CCA would result in removal of cases for which A is missing and, therefore, a significantly higher proportion of observations in which B=1 than is plausible by chance. Not only will statistical efficiency be adversely affected in this analysis, but missingness in A would certainly bias our estimates of the relationship between B and the outcome. We can omit A from the model but risk failing to account for its confounding effects.

Simulation studies have found that both CCA and MI can be valid and can fail under particular mechanisms of missingness. Inferences based on MI are more accurate across a greater range of scenarios but no method is consistently better than the other (White & Carlin, 2010). Under MCAR, both CCA and MI generally produce unbiased estimates but CCA lowers statistical efficiency and may produce further problems depending on the analytic approach, as previously mentioned. If data are missing due to an MAR mechanism, which is far more reasonable to assume in practice than MCAR, CCA will produce a less efficient analysis as well as biased parameter estimates more

often than MI (White & Carlin, 2010). However, because MI is not always less biased or more efficient than CCA and is generally less well understood among the general medical readership, some authors recommend that both CCA and MI results be presented. We followed the recommendation regarding presentation and also based our primary analysis on the complete-case data, using the imputed results for sensitivity analysis.

References

Ageno, W. (1998). A randomized comparison of a computer-based dosing program with a manual system to monitor oral anticoagulant therapy. *Thrombosis research*, *91*(5), 237-240. Retrieved from http://cat.inist.fr/?aModele=afficheN&cpsidt=2420650

Albert, A., & Anderson, J. A. (1984). On the Existence of Maximum Likelihood Estimates in Logistic Regression Models. *Biometrika*, *71*(1), 1. Biometrika Trust. doi:10.2307/2336390

Austin, P. C., & Tu, J. V. (2004). Bootstrap methods for developing predictive models. *The American statistician*, *58*(2), 131–137. ASA. doi:10.1198/0003130043277

Austin, P., & Tu, J. (2004). Automated variable selection methods for logistic regression produced unstable models for predicting acute myocardial infarction mortality. *Journal of clinical epidemiology*, *57*(11), 1138-46. doi:10.1016/j.jclinepi.2004.04.003

Austin, P., Mamdani, M., Juurlink, D., & Hux, J. (2006). Testing multiple statistical hypotheses resulted in spurious associations: a study of astrological signs and health. *Journal of clinical epidemiology*, *59*(9), 964-9. doi:10.1016/j.jclinepi.2006.01.012

Babyak, M. A. (2004). What you see may not be what you get: a brief, nontechnical introduction to overfitting in regression-type models. *Psychosomatic medicine*, *66*(3), 411. Am Psychosomatic Soc. doi:10.1097/01.psy.0000127692.23278.a9

Baker, G. R., Norton, P. G., Flintoft, V., Blais, R., Brown, A., Cox, J., Etchells, E., et al. (2004). The Canadian Adverse Events Study: the incidence of adverse events among hospital patients in Canada. *CMAJ : Canadian medical association journal = journal de l'association medicale canadienne*, *170*(11), 1678-86. Retrieved from http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=408508&tool=pmcentrez&rendertype=abstract

Balas, E. A., Weingarten, S., Garb, C. T., Blumenthal, D., Boren, S. A., & Brown, G. D. (2000). Improving preventive care by prompting physicians. *Archives of internal medicine*, *160*(3), 301. Am Med Assoc. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/10668831

Beyene, J., Atenafu, E. G., Hamid, J. S., To, T., & Sung, L. (2009). Determining relative importance of variables in developing and validating predictive models. *BMC medical research methodology*, *9*, 64. doi:10.1186/1471-2288-9-64

Blumenthal, D., & Tavenner, M. (2010). The "meaningful use" regulation for electronic health records. *New England journal of medicine*, 501-504. Mass Med Soc. Retrieved from http://content.nejm.org/cgi/content/full/NEJMp1006114/

Brown, L., Cai, T., & Dasgupta, A. (2002). Confidence intervals for a binomial proportion and asymptotic expansions. *Annals of statistics*, *30*(1), 160–201. JSTOR. Retrieved from http://www.jstor.org/stable/2700007

Brown, L., Cai, T., & DasGupta, A. (2001). Interval estimation for a binomial proportion. *Statistical science*, *16*(2), 101-133. doi:10.1002/sim.2930

Van Buuren, S., & Oudshoorn, C. (2010). MICE: multivariate imputation by chained equations. *Journal of statistical software*, *VV*(Ii). Citeseer. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.169.5745&rep=rep1&type=pdf

Christakis, D. A., & Wright, J. A. (2004). Can continuity of care be improved? Results from a randomized pilot study. *Ambulatory pediatrics*, *4*(4), 336-339.

Corrigan, J. M., Donaldson, M. S., Kohn, L. T., Maguire, S. K., & Pike, K. C. (2001). *Crossing the quality chasm: a new health system for the 21st century*. *Washington DC: Institute of Medicine*.

Corrigan, J., Kohn, L., & Donaldson, M. (1999). *To err is human: Building a safer health system*. *National Academy Press*. Retrieved from http://scholar.google.com/scholar?num=50&hl=en&oe=UTF-8&lr=&q=DBYxKbmClxoJ:scholar.google.com/

Donner, A. (1998). Some aspects of the design and analysis of cluster randomization trials. *Journal of the Royal Statistical Society: Series C (Applied Statistics)*, *47*(1), 95-113. Blackwell Publishers Ltd. Retrieved from http://dx.doi.org/10.1111/1467-9876.00100

Durieux, P., Trinquart, L., Colombet, I., Nies, J., Walton, R., Rajeswaran, A., Rege Walther, M., et al. (2008). Computerized advice on drug dosage to improve prescribing practice. *Cochrane database of systematic reviews*, (3), CD002894. Retrieved from http://ovidsp.ovid.com/ovidweb.cgi?T=JS&NEWS=N&PAGE=fulltext&D=medl&AN=18646085

Firth, D. (1993). Bias reduction of maximum likelihood estimates. *Biometrika*, *80*(1), 27. Biometrika Trust.

Fitzmaurice, D. A., Hobbs, F. D., Murray, E. T., Bradley, C. P., & Holder, R. (1996). Evaluation of computerized decision support for oral anticoagulation management based in primary care. *British journal of general practice*, *46*(410), 533-535.

Flottorp, S., Havelsrud, K., & Oxman, A. D. (2003). Process evaluation of a cluster randomized trial of tailored interventions to implement guidelines in primary care--why is it so hard to change practice? *Family practice*, *20*(3), 333-339. Retrieved from http://ovidsp.ovid.com.libaccess.lib.mcmaster.ca/ovidweb.cgi?T=JS&NEWS=N&PAGE=fulltext&AN=12738704&D=med4

Flottorp, S., Oxman, A. D., Havelsrud, K., Treweek, S., & Herrin, J. (2002). Cluster randomised controlled trial of tailored interventions to improve the management of urinary tract infections in women and sore throat. *BMJ*, *325*(7360), 367. Retrieved from http://ovidsp.ovid.com.libaccess.lib.mcmaster.ca/ovidweb.cgi?T=JS&NEWS=N&PAGE=fulltext&AN=12183309&D=med4

Garg, A. X., Adhikari, N. K., McDonald, H., Rosas-Arellano, M., Devereaux, P., Beyene, J., Sam, J., et al. (2005). Effects of computerized clinical decision support systems on practitioner performance and patient outcomes: a systematic review. *JAMA*, *293*(10), 1223. Am Med Assoc. doi:10.1001/jama.293.10.1223

Goddard, K., Roudsari, A., & Wyatt, J. C. (2011). Automation bias: a systematic review of frequency, effect mediators, and mitigators . *Journal of the American medical informatics association* . Retrieved from http://jamia.bmj.com/content/early/2011/06/16/amiajnl-2011-000089.abstract

Graham, J. W., Olchowski, A. E., & Gilreath, T. D. (2007). How many imputations are really needed? Some practical clarifications of multiple imputation theory. *Prevention science : the official journal of the Society for Prevention Research*, *8*(3), 206-13. doi:10.1007/s11121-007-0070-9

Haynes, R B, Wilczynski, N. L., & the Computerized Clinical Decision Support System (CCDSS) Systematic Review Team. (2010). Effects of computerized clinical decision support systems on practitioner performance and patient outcomes: Methods of a decision-maker-researcher partnership systematic review. *Implementation science*, *5*(1), 12. BioMed Central Ltd. Retrieved from http://www.doaj.org/doaj?func=abstract&id=515868

Haynes, R B, Ackloo, E., Sahota, N, McDonald, H. P., & Yao, X. (2008). Interventions for enhancing medication adherence. *Cochrane database of systematic reviews (Online)*, (2), CD000011. doi:10.1002/14651858.CD000011.pub3

Hedges, L. V., & Olkin, I. (1985). *Statistical methods for meta-analysis*. Orlando: Academic Press.

Heinze, G. (2006). A comparative investigation of methods for logistic regression with separated or nearly separated data. *Statistics in medicine*, *25*(24), 4216-4226. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/16955543

Heinze, G., & Schemper, M. (2002). A solution to the problem of separation in logistic regression. *Statistics in medicine*, *21*(16), 2409-19. doi:10.1002/sim.1047

Hemens, B., Holbrook, A., Tonkin, M., Mackay, J., Weise-Kelly, L., Navarro, T., Wilczynski, N., et al. (2011). Computerized clinical decision support systems for drug prescribing and management: A decision-maker-researcher partnership systematic review . *Implementation science*, *6*(1), 89. Retrieved from http://www.implementationscience.com/content/6/1/89

Hirji, K. F., Tsiatis, A. A., & Mehta, Cyrus R. (1989). Median Unbiased Estimation for Binary Data. *The American statistician*, *43*(1), 7-11. American Statistical Association. Retrieved from http://www.jstor.org/stable/2685158

Hunt, D. L., Haynes, R. B., Hanna, S. E., & Smith, K. (1998). Effects of computer-based clinical decision support systems on physician performance and patient outcomes: a systematic review. *JAMA*, *280*(15), 1339-1346. doi:10.1001/jama.280.15.1339

Jacobsen, M. (1989). Existence and unicity of MLEs in discrete exponential family distributions. *Scandinavian journal of statistics*, *16*(4), 335–349. JSTOR. Retrieved from http://www.jstor.org/stable/4616145

Kawamoto, K., Houlihan, C. A., Balas, E. A., & Lobach, D. F. (2005). Improving clinical practice using clinical decision support systems: a systematic review of trials to identify features critical to success. *BMJ*, *330*(7494), 765-772. Br Med Assoc. Retrieved from http://www.bmj.com/cgi/content/abstract/bmj.38398.500764.8Fv1

Kleinbaum, D. G., & Klein, M. (2010). *Logistic Regression: A Self-Learning Text* (Third.). New York, NY: Springer New York.

Larsen, K., Petersen, J. H., Budtz-Jørgensen, E., & Endahl, L. (2000). Interpreting Parameters in the Logistic Regression Model with Random Effects. *Biometrics*, *56*(3), 909-914. International Biometric Society. Retrieved from http://www.jstor.org/stable/2676942

Little, R. J. A., & Rubin, D.B. (1987). *Statistical Analysis with Missing Data*. New York: Wiley & Sons.

Liu, J. L. Y., & Wyatt, J. C. (2011). The case for randomized controlled trials to assess the impact of clinical information systems. *Journal of the American medical informatics association*, *18*(2), 173-180. Retrieved from http://jamia.bmj.com/content/18/2/173.abstract

Martens, J. D., van der Aa, A., Panis, B., van der Weijden, T., Winkens, R. A., & Severens, J. L. (2006). Design and evaluation of a computer reminder system to improve prescribing behaviour of GPs. *Studies in health technology & informatics*, *124*, 617-623. Retrieved from http://ovidsp.ovid.com.libaccess.lib.mcmaster.ca/ovidweb.cgi?T=JS&NEWS=N&PAGE=fulltext&AN=17108585&D=medl

Martens, J. D., van der Weijden, T., Severens, J. L., de Clercq, P. A., de Bruijn, D. P., Kester, A. D., & Winkens, R. A. (2007). The effect of computer reminders on GPs' prescribing behaviour: a cluster-randomised trial. *International journal of medical informatics*, *76*(Suppl 3), S403-S416. Retrieved from http://ovidsp.ovid.com.libaccess.lib.mcmaster.ca/ovidweb.cgi?T=JS&NEWS=N&PAGE=fulltext&AN=17569575&D=medl

McKibbon, K. A., Lokker, C., Handler, S. M., Dolovich, L. R., Holbrook, Anne M, O'Reilly, D., Tamblyn, R., et al. (2011). The effectiveness of integrated health information technologies across the phases of medication management: a systematic review of randomized controlled trials . *Journal of the American medical informatics association* . Retrieved from http://jamia.bmj.com/content/early/2011/08/18/amiajnl-2011-000304.abstract

Mehta, C R, & Patel, N. R. (1995). Exact logistic regression: theory and examples. *Statistics in medicine*, *14*(19), 2143-60. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/8552893

Mollon, B., Chong, J. J. R., Holbrook, A.M., Sung, M., Thabane, L., & Foster, G. (2009). Features predicting the success of computerized decision support for prescribing: a systematic review of randomized controlled trials. *BMC Medical informatics and decision making*, *9*(1), 11. BioMed Central Ltd. Retrieved from http://www.biomedcentral.com/1472-6947/9/11

Negassa, A., & Hanley, J. A. (2007). The effect of omitted covariates on confidence interval and study power in binary outcome analysis: a simulation study. *Contemporary clinical trials*, *28*(3), 242-248. Elsevier.

Nieuwlaat, R., Connolly, S., Mackay, J., Weise-Kelly, L., Navarro, T., Wilczynski, N., Haynes, R., et al. (2011). Computerized clinical decision support systems for therapeutic drug monitoring and dosing: A decision-maker-researcher partnership systematic review. *Implementation science*, *6*(1), 90. Retrieved from http://www.implementationscience.com/content/6/1/90

Norman, G. R., & Streiner, D. L. (2000). *Biostatistics: the bare essentials* (2nd ed.). Hamilton: B.C. Decker.

Osheroff, J. A., Pifer, E. A., Sittig, D. F., Jenders, R. A., & Teich, J. M. (2004). *Clinical decision support implementers' workbook*. *Chicago: HIMSS* (p. 68). Chicago, Illinois, USA: Healthcare Information Management and Systems Society.

Peduzzi, P., Concato, J., Kemper, E., Holford, T. R., & Feinstein, A. R. (1996). A simulation study of the number of events per variable in logistic regression analysis. *Journal of clinical epidemiology*, *49*(12), 1373–1379. Elsevier. Retrieved from http://linkinghub.elsevier.com/retrieve/pii/S0895435696002363

Pendergast, J. F., Gange, S. J., Newton, M. A., Lindstrom, M. J., Palta, M., & Fisher, M. R. (1996). A Survey of Methods for Analyzing Clustered Binary Response Data. *International statistical review*, *64*(1), 89–118. JSTOR. Retrieved from http://www.jstor.org/stable/1403425

Pinheiro, J C, & Bates, D. M. (1995). Approximations to the log-likelihood function in the nonlinear mixed-effects model. *Journal of computational and graphical statistics*, 12-35. JSTOR.

Pinheiro, J.C. (2006). Conditional versus marginal covariance representation for linear and nonlinear models. *Austrian journal of statistics*, *35*(1), 31–44. Retrieved from http://www.stat.tugraz.at/AJS/ausg061/061Pinheiro.pdf

Reeve, J. F., Tenni, P. C., & Peterson, G. M. (2008). An electronic prompt in dispensing software to promote clinical interventions by community pharmacists: a randomized controlled trial. *British journal of clinical pharmacology*, *65*(3), 377-385. Retrieved from http://ovidsp.ovid.com/ovidweb.cgi?T=JS&NEWS=N&PAGE=fulltext&AN=17764471&D=medl

Roshanov, P. S., Misra, S., Gerstein, H. C., Garg, A. X., Sebaldt, R. J., Mackay, J. A., Weise-Kelly, L., et al. (2011). Computerized clinical decision support systems for chronic disease management: A decision-maker-researcher partnership systematic review. *Implementation science*, *6*(1), 92. BioMed Central Ltd. doi:10.1186/1748-5908-6-92

Roshanov, P. S., You, J. J., Dhaliwal, J., Koff, D., Mackay, J. A., Weise-Kelly, L., Navarro, T., et al. (2011). Can computerized clinical decision support systems improve practitioners' diagnostic test ordering behavior? A decision-maker-researcher partnership systematic review. *Implementation science : IS*, *6*(1), 88. doi:10.1186/1748-5908-6-88

Rubin, Donald B. (1987). *Multiple Imputation for Nonresponse in Surveys.* New York: Wiley.

Ryff-de Leche, A., Engler, H., Nutzi, E., Berger, M., & Berger, W. (1992). Clinical application of two computerized diabetes management systems: comparison with the log-book method. *Diabetes research*, *19*(3), 97-105.

Sahota, Navdeep, Lloyd, R., Ramakrishna, A., Mackay, J., Prorok, J., Weise-Kelly, L., Navarro, T., et al. (2011). Computerized clinical decision support systems for acute care management: A decision-maker-researcher partnership systematic review of effects on process of care and patient outcomes. *Implementation science*, *6*(1), 91. Retrieved from http://www.implementationscience.com/content/6/1/91

Schafer, J. L. (1999). Multiple imputation: a primer. *Statistical methods in medical research*, *8*(1), 3-15. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/10347857

Scott, G. P. T., Shah, P., Wyatt, J. C., Makubate, B., & Cross, F. W. (2011). Making electronic prescribing alerts more effective: scenario-based experimental study in junior doctors . *Journal of the American medical informatics association* . Retrieved from http://jamia.bmj.com/content/early/2011/08/11/amiajnl-2011-000199.abstract

Shiffman, R. N., Brandt, C. A., Liaw, Y., & Corb, G. J. (1999). A design model for computer-based guideline implementation based on information management services. *Journal of the American medical informatics association : JAMIA*, *6*(2), 99-103. BMJ Publishing Group Ltd. doi:10.1136/jamia.1999.0060099

Shojania, K. G., Jennings, A., Mayhew, A., Ramsay, C., Eccles, M., & Grimshaw, J. (2010). Effect of point-of-care computer reminders on physician behaviour: a systematic review. *Canadian medical association journal*, *182*(5), E216-E225.

Sicotte, C., Jaana, M., & Girouard, D. (2008). Prioritizing the Risk Factors Influencing the Success of Clinical Information System Projects A Delphi Study in Canada. *Methods*, 251-259. doi:10.3414/ME0512

Sim, I., Gorman, P., Greenes, R. a, Haynes, R B, Kaplan, B., Lehmann, H., & Tang, P. C. (2001). Clinical decision support systems for the practice of evidence-based medicine. *Journal of the American medical informatics association : JAMIA*, *8*(6),

527-34. Retrieved from http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=130063&tool=pmcentrez&rendertype=abstract

Solberg, L. I., Brekke, M. L., Fazio, C. J., Fowles, J., Jacobsen, D. N., Kottke, T. E., Mosser, G., et al. (2000). Lessons from experienced guideline implementers: attend to many factors and use multiple strategies. *The Joint Commission journal on quality improvement*, *26*(4), 171-88. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/10749003

Souza, N., Sebaldt, R., Mackay, J., Prorok, J., Weise-Kelly, L., Navarro, T., Wilczynski, N., et al. (2011). Computerized clinical decision support systems for primary preventive care: A decision-maker-researcher partnership systematic review of effects on process of care and patient outcomes. *Implementation science*, *6*(1), 87. Retrieved from http://www.implementationscience.com/content/6/1/87

Steyerberg, E W, Harrell, F. E., Borsboom, G. J., Eijkemans, M. J., Vergouwe, Y., & Habbema, J. D. (2001). Internal validation of predictive models: efficiency of some procedures for logistic regression analysis. *Journal of clinical epidemiology*, *54*(8), 774-81. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/11470385

Steyerberg, Ewout W, Eijkemans, M. J. C., & Habbema, J. D. F. (1999). Stepwise Selection in Small Data Sets: A Simulation Study of Bias in Logistic Regression Analysis. *Journal of clinical epidemiology*, *52*(10), 935-942. Retrieved from http://www.sciencedirect.com/science/article/pii/S0895435699001031

Talmon, J., Ammenwerth, E., Brender, J., Keizer, N. D., Nykänen, P., & Rigby, M. (2008). STARE-HI — Statement on reporting of evaluation studies in Health Informatics. *Health (San Francisco)*, *8*, 1-9. doi:10.1016/j.ijmedinf.2008.09.002

Thompson, S. G., & Higgins, J. P. T. (2002). How should meta-regression analyses be undertaken and interpreted? *Statistics in medicine*, *21*(11), 1559-1573. MRC Biostatistics Unit, Institute of Public Health, Robinson Way, Cambridge CB2 2SR, U.K. doi:10.1002/sim.1187

Tierney, W. M., McDonald, C. J., Martin, D. K., & Rogers, M. P. (1987). Computerized display of past test results. Effect on outpatient testing. *Annals of internal medicine*, *107*(4), 569-74. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/3631792

Tierney, W. M., Miller, M. E., & McDonald, C. J. (1990). The effect on test ordering of informing physicians of the charges for outpatient diagnostic tests. *The New England journal of medicine*, *322*(21), 1499-504. doi:10.1056/NEJM199005243222105

Tripepi, G., Jager, K. J., Dekker, F. W., & Zoccali, C. (2008). Testing for causality and prognosis: etiological and prognostic models. *Kidney international*, *74*(12), 1512-5. doi:10.1038/ki.2008.416

Trivedi, M., Kern, J., Marcee, A., Grannemann, B., Kleiber, B., Bettinger, T., Altshuler, K., et al. (2002). Development and implementation of computerized clinical guidelines: barriers and solutions. *Methods of information in medicine*, *41*(5), 435–442. FK SCHATTAUER VERLAGSGESELLSCHAFT MBH. Retrieved from http://www.schattauer.de/en/magazine/subject-areas/journals-a-z/methods/contents/archive/issue/702/manuscript/250/download.html

Wald, N., Hackshaw, A., & Frost, C. (1999). When can a risk factor be used as a worthwhile screening test? *BMJ*, *319*(7224), 1562. British Medical Journal Publishing Group. Retrieved from http://www.bmj.com/content/319/7224/1562.short

Webster, P. C. (2010). Canada's ehealth software "Tower of Babel". *CMAJ : Canadian Medical Association journal = journal de l'Association medicale canadienne*, *182*(18), 1945-6. doi:10.1503/cmaj.109-3717

Wetter, T. (2002). Lessons learnt from bringing knowledge-based decision support into routine use. *Artificial intelligence in medicine*, *24*(3), 195-203. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/11879989

White, I. R., & Carlin, J. B. (2010). Bias and efficiency of multiple imputation compared with complete-case analysis for missing covariate values. *Statistics in medicine*, *29*(28), 2920-31. doi:10.1002/sim.3944

White, I. R., Royston, P., & Wood, A. M. (2011). Multiple imputation using chained equations: Issues and guidance for practice. *Statistics in medicine*, *30*(4), 377-99. doi:10.1002/sim.4067

Wyatt, J. (1989). Lessons learnt from the field trial of ACORN, an expert system to advise on chest pain. *Proceedings of the Sixth World Conference on Medical Informatics, Singapore* (pp. 111–5). Retrieved from http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Lessons+learnt+from+the+field+trial+of+ACORN,+an+expert+system+to+advise+on+chest+pain#0

Zeger, S. L., Liang, K.-Y., & Albert, P. S. (n.d.). Models for Longitudinal Data: A Generalized Estimating Equation Approach. *Biometrics*, *44*(4), 1049-1060. International Biometric Society. Retrieved from http://www.jstor.org/stable/2531734

References for reviewed studies and supplemental publications

1. Ahmad F, Hogg-Johnson S, Stewart DE, et al. Computer-assisted screening for intimate partner violence and control: a randomized trial. *Annals of internal medicine*. 2009;151(2):93-102.

2. Albisser AM, Wright CE, Sakkal S. Averting iatrogenic hypoglycemia through glucose prediction in clinical practice: progress towards a new procedure in diabetes. *Diabetes research & clinical practice*. 2007;76(2):207-214.

3. Ansari M, Shlipak MG, Heidenreich PA, et al. Improving guideline adherence: a randomized trial evaluating strategies to increase beta-blocker use in heart failure. *Circulation*. 2003;107(22):2799-2804.

4. Apkon M, Mattera JA, Lin Z, et al. A randomized outpatient trial of a decision-support information technology tool. *Archives of internal medicine*. 2005;165(20):2388-2394.

5. Augstein P, Vogt L, Kohnert KD, et al. Outpatient assessment of Karlsburg Diabetes Management System-based decision support. *Diabetes care*. 2007;30(7):1704-1708.

6. Barnett GO, Winickoff RN, Morgan MM, Zielstorff RD. A computer-based monitoring system for follow-up of elevated blood pressure. *Medical care*. 1983;21(4):400-409.

7. Bates DW, Kuperman GJ, Rittenberg E, et al. A randomized trial of a computer-based intervention to reduce utilization of redundant laboratory tests. *The American journal of medicine*. 1999;106(2):144-150.

8. Begg E, Atkinson H, Jeffery G, Taylor N. Individualised aminoglycoside dosage based on pharmacokinetic analysis is superior to dosage based on physician intuition at achieving target plasma drug concentrations. *British journal of clinical pharmacology*. 1989;28(2):137.

9. Bertoni AG, Bonds DE, Chen H, et al. Impact of a multifaceted intervention on cholesterol management in primary care practices: guideline adherence for heart health randomized trial. *Archives of internal medicine*. 2009;169(7):678-686.

10. Bogusevicius A, Maleckas A, Pundzius J, Skaudickas D, Boguševičius A. Prospective randomised trial of computer-aided diagnosis and contrast radiography in acute small bowel obstruction. *European journal of surgery*. 2002;168(2):78–83.

11. Borbolla D, Giunta D, Figar S, et al. Effectiveness of a chronic disease surveillance systems for blood pressure monitoring. In: Vol 129. IOS Press; 2007:223-227.

12. Bosworth HB, Olsen MK, Dudley T, et al. Patient education and provider decision support to control blood pressure in primary care: a cluster randomized trial. *American heart journal*. 2009;157(3):450-456.

13. Brothers TE, Cox MH, Robison JG, Elliott BM, Nietert P. Prospective decision analysis modeling indicates that clinical decisions in vascular surgery often fail to maximize patient expected utility. *Journal of surgical research*. 2004;120(2):278-287.

14. Burack RC, Gimotty PA, George J, et al. Promoting screening mammography in inner-city settings: a randomized controlled trial of computerized reminders as a component of a program to facilitate mammography. *Medical care*. 1994;32(6):609-624.

15. Burack RC, Gimotty PA, George J, et al. The effect of patient and physician reminders on use of screening mammography in a health maintenance organization. Results of a randomized controlled trial. *Cancer*. 1996;78(8):1708-1721.

16. Burack RC, Gimotty PA. Promoting screening mammography in inner-city settings. The sustained effectiveness of computerized reminders in a randomized controlled trial. *Medical care*. 1997;35(9):921-931.

17. Burack RC, Gimotty PA, George J, et al. How reminders given to patients and physicians affected pap smear use in a health maintenance organization: results of a randomized controlled trial. *Cancer*. 1998;82(12):2391-2400.

18. Burack RC, Gimotty PA, Simon M, Moncrease A, Dews P. The effect of adding Pap smear information to a mammography reminder system in an HMO: results of randomized controlled trial. *Preventive medicine*. 2003;36(5):547-554.

19. Burton ME, Ash CL, Hill DP, et al. A controlled trial of the cost benefit of computerized bayesian aminoglycoside administration. *Clinical pharmacology & therapeutics*. 1991;49(6):685-694.

20. Cannon DS, Allen SN. A comparison of the effects of computer and manual reminders on compliance with a mental health clinical practice guideline. *Journal of the American medical informatics association*. 2000;7(2):196-203.

21. Carter BL, Taylor JW, Becker A. Evaluation of three dosage-prediction methods for initial in-hospital stabilization of warfarin therapy. *Clinical pharmacy*. 1987;6(1):37-45.

22. Casner PR, Reilly R, Ho H. A randomized controlled trial of computerized pharmacokinetic theophylline dosing versus empiric physician dosing. *Clinical pharmacology & therapeutics*. 1993;53(6):684-690.

23. Cavalcanti AB, Silva E, Pereira AJ, et al. A randomized controlled trial comparing a computer-assisted insulin infusion protocol with a strict and a conventional protocol for glucose control in critically ill patients. *Journal of critical care*. 2009;24(3):371-378.

24. Chambers CV, Balaban DJ, Carlson BL, Grasberger DM. The effect of microcomputer-generated reminders on influenza vaccination rates in a university-based family practice center. *Journal of the American board of family practice*. 1991;4(1):19-26.

25. Christakis DA, Zimmerman FJ, Wright JA, et al. A randomized controlled trial of point-of-care evidence to improve the antibiotic prescribing practices for otitis media in children. *Pediatrics*. 2001;107(2):E15.

26. Christian JG, Bessesen DH, Byers TE, et al. Clinic-based support to help overweight patients with type 2 diabetes increase physical activity and lose weight. *Archives of internal medicine*. 2008;168(2):141-146.

27. Claes N, Buntinx F, Vijgen J, et al. The Belgian Improvement Study on Oral Anticoagulation Therapy: a randomized clinical trial. *European heart journal*. 2005;26(20):2159-2165.

28. Claes N, Moeremans K, Frank B, et al. Estimating the cost-effectiveness of quality-improving interventions in oral anticoagulation management within general practice. *Value in health*. 2006;9(6):369-376.

29. Cleveringa FG, Gorter KJ, Donk M van den, Rutten GE. Combined task delegation, computerized decision support, and feedback improve cardiovascular risk for type 2 diabetic patients: a cluster randomized trial in primary care. *Diabetes care*. 2008;31(12):2273-2275.

30. Cleveringa FGW, Minkman MH, Gorter KJ, Donk M van den, Rutten G. Diabetes Care Protocol: effects on patient-important outcomes. A cluster randomised non-inferiority trial in primary care. *Diabetic medicine*. 2010;27(4):442-450.

31. Cleveringa FG, Welsing PM, Donk M van den, et al. Cost-effectiveness of the diabetes care protocol, a multifaceted computerized decision support diabetes management intervention that reduces cardiovascular risk. *Diabetes care*. 2010;33(2):258-263.

32. Cleveringa FGW, Gorter KJ, Donk M van den, Pijman PLW, Rutten GEHM. Task delegation and computerized decision support reduce coronary heart disease risk factors in type 2 diabetes patients in primary care. *Diabetes technology & therapeutics*. 2007;9(5):473-481.

33. Cobos A, Vilaseca J, Asenjo C, et al. Cost effectiveness of a clinical decision support system based on the recommendations of the European Society of Cardiology and other societies for the management of hypercholesterolemia: Report of a cluster-randomized trial. *Disease management and health outcomes*. 2005;13(6):421-432.

34. Coe FLL, Norton E, Oparil S, Tatar A, Pullman TNTN. Treatment of hypertension by computer and physician-a prospective controlled study. *Journal of chronic diseases*. 1977;30(2):81–92.

35. Davis RL, Wright J, Chalmers F, et al. A cluster randomized clinical trial to improve prescribing patterns in ambulatory pediatrics. *PLoS clinical trials*. 2007;2(5):e25.

36. Demakis JG, Beauchamp C, Cull WL, et al. Improving residents' compliance with standards of ambulatory care: results from the VA Cooperative Study on Computerized Reminders. *JAMA*. 2000;284(11):1411-1416.

37. Derose SF, Dudl JR, Benson VM, et al. Point of service reminders for prescribing cardiovascular medications. *The American journal of managed care*. 2005;11(5):298-304.

38. Dexter PR, Wolinsky FD, Gramelspacher GP, et al. Effectiveness of computer-generated reminders for increasing discussions about advance directives and completion of advance directive forms. A randomized, controlled trial. *Annals of internal medicine*. 1998;128(2):102-110.

39. Dexter PR, Perkins S, Overhage JM, et al. A computerized reminder system to increase the use of preventive care for hospitalized patients. *New England journal of medicine*. 2001;345(13):965-970.

40. Downs M, Turner S, Bryans M, et al. Effectiveness of educational interventions in improving detection and management of dementia in primary care: cluster randomised controlled study. *British medical journal*. 2006;332(7543):692-696.

41. Eccles M, McColl E, Steen N, et al. Effect of computerised evidence based guidelines on management of asthma and angina in adults in primary care: cluster randomised controlled trial. *British medical journal*. 2002;325(7370):941.

42. Emery J, Morris H, Goodchild R, et al. The GRAIDS Trial: a cluster randomised controlled trial of computer decision support for the management of familial cancer risk in primary care. *British journal of cancer*. 2007;97(4):486-493.

43. Feldman PH, Murtaugh CM, Pezzin LE, McDonald MV, Peng TR. Just-in-time evidence-based e-mail "reminders" in home health care: impact on patient outcomes. *Health services research*. 2005;40(3):865-885.

44. Feldstein A, Elmer PJ, Smith DH, et al. Electronic medical record reminder improves osteoporosis management after a fracture: a randomized, controlled trial. *Journal of the American geriatrics society*. 2006;54(3):450-457.

45. Field TS, Rochon P, Lee M, et al. Computerized clinical decision support during medication ordering for long-term care residents with renal insufficiency. *Journal of the American medical informatics association*. 2009;16(4):480-485.

46. Fihn SD, McDonell MB, Vermes D, et al. A computerized intervention to improve timing of outpatient follow-up: a multicenter randomized trial in patients treated with warfarin. National Consortium of Anticoagulation Clinics. *Journal of general internal medicine*. 1994;9(3):131-139.

47. Fiks AG, Hunter KF, Localio AR, et al. Impact of electronic health record-based alerts on influenza vaccination for children with asthma. *Pediatrics*. 2009;124(1):159-169.

48. Filippi A, Sabatini A, Badioli L, et al. Effects of an automated electronic reminder in changing the antiplatelet drug-prescribing behavior among Italian general practitioners in diabetic patients: an intervention trial. *Diabetes care*. 2003;26(5):1497-1500.

49. Fitzmaurice DA, Hobbs FD, Murray ET, et al. Oral anticoagulation management in primary care with the use of computerized decision support and near-patient testing: a randomized, controlled trial. *Archives of internal medicine*. 2000;160(15):2343-2348.

50. Fitzmaurice DA, Hobbs FD, Murray ET, Bradley CP, Holder R. Evaluation of computerized decision support for oral anticoagulation management based in primary care. *British journal of general practice*. 1996;46(410):533-535.

51. Flanagan JR, Doebbeling BN, Dawson J, Beekmann S. Randomized study of online vaccine reminders in adult primary care. *Proceedings / AMIA ...Annual Symposium.:755-9, 1999*. 1999:755-759.

52. Flottorp S, Havelsrud K, Oxman AD. Process evaluation of a cluster randomized trial of tailored interventions to implement guidelines in primary care--why is it so hard to change practice? *Family practice*. 2003;20(3):333-339.

53. Flottorp S, Oxman AD, Havelsrud K, Treweek S, Herrin J. Cluster randomised controlled trial of tailored interventions to improve the management of urinary tract infections in women and sore throat. *British medical journal*. 2002;325(7360):367.

54. Fortuna RJ, Zhang F, Ross-Degnan D, et al. Reducing the prescribing of heavily marketed medications: a randomized controlled trial. *Journal of general internal medicine*. 2009;24(8):897-903.

55. Frame PS, Zimmer JG, Werth PL, Hall WJ, Eberly SW. Computer-based vs manual health maintenance tracking. A controlled trial. *Archives of family medicine*. 1994;3(7):581-588.

56. Gilutz H, Novack L, Shvartzman P, et al. Computerized community cholesterol control (4C): meeting the challenge of secondary prevention. *Israel medical association journal*. 2009;11(1):23-29.

57. Gonzalez ER, Vanderheyden BA, Ornato JP, Comstock TG. Computer-assisted optimization of aminophylline therapy in the emergency department. *American journal of emergency medicine*. 1989;7(4):395-401.

58. Goud R, Keizer NF de, Riet G ter, et al. Effect of guideline based computerised decision support on decision making of multidisciplinary teams: cluster randomised trial in cardiac rehabilitation. *British medical journal(Clinical research ed.)*. 2009;338:b1440.

59. Goud R, Jasters MWM, Hasman A, Peek N. Subjective usability of the CARDSS guideline-based decision support system. In: *eHealth beyond the horizon: get IT there: proceedings of MIE2008, the XXIst International Congress of the European Federation for Medical Informatics*.Vol 136. Ios Pr Inc; 2008:193.

60. Gurwitz JHH, Field TSS, Rochon P, et al. Effect of computerized provider order entry with clinical decision support on adverse drug events in the long-term care setting. *Journal of the American geriatrics Society*. 2008;56(12):2225-2233.

61. Hales J, Gardner R, Jacobson J. Factors impacting the success of computerized preadmission screening. In: *Proceedings of the annual symposium on computer application in medical care*. American Medical Informatics Association; 1995:728.

62. Hamilton E, Platt R, Gauthier R, et al. The effect of computer-assisted evaluation of labor on cesarean rates. *Journal for healthcare quality*. 2004;26(1):37-44.

63. Harari D, Iliffe S, Kharicha K, et al. Promotion of health in older people: a randomised controlled trial of health risk appraisal in British general practice. *Age and ageing*. 2008;37(5):565-571.

64. Heidenreich PAPA, Chacko M, Goldstein MKMK, Atwood JEE. ACE inhibitor reminders attached to echocardiography reports of patients with reduced left ventricular ejection fraction. *The American journal of medicine*. 2005;118(9):1034–1037.

65. Heidenreich PA, Gholami P, Sahay A, et al. Clinical reminders attached to echocardiography reports of patients with reduced left ventricular ejection fraction increase use of beta-blockers: a randomized trial. *Circulation*. 2007;115(22):2829-2834.

66. Helder OK, Mulder PG, Goudoever JB van. Computer-generated versus nurse-determined strategy for incubator humidity and time to regain birthweight. *Journal of obstetric, gynecologic, and neonatal nursing : JOGNN / NAACOG*. 2008;37(3):255-261.

67. Hetlevik I, Holmen J, Kruger O. Implementing clinical guidelines in the treatment of hypertension in general practice. Evaluation of patient outcome related to implementation of a computer-based clinical decision support system. *Scandinavian journal of primary health care*. 1999;17(1):35-40.

68. Hetlevik I, Holmen J, Kruger O, et al. Implementing clinical guidelines in the treatment of diabetes mellitus in general practice. Evaluation of effort, process, and patient outcome related to implementation of a computer-based decision support system. *International journal of technology assessment in health care*. 2000;16(1):210-227.

69. Hickling K, Begg E, Moore ML. A prospective randomised trial comparing individualised pharmacokinetic dosage prediction for aminoglycosides with prediction based on estimated creatinine clearance in critically ill patients. *Intensive care medicine*. 1989;15(4):233-237.

70. Hicks LS, Sequist TD, Ayanian JZ, et al. Impact of computerized decision support on blood pressure management and control: a randomized controlled trial. *Journal of general internal medicine*. 2008;23(4):429-41.

71. Holbrook A, Thabane L, Keshavjee K, et al. Individualized electronic decision support and reminders to improve diabetes care in the community: COMPETE II randomized trial. *Canadian medical association journal*. 2009;181(1-2):37-44.

72. Holbrook A, Keshavjee K, Lee H, et al. Individualized Electronic Decision Support and Reminders Can Improve Diabetes Care in the Community. In: *AMIA annual symposium proceedings*.Vol 2005. American Medical Informatics Association; 2005:982.

73. Hurley SF, Dziukas LJ, McNeil JJ, Brignell MJ. A randomized controlled clinical trial of pharmacokinetic theophylline dosing. *American review of respiratory disease*. 1986;134(6):1219-1224.

74. Javitt JC, Steinberg G, Locke T, et al. Using a claims data-based sentinel system to improve compliance with clinical guidelines: results of a randomized prospective study. *American journal of managed care*. 2005;11(2):93-102.

75. Javitt JC, Rebitzer JB, Reisman L. Information technology and medical missteps: evidence from a randomized trial. *Journal of health economics*. 2008;27(3):585-602.

76. Judge J, Field TSS, DeFlorio M, et al. Prescribers' responses to alerts during medication ordering in the long term care setting. *Journal of the American medical informatics association*. 2006;13(4):385.

77. Kattan M, Crain EF, Steinbach S, et al. A randomized clinical trial of clinician feedback to improve quality of care for inner-city children with asthma. *Pediatrics*. 2006;117(6):e1095-e1103.

78. Kenealy T, Arroll B, Petrie KJ. Patients and computers as reminders to screen for diabetes in family practice. Randomized-controlled trial. *Journal of general internal medicine*. 2005;20(10):916-921.

79. Krall MA, Traunweiser K, Towery W. Effectiveness of an electronic medical record clinical quality alert prepared by off-line data analysis. *Studies in health technology & informatics*. 2004;107(Pt 1):135-139.

80. Kroth PJ, Dexter PR, Overhage JM, et al. A computerized decision support system improves the accuracy of temperature capture from nursing personnel at the bedside. *AMIA annual symposium proceedings*. 2006:444-448.

81. Kuilboer MM, Wijk MA van, Mosseveld M, et al. Computed critiquing integrated into daily clinical practice affects physicians' behavior--a randomized clinical trial with AsthmaCritic. *Methods of information in medicine*. 2006;45(4):447-454.

82. Kuperman GJ, Teich JM, Tanasijevic MJ, et al. Improving response to critical laboratory results with automation: results of a randomized controlled trial. *Journal of the American medical informatics association*. 1999;6(6):512-522.

83. Lafata JE, Kolk D, Peterson EL, et al. Improving osteoporosis screening: results from a randomized cluster trial. *Journal of general internal medicine*. 2007;22(3):346-351.

84. Lee NJ, Chen ES, Currie LM, et al. The effect of a mobile clinical decision support system on the diagnosis of obesity and overweight in acute and primary care encounters. *Advances in nursing science*. 2009;32(3):211-221.

85. Lesourd F, Avril C, Boujennah A, Parinaud J. A computerized decision support system for ovarian stimulation by gonadotropins. *Fertility & sterility*. 2002;77(3):456-460.

86. Lester WT, Grant RW, Barnett GO, Chueh HC. Randomized controlled trial of an informatics-based intervention to increase statin prescription for secondary prevention of coronary disease. *Journal of general internal medicine*. 2006;21(1):22-29.

87. Lester WT, Grant R, Barnett GO, Chueh H. Facilitated lipid management using interactive e-mail: preliminary results of a randomized controlled trial. *Studies in health technology & informatics*. 2004;107(Pt 1):232-236.

88. Lewis G, Sharp D, Bartholomew J, Pelosi AJ. Computerized assessment of common mental disorders in primary care: effect on clinical outcome. *Family practice*. 1996;13(2):120-126.

89. Lo HG, Matheny ME, Seger DL, et al. Impact of non-interruptive medication laboratory monitoring alerts in ambulatory care. *Journal of the American medical informatics association : JAMIA*. 2009;16(1):66-71.

90. Lobach DF, Hammond W. Computerized decision support based on a clinical practice guideline improves compliance with care standards. *The American journal of medicine*. 1997;102(1):89–98.

91. Lobach DF. Electronically distributed, computer-generated, individualized feedback enhances the use of a computerized practice guideline. In: *Proceedings of the AMIA annual fall symposium*. American Medical Informatics Association; 1996:493.

92. Locatelli F, Covic A, Macdougall IC, et al. Effect of computer-assisted European Best Practice Guideline implementation on adherence and target attainment: ORAMA results. *Journal of nephrology*. 2009;22(5):662-674.

93. Lowensteyn I, Joseph L, Levinton C, et al. Can computerized risk profiles help patients improve their coronary risk? The results of the Coronary Health Assessment Study (CHAS). *Preventive medicine*. 1998;27:730-737.

94. MacLean CD, Gagnon M, Callas P, Littenberg B. The Vermont Diabetes Information System: A Cluster Randomized Trial of a Population Based Decision Support System. *Journal of general internal*. 2009;24(12):1303-1310.

95. MacLean CD, Littenberg B, Gagnon M. Diabetes decision support: initial experience with the Vermont diabetes information system. *American journal of public health*. 2006;96(4):593-595.

96. Manotti C, Moia M, Palareti G, et al. Effect of computer-aided management on the quality of treatment in anticoagulated patients: a prospective, randomized, multicenter trial of APROAT (Automated PRogram for Oral Anticoagulant Treatment). *Haematologica*. 2001;86(10):1060-1070.

97. Martens JD, Weijden T van der, Severens JL, et al. The effect of computer reminders on GPs' prescribing behaviour: a cluster-randomised trial. *International journal of medical informatics*. 2007;76(Suppl 3):S403-S416.

98. Martens JD, Aa A van der, Panis B, et al. Design and evaluation of a computer reminder system to improve prescribing behaviour of GPs. *Studies in health technology & informatics*. 2006;124:617-623.

99. Martin DC, Berger ML, Anstatt DT, et al. A randomized controlled open trial of population-based disease and case management in a Medicare Plus Choice health maintenance organization. *Preventing chronic disease*. 2004;1(4):A05.

100. Matheny ME, Sequist TD, Seger AC, et al. A Randomized Trial of Electronic Clinical Reminders to Improve Medication Laboratory Monitoring. *Journal of the American medical informatics association*. 2004;15(4):424-429.

101. Mazzuca SA, Vinicor F, Einterz RM, et al. Effects of the clinical environment on physicians' response to postgraduate medical education. *American educational research journal*. 1990;27(3):473-488.

102. McAlister NH, Covvey HD, Tong C, Lee A, Wigle ED. Randomised controlled trial of computer assisted management of hypertension in primary care. *British medical journal (Clinical research ed.)*. 1986;293(6548):670.

103. McCowan C, Neville RG, Ricketts IW, et al. Lessons from a randomized controlled trial designed to evaluate computer decision support software to improve the management of asthma. *Medical informatics & the internet in medicine*. 2001;26(3):191-201.

104. McDonald CJJ. Use of a computer to detect and respond to clinical events: its effect on clinician behavior. *Annals of internal medicine*. 1976;84(2):162-167.

105. McDonald CJ, Wilson GA, McCabe GP. Physician response to computer reminders. *JAMA*. 1980;244(14):1579-1581.

106. McDonald CJ, Hui SL, Smith DM, et al. Reminders to physicians from an introspective computer medical record. A two-year randomized trial. *Annals of internal medicine*. 1984;100(1):130-138.

107. McDonald MV, Pezzin LE, Feldman PH, Murtaugh CM, Peng TR. Can just-in-time, evidence-based "reminders" improve pain management among home health care nurses and their patients? *Journal of pain and symptom management*. 2005;29(5):474-488.

108. McPhee SJ, Bird JA, Jenkins CNH, Fordham D. Promoting cancer screening: a randomized, controlled trial of three interventions. *Archives of internal medicine*. 1989;149(8):1866.

109. McPhee SJ, Bird JA, Fordham D, Rodnick JE, Osborn EH. Promoting cancer prevention activities by primary care physicians. Results of a randomized, controlled trial. *JAMA*. 1991;266(4):538-544.

110. Meigs JB, Cagliero E, Dubey a, et al. A controlled trial of web-based diabetes disease management: the MGH diabetes primary care improvement project. *Diabetes care*. 2003;26(3):750-757.

111. Mitchell E, Sullivan F, Watt G, Grimshaw JM, Donnan PT. Using electronic patient records to inform strategic decision making in primary care. In: *Studies in health technology and informatics*.Vol 107. Ios Pr Inc; 2004:1157-1161.

112. Mitra R, Marciello MA, Brain C, Ahangar B, Burke DT. Efficacy of computer-aided dosing of warfarin among patients in a rehabilitation hospital. *American journal of physical medicine & rehabilitation*. 2005;84(6):423-427.

113. Montgomery AA, Fahey T, Peters TJ, MacIntosh C, Sharp DJ. Evaluation of computer based clinical decision support system and risk chart for management of hypertension in primary care: randomised controlled trial. *British medical journal*. 2000;320(7236):686-690.

114. Murray MD, Harris LE, Overhage JM, et al. Failure of computerized treatment suggestions to improve health outcomes of outpatients with uncomplicated

hypertension: results of a randomized controlled trial. *Pharmacotherapy*. 2004;24(3):324-337.

115. Nilasena DS, Lincoln MJ. A computer-generated reminder system improves physician compliance with diabetes preventive care guidelines. In: *Proceedings of the annual symposium on computer application in medical care*.Vol 280. American Medical Informatics Association; 1995:640.

116. Ornstein SM, Garr DR, Jenkins RG, Rust PF, Arnon A. Computer-generated physician and patient reminders. Tools to improve population adherence to selected preventive services. *Journal of family practice*. 1991;32(1):82-90.

117. Overhage JM, Tierney WM, McDonald CJ. Computer reminders to implement preventive care guidelines for hospitalized patients. *Archives of internal medicine*. 1996;156(14):1551-1556.

118. Overhage JM, Tierney WM, Zhou XH, McDonald CJ. A randomized trial of "corollary orders" to prevent errors of omission. *Journal of the American medical informatics association*. 1997;4(5):364-375.

119. Palen TE, Raebel M, Lyons E, Magid DM. Evaluation of laboratory monitoring alerts within a computerized physician order entry system for medication orders. *American journal of managed care*. 2006;12(7):389-395.

120. Paul M, Andreassen S, Tacconelli E, et al. Improving empirical antibiotic treatment using TREAT, a computerized decision support system: cluster randomized trial. *Journal of antimicrobial chemotherapy*. 2006;58(6):1238-1245.

121. Peck CC, Sheiner LB, Martin CM, Combs DT, Melmon KL. Computer-assisted digoxin therapy. *New England journal of medicine*. 1973;289(9):441-446.

122. Peterson JF, Rosenbaum BP, Waitman LR, et al. Physicians' response to guided geriatric dosing: initial results from a randomized trial. *Studies in health technology & informatics*. 2007;129(Pt 2):1037-1040.

123. Peterson KA, Radosevich DM, O'Connor PJ, et al. Improving diabetes care in practice: findings from the TRANSLATE trial. *Diabetes care*. 2008;31(12):2238-2243.

124. Petrucci K, Petrucci P, Canfield K, et al. Evaluation of UNIS: Urological Nursing Information Systems. In: *Proceedings of the annual symposium on computer application in medical care*. American Medical Informatics Association; 1991:43.

125. Plaza V, Cobos A, Ignacio-Garcia JM, et al. [Cost-effectiveness of an intervention based on the Global INitiative for Asthma (GINA) recommendations using a computerized clinical decision support system: a physicians randomized trial]. *Medicina clinica*. 2005;124(6):201-206.

126. Poels PJ, Schermer TRT, Thoonen BPB, et al. Spirometry expert support in family practice: a cluster-randomised trial. *Primary care respirology journal*. 2009;18(3):189–197.

127. Poller L, Wright D, Rowlands M. Prospective comparative study of computer programs used for management of warfarin. *Journal of clinical pathology*. 1993;46(4):299-303.

128. Poller L, Shiach CR, MacCallum PK, et al. Multicentre randomised study of computerised anticoagulant dosage. European Concerted Action on Anticoagulation. *Lancet*. 1998;352(9139):1505-1509.

129. Poller L, Keown M, Ibrahim S, et al. An international multicenter randomized study of computer-assisted oral anticoagulant dosage vs. medical staff dosage. *Thrombosis & haemostasis*. 2008;6(6):935-943.

130. Poller L, Keown M, Ibrahim S, et al. A multicentre randomised assessment of the DAWN AC computer-assisted oral anticoagulant dosage program. *Thrombosis & haemostasis*. 2009;101(3):487-494.

131. Poller L, Keown M, Ibrahim S, et al. A multicentre randomised clinical endpoint study of PARMA 5 computer-assisted oral anticoagulant dosage. *British journal of haematology*. 2008;143(2):274-283.

132. Quinn CC, Clough SS, Minor JM, et al. WellDoc™ mobile diabetes management randomized controlled trial: change in clinical and behavioral outcomes and patient and physician satisfaction. *Diabetes technology & therapeutics*. 2008;10(3):160-168.

133. Raebel MAA, Lyons EEE, Chester EAA, et al. Improving laboratory monitoring at initiation of drug therapy in ambulatory care: a randomized trial. *Archives of internal medicine*. 2005;165(20):2395.

134. Raebel MA, Charles J, Dugan J, et al. Randomized trial to improve prescribing safety in ambulatory elderly patients. *Journal of the American geriatrics society*. 2007;55(7):977-985.

135. Rodman JH, Jelliffe RW, Kolb E, et al. Clinical studies with computer-assisted initial lidocaine therapy. *Archives of internal medicine*. 1984;144(4):703-709.

136. Rogers JL, Haring OM, Goetz JP. Changes in patient attitudes following the implementation of a medical information system. *Quality review bulletin*. 1984;10(3):65-74.

137. Rogers JL, Haring OM, Wortman PM, Watson RA, Goetz JP. Medical information systems: assessing impact in the areas of hypertension, obesity and renal disease. *Medical care*. 1982;20(1):63-74.

138. Rogers JL, Haring OM. The impact of a computerized medical record summary system on incidence and length of hospitalization. *Medical care*. 1979;17(6):618-630.

139. Rood E, Bosman RJ, Spoel JI van der, Taylor P, Zandstra DF. Use of a computerized guideline for glucose regulation in the intensive care unit improved both guideline adherence and glucose regulation. *Journal of the American medical informatics association : JAMIA*. 2005;12(2):172-180.

140. Rosser WW, McDowell I, Newell C. Use of reminders for preventive procedures in family medicine. *Canadian medical association journal*. 1991;145(7):807-814.

141. Rossi RA, Every NR. A computerized intervention to decrease the use of calcium channel blockers in hypertension. *Journal of general internal medicine*. 1997;12(11):672-678.

142. Rothschild JM, McGurk S, Honour M, et al. Assessment of education and computerized decision support interventions for improving transfusion practice. *Transfusion*. 2007;47(2):228-239.

143. Rotman BL, Sullivan AN, McDonald TW, et al. A randomized controlled trial of a computer-based physician workstation in an outpatient setting: implementation barriers to outcome evaluation. *Journal of the American medical informatics association*. 1996;3(5):340-348.

144. Roukema J, Steyerberg EW, Lei J van der, Moll HA. Randomized trial of a clinical decision support system: impact on the management of children with fever without apparent source. *Journal of the American medical informatics association : JAMIA*. 2008;15(1):107-113.

145. Rubenstein LV, McCoy JM, Cope DW, et al. Improving patient quality of life with feedback to physicians about functional status. *Journal of general internal medicine*. 1995;10(11):607-614.

146. Saager L, Collins GL, Burnside B, et al. A randomized study in diabetic patients undergoing cardiac surgery comparing computer-guided glucose management with a standard sliding scale protocol. *Journal of cardiothoracic & vascular anesthesia*. 2008;22(3):377-382.

147. Schriger DL, Gibbons PS, Langone CA, Lee S, Altshuler LL. Enabling the diagnosis of occult psychiatric illness in the emergency department: a randomized, controlled trial of the computerized, self-administered PRIME-MD diagnostic system. *Annals of emergency medicine*. 2001;37(2):132-140.

148. Selker HP, Beshansky JR, Griffith JL, TPI Trial Investigators. Use of the electrocardiograph-based thrombolytic predictive instrument to assist thrombolytic and reperfusion therapy for acute myocardial infarction. A multicenter, randomized, controlled, clinical effectiveness trial. *Annals of internal medicine*. 2002;137(2):87-95.

149. Sequist TD, Gandhi TK, Karson AS, et al. A randomized trial of electronic clinical reminders to improve quality of care for diabetes and coronary artery disease. Journal of the American medical informatics association. 2005;12(4):431-437.

150. Sequist TD, Zaslavsky AM, Marshall R, Fletcher RH, Ayanian JZ. Patient and physician reminders to promote colorectal cancer screening: a randomized controlled trial. *Archives of internal medicine*. 2009;169(4):364-371.

151. Stengel D, Bauwens K, Walter M, Kopfer T, Ekkernkamp A. Comparison of handheld computer-assisted and conventional paper chart documentation of medical records. A randomized, controlled trial. *Journal of bone & joint surgery - American volume*. 2004;86-A(3):553-560.

152. Sundaram V, Lazzeroni LCL, Douglass LR, et al. A randomized trial of computer-based reminders and audit and feedback to improve HIV screening in a primary care setting. *International journal of STD & AIDS*. 2009;20(8):527.

153. Tamblyn R, Huang A, Perreault R, et al. The medical office of the 21st century (MOXXI): effectiveness of computerized decision-making support in reducing inappropriate prescribing in primary care. *Canadian medical association journal*. 2003;169(6):549.

154. Terrell KM, Perkins AJ, Dexter PR, et al. Computerized decision support to reduce potentially inappropriate prescribing to older emergency department patients: a randomized, controlled trial. *Journal of the American geriatrics society*. 2009;57(8):1388-1394.

155. Thomas JC, Moore A, Qualls PE. The effect on cost of medical care for patients treated with an automated clinical audit system. *Journal of medical systems*. 1983;7(3):307-313.

156. Thomas HV, Lewis G, Watson M, et al. Computerised patient-specific guidelines for management of common mental disorders in primary care: a randomised controlled trial. *The British journal of general practice: the journal of the Royal College of general practitioners*. 2004;54(508):832-837.

157. Thomas RE, Croal BL, Ramsay C, Eccles M, Grimshaw J. Effect of enhanced feedback and brief educational reminder messages on laboratory test requesting in primary care: a cluster randomised trial. *Lancet*. 2006;367(9527):1990-1996.

158. Thomson RG, Eccles MP, Steen IN, et al. A patient decision aid to support shared decision-making on anti-thrombotic treatment of patients with atrial fibrillation: randomised controlled trial. *Quality & safety in health care*. 2007;16(3):216-223.

159. Tierney WM, Hui SL, McDonald CJ. Delayed feedback of physician performance versus immediate reminders to perform preventive care. Effects on physician compliance. *Medical care*. 1986;24(8):659-666.

160. Tierney WM, McDonald CJ, Hui SL, Martin DK. Computer predictions of abnormal test results: effects on outpatient testing. *JAMA*. 1988;259(8):1194-1198.

161. Tierney WM, Miller ME, Overhage JM, McDonald CJ. Physician inpatient order writing on microcomputer workstations. Effects on resource utilization. *JAMA*. 1993;269(3):379-383.

162. Tierney WM, Overhage JM, Murray MD, et al. Effects of computerized guidelines for managing heart disease in primary care. *Journal of general internal medicine*. 2003;18(12):967-976.

163. Tierney WM, Overhage JM, Murray MD, et al. Can computer-generated evidence-based care suggestions enhance evidence-based management of asthma and chronic obstructive pulmonary disease? A randomized, controlled trial. *Health services research*. 2005;40(2):477-497.

164. Turner RC, Peden JG, O'Brien K. Patient-carried card prompts vs computer-generated prompts to remind private practice physicians to perform health maintenance measures. *Archives of internal medicine*. 1994;154(17):1957-1960.

165. Unrod M, Smith M, Spring B, et al. Randomized controlled trial of a computer-based, tailored intervention to increase smoking cessation counseling by primary care physicians. *Journal of general internal medicine*. 2007;22(4):478-484.

166. Vadher B, Patterson DL, Leaning M. Evaluation of a decision support system for initiation and control of oral anticoagulation in a randomised trial. *British medical journal*. 1997;314(7089):1252-1256.

167. Vadher BD, Patterson DL, Leaning M. Comparison of oral anticoagulant control by a nurse-practitioner using a computer decision-support system with that by clinicians. *Clinical & laboratory haematology*. 1997;19(3):203-207.

168. Wyk JT van, Wijk MA van, Sturkenboom MC, et al. Electronic alerts versus on-demand decision support to improve dyslipidemia treatment: a cluster randomized controlled trial. *Circulation*. 2008;117(3):371-378.

169. Verstappen SMM, Jacobs JWG, Veen MJ Van der, et al. Intensive treatment with methotrexate in early rheumatoid arthritis: aiming for remission. Computer Assisted Management in Early Rheumatoid Arthritis (CAMERA, an open-label strategy trial). *Annals of the rheumatic diseases*. 2007;66(11):1443-1449.

170. Weir C, Lees K, MacWalter R, et al. Cluster-randomized, controlled trial of computer-based decision support for selecting long-term anti-thrombotic therapy after acute ischaemic stroke. *QJM: monthly journal of the Association of Physicians*. 2003;96(2):143.

171. White KS, Lindsay A, Pryor TA, Brown WF, Walsh K. Application of a computerized medical decision-making process to the problem of digoxin intoxication. *Journal of the American college of cardiology*. 1984;4(3):571-576.

172. White RH, Hong R, Venook AP, et al. Initiation of warfarin therapy: comparison of physician dosing with computer-assisted dosing. *Journal of general internal medicine*. 1987;2(3):141-148.

173. White RH, Mungall D. Outpatient management of warfarin therapy: comparison of computer-predicted dosage adjustment to skilled professional care. *Therapeutic drug monitoring*. 1991;13(1):46-50.

174. Wilson BJ, Torrance N, Mollison J, et al. Improving the referral process for familial breast cancer genetic counselling: findings of three randomised controlled trials of two interventions. *Health technology assessment (Winchester, England)*. 2005;9(3):iii-iv, 1-126.

175. Wolfenden L, Wiggers J, Knight J, et al. Increasing smoking cessation care in a preoperative clinic: a randomized controlled trial. *Preventive medicine*. 2005;41(1):284-290.

176. Zanetti G, Flanagan Jr HL, Cohn LH, Giardina R, Platt R. Improvement of intraoperative antibiotic prophylaxis in prolonged cardiac surgery by automated alerts in the operating room. *Infection control and hospital epidemiology*. 2003;24(1):13–16.