

Gaps in Primary Healthcare Electronic Medical Record Research and Knowledge: Findings of a Pan-Canadian Study

Lacunes dans la recherche et les connaissances sur les
dossiers médicaux électroniques dans les soins de santé
primaires : conclusions d'une étude pancanadienne



AMANDA L. TERRY, PHD

*Assistant Professor, Centre for Studies in Family Medicine
Departments of Family Medicine and Epidemiology and Biostatistics, Schulich Faculty in Public Health
The University of Western Ontario, London, ON*

MOIRA STEWART, PHD

*Distinguished University Professor, Centre for Studies in Family Medicine
Departments of Family Medicine and Epidemiology and Biostatistics
The University of Western Ontario, London, ON*

MARTIN FORTIN, MD, MSC, CMFC (F)

*Professor, Department of Family Medicine
Université de Sherbrooke, Sherbrooke, QC*

SABRINA T. WONG, RN, PHD

*Associate Professor, UBC School of Nursing and Centre for Health Services and Policy Research
University of British Columbia, Vancouver, BC*

MAUREEN KENNEDY, MLIS

*Research Assistant, Centre for Studies in Family Medicine
Department of Family Medicine, The University of Western Ontario, London, ON*

FRED BURGE, MD, MSC, FCFP

*Professor and Research Director, Department of Family Medicine
Dalhousie University, Halifax, NS*

On behalf of the authors (see Acknowledgements)

Abstract

While the barriers to electronic medical record (EMR) adoption by physicians are well-known, we have much less knowledge about the broader challenges regarding EMR use faced by primary healthcare (PHC) EMR stakeholders in Canada. Therefore, we conducted interviews (from June 2009 to September 2010) and consultation sessions (in October and November 2009) with these stakeholders, as well as carrying out a research capacity assessment, to identify, describe and prioritize gaps in PHC EMR knowledge and research. Twelve thematic gaps emerged; four were identified as the most important: the need to ascertain the value of EMRs, the need to better understand elements of EMR implementation and adoption, the need to develop innovative data entry and extraction procedures, and a lack of agreement and understanding of data sharing. To advance EMR use, Canada needs to address these gaps; yet, we currently have a lack of research capacity with which to accomplish this.

Résumé

On connaît bien les obstacles auxquels se heurte l'adoption des dossiers médicaux électroniques (DME) par les médecins, mais il y a peu de données sur les grands défis liés à l'utilisation des DME auxquels font face les intervenants en soins de santé primaires (SSP) au Canada. C'est pourquoi nous avons mené des entrevues (de juin 2009 à septembre 2010) et des consultations (en octobre et novembre 2009) auprès de ces intervenants, en plus de mener une évaluation des capacités de recherche pour repérer, décrire et prioriser les lacunes dans la recherche et les connaissances sur les DME dans les SSP. Douze thèmes lacunaires ont émergé; quatre ont été qualifiés des plus importants : le besoin de déterminer la valeur des DME, le besoin de mieux comprendre les éléments de mise en œuvre et d'adoption des DME, le besoin d'innover en matière d'entrée et d'extraction des données, et le manque de consensus et de compréhension au sujet du partage des données. Pour faire progresser l'utilisation des DME, le Canada devra affronter ces lacunes; il y a cependant un manque de capacités de recherche pour y parvenir.

RELATIVELY RECENTLY, THE TIDE HAS BEGUN TO SHIFT IN THE USE OF ELECTRONIC medical records (EMRs) in Canadian primary healthcare (PHC) (Canada Health Infoway 2011). EMRs are being promoted as a tool that can assist in improving healthcare in Canada (Health Council of Canada 2011). There is some evidence to support the association between EMR use and improved PHC practice (Lau et al. 2012); yet, we know that the realization of these potential benefits is dependent on optimal use of “multi-functional” EMRs (Friedberg et al. 2009; Linder et al. 2007). Moreover, EMR adoption remains variable across the country, and the use of advanced EMR features is even further limited (Schoen et al. 2009). The barriers to EMR adoption are well-known (Boonstra and Broekhuis 2010; Simon et al. 2007); these studies are focused on physician considerations regarding the adoption/implementation of this technology into their practice. This study

explored the challenges to primary and secondary EMR use from a wider group of stakeholder perspectives, including those involving clinical care, policy making/healthcare planning and research. Within this study, we define stakeholders as those individuals holding an interest in the topic of EMRs in PHC; these individuals included clinicians/healthcare practitioners, decision-makers (those who make policy and health planning decisions), researchers and EMR vendors. We also make a distinction in this paper between EMR adoption (deciding to use an EMR in practice), EMR implementation (purchasing and setting up the technology in practice) and EMR use (the ongoing process whereby this technology is utilized for charting and to support patient care in practice).

This paper presents a summary of a Canadian Institutes of Health Research (CIHR)-funded study (Terry et al. 2010) within the “Nationally-Focused Needs, Gaps and Opportunities Assessments in Health Services and Policy Related to Electronic Health Records” competition. The focus of this competition was to understand the present situation with regard to EMR knowledge and research capacity, and what the ideal state would be in the future – i.e., to identify gaps in knowledge and research capacity. Specifically, CIHR was interested in accessibility, availability and quality of EMR data, as it pertained to its use by a variety of stakeholder groups. Due to the emergence of EMRs in PHC, and the role of PHC in the healthcare system – we chose to focus on PHC specifically. Therefore, the purpose of this research was to identify gaps in knowledge and research regarding EMR use in Canadian PHC, and to assess research capacity in this domain.

Methods

Using multiple methods (Creswell et al. 2004), including in-depth interviews, consultation sessions and a research capacity assessment, we identified, described and prioritized key gaps in knowledge and research. We focused on EMRs used in PHC by clinicians/healthcare practitioners in their offices to assist with the care of their patients. This study received ethics approval from The University of Western Ontario’s Review Board for Health Sciences Research Involving Human Subjects.

Data collection: interviews

Participants for interviews were recruited from an initial set of PHC EMR stakeholders identified by the research team. We sought representation across stakeholder roles (e.g., researchers, clinicians/healthcare practitioners and decision-makers), jurisdictions in Canada and acknowledged leaders in the field; snowball sampling was also used, wherein we asked participants to identify other key stakeholders. Fifty-three stakeholders were approached to participate. After obtaining informed consent, in-depth interviews (n = 36) were conducted with nine decision-makers, two decision-maker clinician/healthcare practitioners, nine clinicians/healthcare practitioner researchers, nine clinicians/healthcare practitioners, seven researchers and one EMR software vendor from across Canada (participants were from eight provinces, the Northwest Territories and the Yukon). Thirty-three interviews were

conducted from June 2009 to October 2009; the remaining three were conducted in April and September of 2010. Interviews were digitally recorded and transcribed verbatim. Interview questions related to factors influencing the use of PHC EMRs for clinical care, policy making and research. Two of us (ALT, SW) conducted interviews; these ranged from 15 to 100 minutes in length (see Appendix A for the interview guide at www.longwoods.com/content/23927). We developed the interview guide based on the identified topics within CIHR's grant call, as well as the emerging dominant issues regarding the use of EMRs in PHC.

Data collection: consultation sessions

In addition to the interviews, we held six consultation sessions in Calgary, Halifax, Montreal, Regina, Toronto and Vancouver with 28 stakeholders (recruited from potential interview participants), to discuss and prioritize gaps in knowledge and research that were identified from the first set of interviews. Consultation sessions were held in October and November of 2009. The stakeholders participating in the consultation sessions included 14 decision-makers, two decision-maker clinician/healthcare practitioners, three clinician/healthcare practitioners, six clinician/healthcare practitioner researchers and three researchers. Participants were asked to rank the gaps as either high or low according to two CIHR criteria: strategic importance and scientific importance, as well as an additional criterion of urgency. Rankings were based on the majority of participants in a session ranking a gap as high or low across all three criteria; where there was variability across participants, the gap was scored as variable. Those attending the consultation sessions also participated in strategic discussions of how to address the identified gaps. One of us (ALT) facilitated the sessions; group discussions and scoring were recorded on flip chart paper.

Data collection: research capacity assessment

To assess research capacity, we identified PHC EMR researchers in Canada by conducting a literature search in key bibliographic databases for the period 1999–2010, and searching funding databases, for 1999–2010 (see Appendix B for search details at www.longwoods.com/content/23927). We also explored the perspectives of interview participants regarding research capacity.

Analysis (interviews, consultation sessions and research capacity assessment)

We undertook a thematic approach to analyzing the interview data. Verbatim transcripts of the interviews were coded using NVivo software (QSR International Pty Ltd. 2008). We then analyzed the codes to identify emergent common themes. Consultation session scoring results were tabulated and flip chart summaries were transcribed. Gaps discussed at the consultation sessions were scored as “high,” “low” or “variable” depending on the ranking the majority of participants assigned. The results of the database searches for the research capacity assessment were tabulated. Research team meetings were held to discuss and integrate findings from the interviews, consultation sessions and the research capacity assessment. Our goal was to synthesize the key findings.

Findings

Interviews and consultation sessions

Twelve gaps in knowledge and research emerged from the interviews, which are described in Table 1. The four gaps that were ranked highest in the consultation sessions are highlighted below. The strategies discussed to address these gaps were broad and multi-faceted. Additional gaps emerged during the consultations, and five of these were highly ranked in some sessions (data quality, continuity of care, EMR in the academic setting, strategic investment and purpose of the EMR).

TABLE 1. Description of gaps in knowledge/research and results of prioritization

Gaps in knowledge/research (six sessions)*	Scores assigned in consultation sessions**		
	High	Low	Variable
1. Ascertain the value of EMRs – Theme: “What is the value proposition of EMRs to PHC providers, the healthcare system, researchers and policy makers?”	5		1
2. Need to better understand elements of EMR implementation and adoption – Theme: “How and why are PHC providers adopting EMRs in their practices or not adopting EMRs in their practices?”	4		2
3. Need to develop innovative data entry and extraction procedures – Theme: “How are data best entered and extracted from EMR systems?”	3	1	2
4. Lack of agreement and understanding of data sharing – Theme: “Who can share what with whom, when and how, for what purposes and what should it look like?”	3	1	2
5. Need to better understand and define the roles/views of the patient – Theme: “What are patients’ views about EMRs and what is their role in accessing/becoming involved in EMRs?”	2		4
6. Lack of consensus and understanding of privacy and confidentiality – Theme: “What works and does not work in terms of addressing privacy and confidentiality issues?”	2	1	3
7. Lack of an overarching framework for interoperability – Theme: “Need for interoperability or data flows among providers in the system, parts of the system and among EMR products”	1		5
8. Lack of national leadership (not rated in one session) – Theme: “Lack of overarching vision and leadership in Canada for health information and EMR use”	1		4
9. Need to define data elements – Theme: “What clinical data elements do PHC providers want and what do researchers and policy makers want in terms of data to answer questions about PHC?”	1	1	4
10. Develop an ideal EMR design – Theme: “How can an ideal EMR design facilitate use, ameliorate issues of coding vs. free text, support data entry and extraction”	1	3	2
11. Develop information technology knowledge and resources – Theme: “How can training and education help EMR use” and “Need for human resources in the healthcare system with both informatics and healthcare training”	1	1	4
12. Need to share experiences – Theme: “Need to learn from each other about broad experiences in EMR use (both positive and negative)”		3	3

*Additional gaps identified by participants within the group consultation sessions included data quality and usability; how EMRs could support continuity of care and what clinical content would be required to support transitions in care; how to best use EMRs in the teaching process of primary healthcare providers and how to best utilize EMRs in academic family medicine/primary healthcare; ascertaining the value and impact of EMRs from a social, economic, patient care and provider relationship perspective; and determining the problems we are trying to solve by using EMRs.

**Gaps were ranked either high or low according to two CIHR criteria: strategic importance and scientific importance, as well as an additional criterion of urgency. Rankings were based on the majority of participants in a session ranking a gap as high or low across all three criteria; where there was variability across participants, the gap was scored as variable. A maximum score could be 6 and a minimum 0. 0-6 is a count of the consultation sessions.

Ascertain the Value of EMRs

Determining the value of EMRs to PHC practice, given the lack of certainty of the impact of EMRs on patient care, was of central importance:

Well, having worked with some of the clinicians who are in general practice in primary care ... I think you know the main issue for them is that is all this worth it? Is it really improving patient care? That's the bottom line.

Another individual described a contrast in perspectives regarding the value of EMRs in the following way:

I think we've done a pretty good job in medicine of getting people to think, that evidence-based medicine is the way forward for everything. Now we come along and say, "hey, you've got to use these systems and by the way we've got no evidence that they actually do improve care." That may be the fundamental issue why we're not seeing take up in the same way. In that we've kind of created a culture of evidence and then, we don't really have any. And it's a very odd situation where people can recognize there's no evidence but still think it's the right thing to do.

Participants also discussed the potential benefits of EMRs, such as their use to better manage practice populations. However, the need to evaluate EMRs and to understand how they could be best used was a central theme.

Strategy discussion

Given the uncertainty regarding the value of EMRs, consultation session participants identified the need to focus on ascertaining the impact of EMRs on patient safety, patient outcomes and continuity of care, efficiency, value for patients and the value for the health system versus value for practitioners. Questions were raised regarding the link between the purpose of the systems, their features and potential benefits. Additionally, defining what we want to achieve with EMRs, and "meaningful use" of EMRs were raised as important components of the value question.

Need to Better Understand Elements of EMR Implementation and Adoption

A lack of knowledge surrounding PHC EMRs was viewed as a potential influencer of EMR adoption and use in practice. Participants noted the need to better understand influences on EMR uptake overall, as this quote suggests:

... there's a huge issue around why is Canada different? What is it that's causing the take up to be so different?

Additionally, participants focused on the need to identify both the best ways to implement EMRs, and the elements that would support clinicians/healthcare practitioners in the adoption and full use of this technology.

Strategy discussion

In response to this gap, consultation session participants discussed the need to determine the optimal environment or milieu for implementation, to explore existing success stories and to seek out lessons from other countries. Other factors to be explored included the impact of potential drivers of implementation and adoption, particularly in terms of physician compensation, mandatory implementation of EMRs, the influence of different practice models and the effect of generational gaps. The structure of the EMR, the nature of the users and the impact of different change management and practice strategies were raised as potential – yet unknown – influencers of implementation and adoption.

Need to Develop Innovative Data Entry and Extraction Procedures

Participants described a tension between entering data in the EMR in free-text form and entering the data in a codified way; underlying this was a concern about losing the “art of medicine” – partly the nuances or context of the patient encounter:

That whole interaction that free text allows us is not yet a particularly useful tool for research and evaluation or policy development for EMRs. So from that perspective the more data that occurs in specifically designed and standardized fields, the more power your EMR provides for you but the more you create those standardized fields the more you're pigeon holing clinicians into putting data down in certain ways and there's a distinct tension between those two.

While the significance of coded data was recognized, participants indicated strongly that the entry of these data should not impinge on the work of clinicians/healthcare practitioners in PHC, for example, through interruptions in the process of caring for patients, or by adding an additional time burden.

Strategy discussion

Consultation session participants focused on various knowledge needs, including determining how to produce the best-quality data with the least intrusion on clinical work, and how to apply the best evidence in using the EMR; identifying what is available in the EMR, and what extraction tools are needed to get the information that is desired; creating standards to minimize variation; and identifying the causes of poor data. Further discussion centred on the development of technology to facilitate the extraction and interpretation of free-text EMR data.

Lack of Agreement and Understanding of Data Sharing

Participants described the current lack of frameworks to guide data sharing, which extended beyond data sharing among providers to sharing for secondary purpose as well:

... it's not so bad to exchange it with a specialist I know but when we get into the broader environment, now we're sending it out there, we get into these data sharing agreements, I think there's going to be a lot of time spent in ironing out those, how we share data. And that really ... has not been well appreciated and I think it's going to stop things and we're going to suffer a bit until we do straighten that out.

Data sharing was a topic which raised many unanswered questions:

There's still discussion around who can see what. There is still a few different interpretations about whose information it really is anyway. So ... there's some pretty basic questions that haven't been answered here.

Strategy discussion

Participants clearly identified a number of areas where there was a need for more knowledge and work around data sharing. This included the development of a framework illuminating the data needs of various stakeholders so that gaps in data sharing, including the purpose of the use of these data, could be more clearly understood. There were four main areas where greater knowledge was required: (1) clarity regarding the legal and clinical implications of shared data for patients and providers, (2) an understanding of legislation across Canada, (3) decision-making about what data are needed and (4) being aware of the context of EMR data.

The priority gaps in research and knowledge are inter-related. Multiple factors, including challenges in data entry and extraction, data sharing and a lack of certainty of the impact of EMRs on patient care, could influence the perceived value of the EMR. In turn, these gaps in knowledge and research are potential barriers to use of EMRs in the Canadian PHC context.

Research Capacity Assessment

To assess research capacity, we identified PHC EMR researchers across Canada, and we explored the topic of research capacity with our interview participants. Table 2 presents the number of publications, research grants, Canada Foundation for Innovation grants and Canada Research Chairs for PHC EMR researchers in Canada. These findings illustrate an overall low number of researchers in this field, as well as their concentration in a few provinces – Ontario, Quebec, British Columbia and Alberta (Table 2). This result was confirmed by interview participants, who indicated that there were few researchers in disparate locations across the country, few sources of research funding and a lack of training opportunities in e-health:

It's a pretty dry field right now, there aren't a whole lot of grants and there aren't a whole lot of skill sets available, and those that are available are scarce and hard to come by.

Collaborative initiatives were viewed as one way of addressing some of the research capacity challenges.

TABLE 2. Research capacity assessment of primary healthcare electronic medical record researchers – publications, grants and research chairs

Provinces	Publications n (%) [*] Total N = 84	Research grants n (%) [*] Total N = 38	Canada Foundation for Innovation n (%) [*] Total N = 4	Canada Research Chairs n (%) [*] Total N = 5
Ontario	36 (43)	16 (42)	3 (75)	4 (80)
Quebec	23 (27)	12 (32)	–	1 (20)
British Columbia	16 (19)	4 (11)	–	–
Alberta	5 (6)	5 (13)	–	–
Nova Scotia	2 (2)	1 (3)	1 (25)	–
Pan-Canada organizations	2 (2)	–	–	–

^{*}Percentages may not sum to exactly 100 due to rounding.

Based on the findings of this study, we offer the following set of recommendations directed to PHC EMR policy and research stakeholders, as well as research funders. These recommendations are designed to increase the capacity in EMR research in PHC, and address the main gaps in knowledge and research identified in this study. This is in keeping with a view toward the development of the full potential of PHC EMR use in Canada.

TABLE 3. Recommendations to PHC EMR policy and research stakeholders, and research funders

1. Create and fund a Chair focused on PHC EMR research. This could be a National Chair providing: (a) structure to create a national collaborative network; (b) funds for salary plus funds for the Chair to allot to PhD students and Post-Doctoral Fellows. These provisions would thereby assist the current generation of researchers but mostly would build future researchers.
2. Create a call for research proposals to assess the value of the EMR and/or its components. The call could focus on the following types of proposals: • Systematic reviews of the value of EMRs to a variety of outcomes such as system integration, informational continuity, improvements to the process of care, interprofessional collaboration and provider satisfaction and experiences using the EMR. • Comparison of the use of EMR features (e.g., decision support) in relation to system, provider and patient outcomes. • Exploration of the utility of the secondary uses of EMR data.
3. Issue a call for research proposals on the development of demonstration models on knowledge translation specific to EMRs, and evaluation of these model interventions to promote change.
4. Engage key stakeholder partners to open a dialogue to identify common ground and avenues for future collaborations regarding: (1) raising the sophistication of EMR products; (2) enhancing the standard of EMR products (e.g., through creation of opportunities to develop EMR projects in a secure environment with input from key stakeholders); (3) encouraging joint funding of research calls that will assist the agenda of EMR vendors, such as the call for studies on EMR value.
5. Develop a partnership among key stakeholders to develop innovative data entry and extraction approaches and to test their usability.
6. Create a policy-oriented initiative on the topic of data sharing.

Discussion

This study identified significant gaps in our level of PHC EMR knowledge and research in Canada. In particular, gaps regarding value of the EMR, elements of implementation and adoption, data entry and extraction procedures and data sharing were of the most importance – some of these gaps lend themselves to actions at the policy level, and others are within the research domain. We also identified a lack of research capacity with which these gaps may be addressed. We discuss the implications of these findings in the following.

The PHC EMR environment is rapidly changing in Canada. Recent actions have been taken by several pan-Canadian organizations to increase the uptake of EMRs and to assess potential benefits (Canada Health Infoway), develop EMR content standards (Canadian Institute for Health Information) and to create an EMR-based surveillance network for chronic disease (Canadian Primary Care Sentinel Surveillance Network). These developments signal the interests of decision-makers and planners to foster both EMR adoption and the use of EMR data.

Not surprisingly, stakeholders viewed the value proposition of EMRs as unanswered, yet very important, given the mixed evidence regarding the impact of EMRs on patient care, uncertainty over financial benefits and the lack of Canadian studies on these topics (Bassi and Lau 2013; Lau et al. 2012). Similar to our findings, two other studies found “usefulness” to be a key factor in electronic health record adoption in Canada (Archer and Cocosila 2011; McGinn et al. 2012). These findings illuminate the continued importance of the value question, the mixed evidence regarding the impact of EMRs and the lack of outcomes-focused research specific to the Canadian context. Given the low number of studies regarding this topic, PHC EMR stakeholders (at the time of this study) remained unconvinced as to the ultimate value of this technology, highlighting the key importance of this question for the PHC EMR research agenda in Canada.

Despite existing knowledge regarding barriers and facilitators of EMR implementation and adoption (Archer and Cocosila 2011; Boonstra and Broekhuis 2010; McGinn et al. 2011; Protti 2007), this gap was ranked the second highest. This may point to a lack of uptake of the existing evidence, or a need for more information within the PHC setting. This points to the lack of a strong enough link between existing research findings, and policy action/knowledge translation which could overcome these barriers and capitalize on the facilitators. Certainly, EMR adoption has been characterized as a “highly complex problem” (Archer and Cocosila 2011), where there are differing views as to the relative importance and role of factors influencing uptake (McGinn et al. 2012). This may have created an environment of uncertainty where this issue continues to have salience for EMR stakeholders in Canada.

Increasingly, PHC practitioners are interested in harnessing the power of their EMR data to better understand and manage their patient practice populations. Secondary uses of EMR data for research, policy making and planning are on the rise. Both of these developments require data that are appropriate for these uses, as well as the ability to easily search and extract data. These trends highlight the growing need to develop and test innovative data

entry and extraction procedures, and the need to create infrastructures which can support these processes, leading to enhanced use of data for patient care, policy making and research.

Finally, this study identified a lack of agreement and understanding with regard to data sharing among PHC EMR stakeholders. This topic is considered important with regard to patient care and research. There is a recognized need for data sharing; however, concerns remain regarding privacy and security. Others have identified the need for guidance in this area (Rozenblum et al. 2011). In the absence of a clear understanding regarding the rules and governance of data sharing, a lack of consensus about sharing of data and uncertainty over patient views on this subject, it appears PHC EMR stakeholders are uncertain about sharing data because of the risk of potentially doing the wrong thing. Increased clarity and awareness regarding the circumstances under which PHC EMR data can be shared in a privacy-appropriate manner can help advance the goal of increased and appropriate PHC EMR data availability.

The focus in Canada has increasingly turned toward strategies to increase PHC EMR use – i.e., building information technology capacity in healthcare from the “ground-up.” Yet to realize a positive return on investment, and to maximize the benefit to patients and clinicians/healthcare practitioners, EMRs must be effectively implemented and used. The findings of this study, echoed by a recent report from Canada Health Infoway, suggest there is much we do not know regarding this, which is a challenge given the lack of research capacity in Canada (Canada Health Infoway 2013). How PHC practices can best be supported to achieve this optimal use also requires consideration. While recent developments such as Lau’s eHealth Benefits Evaluation Knowledge Translation Community (eHealth Observatory 2013), and the launch of CIHR’s Community-Based Primary Healthcare Signature Initiative are positive in terms of building capacity, more remains to be done. What is further troubling is the recent lack of broad investment in this area at the pan-Canadian level, as evidenced by the 2014 Federal Budget (Government of Canada 2014). This paper raises policy and research issues – both of which need to be addressed before significant improvements in PHC EMR use can be realized.

Strengths and limitations

While we were successful in ascertaining the views of PHC EMR stakeholders from many jurisdictions across our country, representing a diversity of roles, their views may not reflect those of a broader group of stakeholders. We identified only one other related study, which explored the perspective of Canadian stakeholders regarding e-Health policy in Canada, and its implications for electronic health record adoption (Rozenblum et al. 2011). Therefore, to our knowledge, this is the first study that presents a pan-Canadian perspective on the challenges regarding the use of EMRs in PHC. While there could be diverse views between different stakeholder groups, our thematic analysis provides comment on broad areas of agreement regarding gaps in PHC EMR research and knowledge.

Conclusion

This study explored gaps in research and knowledge regarding PHC EMR use for clinical care, research and policy making in Canada. The findings of this study suggest four main issues are at play: (1) while efforts are underway to increase levels of EMR use in PHC in Canada, there is variability in overall levels of use, and challenges in achieving full use of this technology in practice; (2) there are significant gaps in our knowledge and research regarding EMRs; (3) relatively few resources are available to inform these gaps; and, (4) currently, Canada has sparse research capacity with which to address the gaps. However, addressing these gaps may lead to advances in PHC EMR use in Canada. A natural next step would be to build consensus among PHC EMR stakeholders to create a research and policy agenda for PHC EMRs in Canada.

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Other authors of this paper include Richard Birtwhistle, MD, MSc, FCFP, Professor and Director of the Centre for Studies in Primary Care, Department of Family Medicine, Queen's University, Kingston, ON; Inese Grava-Gubins, MA, Director of Research, College of Family Physicians of Canada, Mississauga, ON; Greg Webster, MSc, Director of the Acute and Ambulatory Care Information Services, Canadian Institute for Health Information, Toronto, ON; and Amardeep Thind, MD, PhD, Professor, Centre for Studies in Family Medicine, Department of Family Medicine and Department of Epidemiology and Biostatistics, Director, Schulich Interfaculty Program in Public Health, The University of Western Ontario, London, ON.

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Correspondence may be directed to: Amanda L. Terry, Assistant Professor, Centre for Studies in Family Medicine, Department of Family Medicine, The University of Western Ontario, 1151 Richmond Street, London, ON N6A 3K7; tel.: 519-661-2111 ext. 20049; fax: 519-858-5029; e-mail: aterry4@uwo.ca.

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