Nurses’ and nurse students’ demands of functions and usability in a PDA

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\textbf{A R T I C L E I N F O}

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\textbf{A B S T R A C T}

Introduction: Healthcare organisations are nowadays expecting the support of IT in the daily routines. Personal digital assistants (PDAs) are in use in some healthcare organisations but in an irregular and unplanned way. The aim of the present study was to describe nurses’ and nurse students’ demands of functions and usability in a PDA.

Methods: Interviews were made with 12 nurses at the County Hospital of Kalmar and a questionnaire was given to nurse students (n = 84) in their last, i.e. third, year at the Department of Health and Behavioural Sciences, University of Kalmar.

Results: There was a need for nurses to make the information in general more rich and efficient by means of a PDA. In a PDA, the nurses and nurse students expected access to information about the patients, knowledge resources and functions for their daily work.

Conclusions: The nurses and nurse students had high expectations of a PDA for information retrieval. A PDA has the potential to be accepted as a supportive tool in healthcare organisations if it contains the demanded content which must be adapted to the users’ needs and the general IT-system used, and the PDA must have a user friendly design.

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1. Introduction

Healthcare is in several ways supported by the information technology (IT) that has been developed during the past decades. IT has the potential to improve the provider efficiency and quality of care. In general, IT has the potential to provide healthcare professionals with faster access to patient information mainly by electronic healthcare records (EHCR) and medical knowledge resources\textsuperscript{[1]}. These functions are normally associated with the use of stationary computers but also of mobile technology such as personal digital assistants (PDAs) which can be used in a more flexible way than the stationary computers.

A PDA is a small handheld computer that is mostly employed as a popular tool for calendar and note functions\textsuperscript{[2]} but also for various medical applications, as well as in business and education environments\textsuperscript{[1]}. A PDA allows large volumes of updated information to be stored in the pocket. The PDA is a complement to existing hardware and software and with connection to a desktop computer it allows regular backups, data transfer and software downloads\textsuperscript{[3]}. A PDA has the potential to work efficiently as a wireless mobile device that implies reading and computing data including images in a hospital environment. Different healthcare professionals have used the PDA to a various extent for different tasks, such as accessing patient records, writing prescriptions, billing, per-
forming medical computations, e-mail, accessing the internet and medical textbooks \[4\].

There are PDAs developed for primarily doctors but rarely developed for nurses. To prepare for a general introduction of a PDA it is important to meet the needs and expectations of nurses both as professionals and students.

The aim of the present study was to describe nurses’ and nurse students’ demands of functions and usability of a PDA.

## 2. Methods

The study included interviews with 12 nurses, 3 (25%) men and 9 (75%) women (mean age 36.8 years, range 26–53) at the County Hospital of Kalmar. All nurses had worked at least one year at the Hospital but had different backgrounds and education. A questionnaire was given to nurse students (n = 112) in their last, i.e. third, year at the Department of Health and Behavioural Sciences, University of Kalmar. The response rate was 75% with 84 students, 18 (21%) men and 66 (79%) women (mean age 30.2, range 21–50).

### 2.1. Interviews

The head nurses of three different departments, cardiac, pulmonary and surgical, respectively, were contacted by telephone. After we had explained the intention of the interviews the head nurses suggested from each department four nurses that agreed to be interviewed. Prior to the interviews e-mail was sent to the nurses explaining the purpose of the study. The interviews of the nurses were conducted by using an inductive method by which two of the authors (MB, CN) studied the nurses needs in order to find theories and conclusions about the reality \[5\]. The interviews were conducted in a secluded office or room and were audio taped with the nurses’ consent for analysis. The nurses were asked to describe their daily work, what kind of content they wanted in a PDA and usability aspects of a PDA. Follow-up questions were asked to deepen, develop further or clarify what they told. In the middle of the interview, we demonstrated a PDA for the nurses with the purpose to demonstrate the interface. The interviews lasted approximately 30 min each. The responding nurse was given a number (r1–r12) for data reporting purposes.

### 2.2. Questionnaire

The questionnaire to the nurse students was composed on the basis of analysis of the results from the interviews with the nurses. The questionnaire included seven questions (Appendix A). The response format was nominal (yes–no), ordinal scale levels (Visual-Analogue Scale, VAS) for five questions, and open-ended for two questions. The questions dealt with the need of information, functions and usability in a PDA. A preceding pilot study showed satisfactory questionnaire wording and feasibility with only minor corrections made. The survey took place with the students in the classroom.

### 2.3. Data analysis

The recorded interviews were transcribed verbatim and the text was analysed by means of qualitative content analysis as inspired by Burnard \[6\]. In step one, the text was read and reread several times by two of the authors (MB, CN), bearing in mind the aim of the study, in order to obtain a sense of the content, and to excavate new categories and subcategories. To increase credibility, the same authors (MB, CN), in step two, through out the analysis, read the text, reflected on, interpreted, discussed and revised the coding to reach general agreement concerning the three categories and their subcategories presented in Table 1.

The questionnaires were analysed according to their response format and scale levels (nominal and ordinal). The open-ended answers were analysed using manifest content analysis which is a quantitative technique that is applied to qualitative data forms \[7\]. Words and phrases in open-ended answers expressing the same content were sorted to categories, counted and presented in descriptive statistics. Iterated reliability was measured between the authors.

## 3. Results

Three main categories were found analysing the interviews with the nurses: the need for information access, information and functions, and usability (Table 1).

### 3.1. The interviews

#### 3.1.1. The need for information access

Some nurses stated that they had spent a great deal of time searching for medical information in books and memos. They meant that the time spent on looking for information could be considerably more efficient. Most nurses (n = 10, 83%) thought that a PDA would be ideal for reading information about the patients and medical information central to their work.

‘There should be a better system for finding correct information. Everything should be collected at one place. There should also be a faster way to access the information.’ (r5)

One of the wards (surgical) was equipped with an EHCR and the nurses of that ward were more enthusiastic about a PDA and regarded a PDA to be a useful tool both for reading and writing the EHCR. Some nurses saw the possibility with a laptop instead of the PDA and thought that a laptop would be

<p>| Table 1 - Categories and subcategories found during the analysis of the interviews |
|-----------------------------------------------|-----------------------------------------------|</p>
<table>
<thead>
<tr>
<th>Categories</th>
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<tr>
<td>The need for information efficiency</td>
<td>Information about the patient</td>
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<td>Information and functions</td>
<td>Knowledgebase for nurses</td>
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<td>Usability</td>
<td>Functions for daily work</td>
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<td>User friendliness</td>
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more efficient than a PDA when writing. A nurse in the cardiac ward stated that the first step is to get an EHCR and that the PDA is a further development from that.

3.1.2. Information and functions

3.1.2.1. Information about the patients. The nurses wanted information about the patient in the PDA, e.g. an EHCR, a schedule displaying the patients’ stay in the hospital and test results. The nurses explained that it is necessary to have an easy tool to describe where a patient is located and what the patient needs during his/her visit, with, e.g. a display of the number of occupied beds. It is also important that the nurses quickly can answer the patients’ and their relatives’ questions about location, test results, and the patient’s medical record. Nurses need this information both when meeting the patients and when executing decisions. To facilitate and speed up the access of the medical record, it would be useful for the nurses to display the EHCR in a PDA. To interact with the patient information, a PDA would be preferable, e.g. making notes in the record or signing a pharmaceutical list and describing pain through a VAS scale.

‘If a patient has severe pain, less pain, where the pain is located and so on. This type of information could go easily and quickly click through [on the PDA] and therefore also be better than the documentation that exists today. It would be more complete since this type of standardization doesn’t exist today.’ (r3)

Some nurses wanted to be able to view images of a patient’s wound in the medical record accessed by a PDA. At two wards, all nurses wanted a camera function in a PDA that would allow them to take photos. These nurses expressed a need for better analysis of wounds, by submitting images of a wound and have a doctor or a colleague to examine it. Preview images would also be useful for check-ups of a wound and to follow its development after treatment.

3.1.2.2. Knowledge database for nurses. The nurses expressed a need for knowledge database including reference books, dictionaries, practical handbooks and internal memos. The information resources must be easy to obtain and carry with you, as provided by a PDA. Instead of heavy books or stationary computers, a PDA was appreciated because it is small, light and mobile. The nurses wanted to access the internal memos, which are used almost daily, via a PDA. The nurses often use internal memos, both from their own ward and other wards, to get information about procedures, e.g. special examinations, or preparations before a surgery. It would be helpful to access this information in a PDA. Some nurses stated that even video instructions would be beneficial to have in a PDA.

‘There are internal memos on the Intranet but I would like to view it more accessible, because today it is not an easy system to navigate. [–] Earlier we had a binder with papers and they were not updated as often as it should be.’ (r2)

Most nurses (n = 10, 83%) regarded access to an electronic pharmaceutical record in a PDA as a way of saving time. All of the respondents wanted an application for searching for synonymous pharmaceuticals in such a record.

3.1.2.3. Functions for daily work. Many nurses (n=9, 75%) regarded an alarm function as a practical function in a PDA.

Two nurses stated that using standardized forms for communicating patient information could be more efficient in the future than today. The two nurses regarded this possibility in a wide field of applications. Today the communication with other parts of the surrounding caring network is very time consuming and with standardized forms the nurses thought that this could save time and frustration.

Other functions for daily work that some nurses expressed was to be able to get an overview of the assortment of pharmaceutical and disability aids and the number in stock at the hospital, without entering the pharmacy room or disability aid storeroom. One nurse explained that the possibility to write pharmaceutical prescriptions in contact with patients by means of a PDA would save considerable time.

Several nurses regarded the possibility to contact different wards and healthcare services as a communication improvement. Some nurses wanted a wireless network to obtain information while mobile and one nurse thought that Internet access would be a valuable function when searching at PubMed/Medline or other Internet based journal servers.

3.1.3. Usability

3.1.3.1. Adoption. The nurses wanted a PDA to be constructed to suit all the wards in the hospital. If standardized, a PDA would preferably be suitable for every ward, since nurses usually do extra work in different wards. On the other hand, they also wanted a PDA to be specifically adapted to provide the information that they use on their own ward.

Some nurses stated that there is also a need that other nurses, assistant nurses or students should easily be able to use a nurse’s PDA with different security levels implemented for different users.

3.1.3.2. Acceptance. To be accepted, several expressed that a PDA must provide an advantage for the nurse and applications that the nurses need to perform a certain task. Otherwise they thought that a PDA would only be a fashion tool for the most interested in IT. The implementation of a PDA requires that the use is requested by the management.

The nurses believed that it would be hard to gain acceptance of a PDA from the older nurses and those nurses that have worked for a long time in the hospital.

‘There are always those who think that it is hard working with computers. Especially older people.’ (r4)

‘I think it differs between wards. The change from one way of working to another, demands that the staff get education and time to learn the new system. There are always those who are satisfied with the way things work today. That’s a fact. Uniformity is important.’ (r9)

According to the nurses the acceptance of a PDA depends on previous knowledge and experience and how the nurses believe they would be able to manage a PDA. It is very important to give information and education about a PDA before it is implemented.

Some brought up the aspect how the patient would react to a nurse using a PDA. Nurses explained that it could look
unprofessional to seek information in the PDA in front of the patient. Other nurses thought that the quick answers that the PDA provides would be in favour for the patient’s acceptance. All agreed that the nurse has to be careful with what type of information they handle in front of the patient.

3.1.3.3. User friendliness. The nurses explained how important it is that a PDA is user friendly. It must be easy to use and provide the nurse with updated information at the right time and at the right place. It must be designed for the users by the programmers and the users must cooperate in the developing process. It must be easy to navigate through the system and to go back and redo if the user makes an error.

‘It is important that the PDA really is functionally and simple.’ (r9)

Some nurses did not think the screen would be large enough to read books or search at the Internet, but after having seen a PDA, they changed their mind and thought that the interface was sufficient.

3.2. The questionnaires for the nurse students

The nurse students (n=77) regarded a PDA to be useful for nurses with a mean of 7.73 (min = 3; max = 10) on an optional VAS scale (1–10) or “don’t know” answer. Seven students (8.3%) did not know.

From the two open-ended questions in the questionnaire the students expressed their demands of information and functions in a PDA. Regarding information that the students wanted in a PDA we identified different aspects in three different areas: information about the patient, information regarding knowledge resources and functions for daily work (Table 2).

The two most frequent demands of information about the patient were laboratory tests and reference values (n=23, 27%) and medical records (n=18, 21%). Regarding knowledge resources most students (n=71, 86%) wanted a pharmaceutical record in a PDA. Furthermore the students saw a variety of other functions as useful in a PDA. The most frequent answers were a calculator (n=28, 33%), a camera (n=21, 25%), the possibility of journal notes (n=18, 21%), and an alarm function (n=17, 20%) (Table 3).

The questionnaire revealed that most students (n=69, 82%) regarded that the nurses would accept a PDA, a few (n=5, 6%) did not, and some (n=10, 12%) did not know. There were several comments and reasons why the students would not accept a PDA; resistance to new technology, and new way of working, lack of interest and that older people will not adapt to it as easily as younger people.

4. Discussion

We found that both nurses and nurse students saw the need for information access. We also found that nurses had high expectations of a PDA as a tool for information retrieval for different tasks in their daily work. They wanted information about the patients, a knowledge database for nurses and functions for daily work. They also demanded adoption, acceptance and user friendliness.

We regarded that the aim of this study was well fulfilled with a large variety of demands on a PDA identified. The level of access to computers and the computer literacy might also have influenced the responses. However, although we believe that most findings of the present explorative study are fairly representative for the group studied, we cannot exclude that other nurses and also other nurse students might have responded differently. The short and simple questionnaire seems adequate for its purpose because it gave fruitful information in combination with a relatively high response rate.
The analysis and categorisation of the answers to the interviews and open questions were similar between the investigators. We regard the methods reliable and do not believe that the results would be different in a major way if other investigators had been involved or other methods had been employed.

Mainly a PDA was believed to improve patient care and save time for nurses because it was regarded as a convenient medium to provide and access information at any time and any place. A PDA has the potential to be a part of nurses’ routine care planning [8]. The nurses expressed many needs that they wanted the PDA to cover but would probably articulate even more opportunities if they learned more about a PDA’s possibilities. The nurses wanted a PDA to be a multitasking tool integrating a variety of functions.

Primarily the nurses wanted a PDA to facilitate transfer of information that is directly concerning the patients, i.e. information and functions that describes the patient’s situation, such as medical records, images and notes. This kind of information is important to handle carefully in particular in front of patients. Security and confidentiality issues associated with such data on a PDA as well as loss and replacement of PDAs is an important issue when using PDAs in the reality but was not handled in the present study when the anticipated use was asked for. Furthermore, the nurses wanted access via a PDA to knowledge databases, involving information to increase their competence and skills. Such information resources, e.g. different types of medical dictionaries and instructions would also be useful for students during their education, cf. Knowmobile [2]. In a third category the nurses wanted information and functions that would be useful in their daily work, e.g. communication with other wards, functions for storages, alarm functions, possibilities to make prescriptions, etc.

We found a difference between what the nurses wanted and what the students wanted. The students’ demands of a PDA were within the same three categories as those that were defined from the interviews with the nurses. In addition the students’ demands on a PDA were focused on their learning (Tables 2 and 3) obviously due to the fact that the students had not finished their education and could not anticipate what their future work would imply. Thus, there is a need to inform and train students about their future professional use of IT.

In a future effective IT-based healthcare, every nurse’s acceptance and training to use a PDA is important because otherwise it makes it difficult for Computer System Cooperative Work (CSCW). Healthcare workers should act as a group through the IT-system and share information for better cooperation, coordination and decision-making processes [9]. This is a fundamental issue to manage the nurses’ needs to share images between each other. A way to attain better acceptance and better performance of CSCW is to implement more IT training at the nurse schools.

If a PDA should be able to match the nurses’ needs it must be equipped with a fully developed IT-system that is standardized for the entire hospital or at least the ward. The nurses meant that a PDA should be predisposed for every single ward but be able to get the information from the entire hospital. If there is no standardized or underlying IT-system, such as an ECHR, the PDA would not be useful to share information about patients with other nurses [10,11]. These requirements are supported by the nurses needs and that we found a difference between the nurses from the ward that already had an ECHR system and the wards that did not. The nurses of the ward that used an ECHR system were more enthusiastic and saw more possibilities with a PDA. This demonstrates that previous knowledge and experience implies better acceptance for innovations in IT.

To make use of a PDA in CSCW, healthcare organisations need to develop a data warehouse that collect all necessary information from which a PDA can mine information. Since the 1960s, people in healthcare organisations have imagined a large central database from which they could “mine” information that would improve the healthcare work and the care of patients. Still a “mining” possibility in a healthcare data warehouse is not implemented [12]. Ideally, the PDA should work towards the data warehouse and update the information at the same time as a nurse compute it. On the reverse, the data warehouse must update the PDA, once it gets new information. Thus, the PDA needs a full time mobile connection to manage that. With a wireless network, the PDA can connect to an intranet and the Internet with ease and also be able to collect and upload information from the stationary servers in the wards. Until the healthcare organisations have developed a synchronized information system, the PDA for nurses is limited to facilitate their competence support, e.g. rapid access to current evidence based nursing information in a resource database. The lack of standardization of IT is the single overall problem to fully integrate the PDA in the healthcare organisations total work [11].

When used in reality the confidentiality of transferred data from the PDA to the stationary computer with its ECHR must be secured.

Some of the nurses explained that it is important that the PDA does not interfere with the interaction between the user and the patient. Thus, the PDA must be easy to use and to understand so that the users will find the PDA more useful and more efficient in performing their work than not using it. Our view is supported by Allwood who reported that the PDA must have an agreeable usability design besides satisfying the user’s need of content and functions [13], and also by Larkin who found it is essential that the PDA do not disturb the workflow and become a burden instead of a useful tool [14].

The old pattern to work in the healthcare organisations makes it difficult to see new possibilities and innovative solutions. But the paradigm in current healthcare organisations is about to change and a new infrastructure with more acceptance to novel technology are being designed which is absolutely essential [15]. It might be too early to implement PDAs in the healthcare smoothly because the technological development is not sufficiently advanced so far [2].

5. Conclusion

We found that nurses had high expectations of a PDA as a tool for information retrieval for different tasks in their daily work. If a PDA would be a part of CSCW and provide the nurses and nurse students the necessary content in a simple and effective manner it has the potential to be accepted as a supportive tool in the healthcare organisations. In the future, it is necessary to involve nurses for testing and developing PDAs further.
Acknowledgements

We would like to thank the staff in Cardiac, Pulmonary and Surgical wards at the County Hospital of Kalmar and the students of 5th and 6th term in the Department of Health and Behavioural Sciences, University of Kalmar for their help in this study.

Appendix A

Age

Semester

- Male
- Female

1. How do you estimate your computer skills?

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2. Do you believe a PDA could support nurses in their work?

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- Don’t know

3. Do you believe a PDA would be accepted and used by nurses if it was provided by the employer?

- Yes
- No
- Don’t know

If “No”, why?

4. How do you apprehend the information accessibility at your place of work, concerning e.g. literature, medical records and computers?

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- Don’t know

5. How do you estimate the IT-education you get considering the IT-development within the institutional care?

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- Don’t know
6. What information do you believe should be advantageous to the nurses to be included in a PDA?

- A PDA is a useful tool for doctors but how is it for nurses?
- Nurses demands for information are high and need to be easy of access
- Nurses want a PDA to be a useful tool with high functionality

7. Which functions should be included in a PDA for nurses?

Thank you for participating!

/Magnus Berglund & Christian Nilsson
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**Summary Points**

What was known about this topic before our study

- A PDA is a useful tool for doctors but how is it for nurses?

What this study has added to our knowledge

- Nurses demands for information are high and need to be easy of access
- Nurses want a PDA to be a useful tool with high functionality

**REFERENCES**


