

How Accurate is the Electronic Health Record? – A Pilot Study Evaluating Information Accuracy in a Primary Care Setting

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Abstract. *Background:* Electronic health records (EHR) are increasingly used for both administrative and clinical tasks with major implications for patient safety and quality of care. This study aims to determine a baseline EHR level of accuracy present on measurable information fields within an Australian general practice. *Methods:* Quantitative and descriptive pilot study of patients attending a private general practice. Patients who consented to participate in the study had their patient records reviewed to determine how many items were correct, incorrect or not recorded in each EHR information field. Statistical analysis was performed on the data collected. *Results:* A total of 33 patients gave consent to participate in this study. High levels of accuracy were found in the area of demographic details (94%). Moderately high levels of accuracy were reported for allergies (61%) but also a considerable percentage of non-recorded information was present (36%). Inaccuracies in medication lists were reported in 51% of records reviewed with 32.1% of all medications being inaccurately recorded. While over 91% of participants had a history summary with eight or less items present, omissions were reported for one in every five participants. There were no significant associations present between inaccurate data and frequency of practice visits or those with more than five past medical conditions listed in the EHR. *Conclusion:* The study has confirmed that errors and inaccuracies exist in EHR in our Australian pilot study. The pilot study has also allowed us to complete a trial ensuring that a study of this type can be done safely and with correct methodology. As health informatics plays an increasingly important role in health care, studies of this type will better inform practitioners/researchers in designing systems to ensure quality electronic patient information.

Keywords. Electronic Health Records, General Practice, Information Mastery

Introduction

For the last twenty years the Australian health sector has been working towards a paperless health care system with computers becoming a crucial component for delivering care. In particular general practice has led the way with over 90% having at least one computer on

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site, an almost three-fold growth from an estimated 31% just a decade ago [1–4]. Despite its initial usage being primarily administrative in nature, computers are also increasingly being used to perform clinical tasks. This is most evidently highlighted by McInnes and Saltman's 2006 study which showed that 92% of general practitioners (GPs) having an integrated clinical software program as part of their clinical management process [3].

As the first point-of-contact for many patients, GPs are expected to provide a broad scope of primary health care services. In addition to this GPs also have a crucial role in coordinating and linking patient management with the wider health care system [5–7]. Having high quality medical information on hand allows practitioners to make better informed clinical decisions and minimise the risk of medical errors occurring [8–11] thereby potentially producing improvements in management outcomes for patients.

General practitioners are now advocating the EHR (electronic health record) as the preferred option for efficient management and maintenance of patient clinical information and this is supported by increased funding and action amongst government organisations [12]. Patient information attained during clinical consultations is usually inserted by direct physician data entry as a mixture of descriptive free prose and medical terminologies already encoded into the EHR program [13–15].

However despite a widespread awareness of EHR and its benefits there is still concern among the medical profession about the quality of information being entered and stored on medical software programs. While practitioners recognise and respect the importance of having high quality medical information, a review of the published literature shows moderate levels of research has been committed to quantifying the information accuracy of electronic records in the general practice setting. Of the studies undertaken these are often based in hospital environments or too specific in the nature of EHR researched for example analysing only the accuracy of medication lists only [10, 16–18]. Hence in this pilot study we aim to review the medical information in a primary health care setting particularly in the area of accuracy of demographics, allergies, past history information and medication list.

1. Methodology

The design of the project was a quantitative and descriptive study. Participants were recruited over nine sessions in a six doctor general practice. Participants were consented on the day of the visit and were briefed about the study before seeing their GP. The collection of data was done subsequent to the consultation. The information required for the study was then reviewed face to face with the patient by the research assistant. Information taken away from the practice back to the research unit was de-identified to ensure patient safety.

After completing data collection, all data accumulated was entered into a Microsoft Excel spreadsheet for further analysis. Statistical analysis was performed primarily using the Statistical Package for the Social Sciences, version 16.0 (SPSS Inc. of Chicago, Illinois, USA). Ratio and frequency tables were constructed and analysed to give an indication of the level of data accuracy in each of the different EHR information fields reviewed. Cross tabulations were performed and significant differences in proportions were sort in regards to whether the accuracy of EHR was dependent on the number of clinic visits a patient made in the last 6 months or on the number of past history

items a patient had. The p-values for such associations were extracted as two-sided exact significant values using the Fisher's exact test. Due to the small sample size of this pilot study, 95% confidence intervals were unable to be calculated for all results and associations analysed.

2. Results

2.1. Participant Recruitment

A total of sixty-eight patients ranging from infants to elderly individuals were approached to be study participants. Of this number only thirty-three patients (48.5%) gave consent to participate in the study with the remaining thirty-five patients (51.5%) declining the offer for a variety of reasons. These included information security concerns, implicit trust that the information on the EHR was always accurate and concern that the GP would be in trouble if errors or omissions were found by the research team.

2.2. Demographic Information

Patients' basic demographic details were assessed in terms of residential address, date of birth, and gender. Complete accuracy was achieved for birth-date and gender whilst 94% of the participants had the correct address details recorded on the EHR.

2.3. Allergies

In accordance with patient verification allergy records were reviewed both in terms of information accuracy and evidence of prior assessment by GP. Analysis showed that 60.6% of the participants interviewed had the correct information recorded i.e. no allergies or if there were the correct allergens were listed. Only one participant reported entry of an incorrect allergic status on EHR. Conversely twelve participants were identified to have had no information recorded with regards to their allergic status. This amounted to just over one-third (36.4%) of the study population of whom prior to this study no inquiry on allergy had been made by any of the attending GPs at the practice.

2.4 Medications

Medication information on patient EHR were evaluated with respect to four key attributes: whether the medication list on patient EHR was accurate and current; the total number of medications prescribed according to EHR; the number of medications recorded incorrectly; and the number of medications omitted from the list (Table 1). Overall almost 91% of participants had a medication regime with five or less prescriptions listed. However only 48.5% felt that the list was an accurate indication of the medications they were currently taking. Of the seventeen participants who disagreed, a majority of them (76.5%) found no more than one to two medications to be incorrect i.e. medications they were no longer taking. Medication omission from EHR was reported in three cases only (9.1%). In summary of the thirty-three participants involved in the study, a total of 106 medications were recorded on EHR to be in current use. Subsequent verification

by participants identified that thirty-four medications were incorrectly recorded thereby giving a final inaccuracy level of 32.1%.

2.5. Past History Items

Analyses of patients' past medical history were conducted to quantify how many items were duplicated, omitted or in error on the EHR (Table 2). Almost all of the participants (90.9%) had a past history summary with eight or less items listed, with duplications found in three cases. While over two-thirds of all participants had no history items omitted, 21.2% of the group did find one omission in their summary. With regards to errors in the past history summary, this was not the case for most of the participants (85%).

In the second part of the study analyses of the proposed associations for this study were conducted using cross tabulations. The results are listed in the below table. (Table 3)

Table 1. Frequency table for Medications

Number of Medications	No. patients with total no. of Medications (%)	No. patients with Medications incorrect (%)	No. patients with Medications omitted (%)
0	4 (12.1%)	16 (48.5%)	30 (90.9%)
1	7 (21.2%)	9 (27.3%)	3 (9.1%)
2	8 (24.2%)	4 (12.1%)	----
3	2 (6.1%)	1 (3.0%)	----
4	4 (12.1%)	1 (3.0%)	----
5	5 (15.2%)	2 (6.1%)	----
>5	3 (9.1%)	----	----

Table 2. Frequency table for Past History Items

Number of Past History Items	No. patients with Past History Items omitted (%)	No. patients with Past History Items in error (%)
0	22 (66.7%)	28 (84.8%)
1	7 (21.2%)	3 (9.1%)
2	3 (9.1%)	2 (6.1%)
3	1 (3.0%)	----

Table 3. Association / Cross Tabulation results

	P value
No of visits (more than 5 visits) & medication list accuracy	0.296
No of visits (more than 5 visits) & duplication of past history items	0.561
No of visits (more than 5 visits) & allergy list accuracy	0.472
No of history items & medication list accuracy	1.000
No of history items & allergy list accuracy	0.561

3. Discussion

It is noted that a number of limitations are present for this study. As this was intended to be a pilot study investigating an emerging topic in health informatics it was not feasible for adequate sampling population to be reached. We also note that only one general practice was used for the study.

In analysing the data for this study, it appeared that there was a variable level of information accuracy in the different fields of EHR assessed. While high percentages of accuracy were reported for patient demographic details, a proportionate number of errors and discrepancies were identified to be present in the areas of allergy lists, patient medication lists and past history summaries.

As indicated in the results more than half of the sample population indicated that the medication list provided on EHR was not an accurate or candid reflection of their current medication regime. In particular, almost a third of total medications (total number = 106) listed by participants as current were found to be incorrectly recorded; these were either prescriptions that patients were no longer taking or those that had since been substituted by their GPs with another medication. These results although representing a small cohort have major implications with regards to patient safety and the quality of information transferred between health care providers. To illustrate a practical example of this would be that of a GP undertaking patient summary letter that was hastily written by the GP before being sent to the emergency department. If the patient was noted to have diabetes but did not have an accurate record of the medication being taken this could potentially cause a delay in making the final diagnosis. Medication inaccuracy could also affect the quality of information passed onto specialists thereby causing unnecessary confusion between the GP, patient and specialist care provider.

With regards to past history summaries, results showed that most of the participants interviewed in this study had an accurate and concurrent summary with no errors present. Almost all of the summaries reviewed consisted of eight history items or less. Omissions of past medical events were detected for less than one-third of the study population while duplications were present in only one out of every ten cases. Based on these results, it is sufficient to say that the level of accuracy for past history summaries is very good. However information errors and discrepancies are still present.

In analysing the association between the numbers of clinic visits made by patients in the last six months and the level of information accuracy achieved in allergy data, medication list and past history items there were no significant associations. In addition to this no significant findings were evident for the association between the number of items listed in patients' past history summaries and the level of accuracy present in the medication list and allergy list. As discussed earlier, the pilot study had small cohort numbers and further study with larger cohort numbers will be required to further develop these hypotheses.

In this study we have seen that there is still room for improvement in the area of EHR accuracy. Whilst further work should be undertaken to consolidate this research there should be concurrent work also as to develop quality frameworks. At a macrostructure level it may be possible to achieve significant improvements in information quality by implementing government initiatives that offer financial pay-offs in exchange for improvements achieved [19]. In the United Kingdom a system of this nature has been implemented in the primary care setting since April 2004 with marked success. The New

GP Contract provides financial payments to GPs who achieve marked improvements in the management of areas such as patient clinical records as well as ongoing clinical conditions for example hypertension and diabetes [7]. Already there is evidence supporting the effects of such a system with reports that over 92% of patients with asthma have now achieved excellent long-term management of their conditions [20].

Improvements in EHR accuracy can also be achieved through implementing changes within the setting of individual practices. Majeed et al. found that physician enthusiasm for achieving improvements in clinical care is a factor influencing the level of accuracy present in data entry. However this is often undermined by other factors for example time constraint due to overwhelming clinical workload [21]. Therefore physicians may find it necessary to pass on to someone else the task of patient record-keeping. In the United Kingdom Rickets et al. have identified marked improvements in information accuracy for primary care practices where there is a specific job appointment devoted to maintaining and improving accuracy of clinical records [22]. Based on this evidence it may be beneficial to either train other practice members such as clinical nurses or administrative staff in the use of EHR or to specifically employ someone for example a system coordinator or information manager to monitor and update patient records [13,23]. Thus this would enable practices to instigate constant monitoring of all clinical records so that any errors and discrepancies present may be quickly picked up thereby improving overall practice-wide EHR accuracy.

4. Conclusion

This pilot study has shown that inaccuracies are present in electronic health records. Further work is required involving a larger cohort of participants that are recruited across multiple Australian general practices. As we enter the twenty-first century it is fundamental that Australian GPs have a well-rounded working knowledge of the EHR.

Acknowledgements

- Ethics approval from The University of Melbourne has been ascertained to undertake this study.
- We wish to thank Doctors of Ivanhoe for their assistance in this project.

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