McMaster eBusiness Research Centre

Health Information Dissemination from Hospital To Community Care: Current State And Next Steps In Ontario

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McMaster eBusiness Research Centre (MeRC)

WORKING PAPER No. 50
May 2014

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ABSTRACT

Introduction: The transition of patients from hospitals back to community care is often poorly managed and lacks organized communication between care providers in each setting.

Objective: The purpose of this paper is to analyze the current state of health information systems used in community based healthcare, and whether they have the functionality to disseminate patient information from the hospital to their community care providers when they go home. This paper aims to evaluate the progress made in this area thus far, and compare existing innovations in technology with the current state in Ontario healthcare.

Literature Review: A literature review was conducted using OvidSP to search the databases Embase 1974 to 2014 April 04, Ovid Healthstar 1966 to February 2014, and Ovid MEDLINE® In-Process & Other Non-Indexed Citations, Ovid MEDLINE® Daily and Ovid MEDLINE® 1946 to Present. A search using terms related to health information technology, hospital discharge, and community health care yielded 42 relevant results.

Findings: The most frequently occurring topic areas in the literature were: the use of discharge summaries and how their quality may be enhanced, and various medication reconciliation tools and methods. Care provider types considered in the literature were predominantly primary care physicians; followed by pharmacists, nurses, with some focus on family member care providers at home. All articles discussed some form of electronic method for sharing information across sectors and facilities in healthcare. Current Ontario initiatives relevant to these topics are Health Links, ClinicalConnect, Hospital Report Manager, and the Canadian Health Outcomes for Better Information and Care project.

Discussion: The four projects described are reliable, sustainable health information technology tools. They should be regarded as innovations, and success of each will likely be realized with additional work in the near future.

Conclusions: Ideally, the system that disseminates vital hospital information to community care providers is electronic, reliable, timely, and complete. The presence of literature on various enhancements to quality of discharge summaries and medication reconciliation tools indicate their significance. Ontario initiatives are underway to strengthen methods for disseminating hospital information to community care providers.

INTRODUCTION

Background

The transition of patients from hospital care back to community care is often poorly managed and lacks organized communication between care providers in each setting [1,2.] In Ontario, the services offered at the community level are vast, and are offered through several types of facilities such as Community Care Access Centers (CCACs), Community Health Centers (CHCs), Nurse Practitioner-Led Clinics, and Public Health Units [3.] Care providers working in the community through these facilities include social workers, occupational therapists, physiotherapists, dieticians, physicians, nurses, and personal support workers, among others [3]. This class of care providers face a challenge in uncovering and utilizing patient information acquired inside the hospital, which can be tremendously important in the follow up care they are directly involved in. Currently, health information, especially that from hospitals, these professionals may access is limited, fragmented across organizations, and exists inconsistently either electronically or on paper [1, 2, 4].

Electronic systems for health information storage and exchange, such as electronic medical records (EMRs), are becoming increasingly prevalent in hospitals and physician offices[4]. Though adoption of these technologies has been slow, the intended benefits are significant. The benefits truly realized can also be significant, but are often hindered by poor adoption and resistance to change by stakeholders and most end users [4, 5]. While development of various electronic systems in hospitals and primary care has become more common, there has been little focus on developing a strong electronic method of transferring this important hospital information to care providers in the community, including primary care physicians [4, 5]. It is known that delayed or inaccurate communication between hospital and primary care physicians at the point of a patient's discharge from hospital can be detrimental to the continuity of care and increase the possibility of adverse events[6]. Therefore, it is likely that better informed decision making by community care providers would result in fewer hospital readmission rates, and better health outcomes in general. Since health is arguably more inclusive than solely physical well-being, but also encompasses mental, social and occupational aspects, it is important that care givers who focus on these areas have as much information as possible especially that captured during an emergency room visit or hospital stay.

Levels of Care

The tiers of Canadian healthcare are important to distinguish when evaluating aspects of the healthcare system. The objective of this paper is to analyze dissemination of patient information from hospitals to the care providers that patients will most likely encounter in the community, whose decisions can be substantially informed by availability of hospital information. These care providers include primary care physicians, nurses and other allied health professionals working in the community such as physiotherapists, occupational therapists, speech language pathologists, social workers, etc., and providers in the home, including family members or friends[3]. Additionally, it is likely that the care providers mentioned, and many more, are involved in the care of one individual patient. Since this paper focuses on multiple levels of care and care provider types, it is important to define these categories.

Primary care is defined as the first point of contact for a patient seeking medical attention, typically for a new problem or health concern [7, 8]. The focus of primary care is general wellness and

prevention, and diagnosis and treatment of less complex medical problems, not requiring expertise of a more specialized physician or care provider [7, 8]. Primary care, especially in Ontario, is also the coordinator for further care (e.g. referral to a specialist), and is normally involved in follow up or monitoring of a more complex healthcare journey that is extended to include further levels of care and care providers. For example, family physicians (primary care providers) may refer a patient to an oncologist for cancer treatment, who may then refer the patient to a surgeon. Although the family physician is not directly involved in the treatment planning, chemotherapy, radiation therapy, or surgery, the family physician is generally kept informed of the patient's status through reports and other communications with specialists. Beyond family physicians, Nurse Practitioners or Physician Assistants can also provide primary care in family physician practices or in independent clinics[7]. Several specialist physicians are also considered to provide primary care, such as obstetrician-gynecologists, geriatricians, pediatricians, and in some cases, emergency room physicians[7]. After discharge from hospital, a common component of immediate follow up care is a visit to the family physician.

Secondary care is defined as the services and expert knowledge of specialist physician, focusing on a specific body system or specific disease; in other words, a step beyond primary care[7]. The number of medical specialties is virtually countless, and it is common for a single patient to require the services of multiple specialists, often requiring these physicians to collaborate with each other, primary care, and other care providers. For example, after a visit to the family physician for flank pain and hematuria, a patient is referred to a urologist and is diagnosed with obstructive kidney stones requiring surgical intervention. After the procedure, the patient stays overnight in hospital and acquires a nosocomial infection, requiring further treatment and care of an internal medicine physician. Together, the urologist and internist monitor the patient and discharge him. The patient's follow up care includes a visit to the urologist, in addition to the family physician. However, secondary care is commonly provided within a hospital itself (allowing providers to have access to the Hospital Information System (HIS) and other systems), or nearby with established methods of information exchange with a hospital. Therefore, with relatively reliable systems and processes in place, secondary care providers and settings are not the focus of this analysis.

Tertiary care typically refers to the type of care provided at the hospital level[7]. Tertiary care involves highly specialized care providers and equipment to perform complex surgeries, dialysis, treat severe burns and other injuries, provide intensive care, etc[7]. In tertiary care, for example, an intensive care unit, the quantity of data generated and required to inform clinical decision-making is tremendous. The majority of this information is captured in various modules of the HIS, however it is common for some information, (e.g. pre-operative assessments, requisitions for tests, standing medication orders) to be captured predominantly on paper. Methods for accessing information from within the hospital are relatively non-problematic; the complexities occur when care providers in one hospital require information acquired at another, or when care providers working outside of the hospital environment require its information. This paper seeks to analyze tertiary care in terms of these scenarios.

Community Health Care

Although separate from the three described levels of care, community health care comprises an enormous variety of care, from different care providers, in unique settings and with many goals in mind. The Ontario Ministry of Health and Long-Term Care categorizes Home, Community, and

Residential Care Services as a single entity that encompasses a tremendous number of services[9]. These services include Visiting Health Professional Services, which provide services to assess patient needs, plan and provide care, and teach patients to care for themselves. These care providers can be nurses, physiotherapists, occupational therapists, social workers, speech-language pathologists, dieticians, pharmacists, respiratory therapists, and social service workers. Another type of service included in this category is Personal Support, which refers to assistance with a range of essential daily activities such as personal hygiene (e.g. bathing, mouth care, hair care, skin care, hand and foot care), and transferring positions (e.g. to vehicles, chairs, beds), dressing and undressing, eating, and toileting. These services are provided by Personal Support Workers. Another type of service included in this category is Homemaking, which refers to assistance with routine household activities, such as laundry, housecleaning, grocery shopping, preparing meals, paying bills, and caring for children or pets. Finally, Community Support Services refer to 18 different programs and services designed to help people live independently and safely at home. These services include Adult Day Programs, Foot Care Services, Meal Services, Independence Training, Transportation, Friendly Visiting, among others[9].

The CCAC acts as the coordinator of virtually all community care services[9]. The CCAC helps people define their needs, determine eligibility for government-funded services, and locate appropriate care providers. Often, patients are referred to the CCAC at the point of hospital discharge, in anticipation that some, if not most, of their needs outside the hospital can be provided in the community.

The abundance of Home, Community, and Residential Care Services available in Ontario is overwhelming. Since home and residential care services are included in this larger category, they are assumed to be included in references to *community care* for the purposes of this paper. Furthermore, primary care occurring in a family physician office or clinic setting will be considered to be *community care* as well, because the overarching purpose of this paper is to analyze how community care providers working outside of hospitals can access pertinent, hospital acquired data to aid them in their practice. Widely implemented information systems existing in community care are scarce, and currently focus on storing information, not sharing it with other systems or facilities. For example, the CCACs employ the Client Health and Related Information System (CHRIS), which houses client records, and many family physician practices employ an EMR system store records and reports[10]. To date, the most accepted form of communicating important patient information about a hospital stay to care providers encountering the patient after they leave is the hospital discharge summary [11, 12]. A discharge summary is generally a text-based document prepared by the most responsible physician during the hospital encounter, and summarizes significant events, procedures, and test results that occurred [11, 12]. Additionally, discharge summaries include plans for follow up care, such as lists of continued medications, follow-up appointments, and referrals to the CCAC. Currently, discharge summaries are mailed or faxed to family physicians and the CCAC (when involved) upon the discharge of a patient. As implied by the name, the discharge summary is merely a summary of significant events occurring during the patient's hospital stay and a plan for follow-up care, and may not always provide community care providers information as sufficient or detailed as they desire.

Objective

The purpose of this paper is to analyze the current state of health information systems used in community based healthcare, and whether they have the functionality to disseminate patient information from the hospital to their community care providers when they go home. This paper aims to evaluate the progress made in this area thus far, and compare existing innovations in technology with the current state in Ontario healthcare. Existing processes and planned technological solutions will be discussed in terms of whether they should be regarded as innovations, trends, successes, or failures.

LITERATURE REVIEW

A literature review was conducted using OvidSP to search the databases Embase 1974 to 2014 April 04, Ovid Healthstar 1966 to February 2014, and Ovid MEDLINE® In-Process & Other Non-Indexed Citations, Ovid MEDLINE® Daily and Ovid MEDLINE® 1946 to Present. A search using terms related to health information technology, hospital discharge, and community health care yielded 42 relevant results.

Due to the nature of the search, all articles reviewed discussed some aspect of an electronic information technology tool. A substantial number of articles focused strongly on electronic health records [13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23] (n=11), fewer focused specifically on patient portals [24, 25] (n=2), and others discussed various electronic methods for sharing information, but were not EHRs or patient portals specifically, or the technology was not the primary focus of the article. Furthermore, the majority of the literature reviewed for this paper focused on discharge summaries [26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36] (n=11), medication reconciliation tools [13, 14, 16, 19, 22, 24, 37, 38] (n=8), or a combination of both [39, 40] (n=2). Other literature reviewed encompassed topics such as reviews of post-discharge processes and probability of readmission (n=4) [15, 41, 42, 43, 44], the use of technology by patients and their family member care providers (n=2) [25, 45], tools developed to reduce missed information at the time of discharge (n=2) [46, 47], the impact of EHR information on nurses (n=2) [48, 49], and general reviews on information usage, quality, resources required for successful systems to be implemented (n=4) [21, 50, 51, 52].

Most of the literature reviewed as a result of this search focused on primary care physicians as the healthcare provider receiving patient information from the hospital. The only literature discussing non-physician care providers focused on pharmacists, community care nurses or family members of patients. Several reports on the state of health information exchange involving community care in other countries could not be considered as full-text articles in English were not available.

FINDINGS

Literature Review Findings

The uses of health information technology for sharing hospital information with care providers and facilities outside of the hospital are documented in the literature. A Philadelphia study published in 2012 evaluated the impact of electronic health records on nurse clinical process at two community health sites, one a site that manages the care of nursing-home eligible patients to avoid nursing home admission and facilitate remaining in their homes, and one home care site[23]. Mixed

methods were used to collect and analyze data related to time spent documenting in the EHR and nursing satisfaction with the EHR. At both sites, the EHR functionality included documentation management for medication information and patient history, and at one site the EHR also supported orders for diagnostic tests, results management, and scanned documents from external organizations. It was found that in terms of time spent documenting information, the EHR allowed nurses to complete documentation in less than one day, on average. Prior to EHR implementation, nursing documentation took an average of 12 to 18 days to complete. However, nurse satisfaction with the EHR was less impressive. User feedback revealed that nurses felt the system: had functionality that did not compliment workflow; was cumbersome to use; lacked complete, correct, and timely data; reduced efficiency; and were generally dissatisfied. Based on these results, the authors recommend that EHRs in community settings be interoperable to improve nurse access to patient information from external services, such as lab or imaging, and external care, such as an emergency room visit or hospital referral[23].

Another 2012 study conducted in Boston investigated the technological resources and personnel costs required to implement an automated alert system to notify primary care physicians when their patients are discharged from hospital[52]. The critical system components were an admission, discharge and transfer registration interface, link to the existing EHR's scheduling system, access to pharmacy dispensing and lab test information systems, and an interface engine. The magnitude of this study was a group practice employing 330 clinicians across 23 ambulatory clinics providing care to approximately 18,000 patients. The final cost was estimated at just over $76,000, nearly half of which was allocated to reimbursing the 614 hours spent by physicians working on the project. Ultimately, the authors conclude that implementing a patient discharge alert system is feasible, but requires strong technical expertise, cooperation with external facilities and providers, development of electronic architecture, and substantial time and effort commitments from physicians[52].

A 2010 study from Boston analyzed utilization patterns of a web-based patient-accessible electronic health record designed for patients with congenital cardiac disease[25]. Both text (history and physical report, patient care instructions) and imaging (operative images, daily bedside images) information from the hospital was made available to 270 patients. It was found that there was a 93% adoption rate of the system and access was higher when patients were in the hospital (67% of total logins) than when they were at home (33% of total logins). Furthermore, imaging data were viewed statistically significantly more often than textual ($p < 0.001$), and the average number of logins per patient family between September 2006 and February 2009 was twenty-five[25]. This tool depicts the desire for patients and their families to access health information from the hospital independently.

Studies with the broad themes of harnessing health information technology to share health information between facilities, providers, and patients, like the three described here, comprise the majority of literature reviewed for this paper. However, the most frequently occurring specific topic areas in the literature were the use of discharge summaries and how their quality may be enhanced, and various medication reconciliation tools and methods.

Discharge Summaries

Discharge summaries are essential in ensuring patient safety when transitioning from the hospital back to the community [28, 29, 36]. It has been shown that high quality discharge summaries, when available to the appropriate care providers, may be able to reduce the risk and occurrence of adverse events, decrease healthcare costs, and promote positive health outcomes for patients[28]. However, it has been reported that availability of a discharge summary at the time a patient visits their family physician after returning home may be as low as only 12%-34% of the time[28]. Furthermore, it is common for discharge summaries to contain misinformation or lack some content. For these reasons, community based physicians have cited poor information transfer when patients transition from hospital back home as the cause for one-third of post-discharge adverse events. Therefore, the need to increase the quality of discharge summaries exists.

A 2009 randomized controlled trial conducted at St. Michael's Hospital in Toronto examined electronic versus dictated hospital discharge summaries, and measured quality based on primary care physician satisfaction with each method[28]. Other outcome measures included hospital physician satisfaction, adverse outcomes after discharge (determined by emergency department visits, readmission rates, and mortality), and patient comprehension of discharge details and instructions. This 2-month study analyzed 209 discharge summaries. There was no significant difference reported in primary care physician or hospital physician satisfaction. There was a significant difference in ease of use for hospital physicians; electronic discharge summaries scored 86.5% for usability versus 49.2% for dictated discharge summaries ($p=0.03$). Finally, there was no significant difference reported in number of post discharge adverse events or patient understanding of discharge details[28]. These results imply that electronic discharge summaries may be beneficial to implement widely in practice, if only to enhance user satisfaction and efficiency.

Other studies relating to hospital discharge summaries have shown that a natural language processing systems can be effective in extracting clinical text entities from discharge summary for interpretation [35, 40]; that errors in medication information in handwritten versus electronic discharge summaries occur at a relatively equal rate[39]; and there are legal, organizational, and financial barriers to overcome in implementing a secure web portal system for sharing discharge summaries from multiple facilities across a large region[31].

Medication Reconciliation

Medication reconciliation refers to the process of maintaining an accurate list of medication information for a patient to ensure medication errors, such as omission, duplication, or interactions, do not occur as the patient receives care across the continuum [22, 24]. Medication discrepancies can often be the cause of adverse drug events, especially in hospitalized and recently discharged patients [22, 24]. Therefore, diligent and effective medication reconciliation processes must be established. The potential for using electronic methods for medication reconciliation is being explored.

A 2011 study done in Boston describes a tool within an EMR to facilitate medication reconciliation after hospital discharge[22]. The tool essentially compares a patient's preadmission medication list with the hospital discharge medication list, identifies all differences, and uses the information to update a current list (by adding, modifying, and/or verifying medications). Initial use of the tool

was low; it was only used in 20% of applicable cases. Efforts in increasing adoption including clinician engagement, education and training sessions, and the addition of a pop-up reminder in the EMR increased use to 41% of applicable visits. Feedback from users indicated that most primary care physicians were theoretically very supportive of the tool, but often forgot to use it and the reminder feature was weak. Additionally, there were several important usability issues hindering the use of the tool that authors will address in an upgrade to the tool[22]. Although the response to the tool by providers was not overwhelmingly positive, it is clear that physicians agree electronic medication reconciliation tools incorporated with EMRs are likely to be beneficial.

A 2011 study done in the United Kingdom describes medication reconciliation using a shared EHR[16]. Several processes for medication reconciliation were compared using a complex methodology, and utilizing functions of the EHR in varying degrees. One general outcome of the study is that EHR use in the medication reconciliation process can reduce medication errors. Other key messages from the authors are that access to a shared EHR assists in determining accurate medication history, but that electronic health records in primary care may be incorrect, incomplete, or outdated, and that often the most reliable source for medication information is the patient or their caregiver[16].

Finally, a 2014 study done in Boston explores patient engagement in medication reconciliation using a web-based patient portal[24]. In this study, a hospital pharmacist reviewed patients' medication information within 2 days, prepared a standardized list to keep on record, and sent via secure email in a patient portal to the patient. At home, the patient would log in, review the list, comment on any discrepancies or ask the pharmacist questions, and send the form back. The lists prepared by the pharmacist and then altered or corrected by the patient were then compared to identify errors and discrepancies. There were 60 participants in the pilot study; among these 60 patients discharged from hospital, 108 medication discrepancies were identified. 23 of these discrepancies were potential adverse drug events, and almost half of these were classified as serious. Beyond the proven effectiveness in detecting discrepancies, the tool was perceived as highly usable by patients, and 90% stated they would use it again[24].

To summarize, medication reconciliation tools are recognized as highly necessary, and becoming increasingly electronic. The high risk of medication errors when patients are transferred within hospital or discharged home implies that information transfer from hospital to external care facilities is especially important.

CURRENT STATE & LOCAL INITIATIVES

Health Links

Ontario Health Links have been developed in response to an overwhelming statistic: two thirds of healthcare dollars in Ontario are consumed by only 5% of its population [53, 54, 55]. This top 5% 'high user cohort' is comprised of patients who are very elderly, have multiple chronic diseases, and people with mental health and addictions issues. Health Links aims to identify these high users and engage the people involved in their circle of care (including care providers, social support, family members, and themselves) in finding ways to minimize reliance on emergency rooms and hospitals for their care and better coordinate and utilize community services or support programs [53, 54, 55]. The care plan is a vital component to Health Links; the initiative operates on the premise that the care plan be shared among every provider the patient encounters, so that the plan can be

followed as closely as possible and updated in real time. Therefore, the success of Health Links essentially lies in developing a reliable, electronic method for the people in the circle of care to access the care plan. Ideally, Health Links will increase quality of care for high users and decrease stress on Ontario's healthcare system [53, 54].

The Health Link itself is a geographic area with a known population and calculated number of 'high user' residents. There are currently 47 Health Links in Ontario, with intentions of designating more[53]. Health Links emphasizes community care, and each one is managed by the CCAC in the area, a family health team, or other significant community health facility. Currently, Health Links care plans are stored and accessed through the eHealth Ontario Portal[53] and several Health Links in southern Ontario are fully operational. However, there is substantial future work to be completed with Health Links. The technical solution for the shared care plan may be forced to evolve or expand to include more care providers, and to allow use by others involved with the high user who is not a healthcare provider, such as a family member or friend. Additionally, education and awareness is essential for care providers who will likely encounter the high user, for example, staff in an emergency department. The Health Link high users must be identifiable to these care providers so that they will be triggered to access the care plan and follow it when determining a course of care. With Health Links, the necessity to establish methods for information exchange between hospital, primary care, and community based care is truly realized.

ClinicalConnect

The vision for a shared EHR across every hospital in a large geographic region has already been realized in two of Ontario's Local Health Integration Networks (LHINs) through the development and implementation of ClinicalConnect [56, 57]. ClinicalConnect is essentially a secure web portal viewer of information pulled from the Hospital Information System (HIS), Client Health and Related Information System (CHRIS), and Oncology Information System (OIS) from every hospital, CCAC, and regional cancer center, respectively, in LHINs 3 (Waterloo Wellington; WW) and 4 (Hamilton Niagara Haldimand Brant; HNHB) [56]. Implementation of ClinicalConnect is underway in facilities located in LHINs 1 (Erie St. Clair) and 2 (South West) [56]. ClinicalConnect gives healthcare providers in these regions real-time access to their patients' electronic health records through simply the Internet, and allows for information from various facilities and information systems to be made available in a single location with an intuitive and seamless user interface.

The quantity of information made available through the ClinicalConnect portal is tremendous. Hospital information includes: laboratory tests and results with the ability to graph and trend over a period of time; text based radiology reports and some images; transcribed reports such as discharge summaries, operative reports, physician notes, etc.; pharmacy, pathology, microbiology, and blood bank information; hospital visit and admission history; orders for tests; known allergies; and patient demographics and contact information [56, 58]. CCAC information available through ClinicalConnect includes client demographics, personal and medical contacts, placement and services details, in-home CCAC services, and long-term care placement status[56, 58]. Oncology information available through ClinicalConnect includes treatment plans, imaging reports, surgical reports, and more.

The value and utility of ClinicalConnect increases as more information sources are integrated. Substantial work is underway to incorporate as much information as possible into the portal so that care providers can eliminate extra steps and tools they must use to find all the information they need. For example, the majority of laboratory tests are conducted in independent clinics, rather than hospitals. This is true of diagnostic imaging tests as well. By capturing lab and radiology results from hospitals only in ClinicalConnect, a large gap in information existed. Therefore, integrations with the Ontario Laboratory Information System (OLIS), and the Diagnostic Imaging Repository (DI-r) are well underway to make independent health facility acquired information available through the portal, alongside the hospital data[56]. In a future state, ClinicalConnect will likely become integrated with a Clinical Data Repository (CDR) and an Integrated Assessment Record (IAR), which will allow more community based health information to be available to providers[56].

The overarching goal of ClinicalConnect is to make important patient information available easily and timely to the care providers who need it to allow better informed decision making, resulting in enhanced provider efficiency, reduced duplication, and superior and safer quality care [56]. The design of the system is intended to make access as easy and convenient as possible; the user interface is adaptable to user preferences, it can be accessed on any computer or mobile device such as a smart phone, tablet, or laptop, and the information is accessible in real time, meaning that there is no delay between the time information is available in the native information system and the time it can be seen through ClinicalConnect[56]. The majority of ClinicalConnect users are physicians, and promotion efforts have been targeted at other care provider types, such as nurses, pharmacists, physiotherapists, occupational therapists, social workers, etc. However, it is certain that physicians, and especially primary care physicians, have an additional benefit to using ClinicalConnect. An extension of ClinicalConnect exists called EMR Download, a system that harnesses ClinicalConnect to create a direct route for hospital information (laboratory, radiology, transcriptions, pharmacy, blood bank, and microbiology data) to populate a physician's EMR[59]. With EMR Download, new information detected by ClinicalConnect is downloaded daily to the EMR, which may have the functionality to flag new results to trigger the physician to review certain records. This means that if a patient is discharged from hospital, the discharge summary, among other reports and results, will be automatically downloaded within one day for the physician to review within the EMR[59].

ClinicalConnect is funded by eHealth Ontario and Canada Health Infoway, hosted by Hamilton Health Sciences, and managed by the HNHB LHIN eHealth Office[56]. Since going living in 2005, its presence in clinical workflow and ability to quickly share health information across the continuum of care has made a substantial difference to care providers and patients alike. The next steps for enhancing and increasing adoption of ClinicalConnect are deeply rooted in the Connecting Southwestern Ontario (cSWO) initiative[56]. cSWO aims to connect healthcare providers across LHINs 1, 2, 3, and 4 in various ways and with various technologies, including ClinicalConnect. Although the objectives of cSWO span far beyond the implementation of ClinicalConnect in LHINs 1 and 2, ClinicalConnect is the enabler for achievement of many cSWO goals. Once integrations are complete in LHINs 1 and 2, 46,000 healthcare providers will have access to ClinicalConnect, and the system will display records on nearly 4 million patients[56].

As integrations with more information systems are completed within the portal and the user group expands, ClinicalConnect will have an even greater impact on clinical workflow and patient care.

To date, ClinicalConnect is an excellent, local example of how technology has been harnessed to share patient information across the continuum of care, and disseminate hospital information to care providers, namely primary care physicians, outside of the hospital itself.

HRM

Hospital Report Manager (HRM) is an eHealth Ontario solution managed by OntarioMD that allows physicians to directly receive text-based radiology and transcribed reports from hospitals and some independent health facilities[60]. Through HRM, reports are sent directly from the source system to the EMR, which must be a Specification 4.1A funding eligible EMR[60]. HRM is a provincial initiative, and will eventually represent the universal method for physicians to receive hospital reports as every physicians implements a Spec 4.1A EMR, and all hospital sites, and later independent health facilities, are integrated and live with HRM.

Through a broader lens, HRM serves as an important component to standardizing the process by which hospital and independent health facility information reaches physicians; HRM disseminates radiology and transcribed reports, and OLIS disseminates laboratory information [60, 61]. With HRM, the process for transmitting hospital reports to physicians is simple, and eliminates several steps and reduces time consumed previously required to achieve the same goal. First, a hospital creates a report, identifies the correct recipients of the report, and transmits it to HRM. Then, HRM converts the report into a standard, EMR-compatible format, encrypts, and deposits the report to a secure folder in the EMR(s) of the recipient(s). Once delivered, the EMR retrieved, decrypts, and posts the report to the correct patient's record and alerts the physician to review and sign-off on the newly received report[60]. Prior to HRM, most hospital reports were delivered to physician offices by means of time-consuming mail, fax, phone calls, or not at all. Some benefits of HRM include the secure methods it employs, its quick and standardized process, the quantity of information it manages, and that it encourages physicians to adopt high functioning EMRs in their practice[60].

The status of HRM implementation across Ontario is variable. Of the currently integrated sites, the majorities are located in LHINs 10 (South East), 11 (Champlain), and 12 (North Simcoe Muskoka), with pilot site integration complete in LHINs 5 (Central West), 7 (Toronto Central), and 8 (Central) [60, 62]. HRM will continue to be implemented in these areas, as well as LHINs 6 (Mississauga Halton) and 9 (Central East) in the near future. The method for HRM rollout in LHINs 1, 2, 3, and 4 is still under discussion, and may leverage existing technology in these regions (e.g. ClinicalConnect) to optimize resource utilization and prevent redundancy. To date, there are 24 HRM sending facilities in Ontario, and nearly 300 physicians are receiving approximately 32,000 hospital reports each month via HRM [60, 62]. Although HRM site integrations are still relatively limited, OntarioMD recommends clinicians to prepare for a future state of clinical workflow that depends almost exclusively on HRM for hospital reports. To prepare, clinicians should first incorporate a Spec 4.1A EMR to their practice, and then work with their OntarioMD Practice Advisor and EMR vendor to connect with HRM[60].

The focus of HRM is clinicians with EMRs, and in particular, primary care physicians. However, OntarioMD has prioritized efforts with the Ontario Association of Community Care Access Centers (OACCAC) to send Emergency Department notifications to CCACs through HRM, and in the winter of 2014, a phased rollout of HRM in a Community Health Center will begin[62]. In extending use to community care providers, HRM serves as a standardized method for

disseminating hospital information, including discharge summaries, to care providers outside of the hospital.

C-HOBIC

The Canadian Health Outcomes for Better Information and Care (C-HOBIC) model collects standardized patient outcome data and uses clinical nursing terminology to be incorporated to large jurisdictional EHRs [49, 63]. C-HOBIC uses structured language to assess patients receiving various types of care at the points of admission and discharge. The objectives of C-HOBIC are to: use standardized nursing language to describe assessments (International Classification for Nursing Practice; SNOMED CT); capture patient information related to outcomes of nursing care in acute care, complex continuing care, long-term care, and home care; share HOBIC information across the continuum of care as patients move through the system; and store the information in a secure, standardized fashion so that it may be entered into large scale (e.g. provincial) EHRs [49, 63].

As a result of extensive research and review, the Ontario Nursing and Health Outcomes Project identified patient outcomes that reflect nursing practice specifically, determined appropriate methods to quantify these outcomes, and identified suitable methods for storing this data[49]. Stemming from this work, there are 8 patient outcomes assessed with the HOBIC methodology: functional status (activities of daily living self-performance), pain, fatigue, dyspnea, nausea, falls, pressure ulcers, and readiness for discharge (therapeutic self-care) [49]. There are numerous components to each of the 8 outcomes, and assessments are carried out immediately before and after any transfer in care the patient undergoes (e.g. acute care to home care). This can result in an overwhelming amount of data that can be difficult to process and use effectively. To make C-HOBIC assessment information more comprehensive, the data points are displayed graphically, in a diagram referred to as the Transitional Synoptic Report (TSR) [49]. The TSR uses a circle divided into 8 wedges, one representing each patient outcome. A measurement scale representing the patient's score in each section is positioned from the center of the circle and outwards. The data points are plotted corresponding to the patient's score in each category at the time of admission to care (e.g. hospital, long-term care facility), and connected to display a filled in area. At the time of discharge, the assessment is repeated, and the resulting diagram is superimposed on the original one. The result is a visually intuitive means of identifying where the patient has improved or declined in another of the 8 outcome measures.

Benefits to incorporating C-HOBIC assessment data to EHRs are abundant[49]. For end users, who are intended to primarily be nurses, making C-HOBIC information accessible through an EHR strengthens interest and commitment to using EHRs in the nursing community, provides relevant nursing information to aide in decision making during the course of care, and allows the impact of nursing on specific patient outcomes to be further realized and appreciated. For people within the healthcare system (e.g. patients and their families), C-HOBIC offers standardized clinical information that can be functional across all sectors of the healthcare system, which is particularly valuable given that much health information that exists is fragmented, asynchronous, and not standardized. For policy makers, C-HOBIC assessment information can serve as a quality metric for the current state of the healthcare system, since it clearly depicts how patient health outcomes improve or decline throughout the course of care[49].

C-HOBIC was originally sponsored by the Canadian Nurses Association (CNA) and the Ministries of Health of Ontario, Prince Edward Island, Saskatchewan, and later Manitoba [49, 63]. Canada Health Infoway supports C-HOBIC through funding. Today, C-HOBIC assessments are performed and captured in these four provinces; in Ontario, C-HOBIC information (TSRs) is shared electronically via ClinicalConnect. The focus of C-HOBIC on providing nurses with relevant, nursing-specific health information across acute care, complex continuing care, long-term care, and home care exemplify how it disseminates important hospital information to care providers outside of hospitals. The additional emphasis on patient status at the time of discharge brings further value to the care providers who encounter the patient soon after they return to the community.

DISCUSSION

Access to high quality information in healthcare is crucial. As in any part of the world, Ontario's healthcare system is complex and involves numerous healthcare facilities and providers. Given the substantial proportion of healthcare services that are offered in the community, and the abundance of patient information captured by hospitals when patients are admitted or visit the emergency room, it can be extremely beneficial to share the information between providers, facilities, and levels of care. This flow of information likely allows community care providers to make better-informed decisions, resulting in more appropriate, more efficient, and safer community healthcare.

With regard to transferring information from hospital systems to care providers in the community, the majority of literature seems to concentrate on enhancing quality and use of discharge summaries, and various medication reconciliation processes and tools that currently exist. Most of these studies explore the potential of using electronic methods and new technologies to maximize benefits. There is a lack of literature focusing on community care providers who are not primary care physicians, pharmacists, or nurses. This is not unexpected given that the care these providers can give patients is the most influenced by hospital information, such as medications, abilities for self-care, etc. However, community care providers such as occupational therapists, physiotherapists, and social workers have yet to be strongly considered in the dissemination of hospital information. A limitation to this paper was the depth of the literature search conducted. It is possible that a search conducted with more specific terms or within professional journals of various allied health professions could have yielded more extensive results.

In Ontario, building technology to share hospital information with community care providers has been prioritized, and is at the center of several large-scale initiatives currently underway. Health Links divide Ontario's population in groups by region, and identify the highest consumers of healthcare living in each one. Coordinated by the CCAC or other community health facility, a group of healthcare providers and other people who are close with the identified high users are engaged in developing a specialized care plan, which is then shared electronically between providers to give instructions and relevant history to better coordinate the person's future healthcare. Health Links is extremely relevant to the focus of this paper; these patients are those who have the most hospital visits and admissions, and also require multiple community health services from a variety of providers. The focus on sharing the care plan, which likely contains pertinent hospital information, proves that there is implied value in every community care provider having access to it. Conversely, the major user groups of ClinicalConnect are hospital physicians

and primary care physicians, and the majority of information accessible through ClinicalConnect is from hospitals. However, the ability for any user to access records from hospitals outside of their own is highly valuable, and EMR Download has been designed specifically to disseminate hospital information to primary care. Currently, funding has been designated to onboard non-physician users, and community care providers may be able to use ClinicalConnect effectively in their practice on mobile devices. Similar to ClinicalConnect, the objective of HRM is to disseminate hospital reports to physicians' EMRs, although limited to radiology and transcribed reports and Spec 4.1A EMRs. Finally, C-HOBIC is an excellent example of shifting the user group of EHRs from physicians to nurses. By standardizing nursing influenced patient outcomes, displaying them in a meaningful format, and incorporating the information into EHR systems, C-HOBIC encourages nurses in acute care, complex continuing care, long-term care, and home care to use HOBIC assessment data (acquired at points of admission and discharge) and electronic health records in their practice.

Given the magnitude of resources invested in these projects, it is conservative to say that Health Links, ClinicalConnect, HRM, and C-HOBIC are not trends. Rather, highly functional technology, significant funds and human resources, and their appeal to patients and care providers of all types protect the sustainability of these projects. The technical architecture and functionality of ClinicalConnect and HRM are innovative, yet practical. The objectives and involvement of many care providers and nurses in Health Links and C-HOBIC, respectively, are innovative as well. Prior to these initiatives, there were no established methods for identifying high healthcare users or interventions for systematically creating plans to better coordinate their care. Similarly, methods of quantifying nursing specific patient outcomes were not standardized and could not be shared electronically. The innovative, collaborative nature of Health Links and C-HOBIC, as well as focus on specific aspects of patient care, are likely keys to their success.

It is unlikely that any of these efforts should ever be regarded as failures. However, this is not to imply that they are entirely successful as of yet. The potential success of these initiatives upon their completion and widespread implementation is tremendous. In a future state, it is possible that virtually all hospital information could be made available to any community care provider through ClinicalConnect and/or HRM. Health Links care plans and C-HOBIC assessments could be made available through the same channels, and it is possible that information acquired in community care will eventually flow back to hospital providers to refer to. As with any large health information technology like ClinicalConnect or HRM, the process of onboarding users and creating accounts can be long. Until more users are fully educated, trained, and have the required technology (e.g. a Spec 4.1A EMR) only minor use from a provincial perspective can be achieved. Finally, some or all of this important health information may eventually be made available to patients themselves, and their family member care providers.

Currently, success is realized in early adopters, but ClinicalConnect, Health Links, HRM, and C-HOBIC have not reached full implementation or acceptance. As with most health information technology, there are several barriers to success. A significant barrier is resistance to change in terms of users, including patients, providers, and facilities such as hospitals. For example, a physician who prefers to use paper-based medical records in their practice will not be able to benefit from HRM or ClinicalConnect. In another example, busy emergency medicine physicians may feel they do not have time to search for information in ClinicalConnect or search for a Health Links care plan, and the technology will not be used. Furthermore, the financial or time commitments

involved in signing up, training, and becoming accustomed to new systems may further deter potential users. Finally, availability and policies surrounding mobile devices used in the delivery of healthcare may further limit the number of potential users. For example, a community pharmacist may have a ClinicalConnect account, but does not have a device to access it through when travelling to patients' homes.

CONCLUSIONS

Ideally, the system that disseminates vital hospital information to community care providers is electronic, reliable, timely, and complete. Discharge summaries are the most common form of communication between hospital and community care providers at the time a patient leaves the hospital. A vital component of hospital discharge information relates to medications, and medication reconciliation is a priority. This is reflected by the current literature, and extensive work has been done around the world to enhance the quality of discharge summaries, and find effective medication reconciliation processes. In Ontario, the dissemination of hospital information can be fragmented, unreliable, and is still commonly achieved through means such as mail, fax, or telephone. Substantial work is underway to build and implement robust, electronic systems that allow hospital information to reach care providers in the community in a standardized way, and to bring the information to all types of care providers whose patient care can be influenced by availability of information. Health Links, ClinicalConnect, Hospital Report Manager, and Canadian Health Outcomes for Better Information and Care tools are excellent examples of these efforts.

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