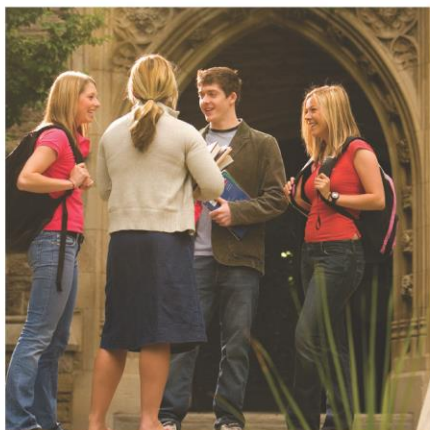
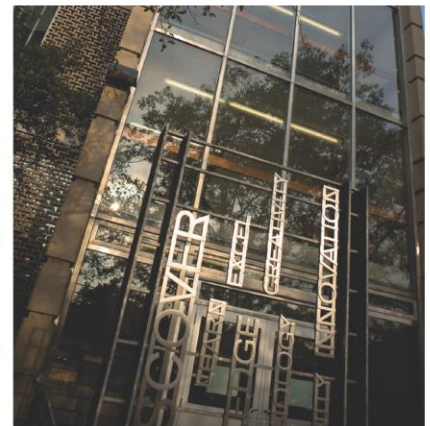




STRENGTHENING NATIONAL HEALTH  
SYSTEMS' CAPACITY TO RESPOND  
TO FUTURE GLOBAL PANDEMICS



4 NOVEMBER 2013

EVIDENCE >> INSIGHT >> ACTION

**Issue Brief:**  
**Strengthening National Health Systems' Capacity to Respond to Future Global Pandemics**

4 November 2013

#### McMaster Health Forum

For concerned citizens and influential thinkers and doers, the McMaster Health Forum strives to be a leading hub for improving health outcomes through collective problem solving. Operating at the regional/provincial level and at national levels, the Forum harnesses information, convenes stakeholders, and prepares action-oriented leaders to meet pressing health issues creatively. The Forum acts as an agent of change by empowering stakeholders to set agendas, take well-considered actions, and communicate the rationale for actions effectively.

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## KEY MESSAGES

### What's the problem?

- The challenges to strengthening national health systems' capacity to respond to future global pandemics of infectious disease can be understood by considering six manifestations of, or contributors to, the problem:
  - 1) pandemics challenge conventional systems of governance;
  - 2) timely information sharing and evidence-informed decision-making is difficult;
  - 3) domestic and international partners often encounter coordination problems;
  - 4) public health and animal health perspectives can be difficult to reconcile when addressing emerging zoonoses;
  - 5) antimicrobial resistance represents a growing threat; and
  - 6) risk and protective factors for pandemics are changing.
- Moreover, existing programs, health system arrangements and implementation strategies may not be optimal:
  - programs and plans may limit capacity to respond to future pandemics;
  - health system arrangements complicate matters; and
  - some previously agreed upon courses of action have not been fully implemented.

### What do we know about three elements of a comprehensive approach to address the problem?

- Element 1 – Enhance national health systems' ability to detect pandemic risk factors, identify causal pathogens, characterize emerging diseases and monitor how they evolve
  - We found a small number of systematic reviews that can be drawn upon to inform some components of element 1. We found benefits for key components of this element, including enhancing ongoing surveillance systems, building capacity for shared rapid data collection, analysis and assessment, and establishing collaborative interprofessional teams to conduct routine surveillance, particularly for zoonotic disease outbreaks.
- Element 2 – Strengthen the capacity of national policymakers and stakeholders and the public to more adequately respond to the variability of pandemics
  - We found several medium- and high-quality systematic reviews that identified benefits for key components of this element, including information products designed to support the uptake of systematic review evidence, public engagement to inform policymaking, risk-communication strategies and social networking.
- Element 3 – Strengthen the global pandemic governance system
  - We found a small number of systematic reviews that revealed benefits for specific sub-elements, including global health initiatives for disease control (specifically HIV/AIDS), contracting out healthcare services in developing countries, result-based financing, and developing international nursing curricula through cooperative partnerships (as a way to strengthen system capacity).

### What implementation considerations need to be kept in mind?

- Potential barriers to strengthening health systems' capacity to respond to future global pandemics can be identified at the local level (e.g. governments and providers may be reluctant to spend time and money on re-training health workers to adopt new pandemic preparedness plans or the One Health model), provincial/state/territorial level (e.g. governments may resist letting national governing bodies take charge of defining priorities during pandemics), national level (e.g. governments may have limited funding and resources for new information and communication technologies) and global level (e.g. member states of multilateral organizations may guard their sovereignty and choose to act unilaterally).
- Efforts to address these issues need to be attentive to potential windows of opportunity, such as the revised North American Plan for Animal and Pandemic Influenza (2012) and calls from the 2011 Report of the Review Committee on the Functioning of the International Health Regulations (2005) in relation to Pandemic (H1N1) 2009, for increased pandemic preparedness through research, strengthened healthcare delivery systems and a multi-sectoral approach.



## REPORT

Effective pandemic governance is more important now than ever as pandemic risk factors like urbanization, the hypermobility of persons, trans-border trade, rapid population growth and changes to the environment and food systems all increase in tandem with the demands of globalization.(1) These transformative global shifts have fundamentally changed the way pathogens are spread around the world.(2) The World Health Organization (WHO) estimates that newly emerging infectious disease outbreaks in one country are now only hours away from affecting many others.(3) Pandemics previously spread over years (e.g., bubonic plague in the 14th century), months (e.g., cholera epidemics in 19th century) or weeks (e.g., Spanish influenza of 1918-1919), but in today's globalized world, Severe Acute Respiratory Syndrome (SARS) took only 17 hours to spread half-way around the world from China to Canada. Future disease outbreaks are expected to take similarly short periods before they affect multiple countries across geographically distinct regions.(3) The current outbreak of H7N9 bird influenza in China (which spreads more easily from infected fowl to humans than the H5N1 strain did in 2003, according to Dr. Keiji Fukuda, WHO's top influenza expert) is a stark reminder that the threat of a pandemic exists as an imminent threat to human health and international security.(4) Of notable concern is the fact that more than 30 unexpected outbreaks of previously unknown pathogens and re-emerging diseases were observed in the past two decades alone.(2) Although the great majority of new and re-emerging diseases have not caused pandemics, national health systems that can respond adequately to pandemic threats are fundamental to controlling pandemic-prone local disease outbreaks within a country or a region.

The consequences of not preparing for pandemic diseases can be catastrophic. For example, the 1918-1920 influenza pandemic caused 50-100 million deaths and infected roughly 500 million people worldwide.(5;6) Today, scientists predict an influenza pandemic could affect up to 1.5 billion people worldwide, cause up to 150 million deaths, and leave US\$3 trillion in economic damages.(3;4) Pandemics can halt all travel to affected areas, cause severe economic hardship, and incite international isolation. Although there have been many calls for government-wide pandemic preparedness plans to be developed, there have been tremendous difficulties in coordinating a collective, integrated response across sectors, including sharing information and capacity (equipment, people, finances) across jurisdictional borders,

### Box 1: Background to the issue brief

This issue brief mobilizes both global and local research evidence about a problem, three elements of a comprehensive approach for addressing the problem, and key implementation considerations. Whenever possible, the issue brief summarizes research evidence drawn from systematic reviews of the research literature and occasionally from single research studies (including economic evaluations). A systematic review is a summary of studies addressing a clearly formulated question that uses systematic and explicit methods to identify, select and appraise research studies, and to synthesize data from the included studies. The issue brief does not contain recommendations, which would have required the authors of the brief to make judgments based on their personal values and preferences, and which could pre-empt important deliberations about whose values and preferences matter in making such judgments

The preparation of the issue brief involved five steps:

- 1) convening a Steering Committee comprised of representatives from key organizations involved in this issue and the McMaster Health Forum;
- 2) developing and refining the terms of reference for an issue brief, particularly the framing of the problem and three viable elements of a comprehensive approach for addressing it, in consultation with the Steering Committee and a number of key informants, and with the aid of several conceptual frameworks that organize thinking about ways to approach the issue;
- 3) identifying, selecting, appraising and synthesizing relevant research evidence about the problem, elements of a comprehensive approach to address the problem and implementation considerations;
- 4) drafting the issue brief in such a way as to present concisely and in accessible language the global and local research evidence; and
- 5) finalizing the issue brief based on the input of several merit reviewers.

The three elements could be pursued singly, simultaneously with equal or different emphasis, or in a sequenced way.

Unlike a Forum evidence brief, a Forum issue brief does not involve a comprehensive evidence review by Forum staff.

The issue brief was prepared to inform a stakeholder dialogue for which research evidence is one of many considerations. Participants' views and experiences and the tacit knowledge they bring to the issues at hand are also important inputs to the dialogue. One goal of the stakeholder dialogue is to spark insights – insights that can only come about when all of those who will be involved in or affected by future decisions about the issue can work through it together. A second goal of the stakeholder dialogue is to generate action by those who participate in the dialogue, and by those who review the dialogue summary and the video interviews with dialogue participants.



streamlining financing for public health, and aligning national action plans to meet the guidelines contained in international agreements.(3;7;8)

North American experiences with SARS (2003), H5N1 (2005) and H1N1 (2009) reveal how responding to pandemics remains a great challenge for health systems.(9-11) For example, in Canada it was found that the federal government's ability to coordinate an effective national response to H1N1 was impaired by a lack of health human resources, standardized processes for rapidly setting priorities, and availability of contingency funds.(12) In the U.S., national public opinion polls found that a substantial proportion of the public may not have taken the H1N1 vaccine because they did not believe the illness posed a serious health threat. In fact, only 1-3% of those surveyed got a prescription for or had purchased antiviral drugs even in circumstances when they were shown to be effective in treating potential infections and the risk of infection was thought to be high.(11;13) In Mexico, delays in reporting and identifying H1N1, combined with the country's uneven public health infrastructure, prevented full information dissemination to all members of the public, particularly those living in rural areas.(14) Additionally, pandemic planning in North America was predicated on the assumption that future outbreaks would originate in birds from another continent (e.g., Southeast Asia). H1N1's North American, non-avian origins caught pandemic response leaders by surprise.(15)

The local consequences of a pandemic are complex to manage given that unpredictable increases in patient volumes force local healthcare institutions to rely on surge capacity to manage the rise in demand for health services (e.g. rapid re-assignment of beds and conversion of some to intensive care unit spaces, and re-directing sick persons away from primary care to triage facilities).(16) Acute care hospitals in Ontario currently functioning at more than 90% capacity could experience an increase of 25% or more in demand for inpatient and intensive care hospital beds and assisted ventilation services in an influenza pandemic.(17) Any inefficiencies with patient assessment, management and treatment within hospitals' emergency departments represent a more strenuous burden than usual. Limited surveillance capacity and conflicting views about roles and responsibilities among all healthcare actors and the general public also represent major challenges.(16) Demands for healthcare during pandemics vastly exceed health systems' capacity.(18)

## **Box 2: Equity considerations**

A problem may disproportionately affect some groups in society. The benefits, harms and costs of elements of a comprehensive approach to address the problem may vary across groups. Implementation considerations may also vary across groups.

One way to identify groups warranting particular attention is to use "PROGRESS," which is an acronym formed by the first letters of the following eight ways that can be used to describe groups†:

- place of residence (e.g., rural and remote populations);
- race/ethnicity/culture (e.g., First Nations and Inuit populations, immigrant populations, and linguistic minority populations);
- occupation or labour-market experiences more generally (e.g., those in "precarious work" arrangements);
- gender;
- religion;
- educational level (e.g., health literacy);
- socio-economic status (e.g., economically disadvantaged populations); and
- social capital/social exclusion.

This issue brief strives to address all people, but (where possible) it also gives particular attention to two groups:

- people living in remote areas; and
- people with one or more pre-existing health conditions.

Many other groups warrant serious consideration as well, and a similar approach could be adopted for any of them.

† The PROGRESS framework was developed by Tim Evans and Hilary Brown (Evans T, Brown H. Road traffic crashes: operationalizing equity in the context of health sector reform. *Injury Control and Safety Promotion* 2003;10(1-2): 11–12). It is being tested by the Cochrane Collaboration Health Equity Field as a means of evaluating the impact of interventions on health equity.

## Key concepts

There are many terms used when discussing pandemics, which may create some conceptual ambiguity and may constitute an obstacle to effective communication among policymakers, civil society actors, researchers and other stakeholders. Central to effective pandemic response planning is the recognition that pandemics require routine prevention strategies, procedures to manage emergence, and adequate response capacity to contain and mitigate outbreaks and aid in recovery from the pandemic. Some key concepts include:

- **Pandemic preparedness** comprises efforts that include ongoing surveillance of newly emerging threats, threat assessments of agents with pandemic potential, and the development and improvement of preparedness tools that can aid public health practitioners, healthcare providers, policymakers and the general public, in the event of a newly emerging disease pandemic.(19) These efforts should also build capacity for a whole-of-society approach by garnering political, legal and financial support, and developing systems and knowledge to anticipate outbreaks.(20)
- **Pandemic prevention** refers to the measures needed to identify, understand and address the upstream conditions and factors that influence the spread of pandemic-prone diseases, including the ongoing efforts and activities that collectively alter the pandemic trajectory of disease in favour of sustainable and equitable health outcomes (including reducing the vulnerability of at-risk populations).(21)
- **Pandemic management** includes the detection, identification, confirmation, alerting of, and coordinated response to infectious-disease outbreaks with the potential to become pandemic in scope such that infection is contained and spread is prevented.(22)
- **Pandemic planning** refers to the preparation of plans of action in advance of, and in response to, imminent disease outbreaks that are decided upon and coordinated by a multitude of stakeholders including those in the public health and healthcare sectors, regional governments, civil society organizations, private industry, charities, media organizations and academic institutions, prior to the onset of the pandemic, to help reduce the impacts on health, essential services and daily life.(23)

Pandemic response requires that health systems build adequate capacity to support the creation and maintenance of well-coordinated pandemic governance architecture. This requires health system decision-makers to have a clear understanding about what types of pathogenic agents have the potential to become pandemic diseases, the epidemiological differences between emerging diseases, epidemics and pandemics, and key functions required for effective health-system responses to pandemics (such as risk communication and surveillance). Some key concepts include:

- **Emerging infectious diseases** can be defined as “infections that have newly appeared in a population or have existed but are rapidly increasing in incidence or geographic range.”(24) Emerging infectious diseases can arise from bacterial, viral or parasitic pathogens, and have in the past included diseases such as bovine spongiform encephalopathy, cholera, dengue hemorrhagic fever, hemolytic uremic syndrome, HIV, Rift Valley fever and schistosomiasis.(24)
- **Epidemics** concerning infectious agents are defined as “an increase, often sudden, in the number of cases of a disease above what is normally expected in that population in that area.”(25)
- A **pandemic** refers to “an epidemic occurring worldwide or over a very wide area, crossing international boundaries, and usually affecting a large number of people.”(26)
- **Health systems** are the governance, financial and delivery arrangements through which health care and population health services are provided.(27)
- **Surveillance** refers to technical systems, institutional structures and networks dedicated to keeping local, territorial/provincial, regional, national and international authorities aware of disease outbreaks.(22) Surveillance can also refer to “the ongoing and systematic collection, analysis, and interpretation of outcome-specific data for use in the planning, implementation, and evaluation of public health practice.”(28)

- **Risk communication** is an interactive process of exchanging information, data, evidence and expert opinion concerning risk and risk-related factors among risk assessors, risk managers, consumers and other interested parties.(29)
- **Pandemic governance** refers to the institutional arrangements involved in acquiring, assessing, adapting, applying and disseminating emerging pandemic information as it is generated, rapidly making policy decisions based on the best available evidence, and coordinating responses with domestic and international partners as well as actors within the private and civil society sectors.

### **What this brief does and doesn't address**

This issue brief was prepared to inform and support the actions of those involved with or affected by health systems' responses to pandemics. The brief aims to identify and define the breadth of challenges associated with pandemics for health systems, and the evidence available to strengthen responses to them, particularly for decision-makers in Canada, but also its partner countries in North America and beyond. It identifies three elements of a potentially comprehensive approach to strengthening health systems' capacity to respond to emerging pandemics, and outlines key implementation considerations at various levels of governance.

This brief does not discuss specific responses to particular types of pandemics (e.g. local stockpiling of vaccines and medicines specific to influenza pandemics). Rather, it takes into account the breadth of variability that exists during pandemics where response strategies need to be customized to each new situation. The brief will not focus on institution-level healthcare delivery strategies or individual-level healthcare practices by health professionals, as its key emphasis is on strengthening overall health systems' capacity at the provincial, state and national levels. The brief does not discuss drug discovery, development and delivery as it relates to pandemics, nor does it focus on pandemics of chronic/non-communicable diseases (e.g. obesity). Finally, normative judgments of past pandemic responses and/or contributions of particular actors have been purposefully avoided.

## **THE PROBLEM**

The complex problems posed by pandemics are multi-dimensional and diverse. We have conceptualized these problems into two main groups for discussion: 1) six key challenges to strengthening health systems' capacity for pandemic management; and recognition that 2) existing programs, health system arrangements and implementation strategies may not be optimal.

### **Six key challenges to strengthening systems' capacity for pandemic management**

The challenges to strengthening national health systems' capacity to respond to future global pandemics can be understood by considering six manifestations of, or contributors to, the problem:

- 1) pandemics challenge conventional systems of governance;
- 2) timely information sharing and evidence-informed decision-making is difficult;
- 3) domestic and international partners often encounter coordination problems;
- 4) public health and animal health perspectives can be difficult to reconcile when addressing emerging zoonoses;
- 5) antimicrobial resistance represents a growing threat; and
- 6) risk and protective factors for pandemics are changing.

We address each of these challenges below in turn:

#### **1. Pandemics challenge conventional systems of governance**

Pandemics are surprises that result from complex socio-ecological interactions.(30;31) Their complexity limits decision-makers' ability to predict pandemic onset and spread with precision, and thus also obscures their ability to target resources proactively in the most effective and efficient manner. Finding consensus and fully accounting for all reasonable possibilities when faced with such uncertainty are difficult in conventional modes of governance. For example, current pandemic response plans often assume that pandemics are linear problems with one-size-fits-all solutions.(31;32) In reality, pandemics emerge as extremely multidimensional problems that occur within complex systems filled with incomplete information.(33-35) Many pandemic response plans fail to account for the variability of pandemics; most have focused only on pandemic influenza.(36;37) Pandemic planning should mean planning for surprises under conditions of uncertainty.(38) The principles of adaptability and plurality that are fundamental to effective pandemic planning (31) are not well supported by the rigidity and linearity of conventional policy responses to most problems.(32)

Furthermore, consideration of global health governance as a complex adaptive system with "multiple and diverse players, and their polyvalent and constantly evolving relationships, and rich and dynamic interactions" further complicates traditional governance structures.(39) Added complexity raises two governance challenges for pandemic planning: 1) multiple players with diverse interests are able to influence outcomes; and 2) truly all-inclusive approaches remain elusive for decision-makers to design and implement.(31;32;40) This makes it difficult to coordinate action among different actors and across countries.

#### **Box 3: Mobilizing research evidence about the problem**

The available research evidence about the problem was sought from a range of published and "grey" research literature sources. Published literature that provided a comparative dimension to an understanding of the problem was sought using three health services research "hedges" in MedLine, namely those for appropriateness, processes and outcomes of care (which increase the chances of us identifying administrative database studies and community surveys). Published literature that provided insights into alternative ways of framing the problem was sought using a fourth hedge in MedLine, namely the one for qualitative research. Grey literature was sought by reviewing the websites of a number of Canadian and international organizations, such as the Public Health Agency of Canada, Centers for Disease Control and Prevention (USA), Department of Health and Human Services (USA), Ministry of Health/Secretaría de Salud (Mexico), Pan American Health Organization, and World Health Organization.

Priority was given to research evidence that was published more recently, that was locally applicable (in the sense of having been conducted in Canada or other countries in North America), and that took equity considerations into account.

## **2. Timely information sharing and evidence-informed decision-making is difficult**

The uncertain origins and quickly evolving nature of pandemics make it difficult for decision-makers to appropriately use and share emerging information as it is generated, especially when they are bombarded by large volumes of competing information collected from multiple sources.<sup>(41)</sup> For example, although risk management will always involve some decision-making without all the evidence, it has been found that critical decisions were made in responding to the H1N1 pandemic before the appropriate data became available.<sup>(42)</sup> Uncertainty during pandemics is compounded by a lack of trust between researchers and decision-makers to calculate when, where or how widespread any outbreak will be. For instance, it was noted by one researcher that Mexico's response to H1N1 was slowed because laboratory employees were neither given the freedom to question situations nor the tools for executing their duties. A myriad of political problems also hampered efforts, such as employee turnover due to changes in government, and compromised institutional knowledge and know-how. These problems, of course, are not unique to Mexico and may exist in other jurisdictions.<sup>(14)</sup>

Timely access to information is also impaired by the fact that governments by themselves lack the capacity to respond to all risks and opportunities posed by emerging global pandemics. It has been broadly acknowledged that a range of actors need to be engaged to effectively identify, assess and act upon international infectious disease threats, including stakeholders within sub-national governments, civil society organizations, charities, businesses, media organizations, and academic institutions, both within and beyond the health sector.<sup>(43;44)</sup> Yet navigating the political landscape has proven difficult in times of emergency when multiple actors and sectors are meant to come together to share information and co-manage responsibilities across jurisdictions. Agency mandates frequently overlap and data can conflict. A lack of shared understanding in advance about how different actors can synergize their collective mandates can undermine decision-makers' ability to effectively respond to pandemics and other public health crises. It is difficult to overcome current legal constraints and attitudes towards sharing information in both preparedness and response phases of pandemics (e.g. Indonesia's refusal to share viral samples during the H5N1 outbreak). There is also resistance to releasing information to decision-makers in different jurisdictions and among provinces/states within countries; reciprocity is not always present among stakeholder groups at the different levels of pandemic preparedness and response. Privacy concerns and the consequences of premature information sharing (e.g. impact on trade) also limit this kind of collaboration.

Furthermore, complex legal, political and economic issues between and within countries have had spillover effects on knowledge sharing between countries during the coordination of international responses. Although the revised International Health Regulations (2005) (IHR) – a set of legally binding agreements that requires countries to report certain disease outbreaks to WHO – were lauded as a key milestone,<sup>(45)</sup> Indonesia's previous refusal to share its H5N1 samples with WHO in 2006 led to contentious disagreements over virus-sharing obligations between developed and developing countries.<sup>(46)</sup> The recent Middle East Respiratory Syndrome (MERS) outbreak in Saudi Arabia demonstrates that global society may have failed to convince national governments to always share information with others.<sup>(47)</sup> This ongoing sense of distrust and lack of transparency at the international level has also recently been deepened by China's possible withholding of knowledge about the first cases of H7N9 from the global community for 30 days, which would have been contrary to the IHR.<sup>(48)</sup> This is not to say that no progress has been made; for example, Indonesia's refusal to share viruses led to the Pandemic Influenza Preparedness Framework (2011), but the best combination of actions needed to address the inherent tensions between national and collective interests remains unclear.<sup>(49)</sup>

The absence of researchers at the political decision-making table can also lead to misinterpretation and misguided implementation efforts in the policy realm.<sup>(50)</sup> This effect is compounded by the challenges researchers and policymakers experience in communicating with each another. Researchers often do not convey research evidence in plain language, and policymakers have not developed mechanisms to consistently translate evidence into complementary policy recommendations. Furthermore, politicians' competing needs to satisfy their constituents and follow the best advice of their scientific advisors may affect political decision-

making during pandemics. High levels of public scrutiny and expectations for swift action make pandemic response a challenging and delicate issue for any politician to address. For example, policymakers may be hesitant to change their decisions during pandemics for fear of losing public confidence or creating confusion between various levels of government and other stakeholder groups.(51)

Finally, it is challenging to develop accurate estimates of how many people will be affected by pandemics. For example, pre-pandemic global estimates of death from H1N1 were often in the millions, while the ultimate death toll was reported at 18,156.(52;53) Over time, such quantitative misalignments can lower the political priority of pandemic responses because projected estimates are so often overstated.

### **3. Domestic and international partners often encounter coordination problems**

The fact that pandemics know no boundaries greatly complicates cross-jurisdictional cooperation. Legislative barriers, overlapping agency mandates and conflicting professional protocols impair necessary integration efforts between experts in public health, animal health and the private sector at national and international levels. Despite recent progress in scaling-up global pandemic response capacity, the world is said to remain largely unprepared for the onset of a newly emerging non-influenza pandemic-disease outbreak due to a host of problems that range from overly bureaucratic and slow decision-making processes to simple but costly communication breakdowns.(54) States often have competing interests and act out of self-interest; governments are so busy coordinating responses to domestic issues that they may have little time or concern to devote to issues of global health security. Developed countries have not yet fully acted on the fact that inadequate pandemic response planning within developing countries will inevitably affect their own citizens.(55)

Coordination challenges between domestic and international partners also impair decision-makers' ability to adequately respond to the variability of pandemics. Divergences in countries' responses to past pandemics and widespread non-adherence to WHO recommendations suggest that governments make life-and-death decisions during pandemics based on different and possibly suboptimal information.(56;57) For example, participants from a previous McMaster Health Forum dialogue noted that the Canadian government is increasingly seen internationally to focus solely on the health of Canadians, with little reflection on how risks are shared and how the country's actions to address risks can even increase risks for others (in comparison to governments like Norway's or the United Kingdom's, which have crafted statements acknowledging their interdependence with other countries, shared risks and opportunities, and the ethical and moral standards that they demand of themselves and others).(56)

The international community also lacks strong global governance architecture to respond to pandemics of worldwide significance. The revised IHR contain no legal enforcement mechanism,(58) rely upon peer pressure and public knowledge for compliance,(59) emphasize surveillance to the exclusion of other essential elements,(60) remain difficult to implement in federated countries,(61-63) provide opportunities for the politicization of epidemic responses,(64) depend upon national governments' acquiescence to new global health responsibilities,(65) fail to specify how national governments are actually supposed to collaborate with one another,(66) narrowly define health security,(67) and rely upon surveillance networks in developing countries that may not be functioning optimally.(3;68) It is important to indicate that this is not just a country-to-country issue. For example, effectively leading coordination across provinces and ministries in Canada remains a challenge for the country's public health agency.(12;69)

### **4. Public health and animal health perspectives can be difficult to reconcile**

Pandemics frequently result in conflicting priorities when deciding on management options. While there are many perspectives to reconcile (e.g. public vs. private and efficiency vs. social justice), challenges posed at the intersection of the human and animal health sectors may be particularly important to address. Legislation, competing interests, lack of a shared single management goal, uncertainty about the roles of animal

management on risk prevention and more, complicate the ability to coordinate across human and animal agencies.(70;71)

Most pandemic preparedness plans to date have largely been focused on the emergence of pandemic influenza in human populations.(37) However, nearly 75% of all newly emerging infectious diseases in humans – representing 2.4 billion infections and 2.2 million deaths annually – are caused by zoonotic pathogens originating in domesticated animals and wildlife, although not all of these pathogens cause influenza-type diseases in humans.(43;72-76) While the majority of newly emerging zoonotic diseases do not pose pandemic risk, proximal interactions between humans and animals increase the risk that pathogens shared with wild or domestic animals will cause significant infectious diseases in humans.(77)

The costs of zoonotic diseases are not solely restricted to expenses of human or animal treatment and control efforts. The SARS pandemic, for example, cost an estimated \$30-50 billion despite causing illness in fewer than 9,000 people.(78) The last six major zoonotic outbreaks – nipah virus (Malaysia), West Nile fever (U.S.), SARS (Asia, Canada, other), highly pathogenic avian influenza (Asia, Europe), bovine spongiform encephalopathy (U.S., U.K.) and Rift Valley fever (Tanzania, Kenya, Somalia), which all occurred from 1997-2009 – cost a total of \$80 billion, or \$6.7 billion per year.(79) Disagreements among medical, public health, veterinary and agriculture experts at policymaking tables have undermined attempts at consensus-building for other issues, such as the appropriate use of antimicrobials in agriculture.(70) Attempts by proponents of the One Health Initiative, a collective movement to attain integrated planning in human, animal and environment health, has failed to gain traction over the past 10 years, although the initiative has recently gained attention at the last three international ministerial conferences on animal and pandemic influenza in New Delhi (2007), Sharm El-Sheikh (2008) and Hanoi (2010), signalling that there may be greater uptake of this paradigm in the future.(80) Still, it has been observed that rigid bureaucratic mandates and pressure on cost-cutting have jeopardized capacity for intersectoral action on this issue.(81) Also challenging is how animal health is often overseen exclusively by private sector actors who may not have the right incentives to act in ways that would be best for public health.

## **5. Antimicrobial resistance represents a growing threat**

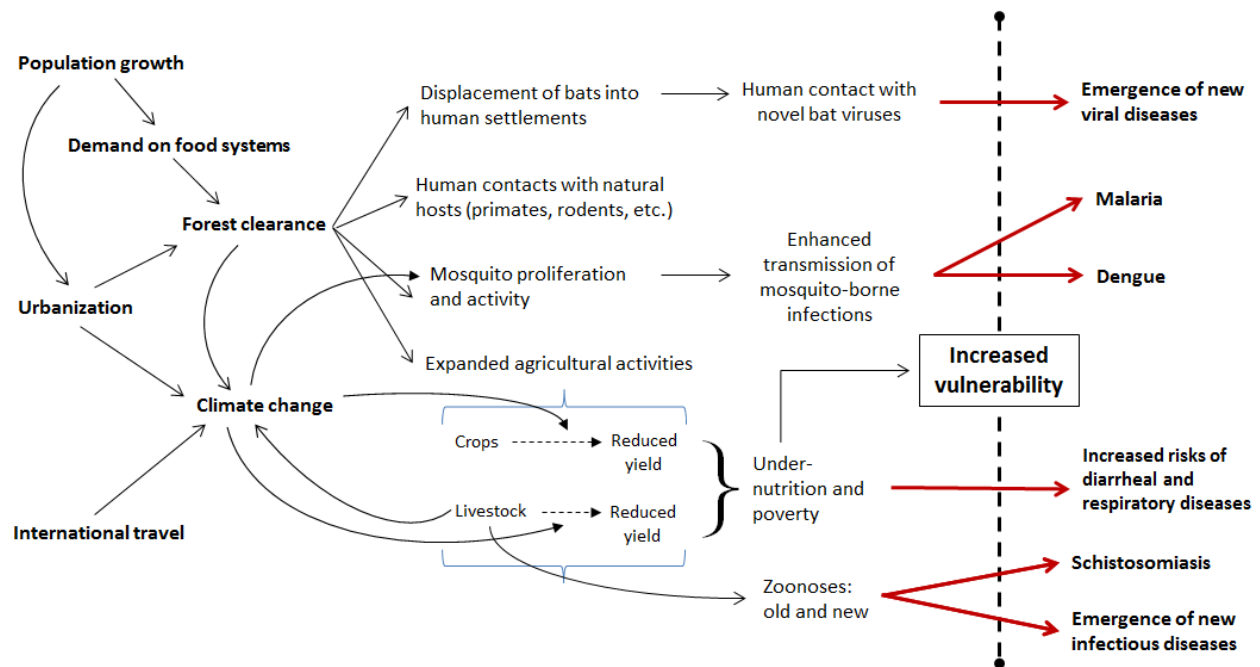
Increasing antimicrobial resistance seriously undermines health systems' ability to treat and effectively respond to certain types of emerging-disease outbreaks. For example, the spread of extensively drug-resistant and totally drug-resistant tuberculosis in South Africa, and the emergence of methicillin-resistant *Staphylococcus aureus* as a community health threat (rather than its historical role as a typical nosocomial infection) are already forcing front-line health workers to overcome tremendous barriers when creating treatment regimens that will have real health impact for infected persons.(82;83) The frequent misuse of antimicrobials during the non-pandemic and inter-pandemic periods diminishes their effectiveness and erodes their utility during a pandemic outbreak. Travel also increases the spread of antimicrobial and antiviral resistance;(84-87) diseases which had previously been eradicated in North America are more likely now than ever to re-emerge.(88) If resistant gene mutations outpace antimicrobial innovations, decision-makers may have very limited options to contain pandemic spread.

## **6. Risk and protective factors for pandemics are changing**

The world is experiencing unprecedented levels of change in almost all sectors of society in response to globalization. The most effective pandemic responses will likely be those that can be customized to address the unique conditions surrounding context-specific cases of pandemic emergence. National and international decision-makers have struggled to link local and global scales of action and transition to a governance paradigm that is inclusive of bottom-up approaches.(89) The global response to H1N1, for example, has been criticized for following a one-size-fits-all approach.(38) Current pandemic prevention and management efforts do not all account for the dynamism of 21<sup>st</sup> century globalized societies.

As was previously mentioned, pandemics are truly complex problems with a multitude of risk factors contributing to their emergence. We have outlined a sample pathway demonstrating how pandemic risk factors can lead to the emergence of diverse types of infectious diseases (See Figure 1).(90) Specifically, this figure illustrates how social demographic risk factors like urbanization and rapid population growth strain agricultural and environmental systems, resulting in increased susceptibility to emerging infectious diseases via the effects of variables such as forest clearance, climate change, increased contact with disease vectors, and expanded agricultural activities.(98;(91)

**Figure 1: Some pandemic risk factors and their relationship to infectious disease emergence (90)**



Some of the key risk factors for pandemics include:

### 1) social risk factors

- increase in the hypermobility of persons*
  - An estimated 2.5 billion people travelled by airplane in 2009 and an additional 800 million passengers are expected annually by 2014.(92) The International Air Transport Association predicts this number will jump to 16 billion passengers and 400 million tonnes of freight by 2050.(93) These trends suggest that humans are becoming increasingly exposed to pandemic risk factors beyond their homelands, and are potentially more likely to transmit pathogenic agents across borders (28).
- impact of urbanization*
  - More than half the global population already lives in urban areas, and this trend is set to increase.(29-30) Increasing person-to-person proximity and escalating population density in metropolitan areas may increase the risk for disease outbreaks and the rate of disease transmission, particularly in cases of uncontrolled urban growth in developing countries.(94)
- exponential population growth*
  - The United Nations estimates that the global population will be more than 9 billion by 2050, placing increasing demands on food, water, health, agricultural and socio-ecological systems.(31-32)
  - Demographic changes linked to an expanding global population have contributed to the emergence of an alarming number of newly described zoonoses, including hantavirus pulmonary



syndrome, monkeypox, SARS, and simian immunodeficiency virus (the animal precursor to HIV).(33)

## **2) economic risk factors**

### *a) increase in trans-border trade*

- The world is currently experiencing unprecedented levels of cross-border trade of goods, services and investments. Trade in merchandise and commercial services is valued by the World Trade Organization at US\$15.8 trillion globally, with over US\$370 billion of that involving Canada.(95) Increased trade increases the number of opportunities for spreading plant, animal and human pathogenic agents.

### *b) changes to food systems and animal-human proximity*

- Agriculture and food systems are increasingly becoming worldwide integrated markets with food sourced globally, prompting the spread of zoonotic disease. The problem may only worsen as animal production is intensified to achieve greater efficiency and economies of scale, which also provides more optimal incubating conditions for emerging zoonotic pathogens.(96;97) The co-location of humans and animals in many countries combined with increasing consumption of uncooked/undercooked meat provides yet additional opportunities for animal diseases to be transferred into human populations.(98)

### *c) illicit activities*

- The illegal trade of goods, animals and people encourages the spread of disease across borders while also restricting decision-makers' access to documented information tracing the flow of goods and services.

## **3) environmental risk factors**

### *a) impact of environmental changes on global disease spread*

- Climate change has caused some vector-borne pathogens to proliferate with warming along the cold latitudinal and altitudinal edges of their present distribution. Examples of vector-borne pathogen range expansion due to climate change include dengue virus in Texas, U.S., Lyme disease in Canada, and tick-borne encephalitis at increasing altitude in Slovakia.(34)

### *b) changes in land use*

- Deforestation and changes in food production have changed the way disease vectors are borne and propagated (e.g. affecting malaria, sleeping sickness, Chagas disease, etc.). For example, changes in land use and increasing human populations exert selective pressure on vector-borne pathogens to be able to infect and be transmitted by people and vectors associated with human development.(34) Land use changes also affect food sources, water security, waste management, and other factors that contribute to infectious disease emergence.(99)

However, the following actions have been identified as potentially protective factors against the consequences of pandemic emergence:

## **1) social protective factors**

### *a) increasing awareness about pandemics and communicating risks to the public*

- Increasing public awareness about pandemic risk factors and how individuals can act to minimize the risk of emergence in their communities can help prevent and mitigate the effects of pandemics.(100;101)
- Accurate representation and access to information regarding scale and severity of pandemics by health authorities, government and health journalists may assist stakeholders in coordinating appropriate responses and preparedness efforts against pandemics.(102)

### *b) reinforcing public health strategies to prevent pandemic emergence*

- Support for interventions that limit the inappropriate use and overuse of antibiotics, self-prescription of antibiotics by individuals without the guidelines of a qualified clinician, and the non-therapeutic use of antibiotics as growth promoters in livestock may preserve the protective potential of antimicrobials.(103)
- Advancing public health interventions such as hand washing and providing access to safe drinking water may reduce the risk of spreading disease, particularly in developing countries.(104)

For example, in a review of roughly 400 public health events of international concern, it was found that a “breakdown or absence of public health infrastructure” was the driving factor in the largest fraction of outbreaks (39.5%); lacking sanitation and hygiene alone accounted for 23% of all outbreaks.(105)

- c) *developing adequate governance tools and structures for decision-making*
  - Developing an ethical framework to guide equitable and transparent decision-making that is reinforced by accountability mechanisms can help to ensure that response strategies reduce the risks posed to health for all persons, particularly those in vulnerable, at-risk groups. (106)
  - Processes for long-term planning and equitable priority-setting that involve all relevant stakeholders can be supported such that they incorporate pre-established mechanisms for revising decisions and providing timely and accurate information to the public.(106;107)
  - Designing interventions that are directly informed by local needs and local approaches can help to bridge the local-global decision-making and action gap.(89)

## 2) economic protective factors

- a) *boosting trade systems and institutions*
  - Instruments like the IHR and APEC Guidelines for Functioning Economies in Times of Pandemic (2007) secure and protect the movement of trade across borders. Tools like these can support the ongoing essentials of daily life and viability of economies where pandemic outbreaks occur.
  - The World Organization for Animal Health’s (OIE) Terrestrial and Aquatic Animal Health Codes set out standards for the improvement of animal health and veterinary public health worldwide, including standards for safe international trade (of mammals, birds, bees, amphibians, crustaceans, fish and molluscs) and their products.(108;109)
  - Preparing plans to guarantee the functioning of essential services to support infrastructure (e.g. health, energy, water, food suppliers), fuel, essential production (e.g. food, medicines), and key institutions (e.g. government, banking, markets, trade and movement ports) in times of outbreak can help to maintain systems’ resilience during pandemics.(110)
- b) *fighting corruption*
  - Developing additional protections against corrupt practices that might emerge during a pandemic could help to stabilize the exchange of legitimate goods and services.(110)

## 3) environmental protective factors

- a) *designing surveillance programs at the animal-ecosystem interface*
  - Regular environmental-animal surveillance networks can track and report on the emergence of zoonoses.(111)
- b) *preserving balance within ecosystems for the interdependent maintenance of health and biodiversity*
  - Increasing current understandings about the changes in ecosystems and their effect on human and animal health will increase decision-makers’ ability to predict the next human pandemic. Learning how microorganisms change in human and animal populations in response to travel, environmental and ecosystem changes may help to identify pandemic risk factors.
- c) *supporting resilience in environments and propensity to adapt to change*
  - Gaining control of vector-borne zoonotic diseases through combined efforts of clinicians and public health officials to treat patients and promote behaviour likely to minimize risk of infection, and by disease ecologists, urban planners, and medical entomologists to advise on development and restoration of ecological communities, and vector control to reverse the ecological drivers of transmission can contribute to resilience.(112)
  - Recognizing the variability of pandemics and the need for flexible planning can promote resilience to pandemic outbreaks.(30;31;113)

**Existing programs, health system arrangements and implementation strategies may not be optimal**

## **Programs and plans may limit capacity to respond to future pandemics**

The world has greatly advanced its capacity to respond to future global pandemics. In the past 10 years in North America alone, new pandemic preparedness strategies have included the Canadian Pandemic Influenza Plan for the Health Sector (2006), the U.S. Department of Health and Human Services Pandemic Influenza Plan (2005), the North American Plan for Avian and Pandemic Influenza (2007), and a revised North American Plan for Animal and Pandemic Influenza (2012). In fact, as of 2011, 158 countries around the world had developed pandemic-preparedness plans, most of which were based on the anticipation of an outbreak of H5N1.<sup>(37)</sup> Despite these advances, it is unclear how many preparedness plans are actually operational at the country level due to a lack of evaluation, but it is doubtful that all countries have the institutional capacity to implement their plans in a state of emergency.<sup>(54)</sup> This is particularly true of many developing countries that lack the capacity to support basic sanitation programs, let alone system-wide pandemic-preparedness systems.<sup>(105)</sup> Thus, while the sheer number of plans and strategies being developed for pandemic response is admirable and important, many likely have yet to be fully implemented.

Further, classical conceptions of global health planning in terms of vertical, disease-specific programs may have undermined basic public-health infrastructure and long-term health systems development, potentially diminishing developing countries' health system capacity to respond to future global pandemics.<sup>(114)</sup> Current plans have failed to fundamentally modify human-environment dynamics at the scale that some experts say are needed, given that plans are focused on post-emergence response rather than prevention.<sup>(105)</sup> Preparedness plans also do not fully address key drivers of pandemic emergence, often lacking diverse strategies to achieve an effective systems approach able to accommodate all of the drivers and actors that could influence pandemic origins, response and recovery in a particular context. For example, methods for strengthening animal health diagnostic laboratories, training veterinarians in public health and vice versa (e.g. epidemiology for disease surveillance, outbreak detection, investigation and intervention), the advent of biosecurity measures on farms, educating bushmeat hunters about disease risks, and working with extractive industries, civil society and the media in emerging infectious disease "hotspots," have all been identified as possible actions to reduce the risk of new pathogens emerging in particular settings.<sup>(105)</sup> Calls for comprehensive health system strengthening in recent years have sought to remedy some of these gaps, although full implementation has yet to be observed, particularly in developing countries.<sup>(115)</sup>

Although considerable research evidence has recognized the vital role of communities in pandemic response and planning, many pandemic preparedness plans do not currently support participatory epidemiology and other innovative strategies that involve bottom-up, community-based approaches to health surveillance and disease management.<sup>(89;116;117)</sup> Despite growing recognition for the role of non-expert citizens as contributors to health system decision-making, the availability of innovative technologies for performing real-time situational analyses during pandemics is limited. For example, Lajous et al.'s assessment of cellphone technologies as potential surveillance and information dissemination tools during the H1N1 outbreak concluded that "when carefully deployed, unstructured supplementary service data surveys may be a practical, low-cost, and timely complement to traditional surveillance,"<sup>(118)</sup> yet little mention of mobile technologies exists in today's pandemic preparedness or surveillance plans. Mobile-phone technologies have proven successful in empowering everyday citizens in developing countries to make autonomous choices about their HIV/AIDS management, and have been recognized as potentially game-changing tools in improving health crises management.<sup>(119)</sup>

Additionally, the role of social media in pandemic surveillance and response has not been given full consideration in modern preparedness plans despite recognition for its role in expediting access to information in times of global crises. For instance, the number of followers on the Centers for Disease Control and Prevention's (CDC) Twitter account increased from 2,500 before the H1N1 flu outbreak to 370,000 in late June 2009.<sup>(120)</sup> This suggests the utility of social media to communicate with large numbers of people and the interest among citizens in receiving real-time health information in this way. During H1N1, the CDC used seven kinds of social media tools: buttons and badges, e-Cards, Flickr, Twitter, Facebook,

YouTube, widgets and podcasts.(121) Pandemic leaders have yet to give serious consideration to the potential of social media technologies. and formally apply key lessons to risk communication and real-time data collection and surveillance strategies.

### **Health system arrangements complicate matters as well**

The challenge of building capacity to respond adequately to pandemics requires identifying how current health systems' delivery, financial and governance arrangements may influence downstream actions. Global governance arrangements must also be considered.

#### *Delivery arrangements within health systems*

Capacity for health systems to take on additional patient loads during pandemics is severely constrained given that institutions are consistently operating at near-maximum efficiency with limited resources (e.g. providing access to high-tech treatments, epidemiological assessments, additional hospital beds and staff, or expert laboratory analysis in the face of unpredictable events is often difficult).(16) Limited laboratory capacity for conducting large-scale rapid diagnostic testing constrains the number of samples that can be examined each day. Moreover, diagnostic surge capacity in laboratories is sometimes inadequate and not supported by appropriate resources and legal frameworks. For example, during an outbreak of H7N3 avian influenza in the Fraser Valley of British Columbia in 2004, the Canadian federal government was only able to confirm results in a laboratory in Winnipeg, causing an almost 48-hour delay in diagnostic confirmation that may have compromised the effectiveness of pandemic containment strategies.(122) During the H1N1 outbreak in Mexico there were also insufficient laboratories for analysis, and those that were present were insufficiently equipped, limiting the quality and diversity of information they could gather.(14)

Furthermore, community resilience and pandemic prevention infrastructure and resources are difficult to maintain during the inter-pandemic period when the issue is not at the top of the political agenda. It is difficult to justify continued investment in pandemic preparedness given that public health practitioners face significant challenges in measuring the outcomes of successful prevention efforts (e.g. quantifying how many pathogenic agents were prevented from reaching pandemic levels due to effective prevention control programs), and because they face so many other pressing public health challenges and have so few resources available to act upon them. Moreover, local healthcare delivery systems have often failed to maintain ongoing surveillance, monitoring and evaluation assessments to identify and protect vulnerable communities.(123;124)

#### *Financial arrangements within health systems*

In federal countries like Canada, pandemic governance is challenging when health services are at least partially funded by one jurisdiction (i.e., federally via cash and tax transfers to provinces and territories) and the actual delivery of services is provided by another jurisdiction (i.e., provincial/territorial responsibility).(125) In a review of the Canadian federal government's response to H1N1, it was noted that existing financial mechanisms are not sufficiently agile to rapidly initiate strategic planning, funding and coordination of a national response.(12) Lacking contingency funds from the federal government and the absence of mechanisms to provide urgently needed funding for project proposals precluded the initiation of rapid research projects at other jurisdictional levels.(12) Additionally, the government lacked standardized processes to rapidly set research priorities during a pandemic and to critically evaluate proposals for research funding against priorities.(12) It is likely that these inefficiencies exist in other federated jurisdictions too.

All countries faced distributional challenges of funding initiatives in rural and remote areas during the H1N1 pandemic.(12;14;101) Governments currently lack streamlined mechanisms and procedures to allocate financing in an equitable way among disadvantaged groups during public health crises.(12;14) Funding channels for general care and treatment services can also be particularly inequitable in countries where there is no social health insurance and where many people are uninsured. This problem is compounded by the high

rate of uninsurance among people with lower incomes (as of September 2013, 24.9% of Americans in households earning less than \$25,000 did not have insurance compared with 15.4% of the entire population), especially given this socioeconomic group also bears a higher burden of comorbidities than wealthier groups.(126)

*Governance arrangements within health systems*

A failure to share information and coordinate actions at the governmental level can impair the process of leading effective responses to pandemic outbreaks. For example, prior to the H1N1 outbreak in Canada, an agreement was developed that included an annex on surveillance information sharing (epidemiologic data and laboratory data). This annex was approved by most jurisdictions, however, during the pandemic it became problematic that no enforcement mechanisms were in place to ensure processes of transparent information sharing between provinces and the federal government. Although data have been shared previously, there are currently no commitments to share information in the event of a future pandemic.(12) In Mexico, it was found that loyalty to political parties was detrimental to the effectiveness of the H1N1 response, and that “in-fighting among the ministries” prevented fluid information sharing between officials.(14) It has been reported that there was limited coordination at the start of the H1N1 outbreak among Mexico’s Ministry of Health, the Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food, the Ministry of Civil Protection, and the Ministry of Defense, resulting in delayed pandemic monitoring and evaluation.(14)

The timeliness of information sharing can be another obstacle to evidence-based decision-making during pandemics. Strengthening national surveillance capacity has been consistently recognized as a challenge for the Public Health Agency of Canada.(12) During the H1N1 pandemic, the Public Health Agency of Canada experienced challenges with respect to its surveillance capacity, including both a lack of real time data on key epidemiological variables and epidemiological resources to review surveillance data.(12) In the U.S., Stoto (2012) identified that a nearly two-month delay between the country’s northeast and south during the autumn peak in some surveillance data seemed to partially reflect regional differences in concerns about H1N1, rather than real differences in H1N1 infection rates. Further analysis revealed underlying problems with surveillance systems in the U.S., particularly their dependence on patient and provider behaviour (which is influenced by a changing information environment), that could limit situational awareness in future public health emergencies.(101) The divide between the federal financing and state/territorial administration of healthcare services also implicated decision-making at the provider level. For example, although the Pandemic Influenza Committee and the Special Federal/Provincial/Territorial Advisory Committee on H1N1 Influenza in Canada strove for consensus at the national level, individual provinces and territories were under no obligation to implement the guidance agreed upon. Some commentators have said the consultative processes at the federal/provincial/territorial level created delays in decision-making and directly interfered with the capacity of front-line professionals to respond to the urgent health needs of their patients.(12)

Finally, a failure to recognize that health is increasingly influenced by decisions that are made in other global policymaking arenas, such as those governing international trade, investment, education, migration and the environment, has impaired some health system responses to pandemic emergence. For example, a lack of formalized legislation granting the federal government the authority to have guaranteed access to surveillance data to link what goes on in the animal and wildlife health sector responses to pandemics within health sectors (e.g. across the local, provincial/territorial, regional and federal levels), between health and non-health sectors (such as education, environment, labour, transportation, trade, media and justice), and across public, private and civil society actors, has precluded fully developed intersectoral action from materializing in times of outbreak.(127) Limited relationship-building opportunities and irregular communication between sectors have also contributed to insufficient trust between authorities from different sectors (including public, private and civil society sectors) and across different jurisdictional levels, potentially implicating the way pandemic response is managed and services are delivered.(128;129) Health actors today are largely unequipped to ensure that health concerns are adequately taken into account in crucial policymaking arenas, suggesting that

opportunities for strengthening interdisciplinary, cross-jurisdictional action and a deliberately inclusive approach in times of pandemic emergence are not being fully exploited.(130) .

#### *Global governance arrangements*

Although the revised IHR were lauded as a much-needed landmark for pandemic-response capacity-building in developing countries, in reality, many countries did not meet the June 2012 implementation deadline and have requested a two-year extension to continue scaling-up and measuring national capacity for pandemic preparedness.(131) It has become apparent that many WHO Member States do not have adequate research, workforce, laboratory or infrastructural capacity to support broad-spectrum pandemic responses.

Additionally, open communication and coordination networks have been linked to a country's ability to build trust, undertake effective crisis management, and develop emergency preparedness strategies with other governments.(132) Proper outbreak communication and information sharing during a pandemic can mitigate confusion and panic, increase trust in health system leaders and better inform decision-makers of best practices and next steps.(133) Adequate global coordination could allow for reduced resource duplication and the establishment of partnerships for future pandemic response.(134) However, current capacity does not allow this level of streamlined communication. For example, Mexico's transparency during H1N1 has been praised, as well as its high degree of cooperation with other nations, particularly in Canada and the U.S. However, despite Mexico's skillful management of public and media relations, many political, economic and cultural problems affected internal communications between ministries, and there was heavy reliance on personal relationships rather than formalized communication plans to coordinate efforts with Canadian and American colleagues.(14)

Another obstacle to effective global capacity-building for pandemic management is the severe lack of funds that are readily available to support WHO Member States. For example, WHO currently has an estimated influenza budget of \$7.7 million, an amount equivalent to less than one-third of what the city of New York dedicates to public health emergencies.(54) It is doubtful that developing countries will be able to fund pandemic preparedness and surveillance schemes on their own. A lack of funding dedicated towards pandemic preparedness and general health system strengthening is further compounded by the rise of "multi-bi" financing that allows donors to transfer non-core funding — earmarked for specific sectors, research priorities, themes, countries or regions — through multilateral agencies of the UN and the World Bank.(114)

#### **Some agreed upon courses of action have not yet been fully implemented**

There are some promising initiatives underway, but there are areas for improvement in their implementation. For example, in 2006, WHO aimed to produce enough influenza vaccine to immunize two billion people by 2015, and hoped vaccines would be available on the market "six months after transfer of the vaccine prototype strain to vaccine manufacturers" during global influenza pandemics. As an indicator of the difficulty in achieving this goal, by December 1, 2009, the six-month milestone for the H1N1 pandemic, global production reached just 534 million doses, and capacity was restricted to mostly developed countries.(135) Similarly, while there has been significant advocacy for the One Health movement, "operationalizing" One Health has been slow because there is not a specific defined budget among government agencies, and each relevant agency competes for funds.(105) Overall, the conclusion from the 2011 Review Committee on the Functioning of the International Health Regulations (2005) was a sobering reminder that the world is "ill-prepared to respond to a severe influenza pandemic or to any similarly global, sustained and threatening public-health emergency", and that despite existing arrangements in support of pandemic responses, health systems at all levels are currently inadequately equipped to cope with the burdens of serious pandemics.(37)

#### **Additional equity-related observations about the problem**

As has been previously mentioned, pandemics appear to disproportionately affect some demographic groups more than others. In particular, notable effects are faced by persons in remote areas and those who have pre-existing health conditions.<sup>(136)</sup> While people in remote areas are certainly at lower risk of being exposed to infectious diseases that emerge in urban areas, once the pathogen spreads to remote communities, inhabitants have far fewer rapidly available opportunities to receive access to diagnostic testing and healthcare services, as was the case in Manitoba First Nations communities during the H1N1 pandemic.<sup>(137)</sup> Persons living in remote areas are also often not considered in prevention strategies (e.g., the deployment of vaccines). Moreover, remote areas may lack adequate sanitation and water treatment, greatly increasing residents' risk of exposure to waterborne pathogens.<sup>(137)</sup> Rural communities are vital to the functioning of some core industries that risk being shut down or abandoned during pandemics (e.g., agricultural and food industry). The H1N1 experience highlighted the importance of having preparedness and response activities tailored for remote and isolated communities.<sup>(12;14)</sup>

People with one or more pre-existing chronic health conditions are also disproportionately affected by some infectious diseases as they are at greater risk of developing serious illness or complications from pathogenic infection. The elderly and persons with cardiovascular disease and other chronic conditions are at particular risk within this category. For example, excess deaths attributed to pneumonia or influenza are significantly higher in HIV-positive persons during influenza seasons.<sup>(138)</sup> HIV or some other immune-compromising co-infection with a pandemic virus can be associated with more severe infections in population groups with comorbidities.<sup>(55)</sup>

### **THREE ELEMENTS OF A COMPREHENSIVE APPROACH FOR ADDRESSING THE PROBLEM**

Many elements could be selected as a starting point for deliberations. To promote discussion about the pros and cons of potentially viable solutions, we have selected three elements (among many) of a potentially comprehensive approach for strengthening national health systems' capacity to respond to future global pandemics. These elements were informed by literature reviews, key informant interviews, and consultations with the Steering Committee, and constructed based on how well they could foster discussion about this issue.

These elements are: 1) enhancing national health systems' ability to detect pandemic risk factors, identify the causal pathogen, characterize emerging disease and monitor its evolution; 2) strengthening the capacity of national policymakers and stakeholders and the public to respond to the variability of pandemics; and 3) strengthening the global pandemic governance system, including better communication, collaboration and policy coherence with other national governments and international agencies during pandemics.

The three elements were identified and selected through a process of consultation with the Steering Committee and with key informants with expertise in pandemic preparedness, infectious disease control, epidemiology or a related field. The three elements were not designed to be mutually exclusive. They could be pursued simultaneously or sequentially, or elements could be drawn from each element to create a new (fourth) element. They are presented separately to foster deliberations about their respective components, the relative importance or priority of each, their interconnectedness, and the potential of (or need for) sequencing.

In the following section of the issue brief, we review available research evidence about each element in turn. While some of the research evidence may not deal specifically with pandemics, it was included since it can provide relevant insights and spur reflection about each element. The principal focus is on what is known about these elements based on findings from systematic reviews as well as economic evaluations or costing studies. We present the findings from systematic reviews along with an appraisal of whether their methodological quality (using the AMSTAR tool)(139) is high (scores of 8 or higher out of a possible 11), medium (scores of 4-7) or low (scores less than 4) (see the appendix for more information about the quality-appraisal process).

#### **Box 4: Mobilizing research evidence about elements of a comprehensive approach for addressing the problem**

The available research evidence about elements of a comprehensive approach for addressing the problem was sought primarily from Health Systems Evidence ([www.healthsystemsevidence.org](http://www.healthsystemsevidence.org)), which is a continuously updated database containing more than 3,000 systematic reviews and more than 1,600 economic evaluations of delivery, financial and governance arrangements within health systems. The reviews were identified by searching the database for records addressing features of each of the elements and sub-elements.

The authors' conclusions were extracted from the reviews whenever possible. Some reviews contained no studies despite an exhaustive search (i.e., they were "empty" reviews), while others concluded that there was substantial uncertainty about the element based on the identified studies. Where relevant, caveats were introduced about these authors' conclusions based on assessments of the reviews' quality, the local applicability of the reviews' findings, equity considerations, and relevance to the issue. (See the appendices for a complete description of these assessments.)

Being aware of what is not known can be as important as being aware of what is known. When faced with an empty review, substantial uncertainty or concerns about quality and local applicability, or a lack of attention to equity considerations, primary research could be commissioned or an element could be pursued and a monitoring and evaluation plan designed as part of its implementation. When faced with a review that was published many years ago, an updating of the review could be commissioned if time allows.

No additional research evidence was sought beyond what was included in the systematic reviews. Those interested in pursuing a particular element may want to search for a more detailed description of the element or for additional research evidence about the element.



**Element 1: Enhance national health systems' ability to detect pandemic risk factors, identify the causal pathogen, characterize emerging disease and monitor its evolution**

The first element involves the enhancement of national health systems' surveillance capacity, such as the ability to detect pandemic risk factors, identify the causal pathogen, characterize emerging disease and monitor its evolution. This element might include:

1. enhancing ongoing surveillance systems' capacity to detect, identify and investigate emergence risk factors and early disease outbreaks, and effectively monitor the evolution of disease (e.g. epidemiology, clinical manifestations, severity, rate of transmission);
2. integrating top-down surveillance programs with bottom-up approaches for monitoring and mitigating risks (e.g. through participatory epidemiology) and overcoming current legal barriers for sharing information gathered across sectors and ministries (e.g. meteorological surveillance systems that detect changes in weather patterns can inform trends in vector-borne disease and could be better integrated within health systems' surveillance networks);
3. building capacity for shared rapid data collection, analysis and assessment by decision-makers at all jurisdictional levels through enhanced information and communication technologies (ICT) such as via platforms that would allow authorities in all jurisdictions (both remote and urban) to have access to national diagnostic data as they are generated, including capacity to continuously update evidence syntheses within surveillance systems;
4. providing dedicated funding for knowledge management and information and monitoring systems;
5. working to improve global surveillance and outbreak management and investigation systems, especially in high-risk countries; and
6. establishing collaborative interprofessional teams to conduct routine surveillance, particularly for zoonotic disease outbreaks (e.g. utilizing expertise of public-health practitioners, clinicians, epidemiologists and veterinarians) to enhance human and animal surveillance system linkages (e.g. using the One Health Initiative as part of the approach).

We found 13 systematic reviews that can be drawn upon to inform some components of element 1. Three key observations can be made:

- we found five systematic reviews identifying benefits for key components of this element, including enhancing ongoing surveillance systems' capacity (sub-element 1); building capacity for shared rapid data collection, analysis and assessment (sub-element 3); and establishing collaborative interprofessional teams to conduct routine surveillance, particularly for zoonotic disease outbreaks (sub-element 6);
- we found no systematic reviews that have relevance to integrating top-down surveillance programs with bottom-up approaches for monitoring and mitigating risks (sub-element 2); providing dedicated funding for knowledge management and information and monitoring systems (sub-element 4); and working to improve global surveillance and outbreak management and investigation systems, especially in high-risk countries (sub-element 5); and
- one systematic review is currently in progress and could inform how to integrate top-down surveillance programs with bottom-up approaches for monitoring and mitigating risks through participatory epidemiology (sub-element 2), by examining the effectiveness of surveillance systems and community-based interventions in identifying and responding to emerging and re-emerging zoonotic infections in Southeast Asia.(140)

A summary of the key findings from the synthesized research evidence is provided in Table 1. For those who want to know more about the systematic reviews contained in Table 1 (or obtain citations for the reviews), a fuller description of the systematic reviews is provided in Appendix 1.

**Table 1: Summary of key findings from systematic reviews relevant to Element 1:  
Enhance national health systems' ability to detect pandemic risk factors, identify the  
causal pathogen, characterize emerging disease and monitor its evolution**

Category of finding	Summary of key findings
Benefits	<ul style="list-style-type: none"> <li>• <b>Enhancing ongoing surveillance systems' capacity</b> <ul style="list-style-type: none"> <li>○ A recent and medium-quality review found several benefits for electronic surveillance systems:(141) <ul style="list-style-type: none"> <li>▪ moderate to high utility to detect nosocomial infections;</li> <li>▪ data come from existing databases after being collected for other laboratory, administrative, or patient care purposes, so it is potentially inexpensive and efficient to extract;</li> <li>▪ automated programs reduce the time to gather and assess the data by up to 61%, which may potentially free up human resources from routine surveillance for proactive preventive efforts or outbreak investigation; and</li> <li>▪ when the infection of interest is defined by the presence of a positive culture, the electronic surveillance should report 100% sensitivity.</li> </ul> </li> </ul> </li> <li>• <b>Building capacity for shared rapid data collection, analysis and assessment</b> <ul style="list-style-type: none"> <li>○ A recent and high-quality review found benefit for clinical decision support systems and knowledge management systems in improving healthcare process measures across diverse settings.(142)</li> <li>○ A recent overview of systematic reviews found benefits for health information systems in improving quality of care, but in varying degrees across different topic areas, but did not find significant improvements in areas such as resource utilization, healthcare cost, and health outcomes.(143)</li> </ul> </li> <li>• <b>Establishing collaborative interprofessional teams to conduct routine surveillance, particularly for zoonotic disease outbreaks</b> <ul style="list-style-type: none"> <li>○ A recent and low-quality review found benefit for team-based care using locally adapted practice guidelines on patient and provider outcomes.(144)</li> <li>○ An older and low-quality review found benefit for interprofessional collaboration on health system, patient/client and provider outcomes, especially for chronic diseases or special needs population.(145)</li> </ul> </li> </ul>
Potential harms	<ul style="list-style-type: none"> <li>• None identified</li> </ul>
Costs and/or cost-effectiveness in relation to the status quo	<ul style="list-style-type: none"> <li>• None identified</li> </ul>
Uncertainty regarding benefits and potential harms (so monitoring and evaluation could be warranted if the option were pursued)	<ul style="list-style-type: none"> <li>• Uncertainty because no systematic reviews were identified <ul style="list-style-type: none"> <li>○ <b>Providing dedicated funding for knowledge management and information and monitoring systems</b></li> <li>○ <b>Working to improve global surveillance and outbreak management and investigation systems, especially in high-risk countries</b></li> <li>○ <b>Integrating top-down surveillance programs with bottom-up approaches for monitoring and mitigating risks</b></li> </ul> </li> <li>• Uncertainty because no studies were identified despite an exhaustive search as part of a systematic review <ul style="list-style-type: none"> <li>○ Not applicable</li> </ul> </li> <li>• No clear message from studies included in a systematic review <ul style="list-style-type: none"> <li>○ <b>Enhancing ongoing surveillance systems' capacity</b> <ul style="list-style-type: none"> <li>▪ An older and medium-quality review examining the potential utility of existing surveillance systems for illnesses and syndromes related to bioterrorism found limited evidence of effectiveness and a lack of information about their key features.(146)</li> <li>▪ An older and low-quality review found little evidence to draw conclusions about key features of surveillance systems for emerging zoonoses.(147)</li> </ul> </li> <li>○ <b>Building capacity for shared rapid data collection, analysis and assessment</b> <ul style="list-style-type: none"> <li>▪ A recent and high-quality review found limited evidence for the effects of clinical decision support systems and knowledge management systems on clinical outcomes and costs.(142)</li> </ul> </li> <li>○ <b>Establishing collaborative interprofessional teams to conduct routine surveillance, particularly for zoonotic disease outbreaks</b> <ul style="list-style-type: none"> <li>▪ A recent and medium-quality review found limited evidence about interventions to improve team effectiveness (e.g., simulations, training based on Crew Resource Management (CRM), interprofessional training or team training).(148)</li> </ul> </li> </ul> </li> </ul>
Key elements of the policy option if it was	<ul style="list-style-type: none"> <li>• <b>Enhancing ongoing surveillance systems' capacity</b> <ul style="list-style-type: none"> <li>○ An older and medium-quality review examining the potential utility of existing surveillance systems for illnesses and syndromes related to bioterrorism identified three key features that may constitute a</li> </ul> </li> </ul>

tried elsewhere	<p>promising surveillance system: timeliness, high sensitivity and high specificity. (146)</p> <ul style="list-style-type: none"> <li>• <b>Building capacity for shared rapid data collection, analysis and assessment</b> <ul style="list-style-type: none"> <li>○ A recent and high-quality review identified nine features associated with the successful implementation in diverse venues (e.g., multiple countries, in patient and ambulatory environments, academic and community settings) of clinical decision support systems and knowledge management systems:(142) <ul style="list-style-type: none"> <li>▪ general system (i.e., integration with charting or order entry system to support workflow integration);</li> <li>▪ clinician system interaction (i.e., automatic provision of decision support as part of clinician workflow, no need for additional clinician data entry, provision of decision support at the time and location of decision-making);</li> <li>▪ communication content (i.e., provision of a recommendation, not just an assessment, justification of decision support via provision of research evidence, and promotion of action rather than inaction); and</li> <li>▪ auxiliary features (i.e., local user involvement in the development process, provision of decision support results to patients and providers).</li> </ul> </li> <li>○ A recent overview of systematic reviews examining health information systems identified key success factors: having in-house systems, developers as users, integrated decision support and benchmark practices, and addressing such contextual issues as provider knowledge and perception, incentives and legislation/policy.(143)</li> </ul> </li> <li>• <b>Establishing collaborative interprofessional teams to conduct routine surveillance</b> <ul style="list-style-type: none"> <li>○ A recent and medium-quality review examining structures and processes required to build successful collaborations between public health and primary care identified key facilitators at the system level:(149) <ul style="list-style-type: none"> <li>▪ government involvement and fit;</li> <li>▪ funding and education and training; and</li> <li>▪ facilitating practitioner “buy in” to collaboration.</li> </ul> </li> <li>○ The same review identified several barriers at the system level:(149) <ul style="list-style-type: none"> <li>▪ funding</li> <li>▪ power and control issues; and</li> <li>▪ information infrastructure.</li> </ul> </li> <li>○ An older and low-quality review identified the need for greater regulatory and legislative support to foster the consistency and clarity of interprofessional collaborative partnerships.(145)</li> <li>○ An older and low-quality review found that team work is most effective when they have a clear purpose, good communication, co-ordination, protocols and procedures, and effective mechanisms for conflict resolution. (150)</li> <li>○ The same review found that the key challenges of building and maintaining effective teamwork are: lack of a common definition of teams and teamwork, the relationship between teamwork and collaboration, the spectrum of collaboration in a healthcare setting, organizational factors, and the implications of current policy and legislation.(150)</li> <li>○ A low-quality review that was recently published suggests that essential components of an interdisciplinary approach in the field of emerging zoonotic diseases includes: (151) <ul style="list-style-type: none"> <li>▪ professional social networks for formal and informal connections;</li> <li>▪ support for passionate interdisciplinary leaders and advocates;</li> <li>▪ focus on building a culture of trust and respect among disciplines;</li> <li>▪ interdisciplinary teams need to have shared problems and visions; and</li> <li>▪ the need to work out processes for collaborative work in formal and informal settings.</li> </ul> </li> <li>○ An older and low-quality review examining the factors that facilitate or inhibit interprofessional teamwork in primary and community care settings found the following success factors:(152) <ul style="list-style-type: none"> <li>▪ the structure of the team (i.e., team members who are separated by location can result in them being less integrated with the rest of the team, and thus limit team functioning and effectiveness);</li> <li>▪ the size and composition of the team (i.e., lower levels of participation in larger teams compared with smaller sized teams);</li> <li>▪ leadership (i.e., a lack of leadership can cause frustration to team members and lead to poor decision-making);</li> <li>▪ stability (i.e., teams with a higher proportion of full-time staff were found to be more effective); and</li> <li>▪ team processes (i.e., team meetings, goals and objectives, and audit) enhancing communication.</li> </ul> </li> </ul> </li> </ul>
Stakeholders' views and experience	<ul style="list-style-type: none"> <li>• None of the identified reviews provided information about stakeholders' views and experiences about the sub-elements</li> </ul>

## **Element 2: Strengthen the capacity of national policymakers and stakeholders and the public to respond to the variability of pandemics**

The second element involves strengthening the capacity of national policymakers and stakeholders and the public to respond to the variability of pandemics that could be encountered. This element might include:

1. enhancing relationship-building, learning, trust and transfer of knowledge from researchers to policymakers via plain language summaries of research evidence, maintaining open lines of communication and hosting regular meetings during pre-, inter- and post-pandemic periods;
2. implementing adaptive governance structures that enable policymakers and stakeholders to respond to the variability of pandemics and which assist decision-makers in navigating the complex informational landscape that frequently evolves during a pandemic (e.g. through professional networks, centralization or decentralization of policy authority, etc.);
3. developing a health risk communication strategy to help politicians and the public become aware of, prepare for, and adapt to, the emerging threat of a pandemic, and which strengthens communication between national governing institutions, other national governments, international agencies, private sector and civil society organizations, and major news and media agencies to ensure the efficient and transparent delivery of accurate information;
4. establishing well-recognized authorities as trusted sources of information that can lead communication efforts with the public during pandemics, and who are equipped with knowledge translation platforms to facilitate the communication of complex information to people with low levels of health literacy (e.g. persons of low socioeconomic status, immigrants, homeless, etc.); and
5. developing methods to analyze the utility of social media tools (e.g. via mobile phone apps, push-alerts, two-way telecommunications strategies) to effectively capture situational analyses within pandemic management platforms such as Facebook, Twitter and crowd-sourcing technologies.

A large body of synthesized research evidence has been accumulated that can be drawn upon to inform all the components of element 2. Two key observations can be made:

- nine medium- and high-quality systematic reviews found benefits for key components of this element, including information products designed to support the uptake of systematic review evidence (sub-element 1), public engagement to inform policymaking (sub-element 2), risk communication strategies (sub-element 3), and mobile phone text messages (sub-element 5); and
- four relevant systematic reviews are currently in progress and could inform various components of element 2: a systematic review examining the effectiveness of communities of practice for healthcare settings (sub-element 2);<sup>(153)</sup> a systematic review examining the effects of community coalition-driven interventions (sub-element 2);<sup>(154)</sup> a systematic review examining the impact of collaborative writing applications as knowledge translation tools in the healthcare sector (sub-element 5);<sup>(155)</sup> and a systematic review examining the effectiveness of mobile technology interventions for improving health and health service outcomes around the world (sub-element 5).<sup>(156)</sup>

A summary of the key findings from the synthesized research evidence is provided in Table 2. For those who want to know more about the systematic reviews contained in Table 2 (or obtain citations for the reviews), a fuller description of the systematic reviews is provided in Appendix 2.

**Table 2: Summary of key findings from systematic reviews relevant to Element 2:  
Strengthen the capacity for national policymakers, stakeholders and the public to more adequately respond to the variability of pandemics**

Category of finding	Summary of key findings
Benefits	<ul style="list-style-type: none"> <li>• <b>Enhancing relationship-building, learning, trust and transfer of knowledge from researchers to policymakers</b> <ul style="list-style-type: none"> <li>○ A recent and high-quality review found that information products designed to support the uptake of systematic review evidence were effective under certain conditions: there is a single clear message, the change is relatively simple to accomplish, and there is a growing awareness by users of the evidence that a change in practice is required.(157)</li> </ul> </li> <li>• <b>Implementing adaptive governance structures</b> <ul style="list-style-type: none"> <li>○ Three reviews found benefit for public engagement in enhancing public awareness, understanding and competencies.(158-160)</li> </ul> </li> <li>• <b>Developing a health risk communication strategy</b> <ul style="list-style-type: none"> <li>○ An older and medium-quality review found benefit for interventions available to public health staff regarding the protection of the public from environmental risks (e.g., mass campaign, counselling, school curriculum, educational sessions, and distribution of printed materials), especially relatively intensive interventions that use multiple methods and settings, and/or are delivered over multiple sessions: positive short-term changes in health-protective awareness, knowledge and self-reported behaviour. (161)</li> </ul> </li> <li>• <b>Developing methods to analyze the utility of social media tools to effectively capture situational analyses within pandemic management platforms</b> <ul style="list-style-type: none"> <li>○ A recent and high-quality Cochrane review found low- to moderate-quality evidence that mobile phone text message reminders increase healthcare appointment attendance rates when compared with no reminders and postal reminders.(162)</li> <li>○ A recent and high-quality Cochrane review found benefit for weekly mobile phone text-messaging as a means for promoting treatment adherence.(163)</li> <li>○ A recent and high-quality review found some evidence of effectiveness of mobile technology interventions delivered to health care consumers to increase treatment adherence.(156)</li> <li>○ A recent and low-quality review found that text messaging offers an effective platform to collect adherence, test results and self-monitored data.(164)</li> <li>○ An older and medium-quality review found benefit for text messaging short-term effect regarding a behavioural or clinical outcome related to disease prevention and management.(165)</li> <li>○ An older and low-quality review found benefit for cellphones and text-messaging interventions in improving health outcomes and processes of care, especially for chronic diseases requiring ongoing advice and support.(166)</li> </ul> </li> </ul>
Potential harms	<ul style="list-style-type: none"> <li>• <b>Developing methods to analyze the utility of social media tools to effectively capture situational analyses within pandemic management platforms</b> <ul style="list-style-type: none"> <li>○ A recent and medium-quality review highlighted concerns about user-generated content on social media and web 2.0 applications, which can be inconsistent with clinical guidelines or scientific evidence.(167)</li> </ul> </li> </ul>
Costs and/or cost-effectiveness in relation to the status quo	<ul style="list-style-type: none"> <li>• <b>Implementing adaptive governance structures</b> <ul style="list-style-type: none"> <li>○ A recent and high-quality Cochrane review found that multi-agency collaborations are generally more expensive and harder to implement compared with routine services.(168)</li> </ul> </li> <li>• <b>Developing methods to analyze the utility of social media tools to effectively capture situational analyses within pandemic management platforms</b> <ul style="list-style-type: none"> <li>○ A recent and high-quality Cochrane review found that mobile phone text message reminders are more cost-effective than phone call reminders.(162)</li> <li>○ A recent and low-quality review found that text messaging is more cost-effective than telephone calls in improving outpatient appointment attendance.(164)</li> </ul> </li> </ul>
Uncertainty regarding benefits and potential harms (so monitoring and evaluation could be warranted if the option were pursued)	<ul style="list-style-type: none"> <li>• Uncertainty because no systematic reviews were identified <ul style="list-style-type: none"> <li>○ Not applicable</li> </ul> </li> <li>• Uncertainty because no studies were identified despite an exhaustive search as part of a systematic review <ul style="list-style-type: none"> <li>○ Not applicable</li> </ul> </li> <li>• No clear message from studies included in a systematic review <ul style="list-style-type: none"> <li>○ <b>Enhancing relationship-building, learning, trust and transfer of knowledge from researchers to policymakers</b> <ul style="list-style-type: none"> <li>▪ Several systematic reviews, including two recent and high-quality reviews, found insufficient evidence to draw firm conclusions about the effectiveness of interventions that have been designed for encouraging the use of research evidence by health policymakers and managers in</li> </ul> </li> </ul> </li> </ul>

	<p>different contexts. (169-172)</p> <ul style="list-style-type: none"> <li>○ <b>Implementing adaptive governance structures</b> <ul style="list-style-type: none"> <li>▪ A recent and high-quality review found limited evidence about the impact of intersectoral action as a public-health practice for health equity through action on the social determinants of health, although more downstream interventions for population health showed the strongest effects (e.g., intersectoral collaborations to improve immunization rates among vulnerable populations).(173)</li> <li>▪ A recent and high-quality Cochrane review found no reliable evidence that enhanced inter-agency collaboration between local health and local government agencies improved health outcomes when compared to routine service delivery.(168)</li> <li>▪ A recent and medium-quality review found limited evidence about direct health effects with public-health partnerships.(174)</li> <li>▪ A recent and high-quality review found limited evidence to support policymakers in selecting the most effective strategies to allocate scarce resources during mass casualty events.(175)</li> <li>▪ There is limited evidence to reliably assess the impact of public engagement in healthcare policy development,(158;176) as well as priority-setting and resource allocation.(171)</li> <li>▪ Two reviews, one of low-quality and the other of medium-quality, found limited evidence about whether communities of practice improve the uptake of best practices in the health sector.(177;178)</li> </ul> </li> <li>○ <b>Developing a health risk communication strategy</b> <ul style="list-style-type: none"> <li>▪ A recent and high-quality review found limited evidence about the effectiveness of communication strategies related to environmental health risks.(179)</li> <li>▪ An older and high-quality Cochrane review found limited evidence about the effectiveness of different types of personalized risk communication for consumers making decisions about screening tests (180)</li> <li>▪ An older and medium-quality found that individualized risk communication is associated with higher uptake of tests, but there is insufficient evidence that these interventions are informing decision-making by consumers.(181)</li> </ul> </li> <li>○ <b>Establishing well-recognized authorities with knowledge translation platforms to facilitate the communication of complex information to people with low levels of health literacy</b> <ul style="list-style-type: none"> <li>▪ A recent and medium-quality review found limited evidence about design features of interventions designed to improve these outcomes for individuals with low health literacy.(182)</li> <li>▪ A recent and high-quality Cochrane review found limited evidence about the effectiveness of interventions for enhancing consumers' online health literacy (i.e., skills to search, evaluate and use online health information).(183)</li> </ul> </li> <li>○ <b>Developing methods to analyze the utility of social media tools to effectively capture situational analyses within pandemic management platforms</b> <ul style="list-style-type: none"> <li>▪ A recent and medium-quality review found limited evidence to support the effectiveness of web 2.0 media on health promotion, or to support such media's capacity in reaching underserved and marginalized populations.(167)</li> <li>▪ A recent and high-quality Cochrane review found limited evidence about the effects of mobile phone messaging for communicating results of medical investigations, on people's healthcare-seeking behaviour and health outcomes.(184)</li> <li>▪ A recent and high-quality Cochrane review found mixed evidence on the effects of text messaging for promoting patients' self-management of their condition.(185)</li> <li>▪ A recent and high-quality Cochrane review found limited evidence about the effects of mobile phone messaging interventions as a mode of delivery for preventive health care, on health status and health behaviour outcomes.(186)</li> <li>▪ A recent and medium-quality review found limited evidence for text messaging as a tool to deliver healthy lifestyle behaviour intervention programs in pediatric and adolescent populations (187)</li> <li>▪ A recent and medium-quality review found limited evidence on the effectiveness of mobile phone messaging for HIV care.(188)</li> </ul> </li> </ul>
Key elements of the policy option if it was tried elsewhere	<ul style="list-style-type: none"> <li>● <b>Implementing adaptive governance structures</b> <ul style="list-style-type: none"> <li>○ A recent and medium-quality review examining interactive and deliberative public engagement concluded that the degree to which these processes are likely to be successfully implemented is shaped by a range of contextual variables (e.g., organizational commitment and issue characteristics).(126)</li> <li>○ An older and low-quality review identified the needs to be a clear, published and readily available set of rules or code of conduct for members of virtual communities in healthcare.(189)</li> </ul> </li> <li>● <b>Developing a health risk communication strategy</b> <ul style="list-style-type: none"> <li>○ A recent and high-quality review identified factors that impact communication uptake related to environmental health risks: personal risk perception; previous personal experience with risk; sources of information and trust in those sources; and preferences for information.(179) The authors formulated recommendations for risk communication plans in public health:</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>▪ ensuring communication coming from a credible source;</li> <li>▪ tailoring communication for the audience;</li> <li>▪ building the content of messages with the best available evidence;</li> <li>▪ incorporating text with visuals;</li> <li>▪ disseminating information through multiple media sources;</li> <li>▪ delivering warning system notices for rare events on a regular, periodic basis;</li> <li>▪ developing communication strategies with the awareness that people make choices based on past experience with disasters;</li> <li>▪ ensuring communication strategies are multi-modal; and</li> <li>▪ preventing the use of automated telephone call-in systems.</li> </ul> <ul style="list-style-type: none"> <li>• <b>Establishing well-recognized authorities with knowledge translation platforms to facilitate the communication of complex information to people with low levels of health literacy</b> <ul style="list-style-type: none"> <li>○ A recent and medium-quality review found that multiple discrete design features improved comprehension (e.g., presenting essential information by itself or first, presenting information so that the higher number is better, adding icon arrays to numerical information, adding video to verbal narratives).(190)</li> </ul> </li> </ul>
Stakeholders' views and experience	<ul style="list-style-type: none"> <li>• <b>Enhancing relationship-building, learning, trust and transfer of knowledge from researchers to policymakers</b> <ul style="list-style-type: none"> <li>○ Several systematic reviews have identified facilitators for policymakers' and stakeholders' use of research evidence, the most commonly cited being facilitated interactions between the users and producers of research evidence, and ensuring timely access to research evidence. Barriers included a lack of awareness and familiarity, a lack of usefulness, a lack of motivation, and other external barriers.(157;191-197)</li> <li>○ Two recent and medium-quality reviews revealed that such barriers may be overcome by adapting and presenting the findings in formats more directly tailored to their needs (e.g., providing summaries, overviews and policy briefs added value to systematic reviews, or evaluating their methodological quality and the applicability of the findings to particular settings).(197;198)</li> <li>○ A recent and low-quality review introduced an integrative model to understand three core dimensions of knowledge transfer: level of polarization (i.e., politics), cost-sharing equilibrium (i.e., economics), and institutionalized channels of communication (i.e., social structuring).(199)</li> </ul> </li> <li>• <b>Implementing adaptive governance structures</b> <ul style="list-style-type: none"> <li>○ A recent and low-quality review examining gaps in complex healthcare organizations found that some professional groups engage in boundary-spanning activities, which may limit connectivity between professional groups. Running a concerted campaign to improve one group's utility to another, appreciating the other group's point of view and relating to their needs may be promising to make meaningful and sustainable connections if organizations are joining up at their boundaries.(200)</li> </ul> </li> <li>• <b>Establishing well-recognized authorities with knowledge translation platforms to facilitate the communication of complex information to people with low levels of health literacy</b> <ul style="list-style-type: none"> <li>○ A recent and low-quality review found that text messaging showed good acceptance.(164)</li> <li>○ A recent and medium-quality review found that mobile phone messaging is accepted as a method to receive information and to communicate with health workers.(188)</li> </ul> </li> </ul>

### Element 3: Strengthen the global pandemic governance system

The third element involves strengthening the global pandemic governance system, which is the broader context within which national health systems' responses would be implemented. It empowers and constrains actions. Possible changes to the global pandemic governance system include better communication, collaboration and policy coherence among national governments and international agencies. This element might include:

1. facilitating global coordination and policy coherence (e.g. via task forces, working groups, high-level forums and encouraging the establishment of partnerships between Member States of shared borders for improved clarity about decision-making authority processes) to better manage trans-border trade and other economic activities during pandemics;
2. identifying what kinds of legal and policy responses should be taken to correct a failure of cooperation on the part of governments within nation states and at the national level;
3. developing mechanisms to support international dispute resolution, plus developing effective enforcement mechanisms and/or incentives to support national compliance with international regulations and legal obligations such as those contained within the IHR;
4. creating more flexibility and responsiveness within the global system to collectively adapt to uncertainty, such as by developing priority-setting procedures, better coordinating responsibilities between countries, and providing technical assistance as needed;
5. improving WHO's information dissemination process to stakeholders and Member States (including enhancement of WHO's Event Information Site); and
6. supporting health systems capacity in high-risk developing countries to detect, diagnose, respond to, and communicate situations of pandemic emergence as per developing countries' international legal responsibilities to provide support to developing countries under the IHR.

We found little synthesized research evidence that can be drawn upon to inform the components of element 3. Three key observations can be made:

- we found four systematic reviews that revealed benefits for sub-elements 1 and 6, more specifically global health initiatives for HIV/AIDS control;(201) contracting out healthcare services in developing countries (202); result-based financing;(203) and developing international nursing curricula through cooperative partnerships;(204)
- we found no systematic reviews that have relevance to four of the sub-elements: identifying what kinds of legal and policy responses should be taken to correct a failure of cooperation (sub-element 2); developing mechanisms to support international dispute resolution (sub-element 3); creating more flexibility and responsiveness within the global system to collectively adapt to uncertainty (sub-element 4); and improving WHO's information dissemination process (sub-element 5).
- one systematic review is currently in progress and could inform sub-element 6: a Cochrane review examining the effectiveness of public sector regulation, training or coordination of the private for-profit health sector in developing countries.(205)

A summary of the key findings from the synthesized research evidence is provided in Table 3. For those who want to know more about the systematic reviews contained in Table 3 (or obtain citations for the reviews), a fuller description of the systematic reviews is provided in Appendix 3.



**Table 3: Summary of key findings from systematic reviews relevant to Element 3**  
**Work to strengthen the global pandemic governance system, including better communication, collaboration and policy coherence with other national governments and international agencies during pandemics**

Category of finding	Summary of key findings
Benefits	<ul style="list-style-type: none"> <li>• <b>Facilitating global coordination and policy coherence</b> <ul style="list-style-type: none"> <li>○ An older and medium-quality review found benefit for global health initiatives for HIV/AIDS control:(201) <ul style="list-style-type: none"> <li>▪ a rapid scale-up in HIV/AIDS service delivery;</li> <li>▪ greater stakeholder participation; and</li> <li>▪ channelling of funds to non-governmental stakeholders (e.g., NGOs and faith-based bodies).</li> </ul> </li> </ul> </li> <li>• <b>Supporting health systems capacity in high-risk developing countries to detect, diagnose, respond to, and communicate situations of pandemic emergence</b> <ul style="list-style-type: none"> <li>○ A recent and high-quality review found some, yet limited, evidence that contracting out healthcare services in low- and middle-income countries may be an appropriate response to scale up service delivery in particular settings, such as post-conflict or fragile states.(202)</li> <li>○ An older overview of systematic reviews found benefit for result-based financing (conditional cash transfers and other financial incentives) targeting healthcare recipients in increasing the use of preventive service, and targeting professional practices in increasing the delivery of immunizations or screening.(203)</li> <li>○ An older and low-quality review found benefit for developing international nursing curricula through cooperative partnerships between institutions of higher learning and/or international development agencies, in order to build international collegial relationships among nursing faculty and professionals worldwide.(204)</li> </ul> </li> </ul>
Potential harms	<ul style="list-style-type: none"> <li>• <b>Facilitating global coordination and policy coherence</b> <ul style="list-style-type: none"> <li>○ An older and medium-quality review found that global health initiatives for HIV/AIDS control can distort recipient countries' national policies in two ways: (201) <ul style="list-style-type: none"> <li>▪ distracting governments from coordinated efforts to strengthen health systems; and</li> <li>▪ re-verticalization of planning, management, monitoring and evaluation systems.</li> </ul> </li> <li>○ A recent and low-quality review examining the Framework Convention on Global Health (FCGH) proposal identified potential limitations and unintended negative consequences that may result from its implementation:(206) <ul style="list-style-type: none"> <li>▪ direct costs of international law;</li> <li>▪ opportunity costs;</li> <li>▪ reducing political dialogue by legalizing political interactions;</li> <li>▪ petrifying principles that may have only contemporary relevance;</li> <li>▪ imposing foreign values on less powerful countries;</li> <li>▪ forcing externally defined goals on countries;</li> <li>▪ prioritizing individual rights over population-wide well-being;</li> <li>▪ further complicating global governance for health;</li> <li>▪ weakening WHO;</li> <li>▪ reducing participation opportunities for non-state actors; and</li> <li>▪ offering sub-optimal solutions for global health challenges.</li> </ul> </li> </ul> </li> <li>• <b>Supporting health systems capacity in high-risk developing countries to detect, diagnose, respond to, and communicate situations of pandemic emergence</b> <ul style="list-style-type: none"> <li>○ An older overview of systematic reviews found that result-based financing can have unintended effects:(203) <ul style="list-style-type: none"> <li>▪ motivating unintended behaviours;</li> <li>▪ distortions;</li> <li>▪ gaming;</li> <li>▪ corruption;</li> <li>▪ cherry-picking;</li> <li>▪ widening the resource gap between rich and poor;</li> <li>▪ dependency on financial incentives;</li> <li>▪ demoralization; and</li> <li>▪ bureaucratization.</li> </ul> </li> </ul> </li> </ul>
Costs and/or cost-effectiveness in	<ul style="list-style-type: none"> <li>• <b>Supporting health systems capacity in high-risk developing countries to detect, diagnose, respond to, and communicate situations of pandemic emergence</b> <ul style="list-style-type: none"> <li>○ An older overview of systematic reviews found that the flows of money required for results-based</li> </ul> </li> </ul>

relation to the status quo	financing may be substantial, including the incentives themselves, administrative costs, and any additional service costs. (203)
Uncertainty regarding benefits and potential harms (so monitoring and evaluation could be warranted if the option were pursued)	<ul style="list-style-type: none"> <li>• Uncertainty because no systematic reviews were identified <ul style="list-style-type: none"> <li>○ <b>Identifying what kinds of legal and policy responses should be taken to correct a failure of cooperation</b></li> <li>○ <b>Developing mechanisms to support international dispute resolution</b></li> <li>○ <b>Creating more flexibility and responsiveness within the global system to collectively adapt to uncertainty</b></li> <li>○ <b>Improving WHO's information dissemination process</b></li> </ul> </li> <li>• Uncertainty because no studies were identified despite an exhaustive search as part of a systematic review <ul style="list-style-type: none"> <li>○ Not applicable</li> </ul> </li> <li>• No clear message from studies included in a systematic review <ul style="list-style-type: none"> <li>○ <b>Facilitating global coordination and policy coherence</b> <ul style="list-style-type: none"> <li>▪ A recent and medium-quality review examining the influences that BRICS (Brazil, India, Russia, China and South Africa) wield in global health found mixed evidence. On one hand, some authors perceived successes of the four BRICS Summits and the two BRICS Health Ministers Meetings suggest a positive first step that will hopefully turn into collective global health action. However, others believed that BRICS are incapable of cooperating and coordinating their actions, and they may impede continuous efforts and progress made by developed countries. As a result, the internationally agreed principles and norms have the potential to become jeopardized.(207)</li> </ul> </li> <li>○ <b>Supporting health systems capacity in high-risk developing countries to detect, diagnose, respond to, and communicate situations of pandemic emergence</b> <ul style="list-style-type: none"> <li>▪ An older overview of systematic reviews found a lack of evidence about the cost-effectiveness of results-based financing.(203)</li> <li>▪ A recent and low-quality review found limited evidence about how governance issues influence health human resource policy implementation in low- and middle-income countries.(208)</li> <li>▪ A recent and medium-quality review found limited evidence regarding the potential negative health system effects of global health initiatives on health systems in developing countries.(209)</li> <li>▪ An older overview of systematic reviews found limited evidence about the effects of policy options to improve human resources for health in countries with low and middle incomes.(210)</li> <li>▪ An older overview of systematic reviews found limited evidence about the effects of training, regulatory, financial and organizational mechanisms on the supply, distribution, efficiency and performance of health workers.(211)</li> </ul> </li> </ul> </li> </ul>
Key elements of the policy option if it was tried elsewhere	<ul style="list-style-type: none"> <li>• <b>Supporting health systems capacity in high-risk developing countries to detect, diagnose, respond to, and communicate situations of pandemic emergence</b> <ul style="list-style-type: none"> <li>○ A recent and high-quality review identified factors that may influence the effects of contracting out strategies:(202) <ul style="list-style-type: none"> <li>▪ government capacity to manage the contract;</li> <li>▪ the feasibility of sufficient monitoring service delivery in remote areas; and</li> <li>▪ the introduction of non-state providers.</li> </ul> </li> <li>○ An older overview of systematic reviews found that effective results-based financing necessitates:(203) <ul style="list-style-type: none"> <li>▪ stakeholder involvement in the design of results-based financing;</li> <li>▪ availability of technical capacity;and</li> <li>▪ being part of an appropriate package of interventions.</li> </ul> </li> <li>○ An older and medium-quality review examining the costs of scaling up health interventions found general principles that should guide this process:(212) <ul style="list-style-type: none"> <li>▪ calculate separate unit costs for urban and rural populations;</li> <li>▪ identify economies and diseconomies of scale, and separate the fixed and variable components of the costs;</li> <li>▪ assess availability and capacity of health human resources; and</li> <li>▪ include administrative costs.</li> </ul> </li> <li>○ An older and low-quality review suggests that planning and decision-making to improve retention in rural areas in middle- and low-income countries requires multi-sectoral collaboration within and beyond government.(213)</li> </ul> </li> </ul>
Stakeholders' views and experience	<ul style="list-style-type: none"> <li>• None of the identified reviews provided information about stakeholders' views and experiences about the sub-elements</li> </ul>

### **Additional equity-related observations about the three elements**

In our review of the research evidence, we found few systematic reviews focusing explicitly on people living in remote areas or people with one or more pre-existing health conditions. For instance, one overview of systematic reviews identified for element 3 found result-based financing schemes may cause healthcare providers to cherry-pick patients, either by “selecting those who may help them score well or by avoiding those who may cause them to score poorly”(203). This finding suggests that such schemes may increase access problems for people with one or more pre-existing health conditions.

## **IMPLEMENTATION CONSIDERATIONS**

Although this issue brief has presented three elements of a comprehensive approach to addressing the problem of pandemic response, obstacles to implementation could undermine efforts for change. This document presents ideas, but these should not be misconstrued to imply that the challenges posed by pandemics can easily be solved if decision-makers just had better tools (e.g. more money, new legislation, interprofessional teams, adherence to global standards). Rather, these tools need to be effectively employed at the right level and in the right way for whatever political, social and economic contexts are faced. It is not possible to define the desired state of preparedness in technical terms for every situational context, but optimal readiness might, for example, balance affordability, feasibility and adequate protection. With those underlying goals in mind, it is possible to begin to assess the importance of barriers to implementation and set priorities for action.

Given that the potential facilitators to action often seem more self-evident than the potential barriers, and that some barriers may be so important that they force a re-evaluation of whether a particular way forward is even worth serious discussion at a particular moment in time, we focus here initially on the potential barriers to building momentum for improved pandemic response, especially in North America. Key implementation considerations for the integrated approach at various jurisdictional levels of governance (i.e. local, provincial/state/territorial, national and global) are assessed. A detailed list of potential barriers to implementing the three elements is provided in Table 4 as a way to spur reflection about some of the considerations that may influence choices about an optimal way forward.

At the local level, policymakers may be hesitant to adopt new information and communication technology (ICT) or reporting protocols, and may be reluctant to spend the money and time required to re-train health personnel to adopt the new surveillance measures called for in element 1. With respect to element 2, the ability for officials to communicate risk through the media may be compromised in some areas, and policymakers may find it difficult to develop flexible, adaptive emergence-management structures across jurisdictions. In trying to strengthen the global pandemic governance system, element 3 may encounter resistance from local policymakers hesitant to let provincial/territorial or national governing bodies dictate priorities during pandemic outbreaks.

At the provincial/state/territorial (PST) level, policymakers may share the same hesitations about adopting new ICT and protocols as their local-level counterparts when it comes to implementing element 1. Concerning element 2, PST policymakers may encounter difficulty ensuring established coordination networks are truly collaborative in their decision-making processes (i.e. sufficiently sharing resources; territorial, municipal, and provincial jurisdictions implementing the guidance received from national jurisdictions). When striving to implement element 3, similarly to the reaction of local policymakers, PST policymakers may resist letting national and international governing bodies take charge of defining priorities during pandemic.

National policymakers may struggle to convince their municipal and PST counterparts to build consensus about openly sharing surveillance data across jurisdictions when trying to implement element 1. It may be challenging to implement element 2 given that federal policymakers may find PST governments playing the role of an intermediary in transmitting risk communication from federal authorities to the general public. It may be challenging for federal decision-makers to implement element 3 given that policymakers from sub-national jurisdictions may resist the federal government adopting a formal information-sharing agreement with other countries.

Finally, at the global level, member states of multilateral organizations may hold conflicting opinions over what constitutes best evidence in decision-making, making it difficult to reach the global consensus noted in element 1, particularly if they choose to unilaterally act in opposition to an integrated approach with other states. It may be challenging to implement element 2 if nation-states are restricted from contributing to, or

receiving information from, a global platform for information sharing because of their wide-ranging infrastructural and resource capacities. With respect to element 3, implementation could be compromised by the fact that states have external political justifications for not forming partnerships, and they may not be amenable to receiving criticisms about their response strategies as can be made by WHO under the IHR.

Some implementation barriers are faced at all levels of governance. For example, securing sustained, long-term financing for public health infrastructure and integrated approaches to pandemic preparedness, particularly during the pre- and inter-pandemic periods, may prevent policymakers at every level from acting on any of the three elements.

**Table 4: Potential barriers to implementing the elements**

Levels	Element 1: Enhance national health systems' ability to detect pandemic risk factors, identify the causal pathogen, characterize emerging disease and monitor its evolution	Element 2: Strengthen the capacity for national policymakers and stakeholders and the public to respond to the variability of pandemics	Element 3: Strengthen the global pandemic governance system
<b>Local</b>	<ul style="list-style-type: none"> <li>• Citizens may view information sharing for surveillance purposes as a breach of privacy (16)</li> <li>• Policymakers and providers may be hesitant to adopt new ICT or reporting protocols (214)</li> <li>• Policymakers and providers may be reluctant to spend time, money and resources on re-training health workers on new pandemic preparedness plans and the One Health model (215)</li> <li>• Policymakers may resist adopting new decision-making strategies (215)</li> </ul>	<ul style="list-style-type: none"> <li>• Not all citizens may have access to media outlets used for risk communication campaigns (214)</li> <li>• Policymakers may be concerned with the financial costs of the initiative (102)</li> <li>• Policymakers may find it difficult to hold public and mass media attention during pre-pandemic phases</li> <li>• Policymakers may find it difficult to develop and provide resources for flexible, adaptive emergency management structures for diverse jurisdictions</li> <li>• Policymakers may find it difficult to sufficiently train themselves, colleagues and other decision-makers to adopt necessary computer simulations in policy and decision-making processes (214)</li> </ul>	<ul style="list-style-type: none"> <li>• Policymakers may be hesitant to let national governing bodies take charge of defining priorities during pandemics</li> </ul>
<b>Provincial/state/territorial (PST)</b>	<ul style="list-style-type: none"> <li>• Policymakers may resist adopting new decision-making strategies</li> <li>• Policymakers and providers may be hesitant to adopt new ICT or reporting protocols (214)</li> <li>• Policymakers may be reluctant to invest significant time and money to re-write pandemic preparedness plans, and rehearse for the implementation of these plans (215)</li> </ul>	<ul style="list-style-type: none"> <li>• Providers and administrators within hospitals/regional health networks may find it difficult to integrate new infrastructure into existing systems</li> <li>• Policymakers may encounter difficulty ensuring established coordination networks are truly collaborative in their decision-making processes (i.e. sufficiently sharing resources; territorial, municipal, and provincial jurisdictions implementing the guidance received from national jurisdictions) (215)</li> </ul>	<ul style="list-style-type: none"> <li>• Policymakers may resist letting national and international governing bodies take charge of defining priorities during pandemics</li> </ul>

<b>National</b>	<ul style="list-style-type: none"> <li>• Local and PST policymakers may be unwilling to fully cooperate with national governments to build consensus about information sharing and surveillance</li> <li>• Policymakers may have limited access to funding and resources for new ICT (214)</li> </ul>	<ul style="list-style-type: none"> <li>• Policymakers may find it difficult to ensure decision-making and policymaking processes are truly collaborative (216)</li> <li>• Federal governments may find PST governments playing the role of an intermediary in the risk communication from federal government to the general public (214)</li> </ul>	<ul style="list-style-type: none"> <li>• Policymakers from sub-national jurisdictions may resist the federal government adopting a formal information-sharing agreement with other countries (12)</li> </ul>
<b>Global</b>	<ul style="list-style-type: none"> <li>• States may hold conflicting opinions over what constitutes best evidence in decision-making, making it difficult to reach global consensus</li> <li>• States may resist sharing information with other countries on a regular basis</li> <li>• Member states of multilateral organizations may guard their sovereignty and may choose to act unilaterally</li> <li>• WHO Member States could violate agreements of the IHR despite WHO having some mechanisms in place to encourage compliance (8)</li> </ul>	<ul style="list-style-type: none"> <li>• States may be restricted from contributing to, or receiving information from, a global platform for information sharing given wide-ranging infrastructure and resource capacities</li> </ul>	<ul style="list-style-type: none"> <li>• States may have external political justifications for not establishing partnerships, although the Middle East Consortium on Infectious Disease Surveillance should prove an example of collaboration for these states.</li> <li>• States may not be amenable to forums in which their conflicting measures may be called out and investigated.</li> <li>• WHO Member States may not be amenable to receiving criticisms of their response strategies as WHO can offer under the IHR (8)</li> </ul>

Despite the potential barriers to action outlined above, implementation of the three elements to address the problem can be facilitated by potential windows of opportunity. These windows of opportunity and their respective enablers could facilitate or trigger positive change (see Table 5). For instance, the findings of WHO's 2011 IHR Review concluded that the world is still underprepared to adequately manage the next severe pandemic threat or other serious public health emergency, which could help motivate policymakers at all levels to enhance current efforts for pandemic preparedness. In fact, the review called for increased preparedness through research, strengthened health systems and multi-sectoral approaches (37). In 2012, American, Canadian and Mexican heads of state adopted the North American Plan for Animal and Pandemic Influenza (NAPAPI), calling for action to further strengthen the trilateral response to future animal and pandemic influenzas among these countries (217). Additionally, efforts have been underway at inter-ministerial meetings on animal and human influenza in 2007, 2009 and 2010, to enhance the uptake of One Health models in the surveillance of zoonotic disease emergence at the global level.(80) Additionally, the ongoing media coverage of the Middle East respiratory syndrome (MERS) and avian influenza H7N9 outbreaks in Saudi Arabia and China, respectively, highlight that pandemics loom on the cusp of emergence. Public calls for increased government transparency and capacity-building have given pandemic preparedness greater political prioritization on the global agenda. (218)

**Table 5: Potential windows of opportunity for implementing the options**

Type	Element 1: Enhance national health systems' ability to detect pandemic risk factors, identify the causal pathogen, characterize emerging disease and monitor its evolution	Element 2: Strengthen the capacity for national policymakers and stakeholders and the public to respond to the variability of pandemics	Element 3: Strengthen the global pandemic governance system
<b>General</b>	<p>The findings of WHO's 2011 IHR Review were a sobering reminder that the world is underprepared to adequately defend itself against a severe pandemic threat or other serious public health emergency. The review called for increased preparedness through research, strengthened health systems and multi-sectoral approaches.(37)</p> <p>In 2011, the Harvard Business Review named global pandemics as one of 12 upcoming “megatrends” in global health care, acknowledging that urban sprawl, population growth, global travel, and rudimentary health systems in poorer countries ensure that global pandemics remain a serious threat.(219)</p> <p>In April 2012, Canada's Prime Minister Stephen Harper, along with President Barack Obama of the United States and then President Felipe Calderón of Mexico, announced the adoption of the revised North American Plan for Animal and Pandemic Influenza (NAPAPI) at the 2012 North American Leaders Summit in Washington, D.C. The plan calls for action to further strengthen the trilateral response to future animal and pandemic influenzas in North America.(217)</p> <p>In May 2013, WHO Director-General Margaret Chan opened her speech to the 66<sup>th</sup> World Health Assembly on the subject of pandemics, citing the novel coronavirus in the Eastern Mediterranean region and France, and the H7N9 avian influenza virus in China. In her words: “These two new diseases remind us that the threat from emerging and epidemic-prone diseases is ever-present. Constant mutation and adaptation are the survival mechanisms of the microbial world. It will always deliver surprises.” Chan called for vigilance, transparency in reporting, collaboration and cooperation for pandemic preparedness, and adherence to the IHR.(220)</p>		
<b>Element-specific</b>	<p>Efforts have been underway at inter-ministerial meetings since 2007 to enhance the uptake of One Health models in the surveillance of zoonotic disease emergence at the global level.(80)</p>	<p>The ongoing media coverage of the MERS and avian influenza H7N9 outbreaks in Saudi Arabia and China, respectively, highlight that pandemics loom on the cusp of emergence. There have been heightened calls for increased risk communication with the public.(218)</p>	<p>Scrutiny over information sharing in the recent MERS and avian influenza H7N9 outbreaks have prompted the need for increased transparency among WHO Member States.(218)</p> <p>WHO adopted in 2011 the Pandemic Influenza Preparedness Framework for the Sharing of Influenza Viruses and Access to Vaccines and Other that equally balances the need for virus sharing and access to vaccines developed with these shared viruses.(221)</p>

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## APPENDICES

The following tables provide detailed information about the systematic reviews identified for each option. Each row in a table corresponds to a particular systematic review and the reviews are organized by element (first column). The focus of the review is described in the second column. Key findings from the review that relate to the option are listed in the third column, while the fourth column records the last year the literature was searched as part of the review.

The fifth column presents a rating of the overall quality of the review. The quality of each review has been assessed using AMSTAR (A Measurement Tool to Assess Reviews), which rates overall quality on a scale of 0 to 11, where 11/11 represents a review of the highest quality. It is important to note that the AMSTAR tool was developed to assess reviews focused on clinical interventions, so not all criteria apply to systematic reviews pertaining to delivery, financial, or governance arrangements within health systems. Where the denominator is not 11, an aspect of the tool was considered not relevant by the raters. In comparing ratings, it is therefore important to keep both parts of the score (i.e., the numerator and denominator) in mind. For example, a review that scores 8/8 is generally of comparable quality to a review scoring 11/11; both ratings are considered “high scores.” A high score signals that readers of the review can have a high level of confidence in its findings. A low score, on the other hand, does not mean that the review should be discarded, merely that less confidence can be placed in its findings and that the review needs to be examined closely to identify its limitations. (Lewin S, Oxman AD, Lavis JN, Fretheim A. SUPPORT Tools for evidence-informed health Policymaking (STP): 8. Deciding how much confidence to place in a systematic review. *Health Research Policy and Systems* 2009; 7 (Suppl1):S8.

The last three columns convey information about the utility of the review in terms of local applicability, applicability concerning prioritized groups, and issue applicability. The third-from-last column notes the proportion of studies that were conducted in North America, while the second-from-last column comments on the proportion of studies included in the review that deal explicitly with one of the prioritized groups. The last column indicates the review's issue applicability in terms of the proportion of studies focused on supporting health systems' capacity to respond to pandemics.

All of the information provided in the appendix tables was taken into account by the issue brief's authors in compiling Tables 1-3 in the main text of the brief.

**Appendix 1: Systematic reviews relevant to Element 1: Enhance national health systems' ability to detect pandemic risk factors, identify the causal pathogen, characterize emerging disease and monitor its evolution**

Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
Enhancing ongoing surveillance systems' capacity to detect, identify and investigate emergence risk factors and early disease outbreaks, and effectively monitor the evolution of disease (e.g. epidemiology, clinical manifestations, severity, rate of transmission)	Examining the evidence on the extent of emerging infectious diseases surveillance system evaluation (147)	This systematic review identified 221 surveillance and monitoring systems, of which only 17 had limited evaluations. Researchers suggest that the lack of evaluation data may have resulted from unwillingness to publicly report negative evaluation results. Furthermore, the lack of available gold standards makes comparisons for evaluations very difficult.  Future implications for research include the need to study, define and standardize surveillance.	2006	2/9 (AMSTAR rating from McMaster Health Forum)	85/212	Not reported in detail	212/212
	Assessing the validity of electronic surveillance systems compared with conventional surveillance techniques for infectious diseases using systematically identified and appraised published literature (141)	Electronic surveillance has moderate to high utility to detect nosocomial infections. The use of electronic surveillance has several benefits. Firstly, the data are utilized from existing databases after being collected for other laboratory, administrative, or patient care purposes, so it is potentially inexpensive and efficient to extract. Furthermore, evidence shows that automated programs reduce surveillance time by up to 61%, which may potentially free up human resources from routine surveillance for proactive preventive efforts or outbreak investigation. Finally, when the infection of interest is defined by the presence of a positive culture, the electronic surveillance should report 100% sensitivity. An important	2007	4/10 (from Program in Policy Decision-making)	18/24	0/24	0/24

Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
		limitation of electronic systems is for surveillance of infections that may be diagnosed based on clinical evaluation of symptoms or tests other than a positive culture-based test. Another limitation electronic systems pose is in cases where positive cultures may not represent infection, such as with common skin contaminants in blood cultures. The electronic system utilizing laboratory cultures may potentially classify these as infected, and clinical judgement will be required to exclude these.					
	Evaluating the potential utility of existing surveillance systems for illnesses and syndromes related to bioterrorism (146)	Of the 115 reviewed existing surveillance systems, researchers identified 29 that were designed for surveillance of illnesses and syndromes related to bioterrorism-relevant pathogens. There was limited evidence to judge the usefulness of the reviewed systems; therefore, it was only possible to infer that a system might be useful in responding to bioterrorism. The three key features that constitute an efficient surveillance system are timeliness, high sensitivity and specificity. However, there is a striking lack of information on these features, and clinicians and public health officials currently deploying these systems do so with little scientific evidence to guide them.	2002	6/10 (AMSTAR rating from McMaster Health Forum)	Not reported in detail	0/192	Not reported in detail
Integrating top-down surveillance programs with bottom-up approaches for	Examining the effectiveness of surveillance systems and community-based interventions in	Systematic review in progress: findings not reported					

Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
monitoring and mitigating risks (e.g. through participatory epidemiology) and overcoming current legal barriers for sharing information gathered across sectors and ministries (e.g. meteorological surveillance systems that detect changes in weather patterns can inform trends in vector-borne disease and could be better integrated within health systems' surveillance networks)	identifying and responding to emerging and re-emerging zoonotic infections in Southeast Asia (140)						
Building capacity for shared rapid data collection, analysis and assessment by decision-makers at all jurisdictional levels through enhanced information and communication technologies (ICT) such as via platforms that would allow authorities in all jurisdictions (both remote and urban) to have access to national diagnostic data as they are generated, including capacity to continuously update evidence syntheses within surveillance systems	Examining the clinical effectiveness of clinical decision support systems (CDSSs) and knowledge management systems (KMSs), and identifying features that impact its successes (142)	Based on meta-analysis of studies, the researchers confirmed nine features associated with successful CDSS implementations. The features are grouped into general system (integration with charting or order entry system to support workflow integration), clinician system interaction (automatic provision of decision support as part of clinician workflow, no need for additional clinician data entry, provision of decision support at the time and location of decision-making), communication content (provision of a recommendation, not just an assessment, justification of decision support via provision of research evidence, and promotion of action rather than inaction), and auxiliary features (local user involvement in the development process, provision of	2010	8/10 (from Program in Policy Decision-making)	228/323	0/323	0/323



Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
		<p>decision support results to patients and providers). These features can be implemented in diverse venues (multiple countries, in patient and ambulatory environments, and in academic and community settings).</p> <p>Positive effects of CDSS that include the nine features are observed in healthcare processes such as prescribing treatments, facilitating preventive care services and ordering clinical studies. However, there is limited evidence on the positive effects on clinical and economic outcomes, clinical workload and efficiency.</p>					
	Examining the effects of health information system (HIS) evaluation studies to inform HIS practice, quality of care and research (143)	<p>There is some evidence for improved quality of care, but in varying degrees across different topic areas. The findings suggest there is improved quality in preventive-care reminders, computerized physician order entry (CPOE) systems and clinical decision support systems (CDSS) for medication arrangement.</p> <p>HIS did not lead to significant improvements in areas such as resource utilization, healthcare cost and health outcomes. Based on the evaluation dimension from the meta-synthesis, the areas requiring ongoing research attention are HIS technical performance, information availability, service quality, user readiness, user competency, care access/availability and care coordination.</p>	2008	No rating tool available for this type of document	28/50	0/50	0/50

Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
		Based on the evidence from the study, researchers have identified three recommendations to improve HIS adoption: 1) to emulate successful HIS benchmark practices, one must pay attention to specific HIS features and key factors that are critical to make the system work; 2) there needs to be a planned and coordinated approach to face contextual issues; and 3) one has to demonstrate return-on-value by measuring the clinical impact.					
Providing dedicated funding for knowledge management and information and monitoring systems	No reviews identified						
Working to improve global surveillance and outbreak management and investigation systems, especially in high-risk countries	No reviews identified						
Establishing collaborative interprofessional teams to conduct routine surveillance, particularly for zoonotic disease outbreaks (e.g. utilizing expertise of public-health practitioners, clinicians, epidemiologists, and veterinarians) to enhance human and animal surveillance system linkages (e.g. using the One Health Initiative as part of the approach)	Examining the breadth, nature and status of research in interdisciplinary collaboration (151)	<p>Significant attention is paid to the terminology around knowledge and interdisciplinarity in the literature.</p> <p>Researchers hypothesize that there must be effective collaboration and exchange of knowledge among a diverse group of practitioners in order to manage complex health issues. Although there is a dearth of information on the strategies to put interdisciplinary collaboration into practice, there is no evidence of its effectiveness.</p>	Not reported in detail	2/9 (AMSTAR rating from McMaster Health Forum)	Not reported in detail	Not reported in detail	Not reported in detail

Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
		Some general essential components of an interdisciplinary approach to support initiatives include: (a) professional social networks for formal and informal connections; (b) support for passionate interdisciplinary leaders and advocates; (c) focus on building a culture of trust and respect among disciplines; (d) shared problems and visions among interdisciplinary teams; and (5) the need to work out processes for collaborative work in formal and informal settings.					
	Examining structures and processes required to build successful collaborations, outcomes of collaborations and markers of successful collaboration between public health and primary care (149)	The primary care and public health collaboration in North America, Europe, New Zealand and Australia has grown steadily since the mid- to late-1990s. At the system level, major barriers for collaboration include policy, funding, power and control issues, and information infrastructure. The major facilitators at the system level are government involvement and fit, funding, and education and training. Governments recognize the importance of collaboration between levels of government, for instance in an emergency, and for coordination and priority setting. Some recommendations include the importance of facilitating practitioner "buy in" to collaboration. It must be perceived to be of benefit for each professional sectors and to the clientele they serve.	2008	4/10 (AMSTAR rating from McMaster Health Forum)	60/114	3/114	0/114

Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
	Examining the effectiveness of different practice guideline implementation and dissemination strategies on team-based practice and patient outcomes (144)	<p>Among the included studies, 72.7% reported significant changes in knowledge, practice, patient and or economic outcomes after utilizing at least one dissemination and implementation strategy. Researchers were not able to find a pattern over time of an increasing number of professionals involved in improved dissemination and implementation strategies. The most common approach to dissemination and implementation strategies is distribution of educational materials. The least common is mass media information. Of the 60 studies that distributed educational materials, 73% reported statistically significant results, although it is not possible to determine that the distribution of materials was directly responsible for the results. Furthermore, utilization of guidelines through distribution of educational material was found to reduce hospital costs.</p> <p>Some implications for practice include the involvement of all professional groups and the recipients of care when planning to make a change in normal care processes and procedures. Full understanding of the practice guidelines is needed to insure all team members and recipients of care will abide by the guidelines. The complexities of healthcare require increasingly complex approaches to ensure evidence-based guidelines are</p>	2007	3/10 (from Program in Policy Decision-making)	55/88	0/88	0/88

Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
		utilized in practice. Healthcare providers need to be given background about why evidence-based practice is important. It is then important to assist them in becoming aware of how they learn best. They will then be able to develop techniques for themselves, and to promote keeping themselves updated on new knowledge and findings.					
	Examining the effects of interprofessional collaboration on health system, patient/client and provider outcomes (145)	High quality evidence is found to support positive outcomes for patients/clients, providers and the system with interprofessional collaboration, and this is particularly pronounced for chronic diseases or special needs populations. Furthermore, in some jurisdictions, positive outcomes are supported on the basis of servicing geographic populations or population health models, including enhanced patient/client self-care, knowledge and outcomes. Researchers were also able to find literature related to cost benefits of interprofessional collaboration in some primary care settings.  Implications of the research show a need for greater regulatory and legislative support to foster the consistency and clarity of interprofessional collaborative partnerships.	Not reported in detail	2/11 (AMSTAR rating from Program in Policy Decision-making)	Not reported in detail	Not reported in detail	Not reported in detail
	Examining interventions to improve team effectiveness and	The majority of the studies had a low quality of evidence, and only eight of	2008	4/9 (AMSTAR rating from	Not reported in detail	0/48	0/48

Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
	their 'evidence-based' level (148)	<p>all articles had a high or moderate quality of evidence. A downside to the high-quality studies is that they generally provide little information about the context in which the intervention was tested, making it difficult to evaluate whether the intervention will be effective in other settings.</p> <p>Most of the studies looked at training programs, which can include simulations, training based on Crew Resource Management (CRM), interprofessional training or team training. Non-technical team skills were used as outcomes for most studies, such as communication, cooperation, coordination and leadership, and the majority of the studies found a positive correlation between the intervention and non-technical team skills.</p> <p>It appears there are several gaps in the literature on interventions to improve team effectiveness, and there is little research on such interventions conducted in long-term care. Policymakers should be aware of the few high-quality studies. There is growing evidence that communication skills in acute care can be improved by simulation training based on CRM.</p>		Program in Policy Decision-making)			
	Examining the characteristics of an effective team, and the ways to measure the effectiveness of a	Through in-depth interviews with key informants and a wide-ranging survey, the team identified the challenges of	Not reported in	2/11 (AMSTAR rating from Program in Policy	Not reported in detail	Not reported in detail	Not reported in detail

Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
	team. The review also synthesizes successful interventions in implementing and sustaining teamwork in healthcare, and the lessons that can be learnt through other settings and countries (150)	<p>building and maintaining effective teamwork. These challenges include the lack of a common definition of teams and teamwork, the relationship between teamwork and collaboration, the spectrum of collaboration in a healthcare setting, organizational factors, and the implications of current policy and legislation.</p> <p>Leadership and commitment are essential from all levels of the healthcare system to implement and maintain teamwork in the long term. After reviewing successful interventions in other jurisdictions, it is concluded that team work is most effective when there is a clear purpose, good communication, co-ordination, protocols and procedures, and effective mechanisms for conflict resolution.</p> <p>Despite the growing body of knowledge, there has been little impact on current practices since professionals continue to protect their turf and try to limit the scope of practice of other professionals, to protect their own needs and interests. Other constraints include self-regulation of professionals, current malpractice laws, and funding models that fail to support teamwork.</p>	detail	Decision-making)			
	Examining the factors that facilitate or inhibit interprofessional teamwork in	The structure of the team is a very important factor for effective teamwork. Team members who are	Not reported in	1/9 (from Program in Policy Decision-making)	2/10	0/10	0/10

Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
	primary and community care settings (152)	separated by location can cause them to be less integrated with the rest of the team, and thus limit team functioning and effectiveness. The size and composition of the team also appears to have an impact on teamwork, and there appears to be lower levels of participation in larger teams compared with smaller teams. Leadership is another important issue that emerged from the analysis. A lack of leadership can cause frustration among team members and lead to poor decision-making. Finally, stability of the teams in regards to its members is an issue, and teams with a higher proportion of full-time staff were found to be more effective. A second theme that emerged was team processes, which is divided into three categories: team meetings, goals and objectives, and audit. Team meetings were identified as enhancing communication, and serve as an important facilitator for effective teamwork. In conclusion, the functions of interprofessional healthcare teams are complex, and there are many interrelating factors. Further work needs to be conducted at both a team and organization level to ensure that enhancement and facilitation of teamwork leads to an improved quality of healthcare provision over time.	detail				



**Appendix 2: Systematic reviews relevant to Element 2: Strengthen the capacity of national policymakers and stakeholders and the public to respond to the variability of pandemics**

Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
Enhancing relationship-building, learning, trust and transfer of knowledge from researchers to policymakers via plain language summaries of research evidence, maintaining open lines of communication, and hosting regular meetings during pre-, inter- and post-pandemic periods	Examining the effects of information products designed to support the uptake of systematic review evidence by health system managers, policymakers and healthcare professionals (157)	Mass mailing a printed bulletin which summarizes systematic review evidence may improve evidence-based practice when there is a single clear message, if the change is relatively simple to accomplish, and there is a growing awareness by users of the evidence that a change in practice is required. If the intention is to develop awareness and knowledge of systematic review evidence, and the skills for implementing this evidence, a multifaceted intervention that addresses each of these aims may be required. However, there is insufficient evidence to support this approach.	2011	9/10 (AMSTAR rating from Program in Policy Decision-making)	1/8	0/8	0/8
	Exploring the barriers to the uptake of evidence from systematic reviews and meta-analyses from the decision-makers' perspective (191)	This systematic review revealed that strategies to improve the uptake of evidence from reviews and meta-analyses will need to overcome a wide variety of obstacles. The review described the reasons why knowledge users, especially physicians, do not call on systematic reviews, such as lack of use, lack of awareness, lack of access, lack of familiarity, lack of usefulness, lack of motivation, and external barriers.	2010	7/10 (AMSTAR rating from Program in Policy Decision-making)	5/27	0/27	0/27
	Exploring knowledge translation resources and tools to maximize the impact of systematic reviews in healthcare decision-making (197)	This systematic scoping review identified knowledge-translation resources that address barriers to the use of systematic reviews by	2009	5/9 (AMSTAR rating from Program in	5/20	0/20	0/20

Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
		<p>polymakers. These barriers may be overcome by resources that adapt and present the findings in formats more directly tailored to their needs. Knowledge-translation resources, including summaries, overviews and policy briefs, added value to systematic reviews. They did this by, for example, evaluating their methodological quality or assessing the reliability of their conclusions or their generalizability to particular settings. More evaluations of these resources are required to ensure users' needs are being met, to justify their funding, and to demonstrate their impact.</p>		Policy Decision-making)			
	Examining interventions encouraging the use of systematic reviews by health policymakers and managers (169)	There is insufficient evidence to draw conclusions about the effectiveness of interventions that encourage health policymakers and managers to use systematic reviews in decision-making.	2010	9/10 (AMSTAR rating from Program in Policy Decision-making)	3/3	0/3	0/3
	Examining potential strategies for increasing the impact of systematic reviews on policy (198)	Facilitators for the use of systematic reviews included involving policymakers in the review process, making reviews relevant to local settings and contexts, collaboration between researchers and policymakers, and disseminating results from systematic reviews in user-friendly formats	2011	5/9 (AMSTAR rating from Program in Policy Decision-making)	7/13	0/13	0/13
	Examining strategies to increase the use of research in population health policy and programs (170)	There is little evidence about which strategies increase the use of evidence in population health policy and programs.	2011	3/9 (AMSTAR rating from Program in Policy	Not reported in detail	0	0

Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
		<p>There is some evidence that tailored targeted messages combined with access to registries of research evidence may increase the use of research evidence in policy development.</p> <p>None of the included studies provided evidence that interaction between researchers and policymakers has an impact on the use of research evidence.</p> <p>Training in the appraisal of research and its use appears to increase participants' skills in critical appraisal, and possibly their perceptions about the value of research (but not their use).</p> <p>One study evaluated the impact of using knowledge brokers, but did not find evidence to support their effectiveness.</p>		Decision-making)			
	Examining the use of research evidence in public health decision-making processes (196)	<p>Barriers to the use of research evidence included: decision-makers' perceptions of research evidence; the gulf between researchers and decision-makers; the culture of decision-making; competing influences on decision-making; and practical constraints.</p> <p>Mechanisms for overcoming barriers to research use were suggested in many studies, but were largely</p>	2010	7/10 (AMSTAR rating from Program in Policy Decision-making)	7/18	0/18	0/18

Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
		<p>untested. They include research targeted at the needs of decision-makers, research clearly highlighting key messages, and capacity building.</p> <p>Minimal evidence on the role of research evidence in decision-making to reduce inequalities was identified.</p>					
	Identifying the factors that influence the use of research evidence in ways to improve the usefulness of systematic reviews for healthcare managers and policymakers (194;195)	<p>Interactions between researchers and healthcare policymakers and timing/timeliness appear to increase the prospects for research use among policymakers.</p> <p>Interviews with healthcare managers and policymakers suggest that they would benefit from having information that is relevant for decisions highlighted for them (e.g. contextual factors that affect a review's local applicability and information about the benefits, harms/risks and costs of interventions), and having reviews presented in a way that allows for rapid scanning for relevance, and then graded entry (such as one page of take-home messages, a three-page executive summary and a 25-page report).</p> <p>Managers and policymakers have mixed views about the helpfulness of recommendations.</p> <p>An analysis of websites found that contextual factors were rarely</p>	2008	No rating tool available for this type of document	Not reported in detail	0/17	0/17

Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
		highlighted, recommendations were often provided, and graded entry formats were rarely used.					
	Examining the evidence from interview studies of facilitators of, and barriers to, the use of research evidence by health policymakers (193)	<p>The most commonly reported facilitators for research use were personal contact, timely relevance, and the inclusion of summaries with policy recommendations.</p> <p>The most commonly reported barriers were absence of personal contact, lack of timeliness or relevance of research, mutual mistrust, and power and budget struggles.</p>	2000	No rating tool available for this type of document	3/24	0/24	0/24
	Examining the evidence for knowledge transfer and exchange (KTE)(171)	The review found inadequate evidence base for doing “evidence-based” KTE for health policy decision-making.	2005	No rating tool available for this type of document	8/18 (implementation studies)	0/18	0/18
	Examining the evidence on knowledge exchange interventions at the organizational and policymaking level (199)	<p>Researchers introduce an integrative model to understand the main dimensions of knowledge transfer in diverse disciplinary fields. The model is based on three core dimensions: level of polarization (politics), cost-sharing equilibrium (economics), and institutionalized channels of communication (social structuring).</p> <p>Reflection for future research is the understanding that context-independent evidence is unlikely due to the deeply embedded phenomena of collective knowledge exchange.</p> <p>On the practice side, results showed that the best available resource for</p>	2010	1/9 (AMSTAR rating from Program in Policy Decision-making)	Not reported in detail	0/205	0/205

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Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
		someone designing a knowledge exchange intervention is found in empirically-informed conceptual frameworks that can be used as field guides.					
	Examining the effectiveness of knowledge translation strategies to promote evidence-informed decision-making among public health decision-makers (172)	Due to differing characteristics of the users, the providers, the intervention and the organizations where the interventions are implemented, conclusions about interventions do not suggest that they will remain constant in different contexts.	2010	8/10 (AMSTAR rating from Program in Policy Decision-making)	3/5	0/5	0/5
	Examining the facilitators to the uptake by decision-makers, of evidence from systematic meta-analyses and the databases containing them (192)	<p>Studies included had limited quality and generalizability of their results.</p> <p>Although respondents and investigators used different words to describe facilitators to the use of research evidence, several common factors were raised across studies. Of the 51 facilitators identified, 26 can be viewed as having an impact on knowledge, 21 on attitude, and four on behaviour. The five most common facilitators are focused on the perception of usefulness of systematic reviews.</p> <p>Implication for future research suggests the use of more open-ended questions and exploratory studies to reveal unanticipated facilitators to targeted audiences.</p>	2010	4/10 (AMSTAR rating from Program in Policy Decision-making)	6/15	0/15	0/15

Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
Implementing adaptive governance structures that enable policymakers and stakeholders to respond to the variability of pandemics, and which assist decision-makers in navigating the complex informational landscape that frequently evolves during a pandemic (e.g. through professional networks, centralization or decentralization of policy authority, etc.)	Examining the impact and effectiveness of intersectoral action as a public health practice for health equity through action on the social determinants of health (173)	<p>Evidence that considers intersectoral action as a promising practice is mixed, and it revealed moderate to no effect on the social determinants of health. Given the challenges in documenting evidence for intersectoral action, it is not surprising that only one primary study is considered methodologically strong, which further limits the evidence on the impact of intersectoral action on health equity.</p> <p>More downstream interventions for population health showed the strongest effects, such as intersectoral collaborations to improve immunization rates among vulnerable populations. The association between upstream interventions and health outcomes was least conclusive, and this is likely due to the increased difficulty in measuring and evaluating the impact of upstream interventions on health equity.</p> <p>For future practice and policy, collaborations between public health and other sectors show promise to create supportive environments, but there is a need to address structural determinants of health across the whole population with more multi-level interventions.</p>	2012	8/11 (AMSTAR rating from McMaster Health Forum)	10/17	0/17	0/17

Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
	Examining the effects of inter-agency collaboration between local health and local government agencies on health outcomes (168)	<p>There is no reliable evidence that enhanced collaborations between agencies improve health outcomes when compared to routine service delivery. Reasons that need to be considered for the lack of effect are: 1) the process of collaboration may not have been optimal; and 2) failure to fully implement the intervention. Multi-agency collaborations are generally more expensive and harder to implement compared with routine services. New partnerships need to be clear about the outcomes they aim to achieve, and this needs to be understood by all partners.</p> <p>Methodological problems in the primary studies and incomplete implementation of initiatives prevented researchers from establishing strong evidence to understand what works and why. The design of study methods needs to be considered in line with best practice before implementation of the intervention.</p>	2008	11/11 (AMSTAR rating from Program in Policy Decision-making)	3/17	9/17	0/17
	Examining the impact of organizational partnerships on public health outcomes in England between 1997 and 2008 (174)	Little evidence showed direct health effects with public health partnerships. Even when successes relating to public health outcomes were observed, it is difficult to assess to what extent these are attributable to public health partnerships. The term 'partnership working' is rarely adequately defined, and most interventions were multifaceted and	2008	6/9 (from Program in Policy Decision-making)	0/15	0/15	0/15



Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
		<p>did not rely solely upon partnership working, making it difficult to attribute outcomes directly to partnership working.</p> <p>The lack of evidence in literature does not necessarily mean that partnerships are ineffective, but it is important to acknowledge that the benefits attributed to partnerships are largely presumed.</p>					
	Examining key dimensions regarding allocation of scarce resources in mass casualty events (MCEs) (175)	<p>Although there is limited evidence to support policymakers in selecting the most effective strategies to allocate scarce resources during MCEs, some specific strategies identified were promising. It is widely accepted that rapid deployment of biological countermeasures, such as mass vaccinations, mass dispensing of antivirals or the rapid distribution of prophylactic antibiotics, could reduce demand for healthcare resources immediately following a pandemic. Low- to medium-strength shows that using a 'push' method, such as via U.S. Postal Service letter carriers, to deliver medications is more effective than a 'pull' method, such as bringing patients to a fixed point of dispensing.</p> <p>Other than these observations, there is no evidence to guide policymakers in allocating scarce resources during crises, and a prioritized agenda for the development of policy guidelines</p>	2011	9/10 (from Program in Policy Decision-making)	116/170	0/170	23/170

Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
		<p>is urgently needed.</p> <p>Similar observations are seen with strategies to guide providers to optimize the allocation of scarce resources during MCEs. Field triage is the only provider-oriented strategy subjected to comparative assessment, but even then, there is weak evidence to support the use of this approach over others.</p>					
	Examining the evidence exposing gaps in complex healthcare organizations (200)	<p>The studies abstracted focus predominantly on healthcare groups, networks, social clusters and professional tribes, and only peripherally examine group boundaries or the spaces in between. This is an important but under-recognized dimension of the social-professional environments. In the few studies that provide evidence, it is shown that some groups from the bottom-up engage in boundary-spanning activities. These kinds of gaps shed light on the circumstances under which ties have been severed, and the limits of connectivity between groups.</p> <p>Some studies identified strategies to succeed, including running a concerted campaign to improve one group's utility to another, appreciating the other group's point of view and relating to their needs. Verbal communications are expected to be useful. These strategies are</p>	Not reported in detail	3/9 (from Program in Policy Decision-making)	5/13	0/13	0/13

Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
		thought to be useful in making meaningful and sustainable connections if organizations are joining up at their boundaries.					
	Examining the evidence on outcomes of public involvement in healthcare policy (158)	<p>There is minimal robust evidence on the impact of public involvement. The indicators used to evaluate impact were poorly specified and inconsistent in studies. This finding is not surprising due to the lack of consensus on the definition of public involvement. It was not possible to draw firm conclusions from existing evidence due to the lack of formal evaluation when drawing conclusions about the success of a given public involvement initiative.</p> <p>Despite these limitations, evidence shows that public involvement initiatives appear to affect the healthcare policy process through influencing strategic decisions on service delivery or priority-setting. Studies show that where participants' preferences 'match' policy or service preferences, the public's requests are more likely to be met.</p> <p>Implications for future studies suggest a need to understand how individuals assume different roles in being active citizens, and how individual expectations are influenced by the healthcare system.</p>	2010	3/9 (AMSTAR rating from McMaster Health Forum)	8/19	3/19	0/19
	Examining the effects of consumer involvement and comparing	Moderate-quality evidence demonstrates that by involving	2005	9/11 (AMSTAR	4/6	0/6	0/6

Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
	different methods of involvement in developing healthcare policy and research, clinical practice guidelines and patient information material (176)	<p>consumers in the process of developing patient information material, the material is more relevant, readable and understandable to patients, without influencing their anxiety.</p> <p>There is low-quality evidence that consumer interviewers, rather than staff interviewers, in satisfaction surveys can have a small influence on the results. Low-quality evidence showed that informed consent forms developed with consumer input have an impact compared to one developed by trial investigators only. Very low-quality evidence showed that telephone discussions and face-to-face group meetings engaged consumers better than mailed surveys in setting priorities for community health goals.</p> <p>In summary, there is minimal evidence on the desirable and adverse effects of consumer involvement in healthcare decisions at the population level.</p>		rating from <a href="http://www.rxforchange.ca">www.rxforchange.ca</a> )			
	Examining the effectiveness of strategies for interactive public engagement in developing healthcare policy and program delivery at a provincial/regional level (159)	Interactive public engagement designed to contribute to decision-making can be successfully implemented in various situations. The relative success of implementation is influenced by a range of contextual variables, of which organizational commitment and issue characteristics play more	2009	4/9 (AMSTAR rating from McMaster Health Forum)	8/12	0/12	0/12

Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
		<p>important roles than other contextual variables.</p> <p>In well-designed interactive public engagement processes, participants generally report high levels of satisfaction with the communication of objectives, adequacy of the information materials, and the logistics of the deliberations. These public engagement methods can influence participant views, but are less likely to alter dominant views, such as the highest priorities.</p> <p>Researchers note that continued ambiguity in the terminology, goals, theoretical properties and benefits of public engagement amongst Canadian health system managers and policymakers will threaten potential meaningful progress towards informing practice and involving the public in the development of healthcare programs.</p>					
	Examining factors considered during healthcare resource allocation decision-making and assess its utility (160)	There is wide-spread recognition of the need for explicit priority-setting in healthcare at all levels of government. The aims at the national level tend to focus on articulating publicly acceptable guidelines for priority-setting, whereas, the regional and community levels focus on narrower topics, such as establishing systematic approaches to setting priorities for services and programs.	2002	6/9 (AMSTAR rating from Program in Policy Decision-making)	30/117	0/117	0/117

Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
		<p>Evidence supports the agreement that healthcare resource allocation decision-making must accommodate the values of citizens within the nation, region or community. Factors important for priority-setting vary depending on the location, but some relevant factors include: population needs, equity, costs, effectiveness of interventions or technologies, health status, severity and nature of the disease, potential for health gain, socioeconomic status, age and cause of disease or condition.</p> <p>Implications for future research suggest conducting a secondary synthesis of evidence on proposed and used critiquing models, as there is currently minimal formal evaluation available.</p>					
	Examining how communities of practice (CoPs) is defined and used in business and health sectors, and assessing the effectiveness of CoPs in healthcare settings (177)	<p>Evidence shows there is a broad variety of structures of CoP groups within the two sectors. These CoP groups range from voluntary informal networks to work-supported formal education sessions, and from apprentice training to multidisciplinary, multi-site project teams.</p> <p>Some common characteristics of CoP groups include social interaction, knowledge-sharing, knowledge creation and identity-building.</p>	2005	5/10 (AMSTAR rating from Program in Policy Decision-making)	Not reported in detail	0/31	0/31

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		The majority of the included studies focused on describing how these CoP groups function, or the complexities in developing and sustaining them. There was minimal evidence available about whether CoP groups improve the uptake of best practices in the health sector.					
	Examining virtual communities in healthcare, taking into consideration the ethical, legal and technical aspects (189)	<p>In many healthcare-related domains, virtual communities that aim to support patients, caregivers, families and healthcare providers are emerging. There needs to be a clear, published, and readily available set of rules or code of conduct for members of the virtual community.</p> <p>Implications for future research include the need to determine the impact of virtual healthcare communities on clinical outcomes, the process, and quality of care. In practice, healthcare professionals who utilize virtual community tools with patients need to resolve concerns about privacy and the fear of de-humanizing practice.</p>	2005	2/10 (AMSTAR rating from Program in Policy Decision-making)	Not reported in detail	0/47	0/47
	Examining how and why communities of practice (CoPs) are established, and assessing the impact on healthcare practice (178)	<p>Included studies show that there is a broad diversity in terms of how and why CoPs are established.</p> <p>More recent research efforts have attempted to assess the impact of CoPs in improving healthcare quality, and there is evidence that they play a role in improving the quality of healthcare performance.</p>	2009	3/9 (AMSTAR rating from Program in Policy Decision-making)	16/35	0/35	0/35

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Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
		CoPs aid in the process of achieving many outcomes, including gaining competencies following completion of basic training, breaking down professional, geographical and organizational barriers, sharing information, reducing professional isolation, and facilitating the implementation of new process and technology.					
	Examining the effectiveness of communities of practice for healthcare settings (153)	Systematic review in progress: findings not reported					
	Examining the effects of community coalition-driven interventions on improving health status or reducing health disparities among racial and ethnic minority populations (154)	Systematic review in progress: findings no reported					
Developing a health risk communication strategy to help politicians and the public become aware of, prepare for, and adapt to, the emerging threat of a pandemic, and which strengthens communication between national governing institutions, other national governments, international agencies, private sector and civil society organizations, and major news and media agencies, to ensure the efficient and transparent delivery of accurate	Examining the effectiveness of communication strategies and factors that impact communication uptake related to environmental health risks (179)	<p>Literature that met the inclusion criteria of this review lacked methodological quality.</p> <p>Factors that influence response to risk communications include: personal risk perception, previous personal experience with risk, sources of information and trust in those sources, and preferences for information.</p> <p>Recommendations for risk communication plans in public health include: ensuring communication comes from a credible source; tailoring</p>	2009	9/10 (AMSTAR rating from McMaster Health Forum)	17/24	0/24	3/24



Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
information		communication for the audience; building the content of messages with the best available evidence; incorporating text with visuals; disseminating information through multiple media sources; delivering warning system notices for rare events on a regular, periodic basis; developing communication strategies with the awareness that people make choices based on past experience with disasters; ensuring communication strategies are multi-modal; and preventing the use of automated telephone call-in systems.					
	Examining the effectiveness of interventions available to public health staff regarding the protection of the public from environmental risks (161)	<p>There is evidence that a number of health promotion interventions are effective in enhancing short-term awareness and concern about environmental risks to health. The studies that reported positive behavioural changes generally used intensive interventions.</p> <p>Due to weak methodological quality of the studies evaluating the effects of mass distribution of printed materials, researchers cannot draw firm conclusions.</p> <p>Researchers recommend more rigorous evaluation research to be conducted on common interventions such as alerts, advisories, educational sessions, dissemination of educational materials, telephone counseling and media advocacy. Such</p>	Not reported in detail	7/10 (AMSTAR rating from McMaster Health Forum)	11/14	1/14	0/14

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		interventions are attractive because they are less costly to implement.					
	Examining the effects of different types of personalized risk communication for consumers making decisions about screening tests (180)	<p>There is weak evidence that personalized risk communication slightly increases uptake of screening tests. Minimal evidence showed that interventions achieved informed decision-making by consumers about participating in screening tests.</p> <p>Five studies included in this review assessed risk communication in high-risk individuals, and these participants show higher ratios for uptake of screening tests compared to low-risk individuals.</p> <p>In the absence of firm evidence that increased uptake of screening tests is associated with informed decision-making by consumers, it is difficult to support such interventions.</p>	2005	10/11 (AMSTAR rating from McMaster Health Forum)	21/22	0/22	0/22
	Examining the effects of different types of individualized risk communication for patients who are deciding whether to participate in screening (181)	<p>Evidence demonstrates individualized risk communication is associated with higher uptake of tests, but there is insufficient evidence that these interventions inform decision-making by consumers.</p> <p>As informed decision-making by consumers is important, it is necessary to have a valid instrument to measure whether this has occurred. Researchers suggest evaluation of strategies to promote informed decision-making is required</p>	Not reported in detail	7/11 (AMSTAR rating from McMaster Health Forum)	13/13	0/13	0/13

Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
		in future research.					
Establishing well-recognized authorities as trusted sources of information who can lead communication efforts with the public during pandemics, and who are equipped with knowledge translation platforms to facilitate the communication of complex information to people with low levels of health literacy (e.g. persons of low socioeconomic status, immigrants, homeless, etc.)	Examining the effectiveness of interventions to improve the use of healthcare services, improve health outcomes, affect the costs of care, and reduce disparities in healthcare service use for those with low health literacy (190)	<p>Discrete design features in some studies showed improved participant comprehension for those with low health literacy, such as presenting essential information in tables rather than text, adding icon arrays to numerical information, and adding video to verbal narrative.</p> <p>Significant advances were noted in the field of health literacy research. Some common features of interventions in studies that changed distal outcomes include high intensity, theory basis, pilot testing, emphasis on skill building, and delivery by a health professional.</p> <p>Implications for future research suggest focusing on confirming the effectiveness of discrete design features that have only shown success in specific populations, exploring untested interventions, interventions that work around the issue of low health literacy, interventions that change physician behaviour, practice structure or existing health policy, and finding the best ways to disseminate effective health literacy interventions.</p>	2011	6/9 (AMSTAR rating from Program in Policy Decision-making)	32/38	0/36	0/36
	Updating a 2004 systematic review of healthcare service use and health outcomes related to differences in health literacy level, and interventions designed to improve	Moderate-level evidence about healthcare service use demonstrated that lower health literacy was associated with increased hospitalization, greater emergency	2010	7/10 (AMSTAR rating from Program in Policy	68/123	Not reported in detail	0/123

Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
	these outcomes for individuals with low health literacy (182)	<p>care use, lower use of mammography, and lower receipt of influenza vaccine. Lower health literacy is also associated with poorer outcomes in some health outcomes, such as ability to demonstrate taking medications appropriately, ability to interpret labels and health messages, and overall health status among seniors.</p> <p>Although the strength of evidence for specific design features appeared low among intervention studies, a few studies showed improved comprehension for several specific features.</p> <p>Further research implications include the need to justify appropriate cutoffs for health literacy levels prior to conducting studies, and to develop tools that measure additional related skills.</p>		Decision-making)			
	Examining the effects of interventions for enhancing consumers' online health literacy (183)	The authors of the RCT study reported significant beneficial effects of the intervention on five outcomes, including self-efficacy for health information seeking, health information evaluation skills, and the number of times the patient discussed online information with a health provider. As no outcome favoured the control group, both studies suggested that the intervention had a low risk of harm.	2008	10/11 (AMSTAR rating from Program in Policy Decision-making)	2/2	0/2	0/2

Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
		The small number of included studies limited the ability to sufficiently answer the review questions. There is low-quality evidence that the reported interventions may improve some outcomes related to online health literacy in certain populations.					
Developing methods to analyze the utility of social media tools (e.g. via mobile phone apps, push-alerts, two-way telecommunications strategies) to effectively capture situational analyses within pandemic management platforms such as Facebook, Twitter, and crowd-sourcing technologies	Examining the impact and utility of web 2.0 and social media on health promotion (167)	The scarcity of empirical evidence points to the need for more interventions with participatory and user-generated features. Innovative study designs and measurement methods are needed to understand the communication landscape and to critically assess intervention effectiveness. To address health disparities, interventions must consider accessibility for vulnerable populations.	2012	4/10 (AMSTAR rating from the McMaster Health Forum)	Not reported in detail	Not reported in detail	Not reported in detail
	Examining the evidence on collaborative writing application and assessing their impact as knowledge-translation tools in the healthcare sector (155)	Systematic review in progress: findings not reported					
	Examining the effects of mobile phone messaging for communicating results of medical investigations, on people's healthcare-seeking behaviour and health outcomes (184)	Only one study was included in this review. The study had low methodological quality and limited evidence that communicating results of medical investigations by mobile phone messaging may make little or no difference to women's overall anxiety levels, or in women with positive test results. However, it may reduce anxiety in women with negative test results.	2009	10/10 (AMSTAR rating from Program in Policy Decision-making)	0/1	0/1	0/1

Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
		There is insufficient evidence to inform further recommendations. Researchers suggest further research to report on intermediate indicators such as health-seeking behaviour, patients' evaluation of the intervention, costs, economic benefits and potential adverse effects.					
	Examining the effects of mobile phone messaging reminders for attendance at healthcare appointments (162)	There is low- to moderate-quality evidence that mobile phone text message reminders increase healthcare appointment attendance rates when compared with no reminders and postal reminders. Results also show mobile phone text message reminders are as effective as telephone call reminders, and two studies found that they are more cost-effective than telephone call reminders.  Implications for future research include the need for high-quality, randomized trials that measure patients' attendance rates and costs.	2009	11/11 (AMSTAR rating from Program in Policy Decision-making)	0/4	0/4	0/4
	Examining the use of text messaging for clinical and healthy behaviour interventions (164)	Text messaging showed good acceptance and early efficacy in most studies. Researchers were able to use customized text messaging to deliver reminders, support and education to patients, and offer an effective platform to collect adherence, test results and self-monitored data.  Text messaging is more cost-effective than telephone calls in	2009	3/9 (AMSTAR rating from Program in Policy Decision-making)	10/24	0/24	0/24

Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
		improving outpatient appointment attendance. However, this area is poorly assessed in studies on behaviour modifications. Researchers suggest future research on cost-benefit analysis to explicitly compare text messaging with traditional interventions.					
	Examining the effects of mobile phone messaging interventions as a mode of delivery for preventive healthcare, and on health status and health behaviour outcomes (186)	Results of the review show that mobile phone messaging can result in some improvements in the health status and health behaviours of the participants. However, most studies did not report participants' evaluation of the intervention or adverse effects.  However, due to the small number of participants in three of the included studies, the evidence for these effects is of low quality.	2009	11/11 (AMSTAR rating from Program in Policy Decision-making)	2/4	0/4	0/4
	Examining behaviour-change interventions for disease management and prevention delivered through text messaging (165)	Most included studies found evidence of a short-term effect for behavioural or clinical outcomes related to disease prevention and management. There is evidence that text messaging for disease prevention and management interventions had an impact on weight loss, smoking cessation and diabetes management.  The results are consistent with existing literature that mobile phones can be a useful tool for interventions seeking improvement in health outcomes.	2008	6/10 (AMSTAR rating from Program in Policy Decision-making)	3/12	0/12	0/12

Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
		Future studies must take into consideration that text messages should be written in the most appropriate way for the specific population. Researchers also suggest cost-benefit analyses be considered.					
	Examining whether mobile phone text messaging is effective in enhancing adherence to antiretroviral therapy in patients with HIV infection (163)	<p>Two high-quality trials from Kenya were included in this review; one compared short weekly text messages against standard care, while the other compared short daily, long daily, short weekly and long weekly messages against standard care.</p> <p>Results show any weekly text-messaging, whether short or long, was associated with a lower risk of non-adherence at 48 to 58 weeks. Short weekly text-messaging also showed significant improvement.</p> <p>For practice implications, researchers suggest policymakers consider funding these programs in clinics and hospitals.</p>	2011	11/11 (AMSTAR rating from Program in Policy Decision-making)	0/2	2/2	0/2
	Examining the use of text messaging as a tool to deliver healthy lifestyle behaviour intervention programs in pediatric and adolescent populations (187)	<p>Due to the relatively new field of research in using mobile phones in interventions for children and adolescents, few studies met the inclusion criteria.</p> <p>Text-messaging interventions have been proven to be accepted in diverse population of urban parents, and they are preferred to mail or telephone reminders. It is considered a convenient and culturally</p>	2011	7/10 (AMSTAR rating from Program in Policy Decision-making)	3/6	3/6	0/6



Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
		<p>acceptable way to disseminate health information in pediatric and adolescent populations.</p> <p>There is insufficient evidence to draw conclusions on the long-term effects, or on how much reinforcement is needed to sustain health behaviour change.</p> <p>Researchers suggest the need for more rigorous, theory-based intervention research using mobile technology.</p>					
	Examining the effects of mobile phone-messaging applications designed to facilitate self-management of long-term illnesses, in terms of impact on health outcomes and patients' capacity to self-manage their condition (185)	<p>Results of this review show that mobile phone-messaging interventions had few direct impacts on health outcomes related to the management of long-term conditions.</p> <p>There are mixed results on the effects of text messaging for promoting patients' self-management of their conditions. Although text messaging appears useful in supporting self-management in some cases, more research is needed into the mechanisms of these effects.</p> <p>Implications for research suggest the need to validate findings of pilot studies through follow-up studies with adequate research designs.</p>	2009	9/9 (AMSTAR rating from Program in Policy Decision-making)	Not reported in detail	4/4	0/4
	Examining the scope, effectiveness, acceptability and feasibility of the use of mobile	Included studies show mobile phone messaging is accepted as a method to receive information and to	Not reported in	7/9 (AMSTAR rating from	5/21	7/21	0/21

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Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
	phone messaging for HIV infection prevention, treatment and care (188)	<p>communicate with health workers. However, there is insufficient evidence of clear benefits to draw generalizable conclusions.</p> <p>Cross-sectional studies indicated the obvious differences across studies in different settings and contexts, and emphasized the importance of context and patient group.</p> <p>Although mobile phone interventions have the potential to improve health outcomes, formal evaluation and cost-effectiveness questions need to be answered with further research.</p>	detail	McMaster Health Forum)			
	Examining the evidence for the effectiveness of mobile technology interventions for improving health and health service outcomes around the world (156)	Systematic review in progress: findings not reported					
	Examining the evidence related to the role of cellphones and text-messaging interventions in improving health outcomes and processes of care (166)	<p>Interventions delivered through wireless mobile technology showed both clinical and process improvements in the majority of the included studies. The most notable benefits were observed in chronic diseases such as diabetes and asthma, and in smoking cessation, that require ongoing advice and support.</p> <p>As this review included studies conducted on several continents, it enhanced the international applicability of this technology.</p>	2008	2/9 (AMSTAR rating from Program in Policy Decision-making)	2/23	5/23	0/23

Option element	Focus of systematic review	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
		Implication for future research encourages more controlled studies with larger sample sizes.					
	Examining the effectiveness of mobile technology interventions delivered to healthcare consumers (156)	<p>None of the included studies were of high quality. The reported results for healthcare provider support interventions are mixed for medical process outcomes, and there may be modest benefits in outcomes regarding correct clinical diagnosis and management delivered via application software.</p> <p>No clear benefit was observed for educational interventions for healthcare providers.</p> <p>Researchers recommend that high-quality trials be conducted to examine the effects of clinical diagnosis and management support on clinical outcomes using software applications on mobile phones.</p>	2010	10/11 (AMSTAR rating from Program in Policy Decision-making)	21/42	1/42	0/42

**Appendix 3: Systematic reviews relevant to Element 3: Work to strengthen the global pandemic governance system, including better communication, collaboration and policy coherence with other national governments and international agencies during pandemics**

Option element	Focus of systematic review/cost-effectiveness study	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
Facilitating global coordination and policy coherence (e.g. via task forces, working groups, high-level forums and encouraging the establishment of partnerships between Member States of shared borders for improved clarity about decision-making authority processes) to better manage trans-border trade and other economic activities during pandemics	Examining country-level evidence about the impact of global health initiatives (GHIs) (201)	Initially, the three GHIs studies often resulted in negative effects. Later on, positive effects were observed.  The Multi-country AIDS Program (MAP) is viewed positively for its capacity-building activities at national and district public sector levels. The Global Fund to Fight AIDS, TB and Malaria succeeded in boosting the engagement of non-governmental organizations and faith-based bodies, bringing them together to work on planning structures with the government. The US President's Emergency Plan for AIDS Relief (PEPFAR) showed particular strength in fast and predictable funding disbursements to civil society implementers.	2007	4/10 (AMSTAR rating from Program in Policy Decision-making)	Not reported in detail	Not reported in detail	Not reported in detail
	Examining the evidence on the influences that Brazil, India, Russia, China and South Africa (BRICS) wield in global health, and how this influence has been conceptualized in the literature (207)	Researchers offer two contradictory interpretations of the literature. First, the successes of the four BRICS Summits and the two BRICS Health Ministers Meetings suggest a positive first step that will hopefully turn into collective global health action. However, the second interpretation states that BRICS are incapable of cooperating and coordinating their actions, and they	2012	5/10 (AMSTAR rating from McMaster Health Forum)	7/7	0/7	1/7

Option element	Focus of systematic review/cost-effectiveness study	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
		<p>may impede continuous efforts and progress made by developed countries. As a result, the internationally agreed principles and norms could be jeopardized.</p> <p>It is important to note that although individual BRICS countries are becoming more active in global health movements, there remains little evidence in the literature that they are influencing global health.</p>					
	Identifying possible limitations of the Framework Convention on Global Health (FCGH) proposal that may prevent achievement of expected benefits, and the potential unintended negative consequences that may result from its implementation (206)	<p>Although there are many merits to the FCGH proposal, this review has identified many potential limitations and unintended consequences. Researchers state the need for FCGH advocates to re-examine whether this proposal best serves the goal to meet basic survival needs of the world's least healthy people.</p> <p>Four options are available for revising the proposal: (1) abandon current calls for new international law and pursue a less formal framework; (2) seek fundamental constitutional reform of the World Health Organization (WHO); (3) mobilize for a separate political platform through which states can negotiate global health issues that completely bypasses WHO; and (4) narrow the scope of changes to one particular governance issue.</p>	2012	1/9 (AMSTAR rating from Program in Policy Decision-making)	Not reported in detail	0/22	0/22

Option element	Focus of systematic review/cost-effectiveness study	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
Identifying what kinds of legal and policy responses should be taken to correct a failure of cooperation on the part of governments within nation states and at the national level	No reviews identified						
Developing mechanisms to support international dispute resolution, plus developing effective enforcement mechanisms and/or incentives to support national compliance with international regulations and legal obligations such as those contained within the IHR	No reviews identified						
Creating more flexibility and responsiveness within the global system to collectively adapt to uncertainty, such as by developing priority-setting procedures, better coordinating responsibilities between countries, and providing technical assistance as needed	No reviews identified						
Improving WHO's information dissemination process to stakeholders and Member States (including enhancement of WHO's Event Information Site)	No reviews identified						

Option element	Focus of systematic review/cost-effectiveness study	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
Supporting health systems capacity in high-risk developing countries to detect, diagnose, respond to, and communicate situations of pandemic emergence, as per high-income states' international legal responsibilities to provide aid to low-income countries under the IHR	Examining the effectiveness of contracting out healthcare services in improving access to care in low- and middle-income countries, and improving health outcomes (202)	There are numerous factors that may influence a strategy such as contracting. Contracting out is often presented as a 'pay-for-performance' type of intervention. The observed effect is potentially influenced by the role of a new management style, the incentives and objectives in the contract, or the implementation of monitoring systems.  The included studies of this review provided little evidence of the actual measures implemented by the contractor. Factors that may influence the effects of contracting-out strategies include: (1) government capacity to manage the contract; (2) the feasibility of sufficient monitoring service delivery in remote areas; and (3) the introduction of non-state providers.	2009	8/10 (AMSTAR rating from Program in Policy Decision-making)	0/3	0/3	0/3
	Examining the effects of public sector regulation, training or coordination of the private for-profit sector in low- and middle-income countries (205)	Systematic review in progress: findings not reported					
	Examining result-based financing (RBF) research in the health sector (203)	There is evidence that conditional cash transfer programs are effective in increasing the uptake of some preventive services. This suggests that if the incentives were properly designed, indirect barriers to access could be diminished.	Not reported in detail	No rating tool available for this type of document	Not reported in detail	0/10	0/10

Option element	Focus of systematic review/cost-effectiveness study	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
		<p>Although these programs can bridge important gaps in social provisioning for poor populations, they only serve as an adequate solution where there are no supply biases and geographic barriers.</p> <p>There is some evidence of positive effects of financial incentives on patient compliance and preventive health behaviours. However, the results need to be taken cautiously as most trials were carried out in the U.S.</p> <p>Researchers suggest that RBF may be more effective in low- and middle-income countries, especially for patients and community health workers, as small financial incentives represent a larger proportion of their income.</p>					
	Examining the costs of scaling up health interventions (212)	<p>Although researchers hoped to identify the factors that modify cost curves, there are few studies that provide a full quantitative analysis of changes in cost structures when applied to different settings or coverage levels.</p> <p>There are three reasons for the difficulty in transferring costs across countries: (1) purchasing power parity exchange rates often do not capture differences in healthcare costs, (2) most studies do not report costs in a fashion that</p>	2002	5/10 (AMSTAR rating from Program in Policy Decision-making)	0/37	0/37	0/37



Option element	Focus of systematic review/cost-effectiveness study	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
		<p>makes the findings easily transferrable; and (3) different staffing and infrastructure in different settings.</p> <p>Researchers have identified general trends that can serve as guidelines. First, there is evidence that general average cost in rural areas is higher than in urban areas, and some factors include the higher price of transport, supervision and training. Therefore, such average costs can be calculated for different areas. Secondly, the program being costed needs to be examined to determine what is a fixed, semi-fixed or variable cost. Lastly, there needs to be an assessment of the availability and capacity of human resources.</p>					
	Examining how governance issues have influenced human resources for health (HRH) policy development (208)	<p>Researchers identify the lack of use of the term 'governance' in recent HRH literature, which deserves attention in HRH policy formulation and implementation.</p> <p>There is a lack of insight on how decision-making takes place and which players are involved. The articles show improved equity and quality in a number of interventions as a goal, but these articles rarely address inclusiveness in policy development, and in fairness and transparency.</p> <p>Researchers note the need to</p>	2010	1/9 (AMSTAR rating from Program in Policy Decision-making)	2/16	0/16	0/16

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Option element	Focus of systematic review/cost-effectiveness study	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
		conduct research on the influence of the four governance dimensions on HRH, which are performance, equity and equality, partnerships, and participation and oversight.					
	Exploring the links between attraction and retention factors and strategies, with a focus on the organizational diversity and location of decision-making (213)	<p>There is a need for the strategies employed by government structures to address the factors which have an impact on attraction and retention. Researchers could not find evidence on factors that have an impact on attraction and retention.</p> <p>The studies most often report certain strategies, such as targeted recruitment and training. However, there are few strategies that address immediate living environments. Also, there is little evidence of strategies that address management and working conditions.</p> <p>Currently, the issue with staffing of public sector health facilities remains a serious challenge. More research needs to look at the processes of identification and implementation of HRM strategies to improve attraction and retention.</p>	2007	2/9 (AMSTAR rating from Program in Policy Decision-making)	12/55	0/55	0/55
	Exploring the development of international nursing curricular as a vehicle for studying relationship-building (204)	<p>From the evidence in the included studies, it is evident that the nature of nursing curriculum development is a cooperative group process.</p> <p>There is evidence that effective working relationships are an</p>	Not reported in detail	1/9 (AMSTAR rating from Program in Policy Decision-making)	Not reported in detail	0/26	0/26

Option element	Focus of systematic review/cost-effectiveness study	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
		essential component in international nursing development and research. Furthermore, positive interpersonal and intergroup relationships are also essential.  The included studies provide little evidence on how to establish, maintain, enhance and evaluate the relationship-building process among international curriculum developers.					
	Identifying policy options to address human resources for health in low- and middle-income countries, and assessing the effectiveness of these policy options (210)	There is inadequate evidence about the effects of relevant policy options to guide policymakers in low- and middle-income countries on human resources for health. A small amount of high-quality evidence was identified to improve human resources for health. This includes organizational mechanisms that could increase efficiency, such as substitution or shifting tasks between different types of health workers, enhancing the performance of health workers, through efforts such as quality improvement, and increasing efficiency and enhancing performance, through efforts such as promotion of teamwork and changes to workflow.	2006	No rating tool available for this type of document	Not reported in detail	Not reported in detail	Not reported in detail
	Examining the effects of policy levers (grouped into training, regulatory, financial and organizational mechanisms) to address major challenges of human	Despite the recognition of HRH as a critical component to achieve health-related Millenium Development Goals and national health goals, there is little research	2006	No rating tool available for this type of document	Not reported in detail	Not reported in detail	Not reported in detail

Option element	Focus of systematic review/cost-effectiveness study	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
	resources for health (HRH) (211)	<p>evidence about the effects of training, regulatory, financial and organizational mechanisms on the supply, distribution, efficiency and performance of health workers. Most research was in developed country settings, thus the results could be limited in applying to low- and middle-income country (LMIC) settings.</p> <p>In developed country settings, organizational interventions that involve changes to workflow/workload can increase efficiency. The effects of electronic health records on efficiency are highly varied in developed country settings, and may be difficult to implement in many LMIC settings. Evidence shows substituting nurses for physicians can result in comparable or better patient outcomes and satisfaction. Substituting cheaper care assistants for nurses can have mixed effects in developed country settings, which was only observed in low-quality studies. Lastly, quality improvement and continuing-education strategies focusing on improving the knowledge, attitudes and behaviours of health workers can achieve an average of 10% performance improvement.</p>					
	Examining the evidence generated from 2002 to 2009 for potential	There were no included studies that specifically focused on assessing	2009	5/10 (AMSTAR	0/24	0/24	0/24

Option element	Focus of systematic review/cost-effectiveness study	Key findings	Year of last search	AMSTAR (quality) rating	Proportion of studies that were conducted in North America	Proportion of studies that deal explicitly with one of the prioritized groups	Proportion of studies that focused on supporting health systems' capacity to respond to pandemics
	negative health system effects of Global Health Initiatives (GHI) (209)	<p>health system effects. Instead, researchers extracted anecdotal evidence from the included studies.</p> <p>There were no identified studies that explicitly assessed effects of funding by the Global Fund on health systems. There is evidence of considerable gaps between the optimal study design and the actual study methods used to analyze health system effects of Global Fund investments.</p>		rating from McMaster Health Forum)			

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