

An investigation into the factors of adoption of wireless applications for data management by nurses

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ABSTRACT

The use of wireless hand held devices is becoming popular in healthcare applications for data management. While the concept is attractive, difficulties encountered by nurses included the small size of the device, problems in fitting current data collection forms into one screen of a handheld device and data entry using the 'garfiti' option. It appears that prior studies, while highlighting the importance of wireless applications in healthcare, failed to ascertain factors that determine the adoption of these applications in hospitals. This study conducted a set of interviews to investigate the factors of adoption of wireless applications by nurses in order to enhance healthcare data management. Preliminary findings of these interviews are presented here.

Key words: wireless technology, health care, IS

1. INTRODUCTION

Prior studies indicate that wireless applications using handheld devices can provide significant advantages to healthcare professionals including nursing by providing solutions to some of the existing problems. These advantages include the reduction in transcription errors arising from paper based documents [1], data collection at point-of-care [2], considerable reduction in the amount of paper work [3], administering medications by having textbased alerts using these handheld devices [4], remote monitoring of patients and connecting to other systems such as patient care [5].

While prior studies have highlighted the advantages of handheld applications, they have not yet ascertained factors that determine adoption of such a technology. The outcomes of this study would enable to achieve this. Once the factors of adoption are ascertained, healthcare providers can enjoy the benefits of the appropriate applications of this technology by providing solutions to the staff crisis encountered in many hospitals [6],

managing the increasingly complex information challenges [5], complying with the rigorous regulatory framework [7], reducing the medication errors [8], and generating affordable applications that allow for greater mobility [9]. In addition to these factors, wireless applications would also provide benefits to nursing due to its flexibility and mobility in data management [7], including complex patient data requirements [6], proper integration of data to existing systems [10], and improved access to data from anywhere at any time [11].

2. LITERATURE REVIEW

In healthcare literature, the concept of wireless technology is discussed by many studies [7]; [4]; [2]; [1]; [12]. For example, [7] provides details of how broadband technology, a component of wireless technology, can be used in healthcare. The discussion provided by [7] involves the high cost of setting up a wireless technology in a healthcare setting, improvements to patient care using this technology and potential cost-effective quality of service to patients. [1] provides information on how to improve clinical quality using wireless technology including challenges for maintaining security and privacy. [1] also discusses the concept of portable devices for data collection purposes by providing an argument on benefits that can be realised using these devices. [2], while critiquing the nursing domain, stresses the need for the innovative use of IT to improve the patient care. He points out that new IT technologies can help to address some of the chronic problems encountered including saving nurses time, skilled nursing care and home health care. He also provides details on the expended time per hour of nursing care and suggests that new technologies would provide solutions to some of the acute time allocation problems facing nurses. [4] provides details of how text messaging using wireless devices can be effectively used to remind patients of their appointments. He reports the idea behind a radically new system of managing patient care in conjunction with modern telecommunication applications using wireless devices to improve the quality of patient care.

Common to all these studies is the use of emerging technologies in healthcare and potential benefits that can be achieved.

While many other studies reviewed in the healthcare literature echo similar sentiments, none of these studies have examined the potential problems in data collection methods using wireless devices. It appears that almost all studies have taken this crucial aspect for granted. While some studies have indicated existing problems in collecting patient data and provided some theoretical solutions, these studies have seldom analysed the changing nature of information systems using wireless devices. For instance, [1] mentions the advantages of using mobile devices in collecting patient data, but did not provide an in-depth analysis of the strengths and weaknesses of such a procedure.

To understand the issues associated with data collection using wireless devices, the Information Systems literature is also reviewed. Such a review indicated that this area is not fully researched. For example, [13] states that the wireless technology is in its infancy stage and warns of the potential pitfalls if IT providers rush to implement the technology; [14] warns of the slower speed of wireless networks compared with the desktop computers and highlights the potential problems that could be encountered by healthcare; the relative high costs to initially set up these wireless networks is highlighted by [15]; lack of real time connectivity due to the mobility of the device and the problems associated with such mobility is highlighted by [16]; the size of the screen and hence the problems that may be encountered in displaying data due to screen size while capturing data is stressed by [17]; the problems that may be encountered due to the lack of provision for high quality graphic display on wireless devices is highlighted by [18] and [19] discusses the potential problems of capturing data using wireless devices due to the 'hard-to-see display' nature of these devices. While the studies mentioned above warned the problems that could be encountered while using wireless devices, they also tend to agree that the usage capabilities of these devices are growing and hence these hardware related problems will disappear in a few year's time.

What can be realised from this review is that the majority of the studies have focussed on the 'hardware' or 'physical' component of wireless devices as this appears to be a focal point of interest to many authors now. Others studies can be grouped into the 'implementation' or 'management' of these wireless technology in healthcare organisations as cost appears to be a determining factor in such implementations. None of the studies reviewed appear to have examined the 'usage' aspects of wireless devices. While studies such as [20] have examined the 'Technology Acceptance' in organisation and derived a model for such acceptance, the

outcomes of such studies can't be generalised for wireless technology as the technology is radically different from the traditional desktop technology. In a desktop technology, users go to data by accessing them using wired and fixed devices. On the other hand, in a wireless technology, the data comes to the users via the hand held devices and this new paradigm gives users a lot more mobility and hence access to data.

This mobility has prompted healthcare organisations to consider wireless devices for data collection and management purposes. Further, the data collection at point of care can eliminate transcription of data onto computer forms realising cost savings. Once the data is collected and verified, it is possible to integrate these data with existing systems for distribution to various organisational units in a healthcare setting. Collectively, these activities would realise significant financial savings.

While healthcare organisations are keen to save money, they are also keen to provide high quality services to their patients. Crucial to this high quality is data. The raw data collected at point of care by nursing staff is converted into information by feeding the raw data into various organisational databases. Current literature highlights the importance of incorporating wireless devices in organisations without discussing how effectively can nurses collect data. Limited information is found on the factors of adoption and barriers associated with such devices. Therefore, this study will conduct an investigation into the factors of adoption of wireless applications for data collection by nurses. By doing so, this study will fill-in the gap in the literature and provide insights into those factors that need to be given priority while using wireless handheld devices for data collection purposes. It is also hoped that the outcome of this study would enhance the data collection procedures by nurses in healthcare, realising significant cost and time savings.

3. RESEARCH PROBLEM

This research aims to identify factors that determine adoption of wireless handheld applications in hospitals for data management by nurses. It will also examine potential challenges in adopting wireless handheld devices due to the rapidly changing nature of technology and associated legislative framework.

4. HYPOTHESES/QUESTIONS

1. What are the factors determining the adoption of wireless handheld devices in hospitals for data management purposes?
2. What are the factors impeding the adoption of wireless handheld devices in hospitals for data management purposes?
3. What are the emerging challenges in adopting wireless handheld devices in hospitals for data management purposes?

5. RESEARCH DESIGN

The research design of this study involves both qualitative and quantitative techniques. The qualitative techniques were employed to get 'first hand' information from nurses using a semi structured interview approach. This is essential because the literature is limited in this aspect. The quantitative method involved developing a survey instrument to obtain nurses' perceived opinion on various factors impacting the adoption of wireless technology, as found from the interviews.

The data were collected in two stages that are six months apart. In the first stage, data were collected from nursing staff involved in patient care about their adoption and usage behaviour of data collection using current technologies. In the second phase, respondents were contacted again for a follow-up survey to understand their changing views and behaviour pattern. Three specific hospitals were identified for this purpose where wireless devices are used for data collection purposes. The hospitals were derived from government, private and regional sectors respectively.

While many techniques are available to capture perceptions and attitudes of usage of technology, this study employed an interview and a survey technique [21]. This included open-ended responses to obtain factors that are not constrained by a pre-determined identification of constructs found in traditional surveys, as well as to determine the importance of the pre-determined factors. Given the exploratory nature of this study, these two techniques are considered important.

The instruments of this research constitute two broad categories of questions. The first category of questions were related to the adoption and usage of wireless devices in hospitals for data collection purposes. The second category consisted of demographic variables. Open ended questions were included in the instrument to obtain unbiased and non-leading information. Prior to administering the questions, a complete peer review and a pilot study was conducted in order to ascertain the validity of the instrument. A two stage approach was used in administering the instrument, where the first stage gathered information about the key factors influencing nurses' decision to use wireless applications and the second stage on the importance of those key factors. This approach was followed in this study in order to complement the open ended questions so as to determine the importance of the individual factors determining the adoption and usage of wireless devices and applications.

6. DATA COLLECTION

The first phase of the data collection involved conducting a set of interviews with nurses in Queensland Health Districts to find out their 'feelings' about wireless technology in their workplace. An initial set of 5

questions covering a range of wireless technology adoption (and barriers) were prepared for the purpose of interviews. With the help of a research consultant from the health department, three interviews were trialed to see the comfort of staff, time taken for the interviews, relevance of questions and other factors influencing interview based data collection methods. Using the feedback received, the interview instrument was refined.

For the purpose of data collection, it was decided to use a digital recording machine with the voice recognition feature. The main purpose of this approach was to eliminate manual data transcription activities. However, after attempting to transcribe the digital recording, it was found that heavy training was essential to determine accuracy and the process was discarded. The digital files were then transcribed using a specialist person.

For the purpose of this paper, the first three interviews were reviewed to identify themes and sub-themes of adoption and barriers. Data pertaining to these are presented in this paper as the transcription is being analysed currently.

7. DATA ANALYSIS

The data analysis consisted of three aspects. The first aspect involved manual theme extraction and identifying limitations of the study. The second aspect involved identifying factors of adoption and barriers using manual techniques. The third aspect involved analyzing the data using NVivo software application. The software is used specifically to extract statements so that a relationship model can be loosely built.

Preliminary data analysis indicated emerging patterns. Two factors emerged as initial factors – the first one was the concept of 'time management' and the second one was a set of barriers. The time management included a number of sub factors ranging from saving time due to walking to wards and reduced paper work. The initial analysis yielded 12 specific factors – visitations, reduced paper work, access to data, time savings due to the online revision to patient records, real time data capturing eliminating transcription, order tracking, perception of more free time due to wireless technology, time savings due to online data management, time savings due to currency of data, cost reduction, time savings due to mobility and intangible savings due to better data management.

When the data was further analysed using NVivo, it was found that there were factors with overlapping themes and these themes can be merged. As a result of this exercise, certain factors were merged to obtain a smaller set of factors of adoption for the time management theme. Four prominent themes emerged from the data with respect to time savings. These were time savings due to better management of visitations, data access, data integrity and cost savings. A preliminary model is extracted from the data with relationships as shown below in the following 2 diagrams. Figure 1 provides a snapshot of the 12 factors and figure 2 provides their groupings.

In terms of barriers, the initial interviews revealed that training, resource implication, financial constraints and fear for technology as the four factors inhibiting wireless technology for nurses. Figure 2 provides the details of barriers and adopters as found from the initial interviews.

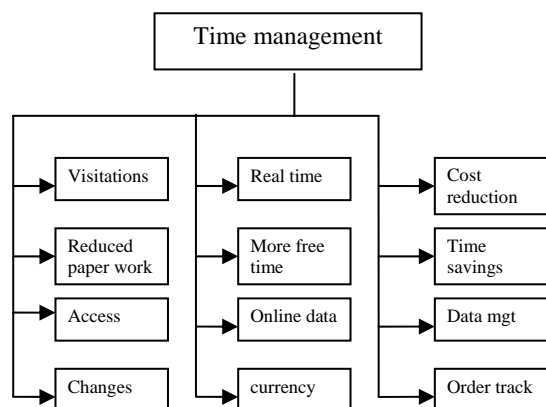


Figure 1: Adopters of wireless technology for nurses

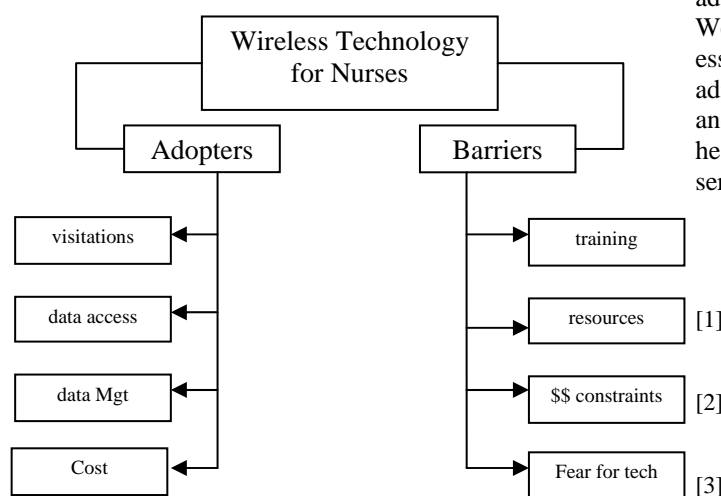


Figure 2: Adopters and Barriers of wireless technology for nurses

8. DISCUSSION

The initial set of interviews examined supports the opinions expressed in the literature. In terms of adopters, the concept of mobility was supported by previous studies [1] indicating that wireless devices may reduce the walking time of nurses in hospitals. Reduced paper work is highlighted by many studies [3]. Access to data and data management have been confirmed as potential factors of adoption in previous studies [7]. This study confirms these factors. In essence, the factors of adopters as identified from the interviews, support what has been found in the literature.

However, in terms of inhibitors, the fear for technology appears to be somewhat surprising because the IS

literature has been claiming that training is not a significant factor in technology acceptance. In fact, versions of Technology Acceptance Models and studies that have used this model claimed that due to the maturity of technology, training has lost its significance. Despite the maturity, the interviews clearly indicate that training is an essential component for technology acceptance in healthcare and this is indicated in terms of training, education, fear for technology etc. Similarly, the hype that the cost of technology is decreasing and hence affordable appears to be weak as the interviews indicate that there is a resource issue (of technology) in healthcare. The barriers are yet to be identified in healthcare literature and the implication of this is that technology investment in healthcare is perhaps low compared to other industries. These aspects need more investigation in future studies.

9. CONCLUSION AND FUTURE RESEARCH

We had time to analyse only three interviews and hence the assertions made in this paper can't be generalized. We are analyzing another about 30 interviews to extract themes of adoptions and barriers of wireless technology in healthcare. We have also prepared a quantitative instrument based on the essence of the interviews and a survey is currently being administered. Further studies should explore the adopters and barriers in depth to understand the current situation in health as there is growing criticism about the quality of service provided to consumers of healthcare.

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