

## Postgraduate Nurses' Use of Personal Digital Assistants in Critical Care

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#### Abstract

Healthcare in the developed world is characterised by rapidly increasing use of mobile technologies to deliver effective and quality patient care. In nursing, personal digital assistants (PDAs) have been used for recording patient information and care planning in real time or point of care with patients. This paper examines whether PDAs were used effectively as a learning tool by postgraduate critical care nurses. Qualitative methods were employed to ascertain how the postgraduate nurses embraced PDAs and whether their use enhanced learning and competency in critical care. Fourteen postgraduate intensive care nurses were supplied with a device for the period of their 12-month postgraduate education program in association with RMIT University. This program is the primary qualification for graduate nurses to be certified as competent for Intensive Care Nursing in Australia by the Australian College of Critical Care Nurses (ACCCN). The Clinical Experience Portal[CEP], a software program using Microsoft SharePoint, provided a method for the students to mainly record their critical care competencies, to share information, and to access resources such as drug information, policy documents, and ward lists. The PDAs had a wireless connection to Intranet and the Internet and they could be used as a storage device for viewing lecture material, clinical notes and personal diaries. Focus group discussions were undertaken half way through the program (6 months) and at the completion of the program (12 months). The findings showed that the majority of nurses used the CEP for recording their competencies via the patient's bedside computer rather than the PDA. The main reason cited was convenience and accessibility to the patient's bedside computer.

#### Keywords: Personal Digital Assistants; Clinical Experience Portal; Critical Care; Competencies; Nursing

### **1** Introduction

The increasing complexity of the health care system in Australia and overseas makes mobile technologies, such as personal digital assistants (PDAs) BlackBerry, and iPhone, a necessary work tool for clinicians. The massive amount of nursing and medical information, the rapid growth in new pharmacotherapy and technologies, increasing time constraints on clinicians, mounting pressure to reduce costs, and substandard systems for delivery of care, makes it virtually impossible for clinicians to provide high quality, error-free care on a consistent basis. In the majority of cases, most errors and adverse events are the result of human failings and faulty system designs, not individual negligence or incompetence [1].

taught and delivered in the future as they have the ability to merge and integrate distinct functionalities in one device that is versatile, customisable, and portable [2]. As learning and teaching adapts to the demands of the 21st century, both educators and students in the nursing profession are finding that the most effective learning approach integrates the management and processing of information into both their practice area and their personal growth and development. Mobile technologies can improve nursing education and practice through connecting people, unifying the education process and enhancing learning. Patient safety is one of the most important aspects of nursing care and these devices can promote the quality and immediacy of bedside information and improve the accuracy of record keep-

PDAs have the potential to change how healthcare is

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#### ing [3] [4] [5] [6].

Other potential benefits include:

- reduction in medication errors, including errors that can cause patient's harm;
- increase appropriate and safe prescribing decisions by providing information about suggested drug dosages and frequency of doses;
- improvement to the quality of medical and nursing care by providing clinicians with ever-changing management guidelines and care standards;
- contribution to patient education, practice audit and clinical outcome analysis by providing the opportunity to use data to review clinical practice patterns, for medication and tests ordered for specific patient groups;
- reduction in physician and nursing time spent on administrative tasks thereby improving efficiency of care to the patient;
- reduction in costs mainly related to less expensive tests and drugs, and fewer medication errors and adverse drug events [7] [8] [9] [10].

These benefits cannot be overstated when the costs associated with drug misuse, under use, overuse and reactions to therapeutic drugs results in 140,000 hospital admissions each year in the Australian health care system and costs the Australia government \$380 million. Other areas that inflate the health systems costs in Australia relate to health care associated infections, patient falls and pressure ulcers. It is estimated that 10-20% of all adverse events are adverse drug events and most are potentially preventable. In most developed countries, including Australia, an adverse event is associated with about 10% of hospital admissions. About 2% of admissions are estimated to be associated with serious adverse events causing major disability (1.7%) or death (0.3%) [11].

It is acknowledged in health care disciplines such as nursing and medicine that the competency of the practitioner impacts on the safety and quality of care delivered and this indirectly influences the number of adverse events. The main defining attribute of competency is the effective application of knowledge, attitudes and psychomotor skills within the work setting [12]. How each competency and its components are executed varies according to the context of the health care settings [13].

A possible solution to this problem is the design of mobile information systems that can assist clinicians in enhancing competencies to provide the highest quality of care to their patients. While these systems have the potential to enhance clinical competencies, more research is needed in terms of implementation and evaluation of these technologies and what impact they have on patient safety and quality of care. This study has addressed such a need by investigating the use of PDAs by critical care nurses and also by developing a CEP that allowed these nurses to record their competencies electronically.

### 1.1 Aims

The general aim of this study was to investigate the use of PDAs for learning and competency by postgraduate nurses in an intensive care unit (ICU). The focus was nurses' PDA use as most research suggests that doctors embrace information technology far more than nurses [14]. As stated previously, the competence level of the health care practitioner has direct impact on the quality and safety of patient care and it is universally recognised that reducing adverse events is a major health care priority. Ensuring competence of the health care practitioner is a challenge for all stakeholders, including the education provider, health care providers, professional organisations, and Federal and State governments.

## 2 Methods

A qualitative design, using focus group discussions, was adopted to investigate PDA use by postgraduate critical care nurses. Focus group discussions occurred at 6-month and 12-month intervals, the duration of the Critical Care Program. The length of the interview was about 60 minutes. The nurses were asked to indicate their general impression of the PDA including the support they received from the training team when using the PDAs, and the impact the PDA had on their learning and competency level within their work environment.

## 2.1 Setting

The study was conducted in an adult ICU of a major teaching hospital in Melbourne, Victoria Australia. The unit had wireless access and PDAs were provided to fourteen postgraduate nurses undertaking a Critical Care Program. They also had access to resources, such as clinical guidelines, evidence-based practice and drug references, and to the CEP.

### 2.2 Equipment

Postgraduate intensive care nurses were supplied with a PDA (Hewlett Packard iPAQ 212) for the pe-

riod of their program. The mobility of the device meant the nurse has access within wireless range, but was not constrained by bedside or staff desk computer stations. The devices were configured by the research team and as mentioned previously the CEP was developed with nSynergy for the recording of the critical care competencies

## 2.3 Clinical Experience Portal

In a Critical Care Program, postgraduate nurses need to acquire skills in the cognitive, affective and psychomotor domains of learning. The program usually covers basic and advanced life support, patient physical assessment skills, ventilators, mechanical ventilation, cardiac and haemodynamic monitoring, and specialist technologies (E.g. Intra Aortic Balloon Pump device [IABP] Continuous Renal Replacement Therapy [CRRT] and surgeries (e.g. cardiovascular or neurology). In a traditional 12-month program these are attained by set experiences anticipating effective learning, hurdles, summative and formative assessment and appraisals. Achievement are usually determined by exams so there is a chance that many nurses do get the required experience to practice safe and quality care for their patients.

There are problems with this curriculum approach as it is based on fixed time, the clinical environment is highly variable and there is limited opportunity for individual nurses to identify specific learning needs. Standardizing clinical learning is almost impossible. In a more dynamic curriculum, digital technologies have the potential to address these problems, as well as responding to the "Y" generation, the mean age for the majority of nurses undergoing such a program. The CEP using Microsoft SharePoint was designed to modulate the learning experience(s), allow for minimum skills sets, standardize learning within groups, give better feedback and improve certification standards and subsequent documentation.

Microsoft SharePoint Server is a collaborative document-management platform that can be used to host web sites that access shared workspaces and documents, as well as specialised applications like wikis and blogs from a browser. The CEP was developed by the research team and nSynergy and the competencies used reflected those endorsed by the Australian College of Critical Care Nurses. An evolving trend within nursing and other health care professions is the emphasis on competency-based education and lifelong education. In this changing paradigm, educators no longer serve as the sole distributors of content, but are becoming facilitators of learning and assessors of competency and this can be achieved through the use of E-learning [15].

Nurses could access the CEP through the PDA or a PC computer. An overview of the concept underlining the competency logging is outline in Figure 1:



Figure 1: Concept of Competency Logging

This figure shows the postgraduate nurse entering the competency onto the PDA. This information is fed into the network server where it can be viewed by the clinical teacher and the shift manager through the ward PC. The nurses could also access their individual log through the PC. This information gathered can be used for reports, audits and transcripts for the nurse at the end of their program.

The nurses were given a log in for their shift entry were they could record their competencies and to the home page where they could view announcements from the teachers, reminders about classes or shift, and uploaded class material such as Power-Point presentations and X-rays related to patient care. When the nurse entered a competency they had undertaken it had to be signed off by their supervisor or clinical teacher to validate the entry. Figure 1 shows a Data Review of a nurse for a monthly period. The spread sheets identifies recoding of no entries, shift time (day or evening), unit allocation (Pod A or Pod B), and no of competencies undertaken (CAGS, Sepsis, Respiratory, Spinal) and confidence score.

## 2.4 Ethics Approval

The University of Ballarat and the Austin Health Ethics Committee's approved the study with some minor adjustments. There were some concerns relating to loss and theft of the PDAs and a statement was included in the participants' plain language statement outlining the process if this should occur.

#### 2.5 Recruitment and Training

Postgraduate nurses were recruited from the group of nurses undertaking the Critical Care Program through a university affiliated with the hospital. There were 14 nurses in the group and all agreed to participate. A training session (2 hours duration) for these nurses was conducted by the research team in the education facilities within the ICU. The nurses were shown how to access resources online and how to use the CES Portal. Further training was not required as all nurses were familiar with Microsoft Pocket PC operating system and most used the keyboard function as opposed to handwriting recognition. As most of the nurses were in Generation Y age group their familiarity with communications, media, and digital technologies was evident.

#### 2.6 Data Collection and Analysis

Two focus group discussions were conducted at a 6month and 12-month interval (end of the program). The research assistant convened, taped and transcribed these discussions. A semi-structured interview (Table 1), consisting of open-ended questions, was used to promote discussion and explore issues around the use of the PDA's and the impact it had on their learning and patient care. The discussions were approximately 30 minutes in duration. The data was analysed using the semi-structured interview questions as a guide. The researchers adopted this approach as there was significant literature around the use of PDAs with consistent themes emerging.

## **3 Results**

### **3.1 Demographic Characteristics**

Demographic data were obtained from the 14 participants with gender being 86% (n=12) and 24%(n=2) female and male respectively. The most common age group was between 18-24 years (n=7) followed by 25-34 years (n=6), and 35-44 years (n=1). English was the first language for 12 of the participants, and Chinese for the remaining two. The majority of participants had been a registered nurse (n=12) for 1-5 years followed by 6-10 years (n=2). All the nurses had Bachelor's Degree and the majority considered themselves computer literate (n=13). The nurses also reported on daily use of information technologies and most common cited were mobile phone (n= 11), internet (n=10), email (n=8), and electronic database at work (n=8).

# **3.2 Nurses' General Impression and Use of the PDAs**

All the nurses found the PDAs easy to use: "Yes, I thought they were easy to use" and "I thought user friendly". As state previously these nurses mainly represented the Generation "Y" age group so were very familiar with the device and software. The size of the screen was not reported as a problem; how-ever that depended on what document was accessed: "As a screen itself its fine but just in terms of reading stuff. Sometimes its size is a problem. You can change the font but lose quality, for example with PDF files".

The features most used by the nurses were interesting. None of the group used the PDAs to access resources online, such as the MIMs pharmacological database as this was readily available on the PC provided at the end of each patient cubicle in the ICU: "Because we have bedside computers, and the reason I don't use it because the screen is too small like X said, you have to scroll across and down. So I find the bedside computer easier to read". Another reason was the quick access to information through the PC: "With the computer it just opens straight to our home page so you can just click to the MIMS (or guidelines, interjected by another), is there straight away and you're there like in 2 seconds but with the PDA you have to turn it on, connect to the internet and then find the file and then, by then you've wasted 10 minutes trying to find where you want to be anyway, whereas computer access is by the bedside is right there."

Other reasons for use of the bedside computer rather than the PDA related to technical issues early in the program: "They said they were going to work on it, every time you turn it on [the PDA], it would default to the wrong wireless connection, if you don't connect to that then you can't open up the webpage to do your data entry." Due to this issue the nurses were frustrated and this had an impact on their duties: "It could take up to 5 minutes to connect, so by the time you needed to do this to open up the page, you could have done it on the bedside computer and washed your patient, the 5 minutes all add up and we don't have time to fiddle around with the PDA." It is interesting to note that once the technical problems were fixed only one of the nurses used the device in the latter part of their program: "Lost motivation for using them because we couldn't use them for the initial purpose [tracking critical care competencies] however the idea and shift entry is great. But for everything else the bedside computer is more user-friendly and quicker."

# 3.3 Nurses' Impression of Training and Support

The nurses felt that the 2-hour training session was of benefit however most suggested that a one on one session would have been more effective. How to use the PDA was not an issue; the issues related more to the use of the programs and the wireless connection: "I think maybe do it one on one, there were 14 of us with one person and everyone was at different stages of trying to set it up and I think everyone was sort of getting confused because one was asking one question and another [nurse] was two steps backwards and another [nurse] two steps forward." A nurse also suggested booking short training sessions that showed them how to access databases, such as MIMS Online, to place in their Favourites: "Book half hour sessions to set up our MIMs, ... save in the favourites so we always have got them, were probably more likely to use them, rather than trying to remember websites and passwords and things." A mini manual was also suggested initially to assist in the setting up of programs. An interesting finding was that all nurses felt they were learning together as an ongoing process.

All nurses stated that the follow up support during the program was adequate. This was provided by the program coordinator and the IT support within the hospital: "We had the IT guys come and they explained everything to us which is good, because the Webpage and program is developing and kind of changes as you go along." Battery loss was an issue for some nurses however most stated that the device had to be recharged every day: "You leave it on, goes on to stand by, and then it's like flat by the next day, so you have to charge it all the time." All nurses knew what to do if the PDA was stolen or loss – one was stolen, the remaining 13 were returned at the end of the Critical Care Program.

# 3.4 PDAs Influence on Nurses' Learning and Competency

All nurses, except for one, stated that they did not use the PDA for recording their competencies and felt that the device did not influence their learning as it was not used. The main reason given was the easy access to the bedside computer: "Intranet is quicker and more easily accessible on the bedside computer, than it is on the PDA, so why would you use it if you have the bedside computer"; "It is not integral to our learning as we can get on to the bedside computer to access information that we want. Other than that all the lectures on are on the CEP portal so we can obtain them from there." All patients in the ICU at Austin Health had a bedside computer so access to a personal computer (PC) within the unit was not an issue.

As stated previously, another reason given was technical and this did not encourage or motivate nurses to use the PDA for this purpose. Most nurses felt that if they were better prepared, that is the devices were fully loaded, passwords and URL links established they would have the used device more, although some did say they would not bother as they had access to the bedside computer: "If the PDA was introduced at the beginning may have used it... however still have the bedside computer open so would not use that fiddly thing." "Just adds another component to your day, which you can access on the bedside computer, it all software, passwords, MIMS were set up, however would still not use it, as you have access to the bedside computer."

Other reasons given for non use of the PDA related to lack of time, patient safety and complexity and severity of illness: "This semester has a lot of assignment, no time when at work trying to get the sicker patient, so you do not have time to use the PDA....at home you study or do nothing." "I have been looking after more unwell patients... looking up what is wrong with the patient with up on Google and spending more time with our educators so leaving time to get on the PDA is far too hard." "Some shifts you just barely have enough time to check the normal computer not alone log into a smaller one...you have to get it out and you do not want to leave the PDA by bedside as it may get stolen." Also some of the electronic documents the nurses needed to access for patient care such as Med tract, Chest x-ray, Slick Chart, were far too large to read on the PDA: "Not the whole package and so you would be using half the computer and half the PDA to view the information."



Figure 2: CEP Data Review

The nurses stated that the PDA would be of use if

the ICU did not have a bedside computer and in a general ward where there were fewer PCs: "They are not overly worthwhile in ICU as you have access to the bedside computer however in a general ward it could be useful." "It would be useful for people in an ICU who do not have a bedside computer... with the introduction of Slick you have to access the bedside computer every hour so do not have time for the PDA." They also stated that if the PDA had been introduced at the beginning of the Critical Care Program they may have used them as an electronic diary instead of paper for patient care and suggested that the yearly academic calendar be loaded onto the PDA. "What be awesome, if the yearly calendar that we get in the back of our book, was fully loaded, so we could check onto the PDA."

The nurse using the PDA logged on "every shift to provide a brief description of the patient" and also for recording the "clinical competencies." This nurse found the PDA useful for this purpose and for drug calculations. All of the other nurses logged their clinical competencies using the CEP on the patient's bedside computer.

## 4 Discussion

The results showed that nurses, except for one, did not use the PDA for recording their clinical competencies onto the CEP. The main reasons cited were the easy access to the patient's bedside computer, technical issues, time and the severity and complexity of patient care. How to use the PDA was not an issue however the nurses did report that if software programs, such as MIMS pharmacological database, had been preloaded (nurses were required to do this task themselves) they may have used the devices more frequently.

The nurses found that it was more convenient and efficient to record their competencies and search for educational material and resources using the bedside computer. All of the nurses believed the PDA did not enhance their learning although supported the use of the CEP for recording clinical competencies, viewing announcements from the teachers, and accessing other class and resource material. The data obtained through the CEP was useful to the program leader for reports, audits and transcripts for the nurse at the end of their program.

An interesting finding was that all nurses could see the advantage of using PDAs in general acute care wards for use as a shift calendar with alerts, drug information and calculations, and for accessing other educational resources through the intranet and internet. This finding is consistent with recent studies that have reported on the frequency of PDA use by nurses in these wards [16] [17]. The nurses in this study could also see the advantage of the PDA as an electronic organizer or day planner for shift entries in the ICU and stated they may have used the device if there were not technical issues at the beginning of the program.

What this study has revealed is that nurses will not use a PDA if a PC is available at the patient's bedside. The ICU unit where the study was undertaken has had bedside computers or all patients for approximately two years. The results may have been different if only one PC was provided for two or more patients. Also nurses are caring for critically ill and complex patients in the ICU and this requires the use of more sophisticated technical interventions. The use of the PDA by these nurses may have been seen as another stressor they had to deal with in this already complex and challenging working environment. Some of the nurses did report that this as was an issue for them.

In this study, all nurses had a mobile phone and used it daily. What type of phone the nurses used was not known however considering their age (most represented the Y generation) it could be assumed that the majority of the devices were iPhones or smart phones. Considering the functionality of these smart phones -new hybrid devices that combine the communication capabilities of mobile phones with easy and fast access to Web and computing features of Pads - perhaps this may be a more effective way to provide real-time access to online nursing knowledge resources at the bedside. In the United States approximately 63% of physicians already own smart phones and some hospitals are hospitals are buying smart phones for affiliated doctors and mandating use [18]. Most hospitals in Australia do not allow the use of mobile phones because of interfere with medical equipment, however a recent study showed a low incidence (1.2%) of clinically important interference [19]. Also the phones currently in use are safer and must be close to medical equipment before any interference is noticed. Another option is the iPad or other upcoming tablets that provides almost the same degree of portability and convenience, but on a significantly larger display adding more functionality than the smart phone. In 2011, the Victorian government (Australia) will provide 500 iPads to graduate doctors in medicine and nursing practitioners to use while treating patients in hospitals. The trial is piloting the use of mobile and wireless technology in hospitals [20]. The findings from this proposed trial will

be interesting and perhaps in the future hospitals in Australia will provide all healthcare professionals with an iPad to use in real time with the patients.

The findings from this study cannot be generalized to the entire population of PDA users, as the sample was convenient and was limited to one group of nurses undertaken a postgraduate program in an acute care hospital.

## **5** Conclusion

This study examined the use of PDAs by critical care nurses to ascertain how they embraced the technology and what effect the devices had on their learning. A CEP, using Microsoft SharePoint, was also developed for nurses to record their competencies, via the PDA or PC. The findings showed that the nurses did not have any issues with the use of the PDA however, technical issues such as logging on and interfering URL addresses did affect how often they used the device. The majority of nurses did not use the PDA as all patients in the ICU had a bedside computer and this was more accessible and convenient. Nurses did record their competencies using the bedside computer however, all consider that this did not enhance their learning. The nurses all agreed that the PDA would be useful in a general acute care wards where PCs are limited. As all nurses in this study owned a mobile phone and used it daily perhaps the future for mobile technologies is the use of this device as a smart phone or iPad.

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