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Usage of a Mobile Medical Information System: An Investigation of Physicians in the Military Service

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Abstract

This paper sets out to investigate military physicians' perceptions and usage regarding a mobile medical information system during their military service in the Finnish Defence Forces. Data were gathered in September and December of 2005 by two semi-structured surveys. The military physicians (n=31) had positive perceptions of the mobile system, and have used it in their daily military training. They showed a few negative opinions on the usefulness of the system in the real military field conditions and crisis situations. They favoured using the mobile system to support their learning and training, and keep their medical knowledge up-to-date anywhere and anytime. Insights of the findings and implications for system improvement are discussed.

Keywords: mobile e-health care, mobile medical information system, usefulness, ease of use, physicians in military service

1. Introduction

Military medicine refers to the science and art of medicine as used for the benefit of the military[1]. It differs from civilian medicine in two perspectives. It must firstly meet the aspects of civilian health professions and, secondly, meet the aspects of military readiness. For example, in the combat situation, military medics save lives in the battle field incorporating the philosophy of triage care. A casualty may also receive emergency treatment at a battalion aid station, or be evacuated to another facility for additional treatment. Military medicine has to plan and train for war and war like situations, e.g., natural catastrophes or outbreaks of pandemic diseases.

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1 http://www.au.af.mil/au/awc/awcgate/milmedhist/acv.htm [accessed on 19 Jan. 2006]

Health information technology has been adopted by military medicine in different environments and for different purposes[2]. However, even if we can see that health information technology is adopted somewhere it does not mean that this has happened everywhere. One early adopter is the U.S. Military that is, thanks to its large resources, in the forefront of development. Smaller national defence forces (e.g. Finland) have generally allocated fewer resources to implement health information technologies.

Due to the availability and low cost of mobile devices and available health information technology, it is not surprising that, in the recent years, also mobile technologies have started to penetrate military medicine. For example, the U.S. army medical staffs have been equipped with a point-of-care handheld assistant BMIS-T (implemented on Hewlett-Packard iPAQ Pocket PCs) based on Microsoft Windows Mobile software[3]. This mobile system gives some high-tech help to the military medics with a critical part of their job--tracking medical information on the troops under their care. The system also helps medics make quicker, and more accurate diagnoses and treatment decisions, as well as, helps reduce the paperwork, when treated personnel are moved to, e.g., military hospitals. It seems that there are various benefits that can be reaped for military medicine by adopting mobile technologies for managing health care in the line of battle. In order for military medicine to keep up with building of more mobile and agile defence forces, the usage of mobile technology to support military medicine is becoming a trend.

In this paper, we will present some insights that we have obtained from an exploratory study by investigating the adoption and use of a mobile medical information system among thirty one physicians during their military service in the Finnish Defence Forces. The structure of the paper is arranged as follows. In the next section, we briefly review the relevant literature. The research method is discussed in Section 3. Results are reported in Section 4. Discussion is followed by conclusion at the end of the paper.

2.   Literature Review

2.1   Theoretical Background

Users' perceptions of and intentions to adopt an information system (IS) and the rate of diffusion and penetration of technology within and across organizations are two important foci of IS research (e.g. Straub et al., 1995). Well-accepted theories, for examples, the Technology Acceptance Model (Davis et al., 1989), the UTAUT (Unified Theory of Acceptance and Use of Technology) (Venkatesh et al., 2003) have provided good explanations of the adoption and usage of technology in different socio-technical contexts. The conclusions of many studies based on these theoretical approaches have indicated that perceived usefulness and perceived ease of use are two fundamental factors determining a user's acceptance of technology. These theories have recently been applied and tested to explain user adoption of mobile technology (e.g. Pedersen, 2002; Pedersen and Nysveen, 2003; Pedersen et al., 2003). Perceived usefulness and ease of use of a specific mobile system are also found to be important determinants of human behaviour.

There are two temporal dimensions of adoption behaviour. One is pre-adoption or initial adoption behaviour (initial adoption, first-time usage and possible rejection at the pre-implementation stage). The other is post-adoption or post-implementation behaviour, (sustained continuous usage, and discontinued usage). In the two dimensions, users

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2 http://www.military-medical-technology.com/ [accessed on 19 Jan. 2006]

3 http://download.microsoft.com/documents/customerevidence/6640_BMIS_T.doc
[accessed on 19 Jan. 2006]

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usually have different beliefs regarding the technology (Karahanna et al., 1999). As users gain more experience of a system, their beliefs and attitude towards the system might change. Such changes have major impacts on human behaviour regarding continuously system usage (Bhattacherjee and Premkumar, 2004).

2.2   Mobile e-Health Services for Physicians

Through the use of mobile technology, more freedom is offered to both, healthcare providers and patients (Rohm and Rohm, 2004). Mobile e-health services offer a solution for coping with healthcare challenges in the 21st century (Goldberg and Wickramasinghe, 2003; Wickramasinghe and Misra, 2004).

A number of companies are extending their internet services to physicians for use with Personal Digital Assistants (PDAs), or other mobile terminals. The use of PDAs among physicians is rising, having reached 235,400 by the year 2004 in the US (Mobile Health Data, 2004). In Europe, the nations with the highest percentages of general practitioners who use PDAs in their practices are: the Netherlands (31%); the UK (18%); Spain (17%); France (11%); and Germany (10%) (Harris Interactive, 2002). A recent survey of paediatricians, who use PDAs in their practice, claims that PDAs improve healthcare quality. The improvement has resulted from handheld accessing to drug and clinical references at the point of care (Mobile Pipeline, 2004). In Finland the PDA has become a tool of choice for medical physicians; but smart phones, such as the Nokia Communicator, have a much wider user base (Han, 2005; Harkke, 2006).

Existing mobile e-health services available on the market range from simple medical dictionaries to sophisticated patient data systems, capable of handling digital images and laboratory test results. A set of applications is being financed by the pharmaceutical companies and focuses naturally on creating and handling drug prescriptions. Most of the systems are still standalone applications running in the mobile devices themselves, updating their data only when connected to a computer network.

In spite of the technological advantages of supportive mobile medical IT systems, they should be tailored to fit physicians' pragmatic working styles and the context of their work (Berg 1999; Jayasuriya 1998). For military physicians, the context of their work might be concerned more heavily, especially for those military physicians that work on the battalion level aid stations.

2.3   A Mobile Medical Information System

In Finland, the first computerized medical information database was launched in 1989, and disseminated on diskettes. It mainly contained 20 Finnish guidelines dealing with common and important primary healthcare problems. In 1991, a CD-ROM was published with a guidelines database, as well as, additional databases, e.g., Finnish medical journals, laboratory databases, and pictures. Throughout the 1990's, Duodecim Publication Ltd., owned by Duodecim, the Finnish Medical Society, put more effort into improving evidence-based medical guidelines (EBMG) to make them more comprehensive and reliable. With the development of Internet technology, an Internet-based version was introduced in October 2000 (www.ebm-guidelines.com). Translation of these to English was completed in the year 2000, and to Swedish in 2001. Use of the computerized EBMG's by Finnish physicians was found to be very encouraging. They could usually find the information they were looking for and their searches were usually completed within 5 minutes (Jousimaa, 2001). EBMG has become an important source of information for Finnish physicians. Currently, EBMG, as well as, other databases, e.g., drug, diagnosis, etc., can be accessed through various channels. These channels include, e.g., printed books (published annually), Intranets within health care centres, or hospitals,

or the national Internet portal Terveysportti (www.terveysportti.fi), which also contains links to many domestic and international providers of healthcare information. In 2002, a mobile version of those databases was developed and ready for use.

The mobile medical information system, used also in this research, is designed by Duodecim Publication Ltd. It is a set of medical information and knowledge databases. It contains the EBMG (available in both, English and Finnish) with Cochrane abstracts, pharmacology database Pharmaca Fennica with a wireless update service for a complete medicine price list, the international diagnosis code guide (ICD-10) in Finnish, a laboratory guide by the Helsinki University Hospital, an emergency care guide issued by the Meilahti Hospital, a medical dictionary of over 57,000 terms, and a comprehensive database over health-care related addresses and contact information (pharmacies, hospitals, health centres). The content of the system is generated by an XML (eXtensible Mark-up Language) database. The system functions in most mobile devices operated by different systems, e.g., Symbian, Palm OS, and Windows CE. The device most commonly used as a platform in Finland is the Nokia 9210 Communicator. The mobile medical system is delivered on a 128 MB (now 256 MB) memory card, and is self-installing, containing the search engine, user interface programs, and core databases. Currently, an update of the system is available and is delivered on memory cards. In the near future, the system will be able to update itself partly, or completely through the GPRS (General Packet Radio Services), or UMTS (Universal Mobile Telecommunications System) wireless networks. In the autumn of 2003, the price list, part of the Pharmaca Fennica (the pharmacopoeia) was made able to update itself through the GSM (Global System for Mobile Communications) data link provided by the device – Nokia 9210 Communicator. The databases have been updated to include a drug interaction database originally developed by the Karolinska Institute, Sweden.

2.4 The Usage of the Mobile Medical Information System in the Civilian Medicine

In a pilot project in the civilian medicine, the mobile medical information system has played a role in distributing medical knowledge to physicians (Han, 2005). It has already won a steady base of users in Finland. The previous findings have indicated that physicians in the civilian medicine have positive perceptions of, and attitudes to the system. Perceived usefulness was found to be the strongest and dominating factor that influenced physicians' behaviour. Ease of use had exerted an influence on physicians' behaviour in early exposure to mobile technology, but its effects as physicians acquired more hands-on experience were rather limited and weak. We also found that physicians who work on the move believe the system is more compatible with their work; hence, they have spent more time on using it and shown strong intentions to use it in the future.

The previous study also presented that the system in civilian surroundings is mainly used as a complement to the other information systems, including printed material (Harkke, 2006). The usage is concentrated in situations where other means of information retrieval are limited or where the system is easier/faster to use than the alternatives. Situations like these are mainly outside the physician's own office, on ward rounds, secondary workplaces or at home in free time. The system was, however, used surprisingly much even in the office setting next to a desktop PC with access to the same material.

The reasons for using the system were fairly utilitarian. The system was perceived to be easy and fast to use even in situations where other means of information retrieval were available. This does not necessarily tell one so much about the mobile system, but rather that the desktop-based system in use is not perfect and requires too much effort in some instances. One stated reason for using the system was the feeling of security that has its grounds in having relevant, up-to date guidelines along at all times.

3   Research Design and Methods

3.1   Description of the Study

Theories of user technology acceptance can contribute greatly to understanding user behaviour regarding technology. These theories have served as the theoretical background and generated some important concepts that we have focused on in this study. Because the difference between civilian medicine and military medicine, and the new research setting of military conditions, we have adopted a "practice-driven" approach to design our research (Zmud, 1998). Our selection is also due to the fact that in the early stages of studies, of an exploratory nature (like our study), it is better to conduct studies in a natural setting, rather than from a pre-established theoretical perspective (Sharker et al., 2003).

After the study of the pilot usage of the system in the civilian environment (Han, 2005 and Harkke, 2006), we continue our research by investigating the usage of the system in military (field) circumstances. On September 6, 2005, with support from Pfizer Finland Ltd. and Duodecim Publications Ltd, thirty one physicians, later in this paper called military physicians, (including some medical students) undergoing their military service in the Finnish Defence Forces, were given a Nokia Communicator 9210 equipped with a mobile medical information system. After the first user training of the system[4] (on the same day they got the system), we distributed our first, semi-structured, questionnaire to collect their demographic information and to investigate their initial perceptions of perceived usefulness and ease of use of the system (the structured measurements are borrowed from previous established research with changes in wording to make them appropriate for the mobile medical information system and the military medicine context), as well as, their first impression of the system (open questions). In December, after the military physicians had used the mobile medical system for a time of approximately three months, we conducted a survey with a similar questionnaire. The second survey was made to study the use of the system and the opinions regarding the system being used for military purposes. Nineteen of the 31 military physicians who were given the device were present when the second survey was distributed, the rest of the group were stationed elsewhere and, therefore, unavailable.

3.2   Data Analysis

The analysis was primarily descriptive in nature. Frequencies and some central tendencies were calculated to illustrate physicians in the military service, their usage, and opinions on the mobile medical information system. Potential differences in their behaviour over the two points in time were tested by the paired T-Test (Sig. <0.05). The analysis was implemented by SPSS 12.0.

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4 The military physicians were given a two-hour introduction to the device and the mobile medical information system.

4 Results

4.1 Background Information

Of the thirty one participants, twenty-three have graduated and have become qualified physicians, eight are still medical students. Among the 31 participants, one has earned a doctoral degree in medicine, and two have, or will, become qualified pharmacists. The gender distribution was 30 male and one female. The mean age of the group was 25.19 years, the youngest being 20 and the oldest 28. Among the participants, twenty-two have never used a Nokia Communicator (any models), eight indicated prior usage. Seven have used the mobile medical information system before; among them, two have used it for 1 year (one of the two was the female physician in the group), two have used it for some months, and 3 have tried for a few hours.

In order to know, whether the participants were familiar with the contents of the databases in the mobile medical information system, we also collected information regarding the usage of Terveysportti, the Finnish health care portal in the Internet. Excluding 6 missing answers, all have used it ranging from 7 months to 5 years. They have used it for education/learning purpose (n=30), for patient consultation (n=21), and for completing their specialisation knowledge (n=8).

In general, this group was young, male–dominated, and familiar with the contents of the mobile information system. The participants were mostly naive users of the system.

4.2 Military Physicians' Evaluation of the Mobile Medical Information System

We investigated the military physicians' perceptions regarding the mobile medical information system from two perspectives, i.e., perceived usefulness and perceived ease of use.

4.2.1 Perceived Usefulness

The military physicians' perceived usefulness of the system was studied from four aspects, i.e., (i) using the system improves my medical knowledge; (ii) using the system enhances my effectiveness to do clinical work in the field conditions; (iii) using the system improves my ability to make good decisions; and (iv) I find the system useful for me. The military physicians' evaluation was measured using a five point scale, ranging from (1) strongly disagree to (5) strongly agree.

The perceived usefulness of the system, after a period of actual usage, was still positive in general (mean value > 3), but with a declining trend (Table 1). The military physicians' perceived usefulness of the system measured from the four aspects was slightly higher at the initial stage (September), than after three months (December). However, the difference in the perceived usefulness at the initial stage vs. after three months of use was not significant at the 5% level. The declined perception of usefulness of the mobile system might be due to the differences between the civilian and military medicine. The mobile system is designed for civilian physicians, the contents of the system lacks of focus on military medicine. Therefore, the degree of usefulness of the system has decreased for physicians using it for military purposes. Nonetheless, the military physicians under the investigation did have quite positive perceptions of usefulness of the system in the period of their military training.

Table 1: Usefulness of the mobile medical information system

Perceived Usefulness	Mean		df	Sig. (2-tailed) (p<0.05)
	Sep. (n=31)	Dec. (n=19)		
Improve medical knowledge	3.97	3.68	18	0.79
Enhance effectiveness in the field conditions	4.34	3.94 (n=18)	17	0.31
Improve my ability to make good decisions	3.83	3.74	18	0.84
Useful	4.58	4.32	18	0.67

4.2.2 Perceived Ease of Use

The military physicians were asked to indicate their perceived ease of use of the system. Questions about four aspects were asked: (1) learning to operate the system is easy for me; (2) I find it easy to get the mobile package to do what I need to do; (3) It is easy for me to become skilful in using the system; and (iv) I find the system easy to use. The evaluation was measured using a five point scale, ranging from (1) strongly disagree to (5) strongly agree.

The military physicians' perceived ease of use of the mobile medical system was also positive (mean value> 4) with an increased trend (Table 2).

The military physicians' evaluation of the ease of use of the system was slightly higher after three months (December), than at the initial stage (September) from the four aspects. However, the differences did not show that perceived ease of use would differ at the initial stage and after three months, since the obtained values of *t* of the four aspects are not statistically significant at the 5% level.

Table 2 Ease of use of the mobile medical information system

Perceived Ease of Use	Mean		df	Sig. (2-tailed) (p<0.05)
	Sep. (n=31)	Dec. (n=19)		
Easy learning to use	4.65	4.84	18	0.95
Easy doing what I need to do	4.19	4.47	18	0.67
Easy to become skilful	4.42	4.53	18	0.80
Easy to use	4.32	4.42	18	0.77

4.3 The First Impressions and Usage Intentions towards the System

In the first survey that we carried out in September, we had two open questions regarding the military physicians' first impression of the system: (1) *under what kind of circumstances, in your opinion, the mobile medical information system will be useful for*

you?, and (2) *what is your impression of having the mobile medical information system in use, while at the defence Forces/performing a military service?*

We found that the 31 answers to the first question can be grouped into 5 different circumstances: (i) the system is useful in the field when there is no network connection to access other databases, e.g., Terveysportti; (ii) it is useful when the military physicians are on duty ; (iii) it is useful when they are training, learning, and studying the medical knowledge; (iv) it is useful, when they need to verify some important medical information quickly and when some knowledge is needed immediately; (v) it is useful when they check the contents of the system, e.g., Pharmaca Fennica, ICD-10 for diagnoses and treatments.

The military physicians had a number of different types of first impressions about having the Nokia Communicator and the medical information system at their disposal for the duration of their military service. From the 28 returned answers, a summary is presented below:

(i) It is a good and useful physicians "weapon" in the field. The system is helpful in both the physicians' military service and when they are acting as physicians in civilian duties;

(ii) It is positive that the Finnish Defence Forces is using up-to-date technology to support military physicians. It is great that they have the Communicator (and the medical information system).

(iii) The medical information system replaces (heavy) books that normally have to be carried and used in medical consultation.

(iv) The system can be used in real environments. They can learn to use the medical information system well.

(v) New way of learning and studying is promoted, especially in field conditions.

(vi) The medical information system will be especially useful in the field, for example, to boost operations.

In the first survey, the military physicians' behavioural intention towards the system was measured also by asking, if they think they will use it in the future (Figure 1). There was one negative answer that indicated that the person would not use the system, several neutral responses that indicated insecurity about the future use. Twenty-three (74.2%, n=31) military physicians expressed clear interest in using the system in the future.
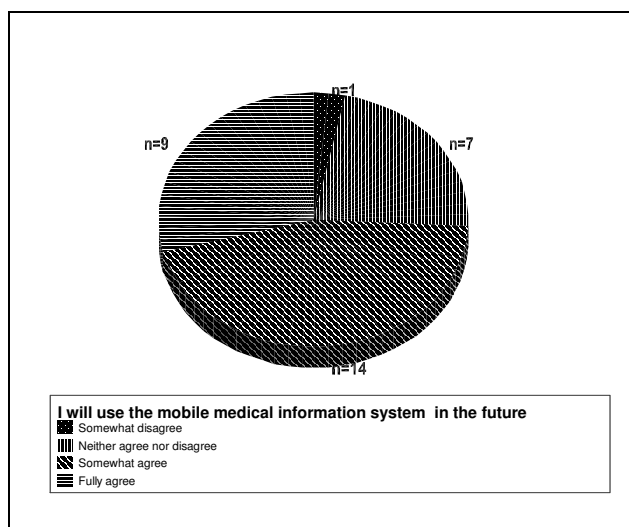

Figure 1: Usage intention towards the system

4.4   Self-reported Usage Frequency and Volume of Use

In the second survey, we investigated the real usage of the mobile medical information system, in terms of usage frequency (Figure 2), and volume of use during a period of one week (Figure 3).

Among the 19 gathered responses, seven (36.8%) medical physicians had used the system several times a week, three had used it about once a day, and the only female subject in our study, had indicated that she used it several times a day. About 25.8% of the responses stated that the system was used about once a week (n=4) and same amount (n=4) stated that the system was used about once a month.
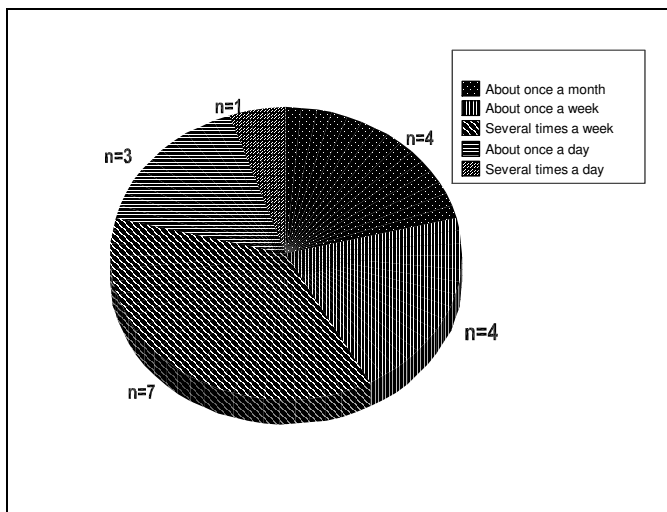

Figure 2: Frequency of system use

With regards to the volume of use of the system in a week (Figure 3), the answers stated that half of the military physicians (n=10) had used the system less than 30 minutes a week. Six had used the system for less than one hour and three used the system for more than one hour. The female physician had used the system more than 2 hours. The reason why the physicians in general did not spend longer time in using the system may be due to the fact that the system is easy to use and the needed information can be found in seconds, or in minutes.
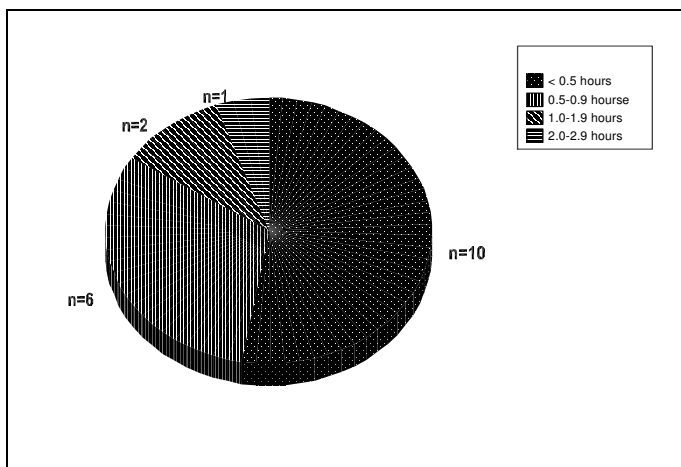

Figure 3 Usage volume

4.5   The Opinions of Usefulness in the Military Crisis Situation

The second survey also contained two open-ended questions. The first question was: "*In what kinds of situations has the mobile system been most useful for you?*" The answers to the first question stressed the speed and the portability of the system, and the ability to check details when access to the Internet, or to relevant literature is not available. The following are some examples of the answers (translation by the authors):

> "*When I need to get information fast at work.*";

> "*On field training camp treating simulated patients.*";

> "*In checking/making sure some details, checking medications. Mostly in own studies, not in patient situations*";

> "*On camp as a practicing physician (With live patients): dosages from Pharmaca, treatment guidelines and pictures of skin conditions from the EBMG*".

The second question in the survey had two parts. The first part was a simple yes/no question*: "Do you believe that the mobile databases would be useful in a real crisis situation?"* The second part was open-ended, asking for "*situations where the mobile system would be most useful* or *the characteristics of the system that make it unsuitable for real crisis situations*". Most respondents (17 of 19 or 89 %) were of the opinion that the mobile system is useful in a real crisis. The situations where the system was deemed to be most useful were such that there is no acute hurry (not necessarily most useful in the front line). The ability to find relevant information in situations where the communications and power networks are down was considered important, as was the compactness of the device/system -- carrying books in extreme situations was not considered possible. Only two of the respondents thought that the system would not do much good in a real crisis. The reasons given were:

> "*In a crisis situation =multiple patients + exceptional circumstances decisions have to be made very fast. Even the mobile database is too slow then.*" and

> "*-Slow -One has to know how to handle acute situations - good support for studies, and perhaps in a "slower" crisis where time is not so crucial it could help.*"

These answers reflect the special purposes of military medical training. The training concentrates on handling patients in the front line, where the situations are usually time critical and procedures tend to be all of a similar nature: acute cases of wounded and seriously wounded, e.g., performing life saving emergency surgery in "mass production". Less acute cases, and attended to, acute cases are sent behind the front line for medical attention. The information needs in the front line are such that the military physicians need to know the procedures by heart, assigning medicine doses, or looking to less than acute cases is not a priority. This type of work does not need databases.

In situations closer to normal clinical work where the only major difference from civilian practice is the surroundings – and sometimes (in the field) the available equipment, the military physicians find the system more useful. This is hardly surprising.

5.   Discussion

This paper sets out to investigate military physicians' perceptions on and usage of a mobile medical information system in the Finnish Defence Forces. The findings from two surveys have provided insights and implications that we will discuss in the following.

First of all, military physicians have positive perceptions regarding the usefulness and ease of use of the mobile medical information system. They are willing to use it during their military service and training. Despite of one negative behavioural intention towards using the system in the first survey, most of the participants in the second survey would use it on weekly basis. The nature of the military physicians' work, in a comparison with those in the civilian medicine, is characterised by working on the move and in field conditions, as well as, crucial emergence of contingencies in the battle line that necessitate a pragmatic and a quick reaction. Their information needs in any of these situations might be difficult to satisfy without the adoption of mobile technology. This argument is also supported by the findings from the open questions regarding the usefulness of the system both at the initial stage and at the time after using the system for three months. Most of the military physicians have pointed out that the system is useful in the field conditions.

Nonetheless, the military physicians' perception of the usefulness of the system declined (not statistically significantly) after three months of use in the military service. Such a negative trend might result from the context of the military training. Firstly, the system given to the physicians in military service was designed for use in civilian environments. The actual medical work with live patients during military training does not necessarily differ very much from civilian medical work. The benefits of the mobile system in these conditions were similar to those of the civilian users of the system. Secondly, the military medical physicians' training consists of a number of subjects that are not directly connected to clinical work. The physician trainees learn about managing and leading troops, organising medical facilities in different situations and other valuable skills for functioning in a military organisation. In addition to this, the actual clinical training concentrates on emergency medicine and treatment of severe trauma, stabilising patients and other front- line types of medical activities. These activities are learned by heart according to the standard military medicine practices. The mobile system being designed for civilian use does, naturally, not support learning of these skills. The usage patterns and the attitude changes of the group do probably partly reflect this in the beginning of their course when they were provided with the devices they were not familiar with the mobile system, or the actual type of training they were to receive.

In sum, the mobile systems were used frequently. The system's ability to support self-learning in free time is probably an important feature for young physicians – especially when they are not allowed to leave the barracks during weeks.

The second important insight we can get from the study is that the system is considered useful in the real military crisis situations. The military physicians were pleased that the Defence Forces adopted new mobile technology to support their work during the military training. By using the mobile medical system, the military physicians can check, or verify, the diagnosis, treatment pressures etc. quickly and immediately anywhere and anytime. The negative answers of the usefulness of the system in the real crisis have given implications on how to use and improve the system for military purposes. Firstly, in the very crucial battle line, as one physician has indicated, the decision-making must be very quick and that the mobile system can be comparatively slow in such a situation. In order to be well prepared for making a good and quick decision, the military physicians have to keep their medical knowledge up-to-date. Therefore, encouraging military physicians to use the mobile system in their leisure time for knowledge capital building will be a win-win strategy for both individuals and the military health care organisations. The mobile system is an easily portable "library" that can be along with the physicians all the time. Secondly, some new contents regarding the military medicine in the crisis situation, military training courses for medicine, and some preventive medicine in different environments can be added in the mobile system. Besides to fulfil the tasks of the civilian medicine, the military medicine should be ready for war and war-like

situations. The new design of the contents for military purpose is very demanding in the further development of the mobile system that supports military physicians' daily work.

Compared the findings of this study with those from previous studies we described in Section 2.4, we can conclude that the results are quite similar. Perceived usefulness and ease of use are important factors influencing physicians' adoption of the mobile system both in the civilian and military medicine. The system was used frequently. The mobile medical information system does provide it's users with some unique benefits in a military medical physicians' training. The ability to carry vast amounts of information to different locations does improve the ability of the physicians to cope with different situations. As the system is not designed for extreme emergencies, it does not replace, or even support, the traditional military medical training, but in situations apart from combat medicine – situations that are common in peace-time or behind the immediate front lines – the system does simplify the work of the physicians. It could even be supposed that the quality of care in field conditions is improved due to the physician's access to up-to-date information.

Before making conclusion of the study, it is worth pointing out its limitations. One limitation results from the fact that the physicians under the investigation are going through a limited term service in the military, rather than on a permanent basis. This might have influence on their answers in the first survey, especially the expected impact on their effectiveness to do clinical work in the field conditions. The second limitation is due to the possible sample bias that the group members missing in the second survey. Their perceptions of the system usefulness and ease of use may have statistical influence on the comparison results we obtained from the two surveys. These limitations will be tackled in the future research.

6.   Conclusion

This study has helped to develop an understanding of how military physicians think about the mobile medical system, while also providing some indications of the actual usage patterns in the field conditions and some behavioural differences across time. There seems to be a need for the kind of mobile information system to be implemented in the military medicine. As the system is developed for civilian use, it can be improved for military purposes.

The survey based on a semi-structured manner leaves some room for the subjects in the investigation to 'speak out' on many contextual factors influencing their opinions on the mobile system. Analysis of qualitative data collected from open questions has enriched our understanding of the research issue concerned in the study.

The research as reported here could be seen as a preliminary study reflecting the military physicians' reactions to mobile technology in general and a mobile medical information system in particular. Since the vast majority of the participants had probably used the system in their military training, their appreciation of the benefits associated with it can be considered as a good basis for future system development to meet the requirements of military medicine.

On the basis of the exploratory study, a future confirmatory research has to be carried out both in civilian and military contexts. The confirmatory study will dig out more similarities and differences between the system being used in two different contexts, and will give more insights on how to extend the mobile services from the civilian to more sophisticated and military context. Aspects regarding the interconnection between teams of physicians or paramedical campaign management can be also considered in the future study.

7. Acknowledgments

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