Knowledge and attitudes of nurses in community health centres about electronic medical records

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Background: Nurses in primary healthcare record data for the monitoring and evaluation of diseases and services. Information and communications technology (ICT) can improve quality in healthcare by providing quality medical records. However, worldwide, the majority of health ICT projects have failed. Individual user acceptance is a crucial factor in successful ICT implementation.

Objectives: The aim of this study is to explore nurses' knowledge, attitudes and perceptions regarding ICT so as to inform the future implementation of electronic medical record (EMR) systems.

Methods: A qualitative design was used. Semi-structured interviews were undertaken with nurses at three community health centres (CHCs) in the King Sabata Dalyindyebo Local Municipality. The interview guide was informed by the literature on user acceptance of ICT. Interviews were recorded and analysed using content analysis.

Results: Many nurses knew about health ICT and articulated clearly the potential benefits of an EMR such as fewer errors, more complete records, easier reporting and access to information. They thought that an EMR system would solve the challenges they identified with the current paper-based record system, including duplication of data, misfiling, lack of a chronological patient record, excessive time in recording and reduced time for patient care. For personal ICT needs, approximately half used cellphone Internet-based services and computers.

Conclusions: In this study, nurses identified many challenges with the current recording methods. They thought that an EMR should be installed at CHCs. Their knowledge about EMR, positive attitudes to ICT and personal use of ICT devices increase the likelihood of successful EMR implementation at CHCs.

Introduction

Community health centres (CHCs) and their satellite clinics provide primary healthcare services to most of the population of South Africa (Reagon, Irlam & Levin 2004:1). These services are provided predominantly by nurses without the supervision of doctors and include preventative and curative services such as mother and child health, immunisations, preventative screening and family planning and treatment of acute and chronic conditions (Mbambo, Uys & Groenewald 2003:46), including antiretroviral therapy (Cameron *et al.* 2012:99). CHCs have reporting requirements mainly for the District Health Information System (DHIS) for the purpose of monitoring and evaluation of healthcare programmes. At present, data at CHCs is handwritten in registers by nurses and aggregated into data sheets for submission to the District office. Problems with this approach include a high work burden and a lack of training as perceived by the nurses, as well as poor data quality (Garrib *et al*. 2008:550; Heunis *et al*. 2011:69; Odama 2010:28).

There is evidence that health information technology (HIT) can improve quality in healthcare by increasing adherence to guidelines, enhancing disease surveillance and decreasing medication errors (Chaudhry *et al*. 2006:744; Goldzweig *et al*. 2009:w284). In South Africa, the Department of Health (DoH) is committed to HIT so as to improve services in the national health system and also to implement the National Health Insurance Plan (DoH 2012:8). The DoH plans that primary healthcare facilities migrate from the current predominantly paper-based system to electronic submission of data for the DHIS. It also plans to introduce a patient-based electronic medical record (EMR) system (DoH 2012:15).

However, the introduction of information and communication technology (ICT) in an organisation does not mean it will be used as intended. Users may reject it, misuse it, sabotage it or work around it (Holden & Karsh 2010:159). In South Africa, examples of failures include a hospital information system in Limpopo Province (Littlejohns, Wyatt & Garvican 2003:860) and a point-of-care handheld computer system in a large private hospital (Whittaker, van Zyl & Soicher 2011:55). Worldwide, it

is estimated that the majority of information technology (IT) projects in various sectors, including healthcare, have failed. The reasons are now considered to be more managerial than technical, with sociological, cultural and financial issues being paramount (Kaplan & Harris-Salamone 2009:291). Understanding HIT systems requires a focus on the interrelation between technology and its social environment. In other words, a sociotechnical approach is required. Sociotechnical approaches favour a central role for the user in the development process. Successful user involvement also recognises that technology 'implementation' is first and foremost a process of organisational change (Berg, Aarts & van der Lei 2003:297).

One of the significant factors in the planned introduction of IT is the attitude of the staff that will be required to use it (Bagozzi 2007:244). Individual users' acceptance of ICT is a crucial factor in determining the success or failure of an ICT system (Holden & Karsh 2010:159; Ward *et al.* 2008:81). Some studies have found negative attitudes by nurses to IT, examples being found in the United Kingdom (Timmons 2003:261; Ward *et al.* 2008:82) and in Taiwan (Lee *et al.* 2008:701), and a need was identified for more qualitative research into the factors which form and influence attitudes. Studies in other countries showed more favourable attitudes on the part of nurses, specifically in the United States (Moody *et al.* 2004:337), Kuwait (Alquraini *et al.* 2007:378), Sweden (Nilsson, Skär & Söderberg 2008:68), Spain (Oroviogoicoechea & Watson 2009:842) and Australia (Callen, Braithwaite & Westbrooke 2009:198). In South Africa, studies to date on acceptance of ICT by healthcare workers have shown positive attitudes toward ICT. Nurses attending a management course in Pretoria had positive attitudes toward IT (Nkosi, Asah & Pillay 2011:876) as did healthcare workers in four rural hospitals and one clinic in the Eastern Cape (Ruxwana, Herselman & Conradie 2010:23).

This study was performed in King Sabata Dalindyebo Local Municipality (KSD) which has a predominantly rural population of 452 000 (Statistics South Africa 2012:63). KSD is located within OR Tambo District Municipality (ORT) in the Eastern Cape. OR Tambo District Municipality is the third most socioeconomically deprived of the 52 districts in South Africa (Day *et al.* 2012:152). The aim was to explore the knowledge and attitudes of nurses to ICT in CHCs in the municipality. The results will inform strategies for EMR implementation in clinics.

Research method and design
Design

A qualitative study design was employed and semi-structured interviews were used for data collection. Three CHCs in KSD were selected on the basis that they are used for service learning by students at Walter Sisulu University. The purpose of the study was explained to the operational manager at each CHC. The managers then identified nurses whom they knew might talk freely about IT and invited them to be interviewed. They were first given a subject information sheet wherein the purpose of the study was explained. It stated that participation in an interview was entirely voluntary; that anyone could refuse to participate without prejudice to work relationships; that they could refuse to answer any question at any time; and that their views were strictly confidential. To ensure confidentiality, the interviews were available only to members of the research team. All data was to be kept on a secure server in the Research Champion's (Health Sciences) Office at Walter Sisulu University. Research numbers were assigned to participants and these were used instead of names. Written consent was obtained.

Data collection method

Interviews were conducted in English by the four authors. An interview guide was used to explore knowledge and attitudes about information technology and electronic medical records in particular. Nurses' views on the current paper-based record system were also explored. The guide included open-ended questions and several associated prompts probing for more detailed information. The schedule was informed by instruments used in published studies on user technology acceptance (Holden 2010:72; Kijsanayotin, Pannarunothai & Speedie 2009:408; Yu, Li & Gagnon 2009:225). The interview techniques involved exploring respondents' views in an unobtrusive and non-directive manner (Rubin & Rubin 2011:31). Basic demographic data was recorded, together with exploration of use of technology, with respect to computers and mobile phones. The number of nurses interviewed was determined by data saturation, namely, the point after which continuing collection of data did not reveal any further insights into the issues under investigation (Kuper, Reeves & Levinson 2008). Interviews were recorded digitally and then transcribed by an audiotypist. The authors listened to random excerpts of the voice recordings and compared them with the transcripts to ensure that they were accurate and complete.

Data analysis

The interviews were analysed and interpreted using content analysis. Six generic steps detailed by Patton (2002) were used in this process, namely, organisation and preparation of data, reading through the data to get a general sense of the meaning, coding, generation of themes, representation of themes and interpretation. Rich, thick descriptions were used to convey findings and to bolster validity.

Results

Thirty-three staff members were interviewed, 25 of whom were professional nurses and eight who were either enrolled nursing assistants or staff nurses. Their ages were between 25–65 years, with a mean age of 41 years. Twenty-six were women and seven men. The number of nurses interviewed was determined by data saturation.

Use of cellphones: Every participant had a cellphone. The following uses were recorded: voice call ($n = 33$), text message ($n = 30$), social networking ($n = 17$), Internet searches ($n = 16$) and Internet banking ($n = 10$).

Use of computer: When asked to rate their ability to use a computer, using a six-point Likert scale (poor, below average, average, above average, good, excellent), their combined responses were: poor to below average (*n* = 17), average to above average (*n* = 11), and good to excellent (*n* = 4). Thirteen either owned a computer or had access to one at home.

Current record system

Filing: There were 34 comments associated with the current paper-based filing system. Separation of data in different registers was identified as being a concern related to continuity of care, stemming from the lack of a complete chronological record. Duplication in writing was perceived to be a waste of time. Missing files were another area of concern, occurring either as a result of loss by patients or because of misfiling in the clinic. In addition, valuable time was spent looking for old registers.

Handwriting: There were 15 comments on the difficulty of reading handwritten notes by both doctors and nurses. One respondent expressed concern that incorrect interpretation of handwriting could result in the wrong medication being administered:

> 'It is big problem because if my writing is illegible and I am not here they can give the wrong medication to the patient; I am sorry it needs to be legible'. (P8, Female, 48)

Time spent on paper records: The nurses perceived that they spent an excessive amount of time on records, leading to incomplete recording:

> 'The bad side it takes time and sometimes you are exhausted and you omit some information'. (P5, Male, 38)

When there is a high workload, actual recording of data may be done long after the event, even the next day. This could lead to inaccuracies:

> 'You will have to finish tomorrow and that is not nice because it is today's work, like today I started with yesterday's work'. (P28, Female, 42)

Reduced time for patient care: Some nurses felt that they are neglecting patient care in favour of collecting data:

> 'It's like we're nursing the books than the patients'. (P26, Female, 37)

It was reported from one CHC that the number of patients booked for antenatal care has been curtailed to allow time for data collection. At that CHC, the interviewers observed that a group of eight nurses had adjourned for the afternoon to enter data from the morning antenatal clinic.

Other concerns raised were that stationery is sometimes out of stock, leading to recording on scraps of paper. Also, some nurses still have difficulties understanding how to complete forms, despite training programmes in this regard.

Computerised health records

Knowledge of EMR: Nineteen respondents knew about EMRs. Two nurses had used a fully-computerised EMR system, one in South Africa and one in Saudi Arabia.

Potential advantages

Fewer errors: Some nurses thought computerisation would reduce errors:

> 'It is not good because you find that there is lots of mistakes in the which are going to mislead us so it was the computer it was going to be easy to see what was expected, what we need to do'. (P22, Female, 49)

Faster work: Some thought that computers were quick and easy for data entry and retrieval. Patients would also spend less time at the CHC:

> 'I think to record electronically it is safe and it saves time, it's convenient because when you want that information you get it there'. (P26, Female, 37)

> 'It can also limit the time clients wait for their cards'. (P6, Male, 30)

Prevent loss of data: Many respondents thought that computers would solve the problem of missing patient cards and ensure a permanent record. One respondent noted that electronic records would be available at the point of care:

> 'It is easy because my old records are in my consulting room'. (P31, Female, 30)

DHIS data: An EMR was also seen to have the potential to calculate statistics for the DHIS, thus reducing the workload:

> 'I think it can help in statistics because now we do the counting and we submit at the end of the month; now we will not have to'. (P6, Male, 30)

Remote access to patient data: Two nurses thought computers would assist in obtaining patient records electronically from other sites. Three respondents stated that online access to laboratory results would be helpful:

> 'We've got lot of patients and we take bloods every day and they do not come back in time. So if we can access them in the computer, that could help and also to track the patient those who didn't come and also even if you call the lab you won't get help as you like so if we can access it in the computer'. (P26, Female, 37)

Access to knowledge: Nurses expected to get quicker access to continuing professional development through the Internet. Also, they could access circulars from the DoH and information on diseases:

> 'Even things that are related to the nursing profession, things like new policies, we get them through computers'. (P28, Female, 42)

> 'Yes, because sometimes when you assess the client you come across an unusual condition you can just Google and get help on the management and treatment'. (P6, Male, 30)

Ensuring confidentiality: One respondent noted that an EMR would lessen the risk of stigma:

> 'When they come [*HIV patients*] every one can tell that those one are sufferers, you see the stigma because they are the only ones who have those files, everyone can see so there in no privacy there because other patients can easily identify those'. (P10, Female, 48)

Follow-up of patients: Many respondents identified that IT would assist in contact tracking of sexually-transmitted

diseases, as well as follow-up of patients on chronic medication who have defaulted. One suggested the use of text messages to track patients.

Drug supply: Online drug ordering was identified as an advantage:

'Ordering of medications it will be much easy than sending [*paper order*s]'. (P5, Male, 38)

Cost saving on stationery and storage: Some nurses identified that there would be cost saving with regard to the purchasing of stationery and a reduction in paper-storage facilities.

Continuity of care: Several nurses commented on how EMR would promote continuity of care:

'It can be introduced for record keeping and also for, to have the whole information of the client in the same page rather than having it in different records and the nurse sometimes have to start afresh, it will be good because clients do lose their clients cards, when you ask them where is the old card they would just say I lost it'. (P6, Male, 30)

Disadvantages

Security: Seven expressed concerns about the risk of theft of IT equipment.

Confidentiality: One expressed concern about the fact that someone could breach security and hack the patient database.

Other concerns: These included the potential for misuse (eg. playing computer games) and IT downtime as a result of crashes and power-cuts. One nurse expressed concern about eye damage, whilst another was worried that the communication with clients would be affected if the nurse were looking at the computer. However, that could be rectified by explaining the procedure to the client:

'It will have to be explained to the client because sometimes you find that it seems as if you are not paying attention to the client when you scroll to the cellphone while attending to her; there is this thing that says when the client enters the door you need to welcome her with love and now when you are paying attention to the computer it will look like you ignore her, but hey it will need to be explained to the clients'. (P1, Female, 27)

Two respondents commented on age. One thought age would be a barrier to adapting to computers. In contrast, however, the other thought that older nurses would be willing to learn:

'Change is not easy for old people, they are traditional and conservative'. (P29, Female, 49)

'And the nurses even those who are old are willing to learn'. (P31, Female, 30)

Installation of an IT system: All respondents thought that an EMR should be installed at the CHC. They felt that it would work, although one said it was conditional on staff training and another on overcoming the reluctance of some to use computers. Of the 22 respondents who indicated a preference

for the language of record, 15 stated English, five isiXhosa and two for both languages. As regards the data-input method, 21 expressed a preference for a touch screen, four for voice and three for typing. Twenty-nine indicated a need for training before an EMR system could be implemented.

Ethical considerations

Ethical clearance was obtained from the Health Research Ethics and Bio-Safety Committee at Walter Sisulu University (No. 020/011). Permission to undertake the study was obtained from the Eastern Cape Department of Health.

Discussion
Outline of the results

The nurses identified many challenges associated with the current paper-based patient record system. Some of these have been noted previously: a perceived high recording workload, entering data after the day's work was finished, duplication, difficulty in keeping track of patients (data in different registers) and lack of training (Garrib *et al*. 2008:551; Heunis *et al*. 2011:69). In this study, nurses identified that poor handwriting may result in errors. They were also concerned that they had less time for patient care. One CHC had even reduced antenatal bookings to allow time for paperwork. There are at least 17 registers per CHC for recording the attendance of single events related to patient care, specific conditions or procedures such as births, tuberculosis, immunisations and patient consultations (Odama 2010:28). In each one, patients' demographic data have to be recorded.

Many nurses articulated clearly the potential benefits of an EMR. Their views referred to point-of-care data entry in real time and the use by nurses of patient-related data for care. They all thought that an EMR should be installed and were confident that it would work, irrespective of their level of perceived computer expertise. This is in contrast to previous studies which reported that nurses with computer expertise are more likely to have a favourable attitude towards EMR compared with those are less computer literate (Moody *et al*. 2004:340; Ward *et al*. 2008:89). One respondent questioned whether older staff would adopt IT, whilst another thought that older staff would at least try to use a computer. Older age has not, in recent studies, been found to influence IT usage (Alquraini *et al*. 2007:378; Ward *et al*. 2008:89). Another respondent thought that using the computer for purposes other than work shouldn't be allowed. The experience of one of the authors (G.W.), however, is that it is easier to get adoption of HIT by allowing users to familiarise themselves with computers by using email, playing games, social networking and surfing the internet.

Practical implications and recommendations

User acceptance is an important factor that influences successful IT implementations; and perceived usefulness is the most accurate predictor of intention to use technology (Stricklin & Struk 2003:464; Venkatesh *et al*. 2003:427). Other factors important for successful IT implementations include

the design of technology; management of planning and rollout; organisational structure, leadership and process and assessment (use, outcomes, impact on work and structure of care) (Lorenzi *et al.* 2008:292). The positive attitudes to adoption of IT shown in this study, coupled with an appreciation of the challenges of paper-based recording, increase the chances for the successful introduction of an EMR system. Berg *et al.* (2003:300) advise that qualitative studies should be done at stages during system development and implementation to monitor user and organisational issues. This study is preparatory to further research during EMR implementation in CHCs. The need for research has also been emphasised in a review of nursing record systems that included computerised records. Little evidence of benefit from computerisation was shown in hospitals and long-term care units (Urquhart *et al.* 2009:12). The need for research specifically into implementation in CHCs has been emphasised (McAlearney *et al.* 2010:814).

Almost half of the nurses rated their computer ability as average or above, with four of these being good to excellent. Two nurses had actually used full EMR systems. These nurses could be potential champions of EMR implementation in CHCs. Many nurses used their phones for Internet access and social networking. This use of computers and phones implies a confidence in the use technology that could be applied readily with regard to use of an EMR system.

In this study, nurses indicated their willingness to record data electronically. Data (coding) quality improves the closer it is to the point of capture and if the staff who enter data (codes) benefit from the coding (Douglas *et al*. 2010:2). Point-of-care data entry is likely to improve data completeness and accuracy and is likely to lead to use of the resulting information in nursing practice. The benefit will be a reduction in time spent in recording and retrieving patient data. Data should be 'collected once only and at the point of care delivery by clinically credible staff' (Stonham *et al*. 2012:30); this process is encapsulated by the dictum, 'enter once; use many times'. This view is endorsed by the DoH. The eHealth Strategy for South Africa 2012 states that all indicators derived from patient data should be captured electronically at the point of care (DoH 2012:9). With EMR implementation, data capturers could be reassigned to other duties, for example producing management reports and clinical audit information.

Nurses expressed a preference for touch screens as a method of data entry. Similarly, in Malawi, healthcare workers expressed a preference for touchscreen over the paper system for data entry at HIV treatment sites (Douglas *et al.* 2010:3). These preferences should inform the design of an EMR system. Concerns about security, confidentiality, crashes, power cuts, training, eye strain, language of record and communication should also be addressed during the planning and implementation of an EMR system.

Limitations of the study

There are limitations to the study. The interviewers have an interest in IT implementation and this could have influenced their interpretation of the respondents' views. However, they are aware of the difficulties in HIT implementation and would have explored any respondent's concerns about HIT. No focus group interviews or document analysis were done, but respondents from three different CHCs were interviewed as a form of triangulation and there was similarity in responses across the sites. The interviews were done in one Local Municipality and the results, whilst not being generalisable, may be transferable to similar settings.

Conclusion

In summary, nurses are the main providers of primary healthcare in South Africa. They are also the largest professional group generating and recording healthcare information. In this study, CHC nurses identified many challenges with the current recording methods. They thought that an EMR system should be installed at CHCs and were confident it would work. Their personal use of IT devices and their positive attitudes to IT and EMR increase the likelihood of successful EMR implementation at CHCs.

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Competing interests

The authors declare that they have no financial or personal relationship(s) which may have inappropriately influenced them in writing this article.

Authors' contributions

D.O'M. (Walter Sisulu University) conceptualised the topic, reviewed the literature, collected and analysed data and compiled the article. G.W., P.Y. and F.G. (Walter Sisulu University) assisted in collecting data and in the writing and submission of the manuscript. D.O'M. and G.W. also undertook the editing and quality assurance.

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