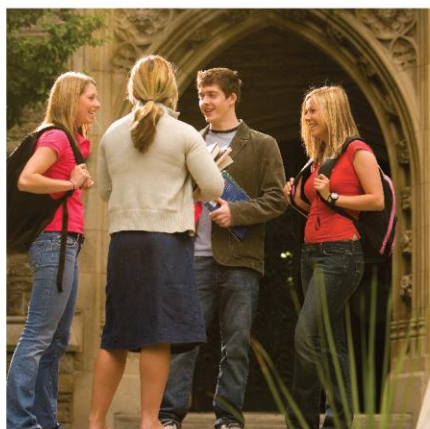
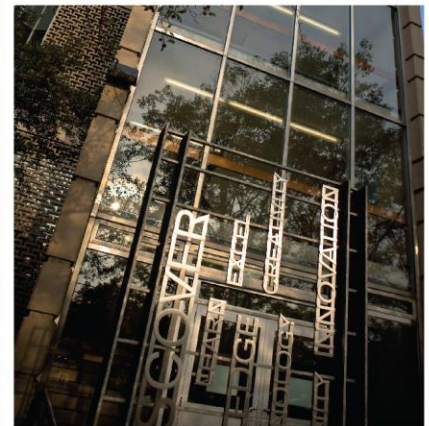
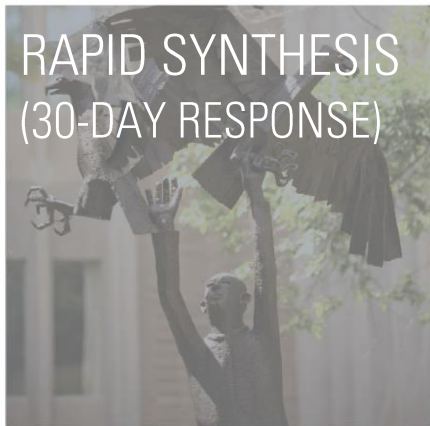


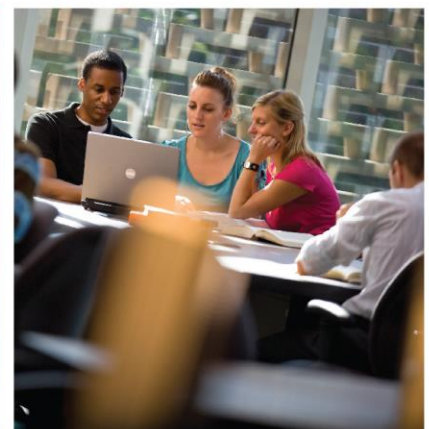


IDENTIFYING OPTIMAL WAYS TO COLLECT, DISTILL AND PROVIDE EFFICIENT ACCESS TO PERSONAL HEALTH INFORMATION IN EMERGENCY SITUATIONS

RAPID SYNTHESIS
(30-DAY RESPONSE)



18 DECEMBER 2014



EVIDENCE >> INSIGHT >> ACTION

**Rapid Synthesis:
Identifying Optimal Ways to Collect, Distill and Provide Efficient Access to Personal Health
Information in Emergency Situations**

18 December 2014

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 regional/provincial levels 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.

Authors

Mathura Mahendren, Forum Fellow, B.H.Sc. student, McMaster University

Harkanwal Randhawa, Forum Fellow, B.H.Sc. student, McMaster University

Michael G. Wilson, PhD, Assistant Director, McMaster Health Forum, and Assistant Professor, McMaster University

Timeline

Rapid syntheses can be requested in a three-, 10- or 30-business day timeframe. This synthesis was prepared over a 30-business day timeframe. An overview of what can be provided and what cannot be provided in each of the different timelines is provided on McMaster Health Forum's Rapid Response program webpage (<http://www.mcmasterhealthforum.org/policymakers/rapid-response-program>).

Funding

The rapid-response program through which this synthesis was prepared is funded by the Ontario Ministry of Health and Long-Term Care through a Health System Research Fund grant entitled 'Harnessing Evidence and Values for Health System Excellence.' The McMaster Health Forum receives both financial and in-kind support from McMaster University. The views expressed in the rapid synthesis are the views of the authors and should not be taken to represent the views of the Ministry of Health and Long-Term Care or McMaster University.

Conflict of interest

The authors declare that they have no professional or commercial interests relevant to the rapid synthesis. The funder played no role in the identification, selection, assessment, synthesis or presentation of the research evidence profiled in the rapid synthesis.

Merit review

The rapid synthesis was reviewed by a small number of policymakers, stakeholders and researchers in order to ensure its scientific rigour and system relevance.

Acknowledgements

The authors wish to thank John Lavis for reviewing an earlier draft of this document and providing revisions. We are especially grateful to Christine Cobbler, Deirdre Dejean and Michael Hillmer for their insightful comments and suggestions.

Citation

Mahendren M, Randhawa H, Wilson MG. Rapid Synthesis: Identifying Optimal Ways to Collect, Distill and Provide Efficient Access to Personal Health Information in Emergency Situations. Hamilton, Canada: McMaster Health Forum, 18 December 2014.

Product registration numbers

ISSN 2292-7980 (print)

ISSN 2292-7999 (online)

KEY MESSAGES

Question

- What are the optimal ways to collect, distill and provide efficient access to personal health information in emergency situations to emergency responders, other healthcare professionals, patients and informal caregivers?

Why the issue is important

- There are more than 16 million visits to emergency departments (EDs) in Canada annually with approximately 52% classified as high acuity (either an immediate threat to life, potential threat to life or limb function, or a possibility of progressing to a serious problem requiring emergency intervention).
- In emergency situations, healthcare providers, patients and their informal caregivers need access to health information to ensure fast and appropriate care.

What we found

- We identified four systematic reviews and 37 primary studies evaluating and/or describing the implementation of various personal health information systems, which we grouped into three types of interventions: 1) information-exchange systems; 2) electronic health records; and 3) patient-focused interventions.
- The 16 studies focused on information-exchange systems found that:
 - health information exchange systems that have been implemented widely in the United States:
 - are designed to share patient-level electronic health information between stakeholders;
 - are used most frequently in EDs for patients with comorbidities, repeat visits to EDs, data in the system, and when both nurses and physicians are authorized to use them; and
 - reduce repeat imaging tests, procedures and resources used in the ED, decrease ED admission, increase adherence to guidelines, improve quality of care, save time for healthcare providers, and are potentially cost saving; and
 - electronic pre-hospital patient care reports are preferred by most physicians for medical emergency decision-making and improve the accuracy of physical exam documentation, but are often unavailable when needed.
- The systematic review and 13 studies about electronic health records (EHR) found:
 - computerized physician order entry in ED settings increases the time spent on computers by nurses and doctors but significantly decreases prescribing errors, potential drug events, and prescribing of excessive doses, and improves guideline compliance, laboratory turnaround and vaccination rates;
 - operational measures, such as length-of-stay, increase during EHR implementation, but in most cases return to baseline levels following an adjustment period;
 - patient-level outcomes associated with EHR use include reduced in-hospital mortality and reduced laboratory tests;
 - EHR adoption by physicians can be facilitated by the implementation of strategic physician-centred incentives; and
 - EHR function can be enhanced by supplementary elements including search engines, clinical decision-support (CDS), and individualized care plans.
- The three systematic reviews and 11 studies about patient-focused interventions outline that:
 - decision-support interventions for patients have been found to improve patient knowledge and satisfaction with care received in EDs;
 - evidence about the use of telephone triage in EDs is not conclusive about whether it can reduce accident and emergency attendance rates, but integrating PHRs into the telehealth infrastructure may improve the delivery of emergency healthcare; and
 - mobile personal health records (PHRs) can help with obtaining medical information during emergencies, are accessible to patients, and most patients are interested in accessing health information on their mobile phones.

QUESTION

What are the optimal ways to collect, distill and provide efficient access to personal health information in emergency situations to emergency responders, other healthcare professionals, patients and informal caregivers?

WHY THE ISSUE IS IMPORTANT

The Canadian Institute for Health Information (CIHI) indicates that there are more than 16 million visits annually to emergency departments (EDs) in Canada.(1) Approximately 52% of these visits are classified as high acuity (either an immediate threat to life, potential threat to life or limb function, or a possibility of progressing to a serious problem requiring emergency intervention).(1) In these situations, it is important to ensure that healthcare providers as well as patients and their informal caregivers have access to the health information they need to ensure fast and appropriate care can be provided.

MedicAlert Foundation Canada (hereafter MedicAlert), which requested this rapid synthesis, has much experience with collecting patient-provided information, distilling and packaging it in a way that is relevant to emergency responders and other healthcare professionals, and providing it in a time-sensitive way in emergency situations. As part of efforts to continually improve their approaches, there is need to determine whether they are aligned with other approaches that have been implemented and evaluated. MedicAlert is interested in integrating the emergency personal health record (PHR) with emergency health services, in a way similar to the 'Access En-route' program in Nova Scotia. High-risk groups include people with medical conditions, allergies, special needs, implants or medication that should be known immediately to emergency responders, when patients are not able to communicate this information.

WHAT WE FOUND

We identified found relevant systematic reviews and 37 primary studies evaluating or describing the implementation of interventions designed to provide health information in emergency situations and/or in EDs. The reviews and primary studies addressed three types of interventions relevant to the question: 1) information-exchange systems; 2) electronic health records; and 3) patient-focused interventions. We provide below a summary of the research evidence that we identified related to each of these interventions. Details of each of the reviews and primary studies that we identified are provided in Appendices 1 and 2.

Box 1: Background to the rapid synthesis

This rapid synthesis mobilizes both global and local research evidence about a question submitted to the McMaster Health Forum's Rapid Response program. Whenever possible, the rapid synthesis summarizes research evidence drawn from systematic reviews of the research literature and occasionally from single research studies. 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 rapid synthesis does not contain recommendations, which would have required the authors to make judgments based on their personal values and preferences.

Rapid syntheses can be requested in a three-, 10- or 30-business-day timeframe. An overview of what can be provided and what cannot be provided in each of these timelines is provided on the McMaster Health Forum's Rapid Response program webpage (<http://www.mcmasterhealthforum.org/policymakers/rapid-response-program>)

This rapid synthesis was prepared over a 30-business day timeframe and involved five steps:

- 1) submission of a question from a health system policymaker or stakeholder (in this case, MedicAlert);
- 2) identifying, selecting, appraising and synthesizing relevant research evidence about the question;
- 3) drafting the rapid synthesis in such a way as to present concisely and in accessible language the research evidence; and
- 4) finalizing the rapid synthesis based on the input of at least two merit reviewers.

Information-exchange systems

We did not identify systematic reviews that addressed information-exchange systems. Of the 16 studies we identified that focused on approaches to supporting information exchange between sites and stakeholders, 13 specifically focused on health information exchange (HIE) systems that have been widely implemented in the United States.(2-14) In general, HIE is a process by which patient-level electronic health information is shared between stakeholders (e.g., clinicians, provider organizations, laboratories), and has been identified as a solution to the fragmentation and isolation of personal health information in healthcare settings.(14) The information shared may include test imaging results, discharge summaries and medication lists. These health records may be used in a variety of settings, including EDs to quickly obtain personal health information.(10) In addition to HIE systems, we identified three studies addressing other models of information exchange systems, including electronic patient care reports,(15;16) and electronic links between EDs and family physicians.(17)

Health information exchange systems

Among the included studies reporting HIE data use in EDs, the percentage of surveyed users accessing HIE systems ranged significantly. Most studies reported few users retrieving data from the system,(3;7;9;11;18) while Bailey et al. and Genes and colleagues both observed more than 20% of authorized personnel making use of the information.(2;8) Regarding the specific data that was accessed in surveyed populations, Johnson et al. found that providers most frequently accessed discharge summaries and test reports,(9) and a survey administered by Shapiro and colleagues found that the most preferred data items included electrocardiograms, discharge summaries and medication lists.(12) Some of the reasons why users chose not to utilize HIE to access patients' health information include the perception that the systems are not user-friendly,(13) the system disrupts workflow,(13) and users were challenged with computer or network difficulties.(5) Additionally, increased utilization of HIE systems was observed when treating patients with comorbidities,(9;18) patients with repeat visits to the ED,(9) patients known to have data in the system, and when both nurses and physicians were authorized to access information.(9)

Although the use of HIE systems was variable, there were several consistent outcomes as a result of their implementation across the studies. For example, Frisse et al. reported that HIE led to a reduction of repeat imaging tests in the ED,(10) and Bailey and colleagues demonstrated that HIE utilization was associated with decreased odds of diagnostic neuroimaging.(2) Similarly, a study by Johnson et al. observed that physician

Box 2: Identification, selection and synthesis of research evidence

We identified research evidence (systematic reviews and primary studies) by searching (in November 2014) Health Systems Evidence (www.healthsystemsevidence.org) and PubMed. We searched Health Systems Evidence on 3 November 2014 by searching for emergenc* in the title and abstract, combined with the following topic categories:

- information and education provision;
- communication and decision-making facilitation);
- health record systems;
- electronic health record;
- other ICT that support individuals who provide care; OR
- ICT that support individuals who receive care.

We supplemented the search for reviews with searches in PubMed using the following targeted strategy: (emergenc*[Title] AND (health record* [Title] OR health information [Title])). We also conducted a related articles search in PubMed using one highly relevant study.(16)

The results from the searches were assessed by one reviewer for inclusion. A document was included if it fit within the scope of the questions posed for the rapid synthesis.

For each review we included in the synthesis, we documented the focus of the review, key findings, last year the literature was searched (as an indicator of how recently it was conducted), methodological quality using the AMSTAR quality appraisal tool (see the Appendix for more detail), and the proportion of the included studies that were conducted in Canada. For primary research (if included), we documented the focus of the study, methods used, a description of the sample, the jurisdiction(s) studied, key features of the intervention, and key findings. We then used this extracted information to develop a synthesis of the key findings from the included reviews and primary studies.

users who provided feedback consistently reported the implementation of HIE as assisting with the prevention of repeat tests and procedures.(9) Other notable outcomes observed among the studies included increased adherence with evidence-based guidelines,(2) overall decreased use of resources,(3) and improved quality of care.(3) Participants in a study by Carr et al. also experienced a mean time savings of 121 minutes for patients with data in the HIE system, and reported improved quality of care for 87% of patients.(3) Finally, Frisse et al. observed that the use of HIE resulted in approximately 200 fewer ED admissions in a two-year period than would have been seen without HIE implementation.(7) Several studies also indicated the potential cost-saving benefits of HIE use,(2;3;6) with Carr et al. estimating a mean savings of nearly \$2,700 over the four-month study period for each patient with information stored in the system.(3)

Other information-exchange systems

Two studies focused on the use of pre-hospital patient care reports (PCRs), which refer to the process of collecting and communicating patient and demographic information in a pre-hospital setting (e.g., by emergency medical response teams) to hospital-based healthcare providers.(15) Efficient and accurate communication of such information is critical given that it guides care received in an ED, and gaps in documentation (e.g., about the physiology of an accident scene) have been found to increase mortality.(15) A survey of emergency physicians' preferences and availability of pre-hospital PCRs at the time of medical decision-making in EDs found that most (52% vs. 17%) preferred electronic PCRs as compared to hand-written PCRs, with the remaining having no preference or only having used one type.(15) In addition, virtually all respondents indicated that PCRs are "very important" (45%) or "important" (43%). However, the same survey revealed that 80% of respondents indicated that electronic pre-hospital PCRs are available less than 50% of the time for medical decision-making.(15) The second study we identified compared the accuracy of physical exam documentation in electronic pre-hospital PCRs to paper PCRs and found a 36% increase in documentation of patient information.(16)

Lastly, another study conducted in Montreal, Canada, evaluated the impact of an electronic link between EDs and family physicians that was designed to allow family physicians to receive detailed patient care reports from EDs.(17) Specifically, the randomized controlled trial evaluated the effects of the electronic link (a web-based standardized communication system - SCS) on the number of repeat visits to the ED within 14 days of initial visit, on duplication of tests and on specialty consultation requests. The study found that the SCS did not reduce the number of repeat visits within 14 or 28 days after initial visit or the number of duplicate requests, and resulted in a significant increase in requests for specialty consultation.(17)

Electronic health records

An electronic health record (EHR) is a repository of patient data in digital form, stored and exchanged securely, and accessible by multiple authorized users. It contains retrospective, concurrent and prospective information, and its primary purpose is to support continuing, efficient and quality integrated health care.(19;20)

We identified one recent medium-quality systematic review that assessed the effects of computerized provider order entry systems on clinical care and work processes in EDs (as an intervention that would draw on EHRs) and 13 studies which evaluated or described the implementation of an EHR or associated measures. These studies assessed: 1) operational measures before and after EHR implementation; 2) patient outcomes associated with EHR use; 3) EHR implementation processes; and 4) interventions that may accompany or supplement EHRs. The systematic review found that computerized provider order entry increased the time spent on computers by nurses and physicians but no significant change in time spent on patient care was observed.(21) In addition, the review found that it resulted in significant decreases in prescribing errors, potential drug events, and prescribing of excessive doses as well as significant increases in guideline compliance, laboratory turnaround and vaccination rates.(21)

Four studies measured outcomes and operational measures before and after EHR implementation. One of these studies demonstrated no statistically significant differences in eight measures of operational performance (including overall length of stay, provider efficiency and patient satisfaction) across 23 community EDs when comparing values before and after EHR implementation.(22) Another study found that initially ED median length of stay increased and patient satisfaction decreased, but then both returned to baseline after eight weeks.(23) The same study found increases in medication administration, laboratory testing, radiologic imaging and ECG rates, with those increases persisting 24 weeks after EHR implementation.(23) The third study found increased rates of overall length-of-stay for both admitted (6-20% longer) and discharged (12-22% longer) patients during EHR implementation. However, approximately three months after implementation, previous steady-state levels were reached for length-of-stay metrics.(24) A fourth study found that EHR implementation required 16% more medical provider hours to manage a 6% increase in patient volume. However, following a five-month adjustment period and controlling for other associated variables, it was found that use of the EHR did not have a significant impact on length-of-stay or triage-to-provider time for the average mid-level acuity discharged patient.(25)

One of the two studies assessing patient-level outcomes associated with EHR use assessed three ED sites and found that patients with EHRs were more likely than controls to have a shorter length-of-stay when admitted to the hospital. The study also found that clinicians ordered fewer laboratory tests and diagnostic procedures for EHR patients compared to controls. Furthermore, the presence of EHR records was not associated with an increase in ED or in-hospital mortality. However, results varied considerably across sites and authors attribute this variability to organizational factors which may have an impact on the effects of an EHR system.(26) Results from another study of three ED sites demonstrated similar findings about in-hospital mortality and laboratory tests, but found that EHRs were not associated with length of stay or amount of procedures performed.(27)

One study described an EHR implementation process, highlighted successes and failures, and provided recommendations for future practice. The ED under study achieved 100% EHR adoption by physicians following implementation, by incentivizing them in various ways. The physician incentives included sharing peer comparisons in use of computerized provider order entry and electronic documentation, sharing clinical examples of how the EHR infrastructure facilitated efficient, quality care, and tying 1% of physicians' yearly compensation to adoption of the EHR system.(28)

The remaining five studies evaluated interventions that may accompany or supplement EHR systems. Focused on reducing the time spent on the computer by emergency physicians, one study tested the efficiency of typed versus voice recognition-based data entry into the EHR system of a hospital in the United States. Voice recognition did not yield a significant difference in the amount of time emergency physicians spent charting or interacting with patients, but significantly fewer workflow disruptions occurred when using the voice recognition software.(29)

Another medical centre developed and tested a search engine for their EHR called Queriable Patient Inference Dossier (QPID). The search engine was designed to facilitate the extraction of information from EHR data banks by adding semantic search and knowledge management layers to an EHR system. It was found that the QPID application was able to complete all 74 searches on each patient with a mean search time of 15+/-seconds. Furthermore, these queries demonstrated high accuracy in extracting information deemed most important to ED physicians.(30)

Another study used a survey to assess physicians' knowledge and attitudes toward clinical decision support (CDS), particularly the incorporation of clinical prediction rules into the EHR. Physicians were given a vignette wherein they had to decide whether or not they would order a cranial computed tomography (CCT). The intervention group was then given CDS, while the control group was given a non-CDS version without the clinical prediction rules. The study found that 70% of the respondents who had initially indicated they would order CCTs changed their decisions to no CCT after receiving CDS, compared to 5% in the control

group. The study also found there to be 75% to 96% agreement across seven favourable statements about CDS, and 60% to 93% agreement across seven favourable statements about approaches to implement CDS into the EHR.(31)

The fourth study evaluated the use of proximity cards designed to simplify information retrieval against an existing EHR system that required manual authentication and patient selection. It was found that access to longitudinal information during patient encounters by clinicians increased from 16% to 40% after the intervention. Additionally, patients were 24% less likely to be admitted to the hospital from the ED after the intervention was implemented.(32)

Lastly, one hospital with an EHR system used health information technologies to identify the most frequently presenting patients and created individualized care plans for them. All providers could then access these care plans through the EHR. It was found that the intervention decreased ED costs by 24%, decreased lab studies ordered by 28%, and reduced the average number of ED visits per patient by 25%. Additionally, the total ED contact time decreased by 39%.(33)

Patient-focused interventions

We found three systematic reviews, one non-systematic review and nine studies assessing patient-focused information and communication technologies for emergency situations. The three systematic reviews addressed decision-support interventions,(34;35) and telephone-based support,(36) and the nine studies addressed mobile personal health records (mPHRs),(37-43) and telephone-based support.(44;45) In addition, the non-systematic review provided an overview of consumer products designed to convey health information in emergencies.(46) This review found the following products:

- engraved jewelry (worn by the owner, provides controlled access to information, one-time cost to the consumer, but cannot be updated once engraved);
- printed identification cards or pamphlets (data typically transcribed by the patient provides controlled access to information, but cannot be updated once printed/embossed);
- universal serial bus (USB) drive (allows for regular data updates that are typically completed by the owner, allows for back-up of data on a personal computer and can be password protected, which can limit efforts to access important information during an emergency);
- web databases (provide large data storage capacity, are easily updated and requires some computer literacy, but requires a healthcare provider to have access to the URL as well as the username and password to access data); and
- toll-free national call centre (provides protected information access using patient-specific codes, and allows healthcare providers to access information without a computer).(46)

Decision support

A recent high-quality review evaluated the use of decision-support interventions designed to communicate information about the risks and benefits of treatment options as part of an initiative to engage patients in healthcare decisions in EDs.(34) Findings from five included studies indicated that decision-support interventions were associated with improvements in patient knowledge and satisfaction with explanations of the care they received. In addition, the two computerized decision-support interventions that were evaluated found that the use of healthcare was reduced with no harms reported as a result of reduced use.(34) The second systematic review, which is recent and of medium quality, evaluated the effectiveness of interventions for low health literacy populations and found several interventions that mitigated the effects of low health literacy on comprehension of health information.(35) These included presenting essential information alone or before nonessential information, presenting numerical information in tables as opposed to in text, and including video with verbal narratives. In addition, there was consistent evidence that multifaceted interventions focused on self-management reduced ED visits and hospitalizations.(35)

Telephone-based support

A recent medium-quality systematic review evaluated primary care service interventions to reduce accident and ED attendances and found that telephone triage was the best evaluated intervention.(36) However, the evidence identified about was not conclusive about whether telephone triage consistently reduced accident and emergency attendance rates and there was a lack of evidence related to clinical outcomes and costs.(36) A paper about the use of PHRs during public health emergencies (PHEs) (37) suggested that integrating PHRs into the telehealth infrastructure could improve the delivery of emergency healthcare by allowing physicians to access patient histories remotely, and by instructing home providers of necessary medical action.(37) It was suggested that this in turn could mitigate patient surges at healthcare facilities.(37) In addition to this paper, we identified two economic evaluations of telephone-based support in emergency situations. The first economic evaluation was conducted in Germany in 2006 and assessed two versions of a telemedical device.(44) The first version is triggered by activation of in-vehicle sensors and sends automatic and real-time messages to the Public Service Answering Point, which includes information such as time of the accident, the exact location, vehicle identification, and the number and severity of injured individuals. The second version contains all the same features as the first, but also includes a telemedicine component that allows emergency physicians from a telemedical centre to assist individuals to perform first aid. The net costs per life year gained were similar for each version (€247,977 for the first and €239,524 for the second, which are equivalent to \$352,127 CAD and \$340,124 CAD at an average 2006 exchange rate of \$1.42 CAD to the Euro) and authors recommended that to be beneficial, the system would need to be implemented in a larger European initiative.(44)

The second economic evaluation assessed the cost-effectiveness of pre-hospital telemedicine electrocardiogram (ECG) triage for a regional public emergency medical service in Italy.(45) The service equips emergency medical service (EMS) crews with an ECG recorder that transmits the results by mobile phone to a regional telemedicine support hub where a cardiologist assesses the results and recommends the best course of action (e.g., discharge from ambulance if readings are normal or taken to the nearest acute cardiac care centre in cases of acute cardiovascular disease). The cost-effectiveness analysis found that of the 109,750 ECGs performed by telemedicine support, the total cost was €1,833,333, and €16.70 per consultation. When compared to standard care, the result was a savings of €8.10 to €8.40 per ECG/consultation, which equated to a total savings of €219,379-€891,759.(45)

Mobile personal health records

Mobile personal health records (mPHRs) allow patients to access health information via the Internet or using telecommunication devices including cellphones, personal digital assistants, and tablet computers.(37) mPHRs enable health care providers to better share health information with patients, and patients can reference this information at any time and share it with other providers, thereby facilitating the continuity of care and preventing duplication of tests.(37)

In terms of accessibility of mPHRs, a survey of patients and visitors in an ED in the United States demonstrated that 82% of participants reported cellphone ownership, and 58% of sampled individuals had cellphone devices in the ED that were capable of receiving health information. Attitudes toward mobile health information were also positive with 58–68% of patients with phones stating that they would like to receive health information on it despite associated fees.(43) Another survey of parents of children arriving at a pediatric ED in Canada showed that 66% of participants and 89% of those with email indicated that they would like to receive information electronically from their child's primary care provider.(38) A survey based in the United States also found that half of respondents expressed interest in receiving only electronic communication from the ED, and one third of respondents indicated interest in having an electronic communication channel between the ED and their primary care provider.(41) Another ED-based survey in the United States found that 96% of respondents indicated that they would want their physician to access all of their health information in a life-threatening emergency. A corresponding survey targeted at their

physicians reported that 83% of providers felt they would access a PHR, while 57% of physicians would only use a PHR if it took less than five minutes to access.(40)

One of the papers we identified provided information about the use of mPHRs as an intervention for obtaining accurate and updated medical information during PHEs.(37) In PHEs, many patients are displaced and healthcare facilities may not be able to access EHRs. In addition, mPHRs may be especially beneficial for specific populations including vulnerable and special populations (non-English speaking persons, mentally unstable patients, etc.), nonresponsive patients who cannot communicate with providers, and children who have been separated from their parents/guardians.(37) By allowing providers to access patient information in a timely manner during PHEs, mPHRs should allow providers to make informed decisions and more accurate diagnoses.(37) To determine a set of minimum health information elements to include in PHRs to be given to first responders during PHEs, another group of researchers convened expert panels and sought professional opinions. The resulting 30 elements were categorized into seven domains: emergency contact, family information, healthcare contact, health profile and past medical history, identification, major allergies/diet restrictions, and medication.(39)

The same paper about the use of mPHRs during PHEs also noted several challenges that may exist in creating a nation-wide repository of personal-health records.(37) While mPHRs do exist (e.g. Microsoft HealthVault, Gazelle, Synchart), there have been no documented cases of PHR usage in disaster responses, thereby making it difficult to identify challenges associated with PHR implementation during PHEs.(37) Furthermore, successful integration of PHRs into a national or provincial/state-based health information technology system requires the difficult task of ensuring standardization across institutions.(37) In addition, while many PHRs are free for patients, institutions interested in implementing PHR systems may face significant costs.(37) There are also legal, regulatory and privacy challenges associated with patient-managed health records, including ownership and control of the information in a PHR, third-party use of consumer data for secondary purposes, and the application of existing laws to PHR systems.(37) Lastly, barriers related to the integration of EHR and PHR systems that were noted include uncertainty about how health-system roles and responsibilities will change as a result of merging two types of information systems, technical challenges to integration, and concerns about liability risk and adverse effects for providers.(37)

To address the challenge presented by ownership, another paper described an emergency access control model for PHRs, wherein an emergency access request triggers several rounds of “online polling” to collect opinions about the request from random physicians registered in the system, as well as from the patient’s emergency contacts. A decision on the release of the health record is then made by using a weighted voting technique.(47)

REFERENCES

1. Canadian Institute for Health Information. Health Care in Canada, 2012: A Focus on Wait Times. Ottawa, Canada: Canadian Institute for Health Information; 2014.
2. Bailey JE, Wan JY, Mabry LM, Landy SH, Pope RA, Waters TM et al. Does Health Information Exchange Reduce Unnecessary Neuroimaging and Improve Quality of Headache Care in the Emergency Department? *Journal of General Internal Medicine* 2013;28(2):176-83.
3. Carr CM, Gilman CS, Krywko DM, Moore HE, Walker BJ, Saef SH. Observational Study and Estimate of Cost Savings from Use of a Health Information Exchange in an Academic Emergency Department. *The Journal of Emergency Medicine* 2014;46(2):250-6.
4. Del Fiol G, Crouch B, Cummins MR. Data standards to support health information exchange between poison control centers and emergency departments. *Journal of the American Medical Informatics Association* 2014;pii: amiajnl-2014-003127. doi: 10.1136/amiajnl-2014-003127. [Epub ahead of print].
5. Finnell JT, Overhage JM. Emergency medical services: The frontier in health information exchange. *AMIA Annual Symposium Proceedings* 2010 November 13;222-6.
6. Friedmann BE, Shapiro JS, Kannry J, Kuperman G. Analyzing workflow in emergency departments to prepare for health information exchange. *AMIA Annual Symposium Proceedings* 2006;926.
7. Frisse ME, Johnson KB, Nian H, Davison CL, Gadd CS, Unertl KM et al. The financial impact of health information exchange on emergency department care. *Journal of the American Medical Informatics Association* 2014;19(3):328-33.
8. Genes N, Shapiro J, Vaidya S, Kuperman G. Adoption of health information exchange by emergency physicians at three urban academic medical centers. *Applied Clinical Informatics* 2011;2(3):263-9.
9. Johnson KB, Unertl KM, Chen Q, Lorenzi NM, Nian H, Bailey J et al. Health information exchange usage in emergency departments and clinics: The who, what, and why. *Journal of the American Medical Informatics Association* 2011;18(5):690-7.
10. Lammers EJ, Adler-Milstein J, Kocher KE. Does health information exchange reduce redundant imaging? Evidence from emergency departments. *Medical Care* 2014;52(3):227-34.
11. Ozkaynak M, Brennan PF. Revisiting sociotechnical systems in a case of unreported use of health information exchange system in three hospital emergency departments. *Journal of Evaluation in Clinical Practice* 2013;19(2):370-3.
12. Shapiro JS, Kannry J, Kushniruk AW, Kuperman G, New York Clinical Information Exchange (NYCLIX) Clinical Advisory Subcommittee. Emergency physicians' perceptions of health information exchange. *Journal of the American Medical Informatics Association* 2007;14(6):700-5.
13. Thorn SA, Carter MA, Bailey JE. Emergency Physicians' Perspectives on Their Use of Health Information Exchange. *Annals of Emergency Medicine* 2014;63(3):329-37.
14. Vest JR, Gamm LD. Health information exchange: Persistent challenges and new strategies. *Journal of the American Medical Informatics Association* 2014;17(3):288-94.
15. Bledsoe BE, Wasden C, Johnson L. Electronic Prehospital Records are Often Unavailable for Emergency Department Medical Decision Making. *Western Journal of Emergency Medicine* 2013;14(5):482-8.
16. Katzer R, Barton DJ, Adelman S, Clark S, Seaman EL, Hudson KB. Impact of implementing an EMR on physical exam documentation by ambulance personnel. *Applied Clinical Informatics* 2012;3(3):301-8.

17. Lang E, Afilalo M, Vandal AC, Boivin JF, Xue X, Colacone A et al. Impact of an electronic link between the emergency department and family physicians: a randomized controlled trial. *CMAJ* 2006;174(3):313-8.
18. Vest J, Jaspersen J, Zhao H, Gamm L, Ohsfeldt R. Use of a health information exchange system in the emergency care of children. *BMC Medical Informatics and Decision Making* 2011;11(1):78.
19. Häyriinen K, Saranto K, Nykänen P. Definition, structure, content, use and impacts of electronic health records: A review of the research literature. *International Journal of Medical Informatics* 2008;77(5):291-304.
20. International Organization for Standardization. Health Informatics - Electronic health record - Definition, scope and context. International Organization for Standardization 2014 December 1;
21. Georgiou A, Prgomet M, Paoloni R, Creswick N, Hordern A, Walter S et al. The effect of computerized provider order entry systems on clinical care and work processes in emergency departments: A systematic review of the quantitative literature. *Ann Emerg Med* 2013;61:644-53.
22. Ward MJ, Landman AB, Case K, Berthelot J, Pilgrim RL, Pines JM. The effect of electronic health record implementation on community emergency department operational measures of performance. *Annals of Emergency Medicine* 2014;63(6):723-30.
23. Ward MJ, Froehle CM, Hart KW, Collins SP, Lindsell CJ. Transient and sustained changes in operational performance, patient evaluation, and medication administration during electronic health record implementation in the emergency department. *Annals of Emergency Medicine* 2014;63(3):320-8.
24. Spellman Kennebeck S, Timm N, Farrell MK, Spooner SA. Impact of electronic health record implementation on patient flow metrics in a pediatric emergency department. *Journal of the American Medical Informatics Association* 2012;19(3):443-7.
25. Mathison DJ, Chamberlain JM. Evaluating the impact of the electronic health record on patient flow in a pediatric emergency department. *Applied Clinical Informatics* 2011;2(1):39-49.
26. Speedie SM, Park YT, Du J, Theera-Ampornpant N, Bershow BA, Gensinger RA et al. The impact of electronic health records on people with diabetes in three different emergency departments. *Journal of the American Medical Informatics Association* 2014;21(e1):e71-e77.
27. Connelly DP, Park YT, Du J, Theera-Ampornpant N, Gordon BD, Bershow BA et al. The impact of electronic health records on care of heart failure patients in the emergency room. *Journal of the American Medical Informatics Association* 2012;19(3):334-40.
28. Propp DA. Successful introduction of an emergency department electronic health record. *Western Journal of Emergency Medicine* 2012;13(4):358-61.
29. Dela Cruz J. Typed versus voice recognition for data entry in electronic health records: Emergency physician time use and interruptions. *The Western Journal of Emergency Medicine* 2014;15(4):541-7.
30. Krishnaraj A, Dutta S, Reisner AT, Landman AB, Choy G, Biddinger P et al. Optimizing emergency department imaging utilization through advanced health record technology. *Journal of the American College of Radiology* 2014;11(6):625-8.
31. Ballard DW, Rauchwerger AS, Reed ME, Vinson DR, Mark DG, Offerman SR et al. Emergency physicians' knowledge and attitudes of clinical decision support in the electronic health record: a survey-based study. *Academic Emergency Medicine* 2013;20(4):352-60.
32. Wilcox AB, Shen S, Dorr DA, Hripsak G, Heermann L, Narus SP. Improving access to longitudinal patient health information within an emergency department. *Applied Clinical Informatics* 2012;3(3):290-300.
33. Stokes-Buzzelli S, Peltzer-Jones JM, Martin GB, Ford MM, Weise A. Use of health information technology to manage frequently presenting emergency department patients. *Western Journal of Emergency Medicine* 2010;11(4):348-53.

34. Flynn D, Knoedler MA, Hess EP, Murad MH, Erwin PJ, Montori VM et al. Engaging patients in health care decisions in the emergency department through shared decision-making: A systematic review. *Academic Emergency Medicine* 2012;19(8):959-67.
35. Sheridan SL, Halpern DJ, Viera AJ, Berkman ND, Donahue KE, Crotty K. Interventions for individuals with low health literacy: A systematic review. *Journal of Health Communication* 2011;16(Supplement 3):30-54.
36. Ismail SA, Gibbons DC, Gnani S. Reducing inappropriate accident and emergency department attendances. *British Journal of General Practice* 2013;63(617):e813-e820.
37. Bouri N, Ravi S. Going mobile: How mobile personal health records can improve health care during emergencies. *JMIR Mhealth Uhealth* 2014;2(1):e8. doi: 10.2196/mhealth.3017.
38. Goldman RD, Macpherson A. Internet health information use and e-mail access by parents attending a paediatric emergency department. *Emergency Medicine Journal* 2006;23(5):345-8.
39. Irmiter C, Subbarao I, Shah JN, Sokol P, James JJ. Personal derived health information: A foundation to preparing the United States for disasters and public health emergencies. *Disaster Medicine and Public Health Preparedness* 2012;6(3):303-10.
40. Menon AS, Greenwald S, Ma TJ, Kooshesh S, Duriseti R. Patient and physician willingness to use personal health records in the emergency department. *Western Journal of Emergency Medicine* 2012;13(2):172-5.
41. Saidinejad M, Teach SJ, Chamberlain JM. Internet access and electronic communication among families in an urban pediatric emergency department. *Pediatric Emergency Care* 2012;28(6):553-7.
42. Zhang Y, Dhileepan S, Schmidt M, Zhong S. Emergency access for online personally controlled health records system. *Informatics for Health & Social Care* 2012;37(3):190-202.
43. Kwon NS, Colucci A, Gulati R, Shawn L, Kasahara Y, El Bakhar A et al. A survey of the prevalence of cell phones capable of receiving health information among patients presenting to an urban emergency department. *Journal of Emergency Medicine* 2013;44(4):875-88.
44. Auerbach H, Schreyogg J, Busse R. Cost-effectiveness analysis of telemedical devices for pre-clinical traffic accident emergency rescue in Germany. *Technology and Health Care* 2006;14(3):189-97.
45. Brunetti ND, Dellegrottaglie G, Lopriore C, Di GG, De GL, Lanzone S et al. Prehospital telemedicine electrocardiogram triage for a regional public emergency medical service: Is it worth it? A preliminary cost analysis. *Clinical Cardiology* 2014;epub.
46. Potini VC, Weerasuriya DN, Lowery-North DW, Kellermann AL. Commercial products that convey personal health information in emergencies. *Disaster Medicine and Public Health Preparedness* 2011;5(4):261-5.
47. Zhang Y, Dhileepan S, Schmidt M, Zhong S. Emergency access for online personally controlled health records system. *Informatics for Health & Social Care* 2012;37(3):190-202.

APPENDICES

The following tables provide detailed information about the systematic reviews and primary studies identified in the rapid synthesis. The ensuing information was extracted from the following sources:

- systematic reviews - the focus of the review, key findings, last year the literature was searched and the proportion of studies conducted in Canada; and
- primary studies - the focus of the study, methods used, study sample, jurisdiction studied, key features of the intervention and the study findings (based on the outcomes reported in the study).

For the appendix table providing details about the systematic reviews, the fourth column presents a rating of the overall quality of each 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).

All of the information provided in the appendix tables was taken into account by the authors in describing the findings in the rapid synthesis.

*Identifying Optimal Ways to Collect, Distill and Provide Efficient Access to
Personal Health Information in Emergency Situations*

Appendix 1: Summary of findings from systematic reviews about optimal ways to collect, distill and provide efficient access to personal health information in emergency situations

Focus of systematic review	Key findings	Year of last search/ publication date	AMSTAR (quality) rating	Proportion of studies that were conducted in Canada
Effect of computerized provider order entry systems on clinical care and work processes in EDs (21)	<p>Overall, computerized provider order entry was associated with an increase in time spent on computers (by nurses or physicians), with no significant change in time spent on patient care.</p> <p>Computerized provider order entry with decision-support systems was related to significant decreases in prescribing errors, potential drugs events, and prescribing of excessive drug dosages. It was also associated with improved guideline compliance, improved laboratory turnaround and increased vaccination rates.</p> <p>The implementation of computerized provider order entry systems has inconsistent effects on the total length of stay in the ED.</p>	2011	5/9 (AMSTAR rating from Program in Policy Decision-making)	Not reported
Primary care service interventions to reduce accident and ED attendances (36)	<p>Of the interventions that were examined in this review (telephone triage systems, community health centres, minor injuries units, in- or 'out-of-hours' primary care provision and GP cooperatives, walk-in clinics, and urgent care centres), telephone triage was the best evaluated intervention. However, there was no conclusive evidence suggesting that any of the interventions consistently reduced accident and emergency attendance rates, and there was a lack of clinical outcomes and cost data in most analyses.</p> <p>Additionally, authors suggest that the extent to which new services are integrated with pre-existing healthcare infrastructure (e.g. access to medical records) is an important determinant of intervention success.</p>	2011	6/9 (AMSTAR rating from Program in Policy Decision-making)	Not reported in detail - 35/38 studies from U.S.A., Germany, New Zealand, and U.K., but Canada not stated
Evaluation of approaches and tools (decision-support interventions) used in engaging patients or patient surrogates in shared decision-making in EDs (34)	<p>The five studies included in the review used decision-support interventions (DSIs) to engage patients or surrogates in decision-making in four different areas: 1) management options in children presenting with small lacerations; 2) options to rehydrate children with vomiting, diarrhea, or both; 3) risk of bacteremia in, and tests and treatment options available for, febrile children; and 4) short-term risk of acute coronary syndrome amongst adults presenting with low-risk nontraumatic chest pain. DSIs were shown to produce a positive effect on a variety of outcomes including: patient knowledge and satisfaction; preferences for level of involvement in decision-making; and eliciting preferences/values about treatment or management options. Two DSIs were also shown to reduce healthcare utilization with no evidence of harm or lack of feasibility.</p> <p>The authors suggest that future studies involve both clinicians and patients in developing DSIs to improve efficacy, adoption and integration into practice.</p>	2010	8/10 (AMSTAR rating from Program in Policy Decision-making)	0/5

McMaster Health Forum

<p>Effectiveness of interventions aiming to improve health outcomes, use of healthcare services, and to reduce disparities in healthcare service use among low health literacy populations (35)</p>	<p>Among the 38 included studies in the review, the authors found various interventions that mitigated the effects of low health literacy on comprehension of health information. These included presenting essential information alone or before nonessential information, presenting numerical information in tables as opposed to in text, and including video with verbal narratives. Additionally, it was demonstrated through consistent evidence that intensive mixed-strategy interventions which focused on self-management were able to reduce ED visits and hospitalizations.</p>	<p>2011</p>	<p>6/9 (AMSTAR rating from Program in Policy Decision-making)</p>	<p>Not reported in detail - 35/38 studies from U.S.A, Germany, New Zealand, and U.K., but Canada not stated</p>
---	--	-------------	---	---

*Identifying Optimal Ways to Collect, Distill and Provide Efficient Access to
Personal Health Information in Emergency Situations*

Appendix 2: Summary of findings from primary studies about optimal ways to collect, distill and provide efficient access to personal health information in emergency situations

Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
Financial impact of health information exchange on ED care (7)	<p><i>Publication date:</i> 2011</p> <p><i>Jurisdiction studied:</i> U.S.A. (Memphis, Tennessee)</p> <p><i>Methods used:</i> Health information exchange (HIE) access encounter records were matched with similar encounter records without HIE access.</p> <p>Outcomes studied: emergency-department (ED) originated hospital admissions, admissions for observation, laboratory testing, head CT, body CT, ankle radiographs, chest radiographs, and echocardiograms.</p>	<p>The study population was drawn from a Tennessee Hospital Association hospital billing database consisting of all ED visit records from the two-year study period (January 2007 to December 2008).</p> <p>The final study population consisted of 15,798 HIE encounter records and 15,798 matched no-HIE encounter.</p>	<p>HIE allows clinicians access to data originating from other sites of care or service. It is defined as a set of services that supports access among parties who are motivated by common interest and governed to ensure that the rights of patients and participants are protected. HIE can be achieved through services provided by one or more solitary health information organization, as well as through direct, point-to-point communication among providers.</p>	<p>HIE data were accessed in 6.8% of ED visits across the 12 EDs studied. The authors suggest that this may have been because the data were not integrated into and presented through the many different electronic health record systems used within the region.</p> <p>HIE use in the direct web access group resulted in 191 fewer admissions than would have been predicted to occur without HIE use, while HIE use at the mixed access site resulted in 221 fewer admissions.</p> <p>Total annual societal savings were approximately US\$1.95 million. Annual operating costs during the study period were approximately US\$880,000. The net societal savings were therefore approximately US\$1.07 million.</p> <p>Reduced admissions from EDs account for 97.6% of the total savings.</p>
Cost-effectiveness analysis of telemedical devices for pre-clinical traffic accident emergency rescue in Germany (44)	<p><i>Publication date:</i> 2006</p> <p><i>Jurisdiction studied:</i> Germany</p> <p><i>Methods used:</i> Two versions of a telemedical device were compared with the baseline in Germany (i.e. non-use of telemedicine in emergency rescues). The analysis was based on retrospective statistical data covering a period of 10 years with discounted costs not adjusted for inflation.</p> <p>Outcome measured: “life years gained” by reducing therapy-free intervals and improvements in first-aid provided by laypersons.</p>	<p>The main sources of data include publicly available official and administrative statistics, studies, special evaluations and databases. The year 2002 was used as the reference year, and certain assumptions and estimates were made (e.g annual sales volume of telemedical devices), due to the uncertainty of the data.</p>	<p>Equipment #1: “Automatic Accident Alert”. It sends an automatic real-time message to the Public Service Answering Point including time of accident, exact location, vehicle identification and the number and severity of injured persons of the incident triggered by the activation of in-vehicle sensors.</p> <p>Equipment #2: “Full Equipment”. It has the same features as the Automatic Accident Alert, but has an additional “telemedicine for laypersons” component. This allows emergency physicians from a telemedical centre to assist laypersons in performing first aid.</p>	<p>At baseline assumptions, introducing “Automatic Accident Alert” is associated with net costs per life year gained of €247,977. Similarly, the “Full Equipment” version of the device results in estimated net costs of €239,524 per life year gained.</p> <p>Examinations of the best and worst case scenarios suggest that decreasing system costs would disproportionately reduce total costs, and that rapid market penetration would significantly increase the system’s benefit, while reducing costs. Authors recommend that it would be more realistic for the device to be implemented as part of a larger European coordinated initiative.</p>

McMaster Health Forum

Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
<p>Cost-effectiveness of pre-hospital telemedicine electrocardiogram triage for a regional public emergency medical service (45)</p>	<p><i>Publication date:</i> 2014</p> <p><i>Jurisdiction studied:</i> Apulia, Italy</p> <p><i>Methods used:</i> Costs and rates for the analysis were retrieved from official local government reports.</p> <p>Cost savings were calculated by subtracting the cost of pre-hospital triage with telemedicine support from the cost of conventional ED triage (ECG and consultation by a cardiologist). Given the different possible reimbursement codes, the cost of conventional ED triage ranged from a minimum to a maximum.</p> <p>The cost for a single diagnosis was calculated by dividing the total cost by the number of specific diagnoses found at pre-hospital triage.</p>	<p>Patients who had dialled 1-1-8 during 2012 and underwent pre-hospital field triage with a telemedicine ECG.</p>	<p>The telephone number 1-1-8 is the free Italian public service for general medical or surgical emergencies, whose aim is an immediate diagnosis of critical diseases to avoid ED delay to diagnosis.</p> <p>All regional 1-1-8 emergency medical service (EMS) crews are equipped with an ECG recorder which records and transmits an ECG by mobile phone to a unique regional telemedicine support hub. Here, a cardiologist is available 24/7, promptly reads the ECGs and advises on the best course of action.</p> <p>In case of normal findings, patients are discharged from the ambulance and not transported at all. In case of acute CVD (acute coronary syndrome, severe arrhythmias), patients are immediately taken to the nearest acute cardiac care unit or catheterization laboratory for appropriate treatment.</p>	<p>From January 1 through December 31, 2012, regional EMS performed 109,750 ECGs by telemedicine support. The total cost reimbursed by the Apulia regional healthcare system for telemedicine triage was €1 833,333, with a €16.7 cost per single ECG/consultation.</p> <p>Given a cost for similar health performance taken from a regional rate list of €24.80 to €55.20, the saving was €8.10 to €38.40 per ECG/consultation (total savings, €891,759.50 to €4 219,379.50).</p>
<p>Identification and assessment of data standards to support health information exchange between poison control centres and EDs (4)</p>	<p><i>Publication date:</i> 2014</p> <p><i>Jurisdiction studied:</i> U.S.A.</p> <p><i>Methods used:</i> HIE between poison control centres (PCC) and EDs were mapped to clinical documents specified in the Health Level Seven (HL7) Consolidated Clinical Document Architecture (C-CDA).</p>	<p>Random sample of 120 poison exposure cases involving communication between Utah Poison Control Center and an ED.</p>	<p>Identify and assess a set of clinical data standards to support the exchange of electronic health information between PCCs and EDs.</p> <p>There was a focus on the standards necessary for electronic health record (EHR) Meaningful Use certification in the U.S., in particular the HL7 C-CDA Standard.</p>	<p>It was found that health information exchange between PCCs and EDs could be supported by four C-CDA document types including Consultation Note, History & Physical Note, Progress Note, and Discharge Summary.</p> <p>The C-CDA standards for PCC-ED health information exchange approach has not yet been validated in actual system implementations.</p>

Identifying Optimal Ways to Collect, Distill and Provide Efficient Access to Personal Health Information in Emergency Situations

Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
	Information types routinely exchanged in PCC-ED telephone conversations were mapped to C-CDA sections.			
Benefits of mobile personal health records (mPHRs) during emergencies (37)	<p><i>Publication date:</i> 2014</p> <p><i>Jurisdiction studied:</i> U.S.A.</p> <p><i>Methods used:</i> Details the benefits and challenges associated with mPHR use.</p>	N/A	mPHRs allow patients to access health information via the internet or telecommunication devices including cellphones, personal digital assistants, and tablet computers.	<p>Proven Benefits mPHRs enable healthcare providers to better share health information with patients. Patients can reference this information at any time and share it with other providers, thereby facilitating the continuity of care and preventing duplication of tests.</p> <p>Existing mPHRs <i>Microsoft HealthVault</i> allows users to create medical records specifically to inform first responders or for unexpected hospital visits. <i>Gazelle</i> is an app which allows smartphone users to receive and share lab results. <i>Synchart</i> is a web-based PHR service which stores patients' health information and can grant clinicians access to this information in an emergency.</p> <p>Potential Benefits mPHRs may be one of few ways to obtain accurate and updated medical information during public health emergencies (PHEs) when many patients are displaced or healthcare facilities are not able to access EHRs. During PHEs, mPHRs may be especially beneficial for specific populations including vulnerable and special populations (non-English speaking persons, mentally unstable patients, etc.), nonresponsive patients who cannot communicate with providers, and pediatric populations who have been separated from their parents/guardians. In allowing providers to access patient information in a timely manner, mPHRs allow providers to make informed decisions and more accurate diagnoses during PHEs.</p> <p>Integrating PHRs into the telehealth infrastructure could improve the delivery of emergency healthcare by allowing physicians to access patient histories remotely and instruct home providers of necessary medical action. This in turn can mitigate patient surges at healthcare facilities.</p> <p>Challenges There are no documented cases of PHR usage in disaster response, thereby making it difficult to identify challenges</p>

McMaster Health Forum

Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
				<p>associated with PHR implementation during PHEs.</p> <p>There is a lack of interoperability between EHR and PHR systems, which hinders the flow of information. Clinicians may lack the ability to verify the integrity and accuracy of patient-entered data.</p> <p>Standardization across institutions is important for the successful integration of PHRs into a national health information technology system.</p> <p>From the patient perspective, many PHRs are free or have a nominal download fee. However, institutions looking to implement PHR systems may face significantly higher costs (one study demonstrated an estimated cost of \$450,000).</p> <p>There are legal, regulatory and privacy challenges associated with patient-managed health records. Specific challenges include ownership and control of the information in a PHR, third party use of consumer data for secondary purposes, and the application of existing laws to PHR systems.</p> <p>There are barriers to the integration of EHR and PHR systems, including uncertainty about how health system roles and responsibilities will change as a result of the merge, technical challenges to integration, and concerns about liability risk and adverse effects for providers.</p> <p>Recommendations</p> <ol style="list-style-type: none"> 1) Policymakers should establish meaningful use criteria to govern the use of PHRs and incentivize providers to use them. 2) Relevant federal institutions should define guidelines for the integration of PHRs and mobile portals into mainstream healthcare. 3) A federal agency should adopt a regulatory role and create a legal framework for mPHRs. 4) All PHR and mPHR system providers should identify and communicate to consumers how their health information will be protected. 5) Policymakers should identify new ways to support the development of health information technologies.

Identifying Optimal Ways to Collect, Distill and Provide Efficient Access to Personal Health Information in Emergency Situations

Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
<p>Typed versus voice recognition for data entry in an electronic health record (29)</p>	<p><i>Publication date:</i> 2014</p> <p><i>Jurisdiction studied:</i> U.S.A.</p> <p><i>Methods used:</i> Prospective observational data was collected at two academic teaching hospital EDs – one using an EHR with typed data entry and the other with voice recognition capabilities.</p>	<p>Of the two community teaching hospital EDs, the first used Cerner FirstNet EHR (Cerner Corporation, North Kansas City, MO, U.S.) with typed data, and the second used Meditech EHR (Meditech, Westwood, MA, U.S.) with voice recognition assisted dictation software (Dragon, Nuance, Burlington, MA, U.S.).</p>	<p>Voice recognition software is tested as an intervention to reduce the time spent by the emergency physician (EP) on the computer, and increase the time spent on patient interaction.</p>	<p>The intervention did not yield a significant difference in the amount of time EPs spent charting or interacting with patients. Authors highlight that while EPs spent less time dictating at site 2 than EPs at site 1 spent on traditional charting, the time savings were spent on correcting errors in dictated charts.</p> <p>There were significantly fewer workflow interruptions with the voice recognition data entry EHR (site 2). One proposed explanation suggests that when physicians are dictating they are not interrupted and are allowed to finish.</p>
<p>Impact of EHR implementation on community ED operational measures of performance (22)</p>	<p><i>Publication date:</i> 2014</p> <p><i>Jurisdiction studied:</i> U.S.A.</p> <p><i>Methods used:</i> Retrospective before/after analysis of 23 EDs from a single management group that experienced EHR implementation.</p> <p>Four length-of-stay measures (arrival to provider, admitted, discharged, and overall length of stay), and four measures of operational characteristics (left before treatment complete, significant returns, overall patient satisfaction, and provider efficiency) were assessed as outcomes.</p>	<p>Data was collected from an enterprise data warehouse created by Schumacher Group, a multi-state management group that provides emergency care in 27 states. Each facility transmits electronic and scanned paper charts daily to a centralized location for storage in an internal management system.</p>	<p>An ED EHR system was implemented in the aforementioned 23 ED facilities.</p> <p>An ED EHR is specifically designed to manage data and workflow in order to optimize ED patient care and operations, including patient registration and tracking, clinical documentation, computerized provider order entry, results reporting, and discharge management.</p>	<p>There were no statistically significant differences in eight measures of operational performance in the 23 community EDs when comparing between a previous baseline and a post-implementation steady-state period.</p>
<p>Effect of health information exchange on redundant imaging in EDs (10)</p>	<p><i>Publication Date:</i> 2014</p> <p><i>Jurisdiction studied:</i> U.S.A.</p> <p><i>Methods used:</i> This retrospective analysis of the</p>	<p>Sample: 310,173 hospital-based ED visits between 2007-2010 in Florida and California:</p> <ul style="list-style-type: none"> • with available Health 	<p>HIE involves electronic sharing of health-related information, including test and imaging results, discharge summaries and medication lists.</p>	<p>HIE reduces repeat imaging among patients visiting multiple EDs, with significant reductions across all three imaging modalities studied.</p> <p>There was no evidence across any of the imaging modalities that HIE reduces repeat imaging among patients visiting</p>

McMaster Health Forum

Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
	<p>impact of HIE participation on repeat imaging (specifically CT, ultrasound and chest x-ray) compared 37 EDs that initiated HIE participation during the study period to 410 EDs that did not participate in HIE during the same period.</p>	<p>Information and Management Systems Society data;</p> <ul style="list-style-type: none"> • with a second visit to an unaffiliated ED by the same patient within 30 days of first visit; • with an imaging study done on the first visit; and • that initiated HIE participation OR a comparison ED that never participated in HIE during the study period. 	<p>A repeat image for a given patient was defined as the same study in the same body region performed within 30 days at unaffiliated EDs.</p>	<p>the same ED. Authors highlight that this discrepancy suggests that the study findings reflect the effect of access, through HIE, to previous clinical information from unaffiliated EDs.</p> <p>If all hospital-based EDs in California and Florida participated in HIE, over \$2.9 million in payments could be avoided annually over the three imaging modalities. Nationally, if all EDs participated in HIE, an estimated \$19 million in savings could be reaped annually across these three procedures.</p>
<p>Optimizing ED imaging utilization through advanced health record technology (30)</p>	<p><i>Publication date:</i> 2014</p> <p><i>Jurisdiction studied:</i> U.S.A.</p> <p><i>Methods used:</i> A custom QPID (Queryable Patient Inference Dossier) ED application was developed, which included a set of 74 query topics deemed important for screening and management by ED physicians.</p> <p>The performance of each of the 74 queries was validated by designing a tool that performed an automated QPID search on all 74 queries included in the dashboard for each of the 500 patients.</p>	<p>The study sample included 500 consecutive adult patients, who presented to an urban academic medical centre in January 2011. All clinical documents containing both structured data and unstructured data in the EHR were reviewed for each patient.</p>	<p>QPID is a programmable health record intelligence system, which aims to facilitate the extraction of information from EHR data repositories. It does so by adding semantic search and knowledge management layers to an EHR system.</p> <p>Advanced integration of EHR data, as done through systems like QPID, offers several advantages over manually searching through EHR systems:</p> <ol style="list-style-type: none"> 1) rapid searches of the entire EHR on the basis of a clinical question; 2) the automation of complex, structured queries on the basis of clinical service schedule or care unit census; 3) easy integration of search results into a web browser or other software application; 	<p>A large set of predefined, automated EHR queries using the QPID application can be carried out rapidly - the mean search time for QPID to complete all 74 searches on each patient was 15 +/- 5 seconds.</p> <p>These queries show high accuracy in identifying information deemed most important to ED physicians. For structured data, the QPID queries demonstrated a pooled calculated positive-predictive value (PPV) of 87% (range, 67%-94%) and a negative-predictive value (NPV) of 86% (range, 50%-94%). For unstructured data, the QPID queries demonstrated a pooled calculated PPV of 75% (range, 25%-94%) and an NPV of 88% (range, 67%-94%).</p>

Identifying Optimal Ways to Collect, Distill and Provide Efficient Access to Personal Health Information in Emergency Situations

Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
			<p>and</p> <p>4) the ability to measure reproducible context-specific stimulus-response patterns of clinicians responding to presentation of EHR information.</p>	
<p>Emergency physicians' perspectives on their use of health information exchange (13)</p>	<p><i>Publication date:</i> 2014</p> <p><i>Jurisdiction studied:</i> U.S.A.</p> <p><i>Methods used:</i> Qualitative study using grounded theory principles. Data were collected using unstructured interviews.</p>	<p>15 emergency physicians from four urban adult EDs that had HIE access for four years.</p>	<p>HIE is the electronic sharing of information across healthcare organizations</p>	<p>Emergency physicians generally felt that HIE disrupted their workflow and many found that it was not user-friendly.</p> <p>They also identified improvements that would be necessary to increase the frequency of HIE use, which include:</p> <ol style="list-style-type: none"> 1) correcting design flaws, such as too many clicks, too much scrolling; 2) standardizing information in HIE and ensure that data submissions from participating organizations are consistent; 3) providing physician access during credentialing; 4) integrating HIE, EHR local, and state pharmacy systems; 5) providing functional portable devices; 6) ensuring speed when accessing HIE information; 7) providing physician champions, education and hands-on training sessions; 8) designing HIE/EHR alert systems for patients with HIE records; 9) including patient catchment area clinics, ambulatory centres, physician offices, psychiatric centres, and radiology clinics; and 10) seeking emergency physician feedback for HIE design and function.
<p>Cost savings from use of a health information exchange in an academic ED (3)</p>	<p><i>Publication Date:</i> 2013</p> <p><i>Jurisdiction studied:</i> U.S.A.</p> <p><i>Methods used:</i> Observational, prospective study using a voluntary, anonymous survey among clinicians at an urban academic ED.</p>	<p>Over the four-month period from August 2011 to December 2011, clinicians in the ED were prompted to complete the survey every time they logged onto the HIE interface to obtain patient information. Surveys were</p>	<p>HIEs were developed and funded to support better coordination of care, by allowing information sharing between doctors' offices, hospitals, and across healthcare systems.</p>	<p>Cost analysis based on observational data from clinician reports demonstrated decreased use of resources as a result of having access to a regional HIE.</p> <p>Estimated savings of \$283,477.69 (mean savings of \$2699.77 per patient who had information in the HIE) during the four-month study period was attributed mainly to avoided radiologic studies and admissions. Clinicians also reported improved quality of care for 86.7% of their patients, as well as a mean time savings of 120.8 minutes.</p>

McMaster Health Forum

Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
	<p>Cost savings were estimated by multiplying the number of services the clinicians reported they avoided through use of the HIE by the costs of those services at the facility.</p>	<p>completed by the clinicians caring for 13.8% of patients whose information was accessed through the HIE. A total of 105 patients formed the sample upon which this analysis was based.</p>		
<p>Transient and sustained changes in operational performance, patient evaluation, and medication administration during electronic health record implementation in the ED (23)</p>	<p><i>Publication Date:</i> 2013 <i>Jurisdictions studied:</i> U.S.A. (Cincinnati, OH) <i>Methods used:</i> Longitudinal analysis of electronic data from an academic ED between May 2011 and November 2011. Outcomes measures: length of stay, use of diagnostic testing, medication administration, radiologic imaging, and patient satisfaction.</p>	<p>All patient presentations to the ED between May 15, 2011, and November 26, 2011, were included.</p>	<p>A comprehensive electronic health record was implemented as part of a hospital-wide system on June 12, 2011. At the same time, voice-recognition software was installed for physician documentation. Decision support for laboratory testing and radiologic imaging was not included in the EHR software, nor was it available in the previous paper-based system.</p>	<p>Median length of stay increased transiently but returned to baseline after four to eight weeks. Patient satisfaction decreased transiently after the implementation of EHR, but returned to baseline after eight weeks. Medication administration per 100 patients almost doubled after implementation, and this increase was sustained throughout the 24 weeks after EHR implementation. The observed increases in laboratory testing (225.4 to 374.5 tests per 100 patients), radiologic imaging, and ECG rates (from 23.7 to 35.7 per 100 patients) persisted throughout the entire study period.</p>
<p>The impact of electronic health records on people with diabetes in three different EDs (26)</p>	<p><i>Publication Date:</i> 2014 <i>Jurisdiction studied:</i> U.S.A. <i>Methods used:</i> Retrospective observational studies of patients in three EDs were conducted comparing patients with prior information in the EHR to those without such information. Outcomes measured included differences in hospitalization, mortality, length of stay (LOS), and numbers of ED orders for tests, procedures and medications.</p>	<p>Patients visiting the ED from June 1, 2006 to December 31, 2007 in one ED, and from June 1, 2006 to March 31, 2009 in the other two EDs. Limited use data were extracted for all patients 18 years or older with an International Classification of Disease code that indicated Type I or II diabetes, and/or diseases associated with diabetes.</p>	<p>If there was evidence of an encounter in the health system's EHR before the index visit the patient was classified as EHR. Otherwise patients were classified as control.</p>	<p>EHR patients at two of the three sites were more likely than controls to have a shorter LOS when admitted to the hospital. This finding was observed at the third site as well, but was not statistically significant. Clinicians in two of the three EDs ordered fewer laboratory tests and diagnostic procedures for EHR patients compared to controls. The presence of EHR records was not associated with a negative change in either ED or in-hospital mortality. Results varied considerably from site to site. Site A demonstrated a lower hospitalization rate, shorter hospital LOS and fewer orders for laboratory tests, diagnostic procedures, and medications for EHR patients. Site B only exhibited lower rates of laboratory test orders for EHR patients. Site C showed a longer ED LOS,</p>

Identifying Optimal Ways to Collect, Distill and Provide Efficient Access to Personal Health Information in Emergency Situations

Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
				<p>a shorter hospital LOS, and fewer diagnostic procedures for EHR patients.</p> <p>Authors suggest that variability across sites may be indicative of important organizational factors that have an impact on the effects of an EHR.</p>
<p>Emergency physicians' knowledge and attitudes of clinical decision support in the electronic health record (31)</p>	<p><i>Publication date:</i> 2013</p> <p><i>Jurisdiction studied:</i> U.S.A.</p> <p><i>Methods used:</i> Self-administered electronic cross-sectional survey.</p> <p>The two-part survey included: 1) an experimental vignette to test the potential effect of EHR clinical decision support (CDS) on a hypothetical clinical decision; and 2) questions assessing general EHR knowledge of clinical prediction rules and attitudes toward their incorporation into the EHR..</p>	<p>Eligible participants: the 499 salaried EPs practising within 20 EDs in the Kaiser Permanente Northern California integrated healthcare delivery system</p>	<p>The tested intervention is clinical decision support (CDS), particularly the incorporation of clinical prediction rules into the EHR.</p> <p>Randomly assigned respondents completed one of two questionnaires, both including a hypothetical vignette and self-reported knowledge of and attitudes about CDS. One vignette version included CDS, and the other did not (NCDS). The vignette described a scenario in which a cranial computed tomography (CCT) is not recommended by validated prediction rules (the Pediatric Emergency Care Applied Research Network [PECARN] rules). In both survey versions, subjects responded first with their likely approach to evaluation and then again after receiving either CDS (the PECARN prediction rules) or no additional support.</p>	<p>Initially, 25% of respondents to each questionnaire indicated they would order CCTs. After receiving CDS, 70% of respondents who initially would order CCTs changed their decisions to no CCT versus 5% with the NCDS version.</p> <p>24% reported having never heard of the clinical prediction rules, 36% knew of the rules but not their specifics, and 40% did not know the rules or their specifics.</p> <p>There was 75% to 96% agreement across seven favourable statements about CDS.</p> <p>There was 60% to 93% agreement across seven favourable statements about approaches to implement CDS in the EHR.</p> <p>EPs with fewer than five years of experience were more likely to report knowing the details of clinical prediction rules compared with EPs with tenure of five or more years.</p> <p>In the initial vignette responses (across both versions), those with fewer than five years of experience were more likely to order CCTs than physicians with 15 or more years of ED tenure.</p> <p>In the initial vignette responses (across both versions), those who reported knowing the specifics of the clinical prediction rules were less likely to order CCTs.</p>
<p>Prevalence of cellphones capable of receiving health information among patients presenting to an urban ED (43)</p>	<p><i>Publication date:</i> 2012</p> <p><i>Jurisdiction studied:</i> U.S.A.</p> <p><i>Methods used:</i> Cross-sectional study</p>	<p>Random sample of patients and visitors visiting an urban, academic medical centre ED from June 2009 to February 2010.</p> <p>Inclusion criteria: age</p>	<p>Not applicable</p>	<p>82% of participants reported cellphone ownership and 90% of these individuals had the phone in the ED.</p> <p>58% of sampled individuals had cellphone devices in the ED that were capable of receiving health information by any of these modalities. 41% of these individuals wished to receive health information with at least one available</p>

McMaster Health Forum

Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
		<p>18 years or more and ability to provide informed consent.</p> <p>Exclusion criteria: medically or psychologically unstable, unable to provide informed consent, previously surveyed, or were a visitor of someone surveyed.</p>		<p>service.</p> <p>58–68% of patients with phones stated they would like to receive health information on it, despite associated fees.</p>
<p>Introduction of an ED electronic health record (28)</p>	<p><i>Publication date:</i> 2012</p> <p><i>Jurisdiction studied:</i> U.S.A.</p> <p><i>Methods used:</i> Description of EHR implementation</p>	<p>Not applicable</p>	<p>Not applicable</p>	<p>The department achieved 100% EHR adoption by its EPs. Strategies used to incentivize physicians' adoption included:</p> <ul style="list-style-type: none"> • sharing of regular non-blinded peer comparisons in use of computerized provider order entry and electronic documentation; • regular sharing of clinical examples of how the new electronic infrastructure has assisted efficient, high quality care; and • approximately 1% of physician yearly compensation was at risk per physician during the initial roll out, based on relative adoption of the EHR system. <p>Findings/recommendations included:</p> <ul style="list-style-type: none"> • decision support must have contextual relevance in order to avoid alert fatigue; • more time spent on the computer could be perceived by patients as nonprofessional time spent by the provider (the computer focus could also compromise the face-to-face provider team communication); • the overall time spent on documentation increased, and varied based on clinician's preference for various features of the EHR system (e.g. voice recognition, time-saving macros, etc.); and • integrating voice recognition within the EHR system allowed for quick and accurate transcription, relative to typing speed.
<p>Patient and physician willingness to use personal health records in the ED (40)</p>	<p><i>Publication date:</i> 2012</p> <p><i>Jurisdiction studied:</i> U.S.A.</p>	<p>Patients over 18 who were medically stable presenting to the Stanford University</p>	<p>A personal health record (PHR) is a patient-centric and patient – controlled tool that is used to manage health information. It</p>	<p>78% of respondents were willing to have all of their health information accessible on the internet.</p> <p>In a life-threatening emergency, 96% of respondents wanted the physician to access all of their health</p>

Identifying Optimal Ways to Collect, Distill and Provide Efficient Access to Personal Health Information in Emergency Situations

Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
	<p><i>Methods used:</i> Observational study, cross-sectional surveys were distributed to patients in an academic ER, and each patient survey was linked to a survey completed by their treating physician.</p>	<p>Medical Center ED between April 2008 and November 2008. Their treating physicians were then surveyed to gauge their willingness to use the PHR.</p>	<p>offers more complete medical information by centralizing patients' medical histories, different physician encounters, and various evaluations and treatments.</p>	<p>information.</p> <p>68% would upload their information only if they did not have to enter the information themselves.</p> <p>Less than 10% wanted a software company, an insurance company, or the government to control their health information, while more than 50% wanted a hospital to control that information.</p> <p>Respondents with multiple medical problems, life threatening allergies, a primary doctor, and private insurance were just as likely to use a PHR as those without these characteristics.</p> <p>There was no significant relationship between the patient's perceived severity of disease and their willingness to use a PHR.</p> <p>83% of providers felt they would access it. 57% of physicians would only use a PHR if it took less than five minutes to access.</p>
<p>Personal derived health information for disasters and public health emergencies (39)</p>	<p><i>Publication date:</i> 2012 <i>Jurisdiction studied:</i> U.S.A.</p> <p><i>Methods used:</i> Multi-phased, mixed methods approach. Combined expert panels, surveys of experts, and examinations of existing/past efforts, were conducted to derive a set of minimum health information elements to include in a personal health record (PHR) to be given to first responders during the first few days of a disaster/public health response to improve clinical health outcomes.</p>	<p>Expert Panel: 116 members from federal organizations, public health associations, health information technology organizations, emergency preparedness officials, and content experts in the fields of aging, chronic diseases and disparities. Databases consulted: MEDLINE-PUBMED, PubMed Central, Free Medical Journals, and the Directory of Open Access Journals.</p>	<p>Not applicable</p>	<p>Out of 676 existing health information elements, 30 essential elements were identified as necessary to include in a PHR for access by first responders during a public health emergency. These elements were categorized into seven domains: identification, emergency contact, healthcare contact and health profile – past medical history, medication, major allergies/diet restrictions, and family information.</p>

McMaster Health Forum

Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
HIE capacity to reduce unnecessary neuroimaging, increase adherence with evidence-based guidelines, and decrease costs in evaluating headaches in the ED (2)	<i>Publication date:</i> 2013 <i>Jurisdiction studied:</i> U.S.A. <i>Methods used:</i> Longitudinal data analysis using electronic health record data	Patients presenting to a Memphis metropolitan area ED with headache two or more times between August 1, 2007 and July 31, 2009 (total repeat-patient-visits (n)=2102.; total patients=1,252)	The HIE connected two regional clinic systems and 15 major adult hospitals. Authorized ED personnel were able to access patient records during the time period in which the patient was in the ED.	Of all patient-visits, 69.8% received neuroimaging. The HIE system was accessed for 21.8% of ED patient-visits, and HIE was associated with decreased odds of diagnostic neuroimaging (odds ratio (OR) 0.38; 95% confidence interval (CI) 0.29-0.50) and increased adherence with evidence-based guidelines (OR 1.33; 95% CI 1.02-1.73). The use of HIE was not found to be significantly associated with changes in cost.
Exploration of social systems' effects on Health Information Exchange (HIE) use (11)	<i>Publication date:</i> 2013 <i>Jurisdiction studied:</i> U.S.A. <i>Methods used:</i> Direct observation of and short interviews with clinicians in three EDs	184 patient care episodes were documented in the observations, and 13 interviews with clinicians were conducted. These were at three Midwestern EDs in the U.S.A. which are located in the same emergency medical service region.	The HIE system used was implemented in March 2008 in the three EDs. It is available for use by clinicians but not required.	Of the 184 patient care episodes documented by the observations, the HIE system was used 5% of the time. The authors noted that the HIE system was used mostly for patients with specific characteristics (typically chronic pain as a chief complaint), and it was often being used to confirm patient statements.
Use of HIE for the emergency care of children (18)	<i>Publication date:</i> 2011 <i>Jurisdiction studied:</i> U.S.A. <i>Methods used:</i> Analysis of user logs of a HIE system's log files.	ED encounters among patients less than 18 years of age between January 1, 2006 and June 30, 2009 in the Integrated Care Collaborative of Central Texas' master patient index/clinical data repository (i.e., I-Care) (n=17,9445 from 11 EDs).	Usage of the HIE was classified as "no system usage", "basic system usage" (i.e., user identification of a patient and viewing a single screen containing a summary of recent encounters), or "novel system usage" (i.e., a user session including additional screen views beyond the initial patient selection screen and summary of recent encounters) using patterns of HIE system user logs.	The HIE system was accessed by users for 15,586 encounters (8.7%). Increasing patient comorbidity was found to be associated with 5% higher odds of basic usage and 15% higher odds for novel usage. In the face of time constraints, and for patients who had not been to the visited location in the previous 12 months, the odds of basic system usage were found to be lower (i.e., odds of usage were demonstrated to be 35% lower on busier than average days in the ED).
Evaluation of access to longitudinal patient information after implementation of an EHR (32)	<i>Publication date:</i> 2012 <i>Jurisdiction studied:</i> U.S.A. <i>Methods used:</i> Retrospective analysis of a patient tracking system	Patient-visits to facilities within the Intermountain Healthcare integrated healthcare delivery system during the control period (n=10,928), and during	The control period (January 1 – April 30, 2004) was chosen because the patient tracking system required manual authentication and patient selection to access longitudinal patient health information at this time. During the	Access to longitudinal information during patient encounters by clinicians increased from 16% to 40% after the intervention. Additionally, patients were 24% less likely to be admitted to hospital from the ED after the intervention was implemented.

Identifying Optimal Ways to Collect, Distill and Provide Efficient Access to Personal Health Information in Emergency Situations

Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
		the intervention period (n=11,415).	intervention period (January 1 – April 30, 2005), clinicians were able to access patient records through a simplified process with proximity card.	
Characteristics, advantages, disadvantages and costs associated with consumer products designed to convey health information in emergencies (46)	<p><i>Publication date:</i> 2011</p> <p><i>Jurisdiction studied:</i> U.S.A.</p> <p><i>Methods used:</i> Searches for candidate vendors conducted through Google and print ads from <i>American Association of Retired Persons (AARP): The Magazine</i></p>	Vendors offering personal health records to the general public (n=39)	All vendors employed one or more of five particular media (i.e., engraved jewelry, printed identification cards or pamphlets, a universal serial bus (USB) drive, web databases, or a toll-free national call centre).	The available media offering personal health records differed significantly with respect to their capacity and accessibility. They also differed in their cost to the consumer, ranging from a one-time expense of \$3.50 to an annual fee of \$200. Engraved jewelry is worn by the owner (i.e., controlled access to information), puts forth a one-time cost to the consumer, and cannot be updated once engraved. Wallet cards typically have data transcribed by the patient (i.e., only as accurate as patient’s knowledge of illnesses), offer controlled access by the owner, and cannot be updated once printed/embossed. USB drives allow for regular data updates (often by the owner, however), can sometimes be backed up on a personal computer, and may be password protected (although this may hinder efforts to access data in an emergency). Web databases offer large information storage capacity, can be easily updated, require some computer literacy, and require a healthcare provider to have the site’s URL and patient’s username/password to access data. Call centres offer protected information access using patient-specific codes, and allow access to information by healthcare providers without a computer.
Effects of EHR on clinical care outcomes (27)	<p><i>Publication date:</i> 2012</p> <p><i>Jurisdiction studied:</i> U.S.A.</p> <p><i>Methods used:</i> Retrospective, cross-sectional, observational study</p>	Adult patients with congestive heart failure visiting any of three metropolitan EDs over a 19-month period (i.e., June 1, 2006 to December 31, 2007) (n=5,166)	Patients with information in the EHR prior to ED presentation were considered “internal” (n=3,974), and those without were in the “external” group (n=1,192)	At two of the EDs, internal patients had lower odds of mortality if hospitalized (OR 0.55; 95% CI 0.38 to 0.81 and OR 0.45; 95% CI 0.21 to 0.96), fewer laboratory tests during their ED visit (-4.6%; 95% CI -8.9% to -0.1% and -14%; 95% CI -19.5% to -8.1%), and less medications (-33.6%; 95% CI -38.4% to -28.4% and -21.3%; 95% CI -33.2% to -7.3%). At one of these two EDs, internal patients had lower odds of hospitalization as well (OR 0.37; 95% CI 0.22 to 0.60). At the third ED, the only difference internal patients showed was a prolonged ED length-of-stay (32.3%; 95% CI 6.3% to 64.8%). No association with hospital length-of-stay or amount of procedures was found.
Off-loading low acuity visits from the ED to an alternative care site EHR implementation (24)	<p><i>Publication date:</i> 2012</p> <p><i>Jurisdiction studied:</i> U.S.A.</p> <p><i>Methods used:</i></p>	Patients visiting the CCHMC ED	The EHR system (EMSTAT) was implemented in the ED for the CCHMC in 2009; an overflow clinic was started to cope with the large volume of	The overall length-of-stay and time to doctor for patients increased during EHR implementation (mean admitted patients’ length-of-stay was 6-20% longer while mean discharged patients’ length-of-stay was 12-22% longer). Attempts to lessen patient volume by off-loading patients

McMaster Health Forum

Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
	<p>Electronic visit data of patients presenting to the Cincinnati Children's Hospital Medical Center (CCHMC) ED were reviewed during two-week blocks around EHR implementation, and again one year later. Metrics data were examined for ED patients presenting for care before, during and after EHR implementation. Data of physicians and advanced practice nurses preceding implementation, two months following implementation, and one year following implementation were reviewed.</p>		<p>non-acute patients during this time because of the H1N1 flu pandemic.</p>	<p>to the overflow clinic were shown to not be effective in minimizing delays in care. Approximately three months after implementation, previous steady state levels were reached for visit metrics; the ED system operated at 80% efficiency regarding length-of-stay in the first two weeks of EHR implementation, and at 90% by the third and fourth weeks.</p>
<p>Extent and patterns of HIE use (9)</p>	<p><i>Publication date:</i> 2011 <i>Jurisdiction studied:</i> U.S.A. <i>Methods used:</i> Mixed-method analysis comprised of cross-sectional audit log data, semi-structured interviews, and direct observation</p>	<p>ED sites (n=12) and ambulatory groups (n=2; comprised a total of nine clinic sites) using HIE in the Memphis Metropolitan Statistical Area</p>	<p>N/A</p>	<p>Users accessed HIE for 6.8% of all ED encounters, and there were higher rates of access for repeat visits, patients with comorbidities, patients known to have data in the exchange system, and at sites which provided HIE access to both nurses and physicians. Discharge summaries and test reports were among the most frequently accessed data. Physician users providing feedback consistently reported outcomes of HIE use as being provision of additional patient history and prevention of repeat tests/procedures.</p>
<p>Technology, utilization statistics, and results from a survey for an emergency medical service electronic record integrated into a HIE (5)</p>	<p><i>Publication date:</i> 2010 <i>Jurisdiction studied:</i> U.S.A. <i>Methods used:</i> Retrospective analysis of data (two data sources) and administration of an anonymous 10-question survey</p>	<p>Patients calling emergency medical service (EMS) providers in Indianapolis between July 1, 2009 and December 31, 2009 (n=28,986) and medics working as EMS providers (n=58)</p>	<p>The Indiana Network for Patient Care (INPC) is an operational statewide HIE with an active surveillance component designed around real-time lab reporting, and the EMS system transmits data recorded by EMS providers into a central database for EMS care specifically. The EMS system was integrated into the INPC.</p>	<p>Over the course of the study period, an increase of 64 to 88 EMS providers requesting INPC data was observed. Additionally, the number of requests for INPC EMS data abstracts rose from 678 to 1,080. Of medics surveyed, 14% indicated never having requested any data from the INPC, and 41% indicated usually or always requesting an EMS INPC data abstract. Of those requesting medics, 66% indicated that the data they received were important to very important in assisting them with provision of care. The most commonly cited reason for not using the system was computer and network difficulties.</p>
<p>Perceptions, workflow, and adoption of HIE among emergency physicians in the</p>	<p><i>Publication date:</i> 2011 <i>Jurisdiction studied:</i> U.S.A.</p>	<p>Emergency medicine physicians who completed prior</p>	<p>N/A</p>	<p>Among respondents with more than one login into the NYCLIX interface (78%), half estimated that successful retrieval of HIE data affected patient care.</p>

Identifying Optimal Ways to Collect, Distill and Provide Efficient Access to Personal Health Information in Emergency Situations

Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
New York Clinical Information Exchange (5)	<i>Methods used:</i> Semi-structured in-person or telephone interviews	training at academic urban hospitals participating in the New York Clinical Information Exchange (NYCLIX) pilot program (n=18)		
Evaluation of EHR impact on ED efficiency (25)	<i>Publication date:</i> 2011 <i>Jurisdiction studied:</i> U.S.A. <i>Methods used:</i> Retrospective analysis	Patient visits before and after implementation of an EHR in May 2008 at the Children's National Medical Center (i.e., October 1, 2007 – March 31, 2008 for pre-EHR, October 1, 2008 – March 31 2009 for post-EHR) (n=34,791; 16,951 pre-EHR and 17,840 post-EHR)	Implementation of an EHR, which allowed complete electronic documentation by physicians and nurses.	Daily patient census increased by 5.8%, without a change in ED admission rates. Nurse and practitioner hours increased by 19.7% and 16.1%, respectively. Patient length-of-stay remained unchanged, but triage-to-provider time increased by five minutes/patient. Overall, patient flow was worsened during days with extremely high patient census when the EHR was implemented.
Effectiveness of health information technologies (HIT) and electronic medical record (EMR) on ED usage in a population of complicated, frequently presenting patients (33)	<i>Publication date:</i> 2010 <i>Jurisdiction studied:</i> U.S.A. <i>Methods used:</i> Retrospective, observational study through chart review	Adult patients (18+) with the highest number of ED visits enrolled in the Community Resources for ED Overuse (CREDO) program between June 2005 and July 2007 (n=36)	Enrolment in CREDO, which led to "flagging" in the ED information system to create a CREDO brief (i.e., summary of pertinent past medical and social history and individualized guidelines for how to best care for the patient) in the patient's electronic medical record. Patients served as their own historical controls to compare between pre- and post-intervention time periods.	ED costs decreased by 24%, lab studies ordered decreased by 28%, and the average number of ED visits per patient decreased by 25%. Additionally, the total ED contact time decreased by 39%.
Emergency physicians' perceived needs and knowledge of HIE (12)	<i>Publication date:</i> 2007 <i>Jurisdiction studied:</i> U.S.A. <i>Methods used:</i> Email questionnaire	Attending emergency physicians employed at 12 hospitals in New York City which help compose the New York Clinical Information Exchange Clinical Advisory Subcommittee (n=216)	N/A	63% of respondents believed that more than one quarter of their patients could benefit from external health information, and 85% of participants also said it would be difficult or very difficult to obtain external data without HIE, taking an average of 66 minutes. 72% of physicians said their attempts fail half of the time, and 56% attempted to obtain external data less than 10% of the time. Among the 40% of participants who responded to a question asking them to rank-order a list for data preferences, the

Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
<p>Workflow evaluations to distinguish mechanisms through which clinicians in the ED could be informed of data contained in the New York Clinical Information Exchange (NYCLIX) (6)</p>	<p><i>Publication date:</i> 2006 <i>Jurisdiction studied:</i> U.S.A. <i>Methods used:</i> Semi-structured telephone interviews</p>	<p>New York Clinical Information Exchange clinical advisory representatives from participating organizations</p>	<p>Not applicable</p>	<p>most preferred data items for HIE were electrocardiograms, discharge summaries and medication lists.</p> <p>Workflow analysis identified tasks common to all groups, which included registration, triage and physician examination.</p> <p>All departments reported the use of electronic admission, discharge and transfer (ADT) systems for registration.</p> <p>In departments that used an electronic patient-tracking monitor, the monitor was seen as a mechanism for interfacing with NYCLIX.</p> <p>“Representatives suggested the use of color-coded icons to signal the existence of historical patient data. Paper-based users envisioned placement of a printed summary of data on the patient chart, or at minimum, a paper notification that data was found in the NYCLIX system.”</p>
<p>Prevalence of internet access and its use for health-related information in families of children treated in a large, urban pediatric ED (38)</p>	<p><i>Publication date:</i> 2006 <i>Jurisdiction studied:</i> Canada <i>Methods used:</i> Interviews conducted with parents of children in the ED (21 item survey used to collect demographic information including frequency of health-related information-seeking over the internet)</p>	<p>Parents of children arriving in the ED of the Hospital for Sick Children in Toronto, Ontario from January 1, 2003 to March 31, 2003 (n=950)</p>	<p>Not applicable</p>	<p>87% of parents reported regular internet access, 75% reported having an email account, and 60% accessed their emails once or more a day. 56% of respondents reported they searched the internet for health-related information, and 8.5% searched the internet immediately prior to their ED visit. 73% indicated they wanted to receive an email containing the results of the tests conducted on their child in the ED when asked during their interview. Overall, 66% of participants and 89% of those with email indicated the desire to receive information electronically from their child’s primary care provider.</p>
<p>Online polling to provide emergency access control to personally controlled health record (PCHR) systems (42)</p>	<p><i>Publication date:</i> 2012 <i>Jurisdiction studied:</i> U.S.A. <i>Methods used:</i> The paper presented the techniques used by a novel emergency access control model for PCHR systems.</p>	<p>Not applicable</p>	<p>Once the PCHR system receives an emergency access request, the authorization module in the emergency access control system begins several rounds of “online polling” to collect opinions about the request from random physicians registered in the system in addition to the patient’s emergency contact group. A decision on the</p>	<p>Because a PCHR system raises an issue of access in that an emergency healthcare provider may not be able to obtain the patient’s health record in certain situations, the emergency access control model was developed to allow for secure and confidential PCHR access control.</p>

Identifying Optimal Ways to Collect, Distill and Provide Efficient Access to Personal Health Information in Emergency Situations

Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
			release of the health record is made by using a weighted voting technique.	
Emergency physicians' preferences for and availability of pre-hospital patient care reports (PCRs) at the time of ED medical decision-making (15)	<i>Publication date:</i> 2013 <i>Jurisdiction studied:</i> U.S.A. <i>Methods used:</i> Prospective, cross-sectional web-based survey of emergency physicians.	Emergency physicians from four American College of Emergency Physicians email lists.	PCR refer to the process of collecting and communicating patient and demographic information in a pre-hospital setting (e.g., by emergency medical response teams) to hospital-based healthcare providers.	Most of the 228 respondents (52% vs. 17%) preferred electronic PCRs instead of handwritten versions with the remaining having no preference or only having used one type. Virtually all respondents indicated that PCRs are "very important" (45%) or "important" (43%). 80% of respondents indicated that electronic pre-hospital PCRs are available less than 50% of the time for medical decision-making.(15)
Impact of an electronic PCR reporting system on physical exam documentation (16)	<i>Publication date:</i> 2012 <i>Jurisdiction studied:</i> U.S.A. <i>Methods used:</i> Retrospective analysis of 154 PCRs. Each PCR was assessed for completion of physical exam findings. The documentation of written versus electronic PCRs were compared.	Of the 154 PCRs, half (n=77) were handwritten and the other half (n=77) were electronic PCRs. The PCRs were from a student-run emergency medical service at Georgetown University.	PCR refer to the process of collecting and communicating patient and demographic information in a pre-hospital setting (e.g., by emergency medical response teams) to hospital-based healthcare providers.	A 36% increase in accuracy and amount of documentation of patient information was found for electronic pre-hospital PCRs as compared to paper PCRs.
Prevalence of internet access and use among caregivers of children visiting the ED and their interest in receiving electronic post-care communication and educational materials (41)	<i>Publication date:</i> 2012 <i>Jurisdiction studied:</i> U.S.A. <i>Methods used:</i> Self-administered survey	Convenience sample of 504 English-speaking caregivers of children in an urban, academic, pediatric ED between November and December 2009	Not applicable	Half of respondents expressed interest in receiving only electronic communication from the ED, and one third of respondents indicated interest in having an electronic communication channel between the ED and their primary care provider.
Impact of an electronic link between the ED and family physicians (17)	<i>Publication date:</i> 2006 <i>Jurisdiction studied:</i> Montreal, Canada <i>Methods used:</i> Four-period crossover cluster-randomized controlled trial with two separate 10-week intervention phases. Family physicians received detailed ED	The sample included 2,022 patient visits to the ED who came from 23 different family practices.	The web-based standardized communication system (SCS) provided a link between EDs and family physicians, and was designed to allow family physicians to receive detailed patient care reports from EDs.	The SCS did not reduce the number of repeat visits within 14 or 28 days after initial visit or the number of duplicate requests, and resulted in a significant increase in requests for specialty consultation.

McMaster Health Forum

Focus of study	Study characteristics	Sample description	Key features of the intervention(s)	Key findings
	<p>visit reports about their patients over the internet, and in the alternating control phases they received a one-page copy of the ED notes through the mail. Outcomes assessed included repeat visits to the ED within 14 days of initial visit, duplication of tests and specialty consultation requests.</p>			



McMaster
HEALTH FORUM

>> Contact us

1280 Main St. West, MML-417
McMaster University
Hamilton, ON Canada L8S 4L6
Tel: +1.905.525.9140 x 22121
Fax: +1.905.521.2721
Email: mhf@mcmaster.ca

>> Follow us

mcmasterhealthforum.org
healthsystemsevidence.org



tinyurl.com/mhf-iTunesU
tinyurl.com/mhf-YouTube
tinyurl.com/mhf-Facebook
tinyurl.com/mhf-Twitter

EVIDENCE >> INSIGHT >> ACTION