Author's response to reviews

Title: Are family physicians comprehensively using electronic medical records?: A Canadian Perspective

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Author's response to reviews: see over
Response to Reviewers

Associate Editor’s Comment:

"Thank you for giving me the chance to read your manuscript titled ‘Comprehensive use of electronic medical records (EMR) among family physicians: A Canadian perspective’. I have now received two thorough referee reports from experts in the field of Electronic Patient Record implementation and adoption and ehealth more broadly. The two referees provide very useful comments for you to consider as you revise your paper. They both ask for major revisions, which is in agreement with my view. I am not going to repeat all the comments and recommendations the reviewers have made, as you will have the chance to read and address them, but I’d like to highlight the areas that require significant revisions:

- The Background section should be enriched with more contextual information about the Canadian EMR initiative and ehealth strategy and should embody a more up to date review of the literature on EMR adoption.

Done

- The assumptions that you make e.g. that data completeness is a proxy for data use requires a more sound justification. This is especially the case since this assumption constitutes one of your most important conclusions. Please also explain what physician time and patient time on EMR imply.

We are using data completeness of the various fields as a proxy measure for completeness of use of the EMR we have rewritten this section to provide more justification for doing this.

Done

- The methods section and the results require further clarification and more explanation. Please respond to the specific questions and comments reviewers make as these will guide you to a much improved version of your paper.

Done

- The discussion should be enriched with relevant literature and you should identify points of convergence and divergence with other relevant studies for instance those dealing with EMR data quality, data completeness or the temporal dimension of EMR etc. Reviewers provide excellent ideas that could strengthen your paper significantly, especially with regard to time dimension.

Done

- The paper needs also to clarify how and in what ways it contributes to the literature and rework the policy recommendations it makes. With regard to the latter the study could potentially provide policy makers with tools and methods for auditing and for performance management. Neither however the methods nor the way in which they can be used for management and monitoring were made clear.

We have added a section on benchmarks and areas for identification of fields that need improvement on completeness. We hope that this will provide policy makers with tools and methods for assessing completeness of EMR records.

Done

- The paper requires careful proof-reading throughout.

I hope the above suggestions and reviewers’ thorough comments help you revise your paper timely. I wish you best of luck for these revisions."

Additional Editorial Requirement:

1. We recommend that you copyedit the paper to improve the style of written English. If this is not possible, you may need to use a professional language editing service. For authors who wish to have the language in their manuscript edited by a native-English speaker with scientific expertise, BioMed Central recommends Edanz (www.edanzediting.com/bmc1). BioMed Central has negotiated a 10% discount to the fee charged to BioMed Central authors by Edanz. Use of an editing service is neither a requirement nor a guarantee of acceptance for publication. For more information, see our FAQ on language editing.
services at http://www.biomedcentral.com/authors/authorfaq/editing.

We would be grateful if you could address the comments in a revised manuscript and provide a cover letter giving a point-by-point response to the concerns.

Please also ensure that your revised manuscript conforms to the journal style (http://www.biomedcentral.com/info/ifora/medicine_journals). It is important that your files are correctly formatted.

We look forward to receiving your revised manuscript by 8 October 2014. If you imagine that it will take longer to prepare please give us some estimate of when we can expect it.

You should upload your cover letter and revised manuscript through http://www.biomedcentral.com/manuscript/login/man.asp?txt_nav=man&txt_man_id=1523158942135986. You will find more detailed instructions at the base of this email.

Please don't hesitate to contact me if you have any problems or questions regarding your manuscript.

With best wishes,

Arlene Pura

Reviewer's report
Title: Comprehensive use of electronic medical records (EMRs) amongst family physicians: A Canadian Perspective
Version: 2
Date: 4 September 2014
Reviewer: Amirhossein Takian
Reviewer's report:
Thank you for sharing with me this paper for peer-reviewing. Generally, the paper has acceptable quality. I have some suggestions, listed below, that you may want to consider for improving the manuscript:
Introduction:
- A little bit more background about ehealth or EHR macro structure in Canada and the role of Canada InfoWay looks to be useful and essential. 
  Done
- The premise that most studies on the scope and quality of EMR data have mainly been performed in the United Kingdom is a bit contested, as the references used for this part are very old (e.g. 2003), ref no 12 along with some others). Much has happened in recent years in N. America regarding EMRs adoption, and the continent seems to become more advance than the UK in terms of implementation and adoption of ehealth solutions, i.e. EMRs. I suggest authors see and include more recent literature to support their argument.
  Done
- In general, given various interpretations of EMRs, and their overlap with EHRs, it is pivotal to clarify authors' precise definition of EMRs, and their components in Canada.
  Done
This premise even for lab and radiology results are not that clear and a bit controversial and needs to be tested.

This section has been revised

- P 4: More background is required to shed light on Canada government's supportive/incentive plans for EMRs, and the way that physicians use it. The linkage between EMRs use and doctors' remuneration and whether or not it is related to EMRs' utilization is influential and important to be mentioned. More importantly, it is the integration and connection of primary and secondary care via EMRs as well as use of clinical components, which motivate physicians to use EHRs more often and in day to day use (See for instance: Takian et al. 2012, We are bitter but we are better off: BMC HSR) Physicians get additional funding to support EMR adoption for demonstrating that they are using various parts of the EMR and are receiving laboratory results electronically. This is described in the last sentence of the first paragraph. Having an EMR makes calculation of some preventative care maneuvers such as FOBT or mammograms easier but this is also doable in paper charts and thus there are currently no other substantial financial incentives or remuneration for physicians using an EMR, only what has been described in the first paragraph, which is EMR adoption/use subsidization.

- P4, lines 102-104: Using the data completeness of a variety of EMR fields as an initial proxy measure for optimal EMR usage is a bit misleading. There could be many cases that data are completely gathered and entered into EMRs, but clinical use remains minimum and quality of care unchanged. Authors expect to explain and justify their claim as how such a proxy is reliable and valid. While we recognize that simply using an EMR does not automatically mean improved quality of care, quality improvement with EMRs can not occur or even be measured if physicians don’t use the EMR to record all activity. For instance if a physician doesn’t use the EMR to write a prescription and uses a paper prescription pad then the benefit of having a legible and longitudinal record of prescriptions that can auto trigger drug interactions can not be realized, thus as a basic minimum the fields need to be populated both for clinical reasons and for secondary use.

- Same as above: Assessing the influence of physician and patient duration of time on the EMR on the population of these fields in Ontario, Canada. I am not sure I understand this and the rationale behind it, pls clarify.

We are trying to determine the duration of time required to have a patient chart reasonably complete and usable for secondary purposes, there are two things that impact duration of the chart, the first being when a physician starts using an EMR and the second being when a patient first sees a physician after they have started using an EMR.

- P4: Lines 108-109: Again accurate and precise definition of EMRs in Ontario, and a summary of the architecture of these packages is required to understand your method(s) of data extraction. We have added a description of our definition of EMRs in the first paragraph of the introduction, ‘… approved EMR software into their clinical practice for capture of clinical activity that occurs within the family physician office and relevant information pertaining to the family physician management of patient health care’

- I understand your design as cross-sectional and was wondering whether such an approach is robustly enough to address your research question. Perhaps, it would be more appropriate to follow this use and completeness via longitudinal approaches, taking into account various conditions of use and impact of different conditions on it.

We have looked at use and completeness via longitudinal approaches, we have looked at completeness of the record in terms of duration of time the physician has been using the EMR and duration of time of the patient record. We have also added a section whereby we look at the population of different fields by relatively new, medium and longer term users.

- P 6, line 163: Physicians with really low numbers? Do you mean low no of patients?
Yes, low numbers of active patients with a prescription or a referral letter, we have revised the sentence to make it clearer.

- P 7, line 181: Inactive patients with some doctors, could it be because of fewer or no use of EMRs by their doctors? Do you have any data to shed light on this?

We believe that our methods for defining an active patient (a physician bill for a visit) are reasonably accurate as even if the physician was seeing a patient and not recording the visit in the EMR, the only way for the physician to get paid for seeing that patient is via a bill which is submitted by generating a bill in the EMR that gets automatically sent to the Ministry.

- P 7-8, Line 185-190: Please give more detail on statistical analysis, the software used, and precise code of your ethical clearance.

SAS version 9.2 (SAS Institute, Cary, North Carolina) were used, this is described in the Statistical Analysis section of the Methods in the manuscript. Our institution has a process whereby we undergo a privacy impact assessment (PIA) prior to commencing any study. For retrospective studies on data already existing in-house at ICES and no intervention on physicians or patients, we are not required to seek additional external REB approval and studies that have undergone and been approved via our PIA process get approval from Sunnybrook Health Sciences REB without a specific code attached.

- P 8, line 193: Please explain why your samples were mostly from higher income quintiles, was this because EMRs adoption was higher among more affluent neighborhoods, or it could be selection bias, or?

There is some selection bias in our sample of EMRALD patients, currently coming more from rural areas and of slightly higher income quintiles, however the representation ratio of rural and urban practices is constantly changing as new physicians come into the database. We are unsure if our selection bias with respect to more patients with higher income quintiles is a bias of EMRALD or a bias of the type of patients that actually seek health care, we have added this limitation to the discussion.

- P 9, line 223: Please explain a little bit more and bring other experiences from literature as why the 1st and 2nd years of data completeness are crucial in this regard.

Done

- P 10, line 235: Please be a bit more specific about what you mean by higher level EMR functions

We've changed the term to 'advanced'

- Conclusion is good, but the main message and contribution of this paper is not clear enough. Also, it would be pivotal to draw some policy implications out of this study, perhaps in a separate sub-section.

In addition, it is essential to include a section on rigor of this study, outlining limitations. We have added statements re policy implications and have expanded the limitations section.

- Table 1: Some words may benefit from terminology definition, as they may be confusing, e.g. referral, lab tests, which one exactly, etc.

We’ve added to the table to help clarify.

**Level of interest:** An article whose findings are important to those with closely related research interests

**Quality of written English:** Acceptable

**Statistical review:** No, the manuscript does not need to be seen by a statistician.

**Declaration of competing interests:**

'I declare that I have no competing interests

Review of the paper

*Comprehensive use of electronic medical records (EMRs) amongst family physicians: A Canadian*
Perspective
By Karen Tu et al.
Submitted to BMC Medical Informatics and Decision Making

The study reported in this paper aimed to assess the degree of use of Electronic Medical Records (EMR) in general practice in Ontario, Canada. The authors used the completeness of a variety of fields in the patient record as a proxy measure for ‘comprehensiveness of use’. Data was extracted from 167 physicians with at least one year of EMR use for 186,237 patients. Records’ fields were assessed ‘as a function of physician and patient time since starting on the EMR’.

The paper seems to suggest that the main contributions of this study are: first, to give insight into the extent of use of EMR in GP practices in Canada. Since these implementations seem to be relatively recent, I believe this is information which may be useful to implementers and policy makers, specifically in North America. Second, the authors propose that the methods developed in this study can be used “to identify physicians who perform poor on measures of data completeness and are in need of further assistance”. I am unsure whether sufficient detail is provided in the paper for this to happen. The authors may consider providing greater detail of the methods for this purpose, possibly with additional files associated to this paper.

Thank you for pointing this out we have added a section on benchmarks to address this issue.

Finally, the authors offer some insight into the time dimension of EMR use. This I found the most interesting but confusing finding, and where I would like to make suggestions for improvement, as follows.

1. Two key dimensions are ‘physician time on EMR’ and ‘patient time on EMR’: these are somehow ambiguous and should be clarified.

We have rewritten this section for clarification.

The definition provided [line 178] that ‘Physician time on EMR was calculated by looking at completeness of the EMR fields over one to five years on the EMR’ is unclear. Is time the same as degree of completeness/presence of data? I also wondered: Is ‘Physicians time on EMR’ the time since the EMR has been installed in the GP practice? Or the time since the physician first recorded data in it? What if the two are different — e.g. a physician had the EMR installed in her computer for months before deciding to use it? Non-use then is as interesting, or perhaps more interesting than use, for the implementers. (Note: this may question the statement at line 220 that “physicians are making use of their EMRs nearly from the outset”).

We were unable to determine the date that the physician first had the EMR installed and we were only able to look at the time since the first physician recorded visit (a progress note with a bill on the same date). However we do not anticipate that there was a significant time lag from the time of EMR installation to the time of use to record visits as the government policy to receive additional funding support requires that physicians be able to demonstrate that they are using a variety of EMR functions. We have added this inability to measure this as a limitation.

‘Patient time on EMR’ is not defined - only how the sampling was done [lines 179-183]. Is this intended as the time the physician has been writing about the patient in the patient record? Yes we have rewritten this section for clarification.

As a corollary of the above, physicians and patient ‘duration on the EMR’ [e.g. line 223] should be explained. For example, does patient duration on the EMR take into account the frequency of entries (visits with the physicians) recorded in a year? For example, is a patient with one visit recorded in year 1 and one in year 5 (2 visits in 5 years), considered the same as a patient with a visit once a month for 5 years (12x5 visits)?

Yes they are considered the same record duration we only looked at the time from the first visit recorded in the EMR and did not take into consideration the number of visits.

2. Regarding the completeness of data over time, did the study find that for each patient more
aggregate data were available over time (something that is to be expected as data cumulates consultation after consultation) or rather is the finding that a new patient record at year 5 (for example) would have more data than a new patient record at year 1 – i.e. increasing trend of completeness over time for each consultation, not for each patient seen in aggregate terms? (a comparison of a new consultation at year 1 with a new consultation at year 5). See for example [Line 208-9]: “Over time, increasing trends of completeness for all fields were observed, except for laboratory tests and consultation letters”. It is unclear whether this refers to aggregate data or not. I invite the authors to clarify.

While in the assessment of the cumulative patient profile we were only able to assess for accumulation of data as the data in the cumulative patient profile are not time stamped, for the analysis at 1-5 years post implementation this was looking soley at entries that occurred in that year for the physicians that had been on the EMR for the specified time period. Thus assessments, for example, in year 4 only included the patients of the physicians that had been on the EMR for at least 4 years and the patient record was at least one year old. A variety of length of patient records were included in the year 4 analysis and we were simply looking at activity in year 4 for physicians that had been on the EMR for at least 4 years. This section has been rewritten for clarification.

3. The statement [lines 228-233]: “researchers should be cautious when making time-dependent observations from EMRs [...] as there is an increasing likelihood of detecting data as patients contribute more observations over time. Therefore we suggest that an assessment of the completeness of EMR data be performed before patient outcomes and process measures can be analysed” seems to be the key finding from this paper. However I found this quite cryptic. The first part of the statement refers to time, the second to data quality dimensions. The connection between the two is lost to me perhaps because of the confusion, mentioned above, between aggregate or not aggregate data. Also the authors should make explicit the reference to the policy (?) of measuring processes and outcomes, explaining what these are, how are they usually measured, and why/how they should be measured differently. By extending this part, they may make this the main argument of the paper, even restructure the paper around this argument by making this the title of the paper and/or extending the literature on measurement of processes and outcomes. I believe the paper would gain by doing this, as the authors would provide valuable advice to policy makers beyond Canada who are still struggling to find the right way of measuring healthcare... (However it does depend on what the finding is – just to say that there is more aggregate data as time passes is not news really)

We’ve rewritten this section.

4. Regarding Fig 1: Average completeness by physician’s duration of EMR use for the fields...
I wonder: Does the increase correspond to the turnover in patients registration at each practice? i.e. I would expect major data entry efforts at year 1 as all existing registered patients are added to the EMR, and then not in the following years unless many new patients join the practice. An answer to this question would give an idea whether the data entry rate is maintained over time (which seems to be the case?), for a constant and limited patient turnover. It would have been an interesting finding if the data entry rate had increased exponentially given the same constant and limited patient turnover, suggesting much greater use of the EMR over the years.

We agree that most likely major data entry efforts occur at year 1 and that patient turnover is likely limited. We saw the greatest increase comparing year 1 to year 2 for many of the fields thereafter for the most part the increase was small but steady.

5. A final comment: The literature from the UK (mentioned also in the abstract) is limited to one paper from 2003 [reference #12]. As GPs in the UK have used EMR for decades, the literature is
extensive and the authors should refer to more recent publications. 

We have revised the abstract and the introduction to include more recent publications.

Overall the paper is relatively brief – there is space for extending the background, discussion and conclusions.

Other aspects the authors may wish to consider:

6. The authors could reflect on the possibility of other users of the EMR apart from physicians. Work with patients and with patient records in GP practices is shared with nurses, healthcare assistants and administrative staff, for example. EMR data completeness does not necessarily equal to physicians’ use.

This is true but we were unable to assess who in the office completed the cumulative patient profile fields and differences in the availability of allied health professionals and their job functions was beyond the scope of the study. We have added this to the limitations.

7. Further data analysis could be performed and discussed on:

a. The extent of use as a function of the size of the GP practice: the study takes every physician as an individual, but there is evidence in the UK, I believe, to suggest that EMR use differs in larger practices, where IT and administrative support is more available and organisational workflows are in place to make sure data (e.g. letters from hospitals) are entered in patient records. Again, this is not something done by the physician directly, at least in the UK.

Again assessments of the individual environments that the physicians were working in were beyond the scope of this study.

b. The geographic distribution of the physicians (or the patients?) – the analysis could be supported by a visualisation, a map showing dispersion or concentration, or distribution in rural/city areas. It would provide an extra lens to interpret data on extent of use. Some data on these aspects are provided in Table 3 but there is not a clear connection with the findings.

Although we have a map showing the distribution of physicians that contributed their data to EMRALD we’ve have opted not to publish this, as an important aspect of the physicians contributing data to EMRALD is anonymity and some of the groups of physicians that contribute data cover an entire community.

8. The double title (Manuscript and Running titles) is confusing. I suggest the authors choose one, or make a new title.

We’ve made a new title, thanks for the suggestion.

9. I would remove the list of abbreviations and embed them in the text.

Done