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**ACCEPTANCE AND USE OF
INFORMATION TECHNOLOGY
AMONG NURSES IN PSYCHIATRIC
HOSPITALS**

by

Marita Koivunen

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From the Department of Nursing Science
University of Turku
Turku, Finland

Supervised by

Professor Maritta Välimäki, RN, PhD
Department of Nursing Science
University of Turku, Finland

Reviewed by

Professor Sirpa Janhonen, RN, PhD
Department of Nursing and Health Administration
University of Oulu, Finland

and

Professor Reima Suomi
Department of Management, Information Systems Science
Turku School of Economics

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To my Family

Marita Koivunen

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Department of Nursing Science, Faculty of Medicine, University of Turku, Finland

ABSTRACT

The use of information technology (IT) has not played a very significant role in psychiatric nursing although on recent years the development of IT applications has radically affected health care delivery and the work processes of nurses. The objective of this study project is to create recommendations on the best practices for improving the acceptance and use of IT among nurses working in psychiatric hospitals.

The study consisted of five phases using a combination of descriptive statistical and qualitative methods. The data were collected during the period 2003-2006 among health care staff working on nine acute psychiatric wards. The Technology Acceptance Model (TAM) was used to structure the research process and to enhance the understanding of the acceptance and use of IT among nurses.

The study showed that there are eight main factors which could improve the acceptance and use of IT among nurses working in psychiatric hospitals if these factors are taken account when new IT applications are implemented in daily practice. The factors were divided into two groups; external variables (resource allocation, collaboration, computer skills, IT education, training, patient-nurse relationship) and ease of use and usefulness of the application (instructions for using the application, usability of the application). The TAM theory was useful in interpreting the findings.

The recommendations developed contain measures by which is possible to improve the commitment of management and nurses, thereby ensuring the acceptance and use of new IT application in nursing practice. The recommendations can be implemented in practice when new IT applications are introduced in psychiatric hospitals.

Keywords: information technology, acceptance of information technology, use of information technology, psychiatric nursing, psychiatric hospitals

Marita Koivunen

HOITAJIEN INFORMAATIOTEKNOLOGIAN HYVÄKSYNTÄ JA KÄYTTÖ PSYKIATRISISSA SAIRAALOISSA

Hoitotieteen laitos, Lääketieteellinen tiedekunta, Turun yliopisto, Turku

TIIVISTELMÄ

Informaatioteknologian (IT) käyttö ei ole ollut kovin merkittävässä roolissa psykiatriassa hoitotyössä, vaikka IT sovellusten on todettu vaikuttaneen radikaalisti terveydenhuollon palveluihin ja hoitohenkilökunnan työprosesseihin viime vuosina. Tämän tutkimuksen tavoitteena on kuvata psykiatrisessa hoitotyössä toimivan hoitohenkilökunnan informaatioteknologian hyväksyntää ja käyttöä ja luoda suositus, jonka avulla on mahdollista tukea näitä asioita psykiatrisissa sairaaloissa.

Tutkimus koostuu viidestä osatutkimuksesta, joissa on hyödynnetty sekä tilastollisia että laadullisia tutkimusmetodeja. Tutkimusaineistot on kerätty yhdeksän akuuttipsykiatrian osaston hoitohenkilökunnan keskuudessa vuosien 2003-2006 aikana. Technology Acceptance Model (TAM) –teoriaa on hyödynnetty jäsentämään tutkimusprosessia sekä syventämään ymmärrystä saaduista tutkimustuloksista.

Tutkimus osoitti kahdeksan keskeistä tekijää, jotka saattavat tukea psykiatrisessa sairaalassa toimivien hoitajien tietoteknologiasovellusten hyväksyntää ja hyödyntämistä, kun nämä tekijät otetaan huomioon uusia sovelluksia käyttöönotettaessa. Tekijät jakautuivat kahteen ryhmään; ulkoiset tekijät (resurssien suuntaaminen, yhteistyö, tietokonetaidot, IT koulutus, sovelluksen käyttöön liittyvä harjoittelu, potilas-hoitaja suhde), sekä käytön helppous ja sovelluksen käytettävyyden varmistaminen). TAM teoria todettiin käyttökelpoiseksi tulosten tulkinna.

Kehitetty suositus sisältää ne toimenpiteet, joiden avulla on mahdollista tukea sekä organisaation johdon että hoitohenkilökunnan sitoutumista ja tätä kautta varmistaa uuden sovelluksen hyväksyntä ja käyttö hoitotyössä. Suositusta on mahdollista hyödyntää käytännössä kun uusia tietojärjestelmiä implementoidaan käyttöön psykiatrisissa sairaaloissa.

Asiasanat: informaatioteknologia, informaatioteknologian hyväksyntä, informaatioteknologian käyttö, psykiatrinen hoitotyö, psykiatriset sairaalat

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ABBREVIATIONS

ECDL test	European Computer Driving Licence test
FITT framework	Fit between individuals, task and technology
GCA	General computer applications
HIS	Hospital information systems
IDT	Innovation Diffusion Theory
IT	Information technology
QCPOS	The Quality Criteria of Public Online Services
PEOU	Perceived ease of use
PU	Perceived usefulness
SNCEQ	The Stagers Nursing Computer Experience Questionnaire
TAM	The Technology Acceptance Model
TPB	Theory of Planned Behavior
TRA	The Theory of Reasoned Action
UTAUT	The Unified Theory of Acceptance and Use of Technology

LIST OF ORIGINAL PUBLICATIONS

The thesis is based on the following papers, which are referred to in the text by their Roman numerals from I-V.

- I Koivunen, M., Välimäki, M., Koskinen, A., Stagers, N. & Katajisto, J. The impact of individual factors on health care staff's computer use in psychiatric hospitals. *Journal of Clinical Nursing*. In press. Published Online: Mar 19 2008 12:00AM DOI: 10.1111/j.1365-2702.2007.02119.x.
- II Koivunen, M., Välimäki, M., Jakobsson, T. & Pitkänen, A. 2008. Developing an evidence-based curriculum designed to help psychiatric nurses learn to use computers and the Internet. *Journal of Professional Nursing* 24 (5), 302-314.
- III Koivunen, M., Välimäki, M., Pitkänen, A. & Kuosmanen, L. 2007. A preliminary usability evaluation of Web-based portal application for patients with schizophrenia. *Journal of Psychiatric and Mental Health Nursing* 14 (5) 462-469.
- IV Koivunen, M., Hätönen, H. & Välimäki, M. 2008. Barriers and facilitators influencing the implementation of an interactive Internet-portal application for patient education in psychiatric hospitals. *Patient Education and Counseling* 70 (3), 412-419.
- V Koivunen, M., Välimäki, M., Patel, A., Knapp, M., Hätönen, H., Kuosmanen, L., Pitkänen, A., Anttila, M., & Katajisto, J. Effects of the implementation of the web-based patient support system on staff's attitudes towards computers and IT use: a randomised controlled trial. Submitted.

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The summary includes also previously unpublished material.

1 INTRODUCTION

The objective of this study is to describe the acceptance and use of information technology (IT) among nurses working in psychiatric hospitals, and to create recommendations on the best practices for improving these issues in this health care sector. IT use did not have a very significant role in psychiatric nursing (Walter et al. 2000, Puskar et al. 2004), although the development of the IT applications has radically affected health care delivery (Lehoux et al. 2000, Kulvik et al. 2006, Commission of the European Communities 2007), organisational performance (Ammenwerth et al. 2002, Courtney et al. 2005, Griffiths et al. 2006) and health care staffs' work processes (Currell & Urquhart 2000, Courtney et al. 2005). Staff in psychiatric nursing may be worried that computers will have negative consequences for patient care and patient–nurse relationship (May et al. 2001, Puskar et al. 2004). However, e.g. telemedicine services, which provide services over a distance, were developed for the field of mental health care (May et al. 2001, Ohinmaa et al. 2008). Evidence of the benefits from such applications is still limited (Hailey et al. 2007) and not enough is so far known about how suitable computer applications are in this health care sector, nor about how nurses accept and use these applications in their daily work (Ammenwerth et al. 2002, Austen & McGrath 2006).

Nowadays electronic data systems are the tools for most of the personnel in social and health care in Finland (The Finnish Ministry of Social Affairs and Health 2007). IT infrastructures should improve the quality of medical and nursing outcomes, and hence the quality of life of citizens in Europe (eHealth ERA 2007, The National Knowledge Society Strategy 2007-2015). Use of computer applications has the potential to improve information management, access to health services, quality of care and cost containment (Bennet & Glasziou 2003, Garg et al. 2005, Kawamoto et al. 2005, Gagnon et al. 2006). Conventionally IT applications in health care have developed to perform the duties of professionals (Hämäläinen et al. 2007, Toivanen et al. 2007).

The implementation of new IT applications to support nursing practices requires systematic investments and guiding (McNish 2001, Van der Meijden 2003, Grimshaw et al. 2004). There is evidence that the exploitation of specific recommendations and guidelines improves the quality of actions in health care (Wollersheim et al. 2005). Recommendations of the best practices are also viewed as useful tools for making actions more evidence-based, consistent and efficient (Burgers et al. 2003). Systematically developed guidelines also support the implementation of IT applications in health care (Nykänen & Brender 2008, Oroviogioicoechea et al. 2008) and also in psychiatric nursing (Hunt et al. 2004). Although the knowledge of IT projects management exist, its utilization has not been very significant (Hyppönen 2007, Toivanen et al. 2007, Hyppönen & Niska 2008).

There are numerous studies on the acceptance and use of IT in health care. These have been especially done among physicians. (Yarbrough & Smith 2007.) Many organisations in the process of implementing IT for nursing practice have experienced resistance from the staff (Van der Meijden et al. 2003, Kirkley & Stein 2004, Palm et al. 2006). Some earlier studies have shown that the existing knowledge about nurses' IT use and acceptance particularly in psychiatric nursing is very poor (Walter et al. 2000, Puskar et al. 2004). The groups with the lowest reported computer use were also nurses in the operating room and in psychiatric nursing (Staggers & Kobus 2000).

Use of IT and guiding patients to relevant sources of health information requires that nursing staff have skills to use computers, positive attitudes to new technologies, and that nurses accept the utilization of new technology in daily practices (Estabrooks et al. 2003, Murray et al. 2004). Health care staff has a major role in selecting the most reasonable health information sources for patients and ensuring that the information sources used are reliable (Monsivais & Reynolds 2003, Norman 2006, Kim et al. 2007, Morey 2007). Internet was used by 79 % of the Finnish population at the beginning of 2007, and 59 % of users reported seeking health-related information (Statistics Finland 2007). Citizens can benefit from eHealth services both through increased individual health knowledge and prevention of diseases (Murray et al. 2004, Fox 2005, Commission of the European Communities 2007, Kim et al. 2007, Morey 2007, Välimäki et al. 2007). This will present new challenges to the Finnish welfare society and its health care organisations. The national objective is to increase citizens' access to health information and to ensure the high quality of this information. (eHealth Roadmap – Finland 2007, Sosiaali- ja terveydenhuollon palveluinnovaatiohanke 2007.) However, some citizens are unable to conduct advanced information searches (Ortega Egea et al. 2007), judge the trustworthiness of health-related websites and differentiate between various information sources (Ivanitskaya et al. 2006, Morey 2007).

User acceptance has been viewed as the pivotal factor in explaining the success or failure of information system implementation project (Venkatesh & Morris 2000, Khalifa & Liu 2004). Lack of acceptance is a significant barrier to the success of new IT applications (Wixom & Todd 2005). To ensure that nurses have capacities to use new working methods with IT, and to guide patients on how to use computers, or to evaluate the quality of the health information available, nurses' acceptance of IT should be ensured (Ammenwerth et al. 2002, McClelland et al. 2002, Repique 2004). This will be achieved by means of on-the-job training including IT education, developing the content of work and management systems, and by offering opportunities to learn at work (Government Programme of Prime Minister Matti Vanhanen's second Cabinet 2007, Sosiaali- ja terveydenhuollon kansallinen kehittämissuunnitelma KASTE 2008 – 2011).

This empirical study is a part of a multi-centre study project where an interactive web-based patient support system (Mieli.Net; Engl. Mental.Net) was developed together with a patient association, psychiatric nursing specialists and computer experts for use in psychiatric nursing and patients with mental illnesses (Mieli.Net Project, Academy of Finland, TERTTU 2004-2007). The nursing staff's perspective was studied among nurses working in psychiatric hospitals. The objective is to describe the acceptance and use of IT among nurses, and to create recommendations on best practices for improving these issues in psychiatric hospitals. Information technology (IT) refers here to general computer applications (GCA), hospital information systems (HIS) and an interactive web-based patient support system. Acceptance of IT has been considered from the perspective of attitudes, that is motivation to use IT, satisfaction with IT and experience of the benefits of IT. In the study the use of IT refers to the use of computers; GCA, HIS and the web-based patient support system.

This study is in the discipline of nursing science; its main focus is on the development of nursing practices which improve patients' health and well being (Meleis 2006). The study generates knowledge of nursing practices in modern health care where IT is a part of daily operations (eHealth ERA 2007). The changing nursing environment and interaction between patient and nurse are essential research subjects in nursing science (Meleis 2006). The nursing environment in the study consisted of psychiatric hospitals, particularly acute psychiatric wards. The study generates knowledge on how it is possible to use IT in this environment, and which factors support and improve the acceptance and use of IT among nurses working in it.

2 INFORMATION TECHNOLOGY IN HEALTH CARE

Earlier studies on the topic of the study were searched for, both systematically and manually. Database searches were conducted in each phase of the study during the study process and these searches were updated in spring 2008. In order to attain a profound understanding of the acceptance and use of IT in health care an extensive literature search was conducted including the CINAHL, Cochrane Library, MEDLINE, PsycINFO, PubMed and ARTO databases. In addition searches were conducted in the net publishing databases of universities, the Internet by Google, and the www addresses of various organisations, such as ministries, research institutes and the European Union. The titles of the articles were reviewed and abstracts of the relevant articles were read. The whole article was read if the abstract contained relevant information on the topics of the study. The reference lists of the articles were also reviewed to find relevant publications. The advance of IT applications and their implementation in health care has been very efficient in recent years. The research of IT use in health care has increased markedly in the 2000s. Thus the studies referred to were mostly published after the mid 1990s. An exception to this is the literature on theories of the acceptance and use of IT and study instruments. In these areas older literature was also included. Literature searches were confined to studies published in English and in Finnish.

2.1 Use of IT and computers in health care

IT in health care is regularly defined as health informatics and nursing informatics (Thede 2003, Hunt et al. 2004). Health informatics deals with the resources, devices and methods required to optimize the acquisition, storage, retrieval and use of information in health and biomedicine. Health informatics tools include computers, information and communication systems for managing data in health care, and also clinical guidelines and formal medical terminologies. (Hersh 2002.)

Nursing informatics is “the integration of nursing, its information, and information management with information processing and communication technology, to support the health of people world-wide” (IMIA-NI SIG 1998). The purpose of nursing informatics is to manage data in health care, and the primary tools for this include IT applications specifically developed for health care personnel (Thede 2003). Nursing informatics involves different actions by which nurses collect and manage data and take knowledge-based and evidence-based decisions for patient care, and use this empirical and experiential knowledge in order to broaden the scope and enhance the quality of their professional practice (Hunt et al. 2004).

Use of IT in the services and operations of the health care system is common in Finland. In 2006, 96 % of all primary care health centres, 20 of the 21 existing hospital districts and 89 % of private sector service providers used electronic patient record systems. Other IT applications used were telemedicine and telecare services, health information networks, decision support tools and Internet-based technologies and services. Internet-based information retrieval channels (e.g. Duodecim, Medical Publications Ltd; Terveysportti) intended for health care professionals are increasingly used in health care organisations. (Hämäläinen et al. 2007.)

Information exchange between institutions has also come more common; e.g. 16 out of 21 hospital districts, and 45 % of the primary health care centres used an eReferral and eDischarge letter system for the communication of patient data between organisations in Finland. (Hämäläinen et al. 2007.) Further, Internet-based health information services directed to the general public are more general today (Bansil et al. 2006, Kim & Chang 2007, Castrén et al. 2008). In Finland a national health portal for the public is being constructed (Doupi et al. 2007). Through Internet services people can seek public health related information, but also individual information on their own health (Car & Sheikh 2004, Murray et al. 2004, Doupi et al. 2007, Castrén et al. 2008). Mobile messages (Hameed 2002, Porn & Kelly 2002) and mobile appointments reservation systems are used to improve the accessibility of care (Åkesson et al. 2006, Suomi et al. 2007).

Issues of privacy protection and data security are very important in using IT in health care (Schoenberg & Safran 2000). Electronic health data must be used in ways and in environments that maintain the accuracy and security of information (Staggers et al. 2002, Puskar et al. 2004). Privacy protection refers to operations intended to minimize the risks related to transmission of health information. Data security subsumes information confidentiality, availability, usability and integrity. (Tammissalo 2005.) Health professionals must be aware of the acts, references and guidelines governing the management of patient data and communication by IT implements (McClelland et al. 2002, Staggers et al. 2002, Veikkolainen & Hämäläinen 2006). In Finland the essential legislation governing IT use in health care are the Act on Electronic Handling of Client Data in Social Welfare and Health Care (159/2007), the Decree of the Ministry of Social Affairs and Health on drawing up patient records and storing them and other material related to care (99/2001), the Personal Data Act (523/1999), the Act on Health Care Professionals (559/1994), the Act on the Status and Rights of Patients (785/1992) and the Patient Injury Act (585/1986).

Individuals' use of computers in health care organisations may vary depending on various factors. Nurses who work very closely with patients use more IT applications that support patients' care, whereas applications for nursing management are more used among ward managers and nursing directors (Dumas et al. 2001). In addition, it has been

found that the frequency of computer use has connections to user satisfaction; those users who use computers more frequently in their daily tasks are more satisfied with IT than those who use it less (Laerum et al. 2004, Lium et al. 2006, Palm et al. 2006). Users reporting greater satisfaction appeared to have more faith in the benefits of the system and are more motivated to use IT (Marasovic et al. 1997, Laerum et al. 2004).

The attitude towards IT seems to be a factor connected to IT use among health care staff (Paré & Elam 1999, Timmons 2003, Yarbrough & Smith 2007, Yusof et al. 2007, Shoham & Gonen 2008). Willingness to use the system can be a key factor facilitating the introduction of the system in practice (Suomi et al. 2001, Yusof et al. 2007). Nursing professionals may have negative perceptions of technology (Darbyshire 2000, Schmitt et al. 2004) and their interest in computers may be slight (Bowies 1997, Mitchell & Sullivan 2001, Yang et al. 2004). Anxiety regarding IT (Dansky et al. 1999, Austen & McGrath 2006) can quickly lead avoiding using it (Estrabrooks et al. 2003). The suspicion that IT use has negative effects on patients' care (Ammenwerth et al. 2003) and face-to-face contacts (Simpson 2004, McLane 2005) may also be negative predictors of technology acceptance and use.

IT use in psychiatric nursing does not differ remarkably from that in other in health care sectors (Ammenwerth et al. 2002, Farrell et al. 2004, Marks 2004, Repique 2004). The applications used to manage patient data are the same as in somatic nursing (Ammenwerth et al. 2002). The main goal of psychiatric care is to empower and restructure patients to cope in daily life (Koivisto et al. 2004, Norman 2006). Therefore the use of IT should support these goals (Marks 2004). For this purpose telemedicine services (Hailey et al. 2004, Norman 2006), such as telepsychiatry used in the field of mental health care were developed (May et al. 2001, Mielonen et al. 2003, Ohinmaa et al. 2008). Videoconferencing between patient and psychiatrist and other experts has been shown to be a useful method for patients with mental problems (Mielonen et al. 2000, Norman 2006). In addition computer-aided cognitive – behavioural therapy has been used successfully (Marks et al. 2007). Psychoeducational programmes for people with severe mental illnesses have also been developed (Rotondi et al. 2007), and the findings have demonstrated the feasibility of providing psychosocial support and treatment through the programmes (Rotondi et al. 2005). However evidence of benefit from telepsychiatry applications is still limited (Hailey et al. 2007).

2.2 Nurses' computer skills

Earlier studies have shown that there is variation in computer skills of nurses in clinical practice (Norris & Brittain 2000, Saranto et al. 2002, Immonen et al. 2003, Honey 2004, Schmitt et al. 2004). Most nursing staff use IT and their computer skills are of an average level (Chastain 2002, Saranto et al. 2002). However, in some university hospitals in

the USA nurses computer skills were rated as only fair to poor (Wilbright et al. 2006). Psychiatric nurses have also been found to be less capable of making effective use of IT applications (Staggers & Kobus 2000).

Lack of familiarity and uncertainty about the skills related to the use of new applications can affect acceptance of the system (Austin et al. 2006, Karsten & Laine 2006, Yusof et al. 2007). Resistance to the use of new applications is a natural reaction which diminishes when users learn to use the system better (Jones 2003, Lium et al. 2006). If users were educated and adopt at using applications they were more satisfied with them and more likely to continue to use them (Ammenwerth et al. 2006). To ensure that the users were skilled enough to use new applications it is important that they have sufficient education and a training period before the implementation (Lee 2004). The content and quality of training and education also decisively influenced user acceptance (Quinzio et al. 2003, Gagnon et al. 2006). To enhance nurses' IT skills, education should provide a systematic and well evaluated approach (McAlpine et al. 2002).

It has been found that IT training and education improved computer competence (Shorten et al. 2001, Brettle 2003, Davis & Yi 2004), and there were connections between skills and acceptance of IT applications (Ammenwerth et al. 2006, Gagnon et al. 2006, Yu & Yang 2006). Lack of the necessary computer skills can be a barrier to the optimal use of the computer applications (Van der Meijden et al. 2001, Ammenwerth et al. 2003, Griffiths et al. 2006, Willbright et al. 2006, Im et al. 2007). Inefficient training is one reason why people do not use available information systems effectively (Davis & Yi 2004, Suomi et al. 2004, Raitoharju 2007a).

In particular employees who have participated in IT education and understand basic technical concepts, are likely to be more positive about impacts of IT in health care (Paré & Elam 1999). Educational interventions can substantially increase IT use (Cabell et al. 2001). It has been shown that nurses with better computer knowledge spent more time using electronic applications at their work (Lee et al. 2004). Generally better educated health care staff (Burkes 1991, Marasovic et al. 1997) and younger ones (Bowies 1997, Liu et al. 2000, Lee et al. 2004, Lium et al. 2008) have been found to be more motivated to use IT than those with less education and greater age. However, there are also studies which do not support these results (Marasovic et al. 1997, Laerum et al. 2004). Laerum et al. (2004) found that nurses and physicians were less satisfied with the computer system than medical secretaries. Marasovic et al. (1997) found no correlation between users' age and attitudes toward computers.

2.3 Usability of IT applications in health care and its connections to the acceptance of IT

IT applications in health care should be easy to use (Kirkley & Rewick 2003, Ammenwerth et al. 2006), easy to access (Zeng & Parmanto 2004) and beneficial to users and organisations (Sachdeva 2001, Griffiths et al. 2006). Barriers to technology acceptance and use in health care may also be related to time spent (Poissant et al. 2005); if use of the application is felt to be time consuming this may be a significant barrier (Ball et al. 2003, Timmons 2003). Staff in hospitals may see IT use as a waste of time (Mitchell & Sullivan 2001, Suomi et al. 2004). Therefore the applications should be as easy as possible to use (Ammenwerth et al. 2006). It is also possible that if there are technical problems with the application and the reality of system limitations become clear to users, they refuse to use it (Sleutel & Guinn 1999, Schmitt et al. 2004).

IT is felt to be useful when it streamlines nursing processes, makes procedures more accurate and reduces the risk of human error (Ball et al. 2003, Kiekkas et al. 2006). On the other hand, nurses may experience that the use of technical equipment increases stress and decreases autonomy (Kiekkas et al. 2006). However, if the functionality and usability of the application are felt to be good, IT will increase staff members' job satisfaction by decreasing the workload and making personal development possible (Engström et al. 2005).

A new application has proven better to use when it has entailed immediate benefits for users (Chismar & Wiley-Patton 2002, Laerum et al. 2004, Lium et al. 2006). Users do not see the use of the application as useful unless they see clear benefits for their work practices (Yarbrough & Smith 2007, Hyppönen & Niska 2008). The content of the application must support the work of staff (McAlearney et al. 2004, Kiekkas et al. 2006) and patients' care (Simpson 2004). The users' needs should be taken into consideration during the development process of the content of the application (Farrell et al. 2004).

It has also been shown that users' gender may be related to satisfaction with using a computer application; males are more often proficient with computers than females (Colley et al. 1994). Venkatesh and Morris (2000) found that, compared to women, men's technology usage decisions were more strongly influenced by their perceptions of usefulness, and in contrast, women were more strongly influenced by perceptions of ease of use. However, Raitoharju (2007b) found that gender did not affect the process of IT acceptance. By contrast, Palm et al. (2006) and Alquirani et al. (2007) suggest that females showed a more positive attitude towards computers than their male colleagues.

Factors of responsibility, privacy protection and data security may also impact the acceptance and use of IT. Using the Internet to transmit health information could allow

providers access to information, but it might violate patient confidentiality (Schoenberg & Safran 2000). Nursing staff must be confident that the application's technical functions support the data security before they use it (Schoenberg & Safran 2000, Costs and Benefits of Health Information 2006).

2.4 Implementation of IT applications in health care

Organisational culture is reported to have connections with the acceptance and use of IT in health care (Bottles 1999, Lorenzi & Riley 2003, Raitoharju 2007b, Saranto 2007). A collaborative organisational culture (Yarbrough & Smith 2007), and systematic and close clinical and administrative cooperation during the implementation process (Lium et al. 2008) support the acceptance of IT. Lack of communication and information during the process may impair staff's acceptance and use of application, whereas an IT-friendly environment and substantial communication have a positive influence on system adoption (McNish 2001, Yusof et al. 2007). It has also been found that technology acceptance is better in organisations that give their employees greater autonomy (Raitoharju 2007b).

Nurses are very little exposed to the development process of designing the IT applications for their own work (Larrabee et al. 2001). Opportunities to participate in these processes would help support nurses' motivation to use computers (Larrabee et al. 2001, Gosling et al. 2004, Saleem et al. 2005, Klemola et al. 2007, Saranto 2007). Cooperation between information system developers, end users and leaders in the organisation is vital to the acceptance of a given technology (Toivanen et al. 2007, Hyppönen & Niska 2008). The teamwork spirit (Yusof et al. 2007), trust within the team and a climate of support (Ammenwerth et al. 2006) among the staff members can also be seen as supportive factors in implementation processes.

It is important for organisation to realise that the introduction of a new technology means much more than just training users to use a ready-made product (Barr 2002, Miettinen et al. 2003). The implementation of new IT applications requires systematic investments and guidance (McNish 2001, Grimshaw et al. 2004, Saranto 2007, Hyppönen & Niska 2008). Organisational support includes investments in infrastructure; such as premises and technical instruments, which helps user satisfaction and acceptance (Dansky et al. 1999, Saleem et al. 2005, Yarbrough & Smith 2007, Yusof et al. 2007). Clearly structured places and times for using applications support the adequate use of IT (Ammenwerth et al. 2006). Organising technical support (Kim & Chang 2007), and adequate education (Lemmetty et al. 2006) and training (Raitoharju 2007a) in using new IT application also promote acceptance of the system.

There may be reluctance to invest much in IT implementation processes in organisations in health care (Lapinsky et al. 2004, Yusof et al. 2007). The investments represent

management commitment and support for a new working practice in the organisation (Lorenzi & Riley 2003, Gagnon et al. 2005). Financial resources and time investments in data system projects would ensure functional computer applications and may save staff's time and resources later (Dienemann & Van de Castle 2003, Kirkley & Rewick 2003). Walter et al. (2000) have been found that staff in mental health care believe that the computer systems have considerable potential for the work environment, particularly if the implementation is accompanied by administrative support.

2.5 Theories of the acceptance and use of IT

A wide variety of theoretical perspectives have been developed in order to understand how users make decisions to use technology applications. Probably the most dominant theories in IT research are Innovation Diffusion Theory (IDT) (Rogers 1995), Theory of Planned Behavior (TPB) (Fishbein & Ajzen 1975), the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al. 2003), the FITT framework (Ammenwerth et al. 2006) and the Technology Acceptance Model (TAM) (Davis 1989, Davis et al. 1989). Theories provide tools to understand success or failure in implementation processes of new IT applications.

Innovation Diffusion Theory (IDT) explains the event of the innovation decision process that determines the rate of adoption in various categories of adopters. Its primary intention is to provide an account of the manner in which technological innovation moves from the stage of invention to widespread use. The theory suggests that individuals can be classified according to their speed of uptake of the innovation. These categories are: innovators, early adopters, early majority, late majority and laggards. IDT also posits four innovation characteristics that affect the diffusion: relative advantage, complexity, trialability and observability. (Rogers 1995.)

The Theory of Planned Behavior (TPB) posits that the main determinants of individual behaviour are attitude toward behaviour, subjective norm and perceived behavioural control. According the theory attitude toward behaviour is an individual's positive or negative feelings about performance. Subjective norm describes an individual's consideration that most people who are important to him think he should or should not perform the behaviour in question. Perceived behavioural control is defined as perceived ease or difficulty of performing the behaviour. TPB holds that attitudes, subjective norms and perceived behavioural control are direct determinants which in turn influence behaviour. (Fishbein & Ajzen 1975.)

The Unified Theory of Acceptance and Use of Technology (UTAUT) proposes to explain user intentions to use technology and actual behaviour. The theory includes four key constructs; performance expectancy, effort expectancy, social influence, and facilitating

conditions, which are direct determinants of usage intention and behaviour. Gender, age, experience, and voluntariness of use are posited to mediate the impact of the key constructs. UTAUT is based on the integration of eight previously established models. (Venkatesh et al. 2003.)

The FITT framework is based on the idea that fit between individuals, task and technology is essential issue in IT implementation processes. According to FITT, adoption in a clinical environment depends on the fit between the attributes of the individual users (e.g. computer anxiety, motivation to use computer), attributes of the technology (e.g. usability, functionality) and attributes of the clinical tasks and processes (e.g. organisational factors). These attributes interact with each other when a new IT application is implemented in clinical practice in health care. The model helps to analyse the socio-organisational-technical factors that influence IT adoption in a health care setting. The theory points out that the fit between attributes is more important than the individual attributes themselves. (Ammenwerth et al. 2006.)

In the field of IT research the Technology Acceptance Model (TAM) (Davis 1989, Davis et al. 1989) is possibly the most frequently used theory (Ma & Liu 2004, Kim & Chang 2007, Yarbrough & Smith 2007). TAM is based on principles adopted from Fishbein and Ajzen's (1975) attitude paradigm from psychology, which specifies how to measure the behaviour-relevant components of attitudes, distinguishes between beliefs and attitudes and specifies how external stimuli are causally linked to beliefs, attitudes and behaviour. The theoretical model on which TAM is based is the Theory of Reasoned Action (TRA). TRA is a general model which is concerned with individuals' intended behaviours. According to TRA an individual's performance is determined by the individual's attitude and subjective norms concerning the behaviour in question. In addition an individual's beliefs and motivation interact with existing behaviour. (Ajzen & Fishbein 1980.)

The Technology Acceptance Model (TAM) predicts that user acceptance of any technology is determined by two factors: perceived usefulness (PU) and perceived ease of use (PEOU). PU is defined as the degree to which an individual believes that using a particular system will enhance his or her job performance. PEOU is defined as the degree to which an individual believes that using a particular system is free of physical and mental effort. (Davis 1989, Davis et al. 1989, Davis 1993.) The TAM suggests that intention to accept technology is determined directly by attitude, perceived usefulness and perceived ease of use. According to TAM individuals' intention to use technology determines the actual use of the application, and attitudes toward technology affect the intention. (Davis et al. 1989, Davis & Venkatesh 2004.)

Perceived usefulness and perceived ease of use may be affected by various external variables, possibly user features such as level of education (see e.g. Burton-Jones & Hubona 2005), gender (see e.g. Venkatesh & Morris 2000), or organisational features

such as training in computer use (see e.g. Venkatesh 1999). It has been found that all types of external variables with usefulness and ease of use mediated behavioural intention and actual IT use (Lee et al. 2006, Yarbrough & Smith 2007). Attitude toward IT is expected to influence the intention to use the system and therefore the actual use of the application. The TAM model proposes that the more perceived usefulness and perceived ease of use, the more positive the user's attitude will be. In such cases the actual IT use is more likely than when the user perceives less usefulness and ease of use and her or his attitude is negative. (Davis et al. 1989.)

The TAM theory has been widely tested in several research contexts as well as with several types of IT applications (see e.g. Chau & Hu 2001, Lee et al. 2006, Raitoharju 2007b, Yarbrough & Smith 2007). TAM seems to generate explanations for the factors of IT acceptance that are transferable to different user populations and different kinds of technologies. The TAM theory has also been used for identifying functional factors in designing health information websites for customers, when the study population was adult citizens in Korea (Kim & Chang 2007). Earlier studies show that the model explains both the variation in behavioural intention (Chau & Hu 2002a) and actual IT use (Venkatesh & Morris 2000). TAM has proven to be a reliable model through frequent empirical testing (Yarbrough & Smith 2007). The validity of the model has been conformed in many different contexts and research constructions (Ma & Liu 2004, King & He 2006), including in health care settings (Chau & Hu 2002a, Chau & Hu 2002b, Chismar & Wiley-Patton 2002).

In this study the TAM theory will be used to structure the research process and to help enhance the understanding of the acceptance and use of IT among psychiatric nurses. The model of the original TAM is described in Figure 1.

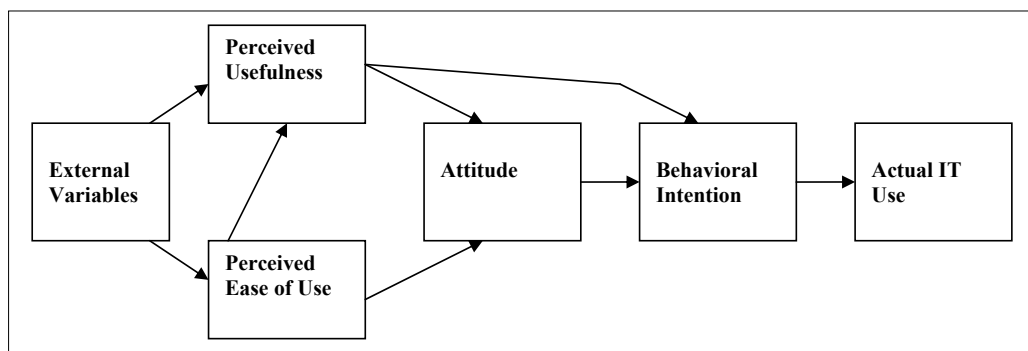


Figure 1. Technology Acceptance Model (TAM) (Davis et al. 1989, 985).

The figure is reprinted with permission; Davis, FD., Bagozzi, RP. & Warshaw, PR. 1989. User acceptance of computer technology: A comparison of two theoretical models. *Management Science* 35 (8), 982-1003. The Institute for Operations Research and the Management Sciences, 7240 Parkway Drive, Suite 310, Hanover, Maryland 21076 USA.

Individual factors such as age, gender, profession, basic education, IT education and IT skills are external variables in the study. Perceived usefulness was assessed by means of the content and benefits of the web-based patient support system and the barriers and facilitators to the implementation of the system. The functionality of the application described perceived ease of use of the system. Attitudes toward IT were taken to consist of motivation to use IT, satisfaction with IT and experience of the benefits of IT. Actual IT use refers to the use of GCA, HIS, the Internet and the web-based patient support system.

2.6 Summary

It can conclude in light of earlier studies that acceptance and use of IT in health care are related to the individual, technology and organisational factors. The better organisational operations, human activity and technology fit with each other, the greater is the potential of IT and the more confident is the acceptance of the application among the users (Ammenwerth et al. 2006, Yarbrough & Smith 2007, Yusof et al. 2007).

A number of individual factors are related to IT acceptance and use. These factors include attitudes toward IT, subsuming motivation to use computers, satisfaction with IT and experienced benefits of IT use. In addition, individual factors include computer competencies and skills, frequency of computer use, users' educational level, users' age and gender.

The technical quality of IT applications also affects acceptance and use of systems. The applications should be easy to use, and in addition, generate benefits for end users and organisations. Reduction of human errors and ensuring privacy protection and data security are also important consideration when IT applications are implemented in health care.

Communication, information sharing, a collaborating culture and teamwork are very important in technology implementation processes in organisations, when the purpose is that users should accept the system in their working practice. End users' participation in the IT development process can ensure their motivation to use the system later. Financial, time and personal resource allocations should ensure the successful acceptance among users. Although knowledge of IT projects management is available, it has been little used in health care.

In the field of the IT research several theories have been developed to understand acceptance and use of IT among individuals. Possibly the most frequently used theory is the Technology Acceptance Model (TAM), which was selected to structure the study process and deepen the understanding of the study focuses.

Although the acceptance and use of IT are widely studied topics in health care there is a lack of knowledge about how nurses working on psychiatric wards accept IT applications for their daily work practices.

3 THE PURPOSE AND GOALS OF THE STUDY

The overall goal of this study is to create recommendations for best practices to improve acceptance and use of IT among nurses in psychiatric hospitals. To achieve this the study pursued five sub-goals:

1. To describe use of computers and factors inhibiting optimal use of computers among staff working in psychiatric hospitals.
2. To describe computer skills and learning experiences related to computer use among nurses in psychiatric hospitals, and develop an evidence-based curriculum to support nurses' computer and Internet skills in psychiatric nursing.
3. To describe the usability evaluation of the web-based patient support system by nurses in psychiatric hospitals.
4. To identify the barriers and facilitators in the implementation process of the web-based patient support system in psychiatric hospitals.
5. To assess the effects of the implementation of the web-based patient support system on staff's acceptance and use of IT in psychiatric hospitals.

The phases of the study and their timetable are described in Figure 2.

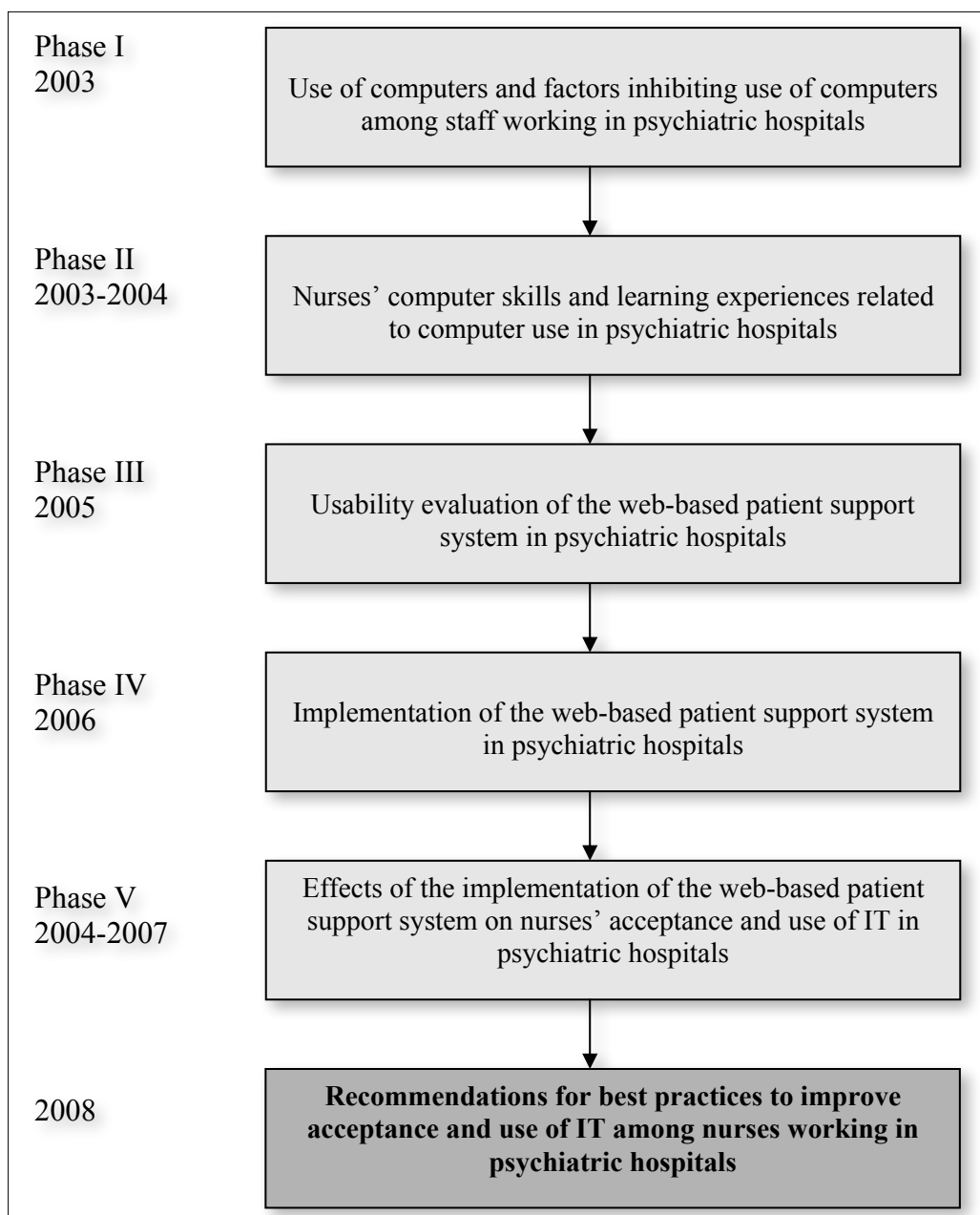


Figure 2. Phases and times of each study phase

More detailed research questions for each sub-goal are as follows:

1. Use of computers and factors inhibiting use of computers among staff working in psychiatric hospitals (Paper I)

1. How are health care staff's individual characteristics (age, gender, job position, basic education, computer education, motivation to use computers) associated with staff's computer use in psychiatric hospital?
2. What factors inhibit staff's use of computers in psychiatric hospital?

2. Nurses' computer skills and learning experiences related to computer use in psychiatric hospitals (Paper II)

1. What kind of learning experiences and learning barriers in computer use do nurses have in psychiatric hospital?
2. What kind of computers skills do nurses have in psychiatric hospital?
3. Which are the effective learning methods for computer education in health care according to the literature?

3. Usability evaluation of the web-based patient support system by nurses in psychiatric hospitals (Paper III)

1. What are nurses' perceptions of the functionality, content and benefits of the web-based patient support system in psychiatric nursing?

4. Implementation of the web-based patient support system in psychiatric hospitals (Paper IV)

1. Which factors according to nurses might be barriers and facilitators in the implementation of a web-based patient support system in psychiatric hospital?

5. Effects of the implementation of a web-based patient support system on nurses' acceptance and use of IT in psychiatric hospitals (Paper V)

1. Does the motivation to use IT, beliefs and satisfaction with IT among nurses using a web-based patient support system differ from those of nurses who used paper leaflets in patient education sessions?
2. Does the extent computer and the Internet use among nurses using a web-based patient support system differ from those of nurses who used paper leaflets in patient education sessions?

Based on the answers of each research questions, the recommendations for best practices in IT implementation processes will be developed to improve the acceptance and use of IT among nurses in psychiatric hospitals.

4 METHODOLOGY

4.1 Research design, setting and population

In **phase I** the descriptive survey design was used to describe staff's computer use and relationships between their age, gender, basic education, job position, participation in professional computer courses or application courses, and motivation to use IT. In addition, factors inhibiting staff's optimal use of computers were explored. (Paper I.) The purpose was to consider the correlations between individuals' characteristics and computer use, and therefore a quantitative approach was chosen (Polit & Beck 2004). In this phase individual factors were user characteristics that operated as external variables in TAM theory (Davis et al. 1989, Venkatesh 1999, Venkatesh & Morris 2000, Burton-Jones & Hubona 2005). The study was implemented in two psychiatric hospitals in two hospital districts in southern Finland, where the web-based patient support system was later implemented. The study population (N = 791) consisted of all staff working with patients in these hospitals, to obtain a picture of staff's experience of IT in these hospitals and factors related to IT use. The inclusion criteria were as follows: permanent or temporary employment during the time of data collection, employment with patients (registered nurses, specialized nurses, nursing managers, practical nurses, psychiatrists, social workers, psychologists, ward secretaries, therapists) and voluntary participation in the study. The exclusion criteria were not working with patients and leave of absence or sick leave. In this study it was hypothesized that there are associations between health care staff's individual characteristics and staff's computer use in psychiatric hospitals. (Paper I.)

In **phase II** a combination of qualitative and quantitative data collection methods was used to describe nurses' computer skills and educational experiences related to computer use. In addition, a systematic literature search was conducted to construct a curriculum to help psychiatric nurses to learn to use computers and the Internet. In this study systematic training was used to ensure users' computer skills and acceptance of the web-based patient support system. (Paper II.) According to the TAM theory education and training for IT use can operate as external variables which have impacts on attitudes toward IT and its use (Venkatesh 1999). At first, the qualitative method, which focused on nurses' learning experiences with, and possible learning barriers to computer use was used. This was done because there was only very little empirical research on this subject, and respondents' own accounts and descriptions were in focus (Morse 1999, Bowling 2004). The qualitative method makes it possible to consider and understand the phenomenon from the participants' point of view (Denzin & Lincoln 2000). The study population consisted of registered nurses and practical nurses (N = 20) on one

acute psychiatric ward. This ward was comparable with wards where the web-based patient support system was to be implemented in practice, but the ward was situated in another hospital. Second, a small-scale quantitative survey was conducted to measure nurses' computer skills on nine acute psychiatric wards in two psychiatric hospitals. The study population consisted of nurses (N = 76) who were randomly allocated to use web-based patient support system. (see Paper V.) Knowledge of nurses' existing IT skills was gathered and the education to based on individual needs was arranged. Third, a literature search was conducted to find evidence-based effective methods for computer education. The databases used were MEDLINE, CINAHL and PsycINFO. (Paper II.)

In **phase III** the functionality, content and benefits of the web-based patient support system were evaluated with qualitative and quantitative data collection methods (Paper III.) According to the TAM theory perceived usefulness (PU) and perceived ease of use (PEOU) are two primary determinants of intention to use, which determines the actual IT use (Davis 1989, Davis et al. 1989). Knowledge of the usefulness of the web-based patient support system was used to ensure its benefits for the nurses in their patient education activities. The study population consisted of nurses (N = 76) on nine acute psychiatric wards who were educated to use the web-based patient support system. (Paper III.)

In **phase IV** the barriers and facilitators of the web-based patient support system implementation process were identified. The research approach used was qualitative. (Paper IV.) The study phase was an attempt gain additional knowledge of the determinants of the TAM; external variables, perceived usefulness, perceived ease of use and attitude (Davis et al. 1989). In addition the results were considered against the FITT framework (Ammenwerth et al. 2006), where the idea is that IT applications adoption in a clinical environment depends on the fit between the attributes of the individual users, the technology and the clinical processes. The study was realized on nine acute psychiatric wards among nurses who had used the web-based patient support system, and who worked as persons in charge in the study process (N = 89). (Paper IV.)

In **phase V** the purpose was to assess the effects of the implementation of the web-based patient support system on nurses' attitudes toward computers and Internet use. The research frame was a randomized controlled trial with quantitative outcome measures. In this kind of design, comparison and testing the differences between two groups before and after the intervention are possible (Trochim 2006). The nurses (at baseline N = 149, at follow-up N = 141) on nine acute psychiatry wards were randomly allocated to educate patients with web-based patient support system (N = 76, intervention group) or leaflets (N = 73, comparison group). (Paper V.) According to the TAM the intention to use a system is jointly determined by the individual's attitude to computer use and the perceived usefulness of the application (Davis et al. 1989). In this study it was

hypothesized that a systematic IT implementation process would make nurses' attitudes towards computers more positive, and increase their computer and the Internet use compared to those who not using the patient support system. (Paper V.) The study design of phase V is described in Figure 3.

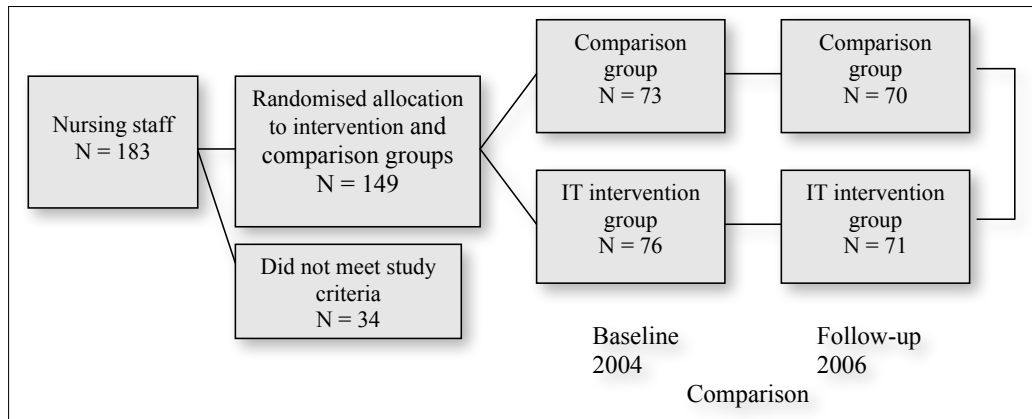


Figure 3. Study design of phase V

4.2 Instruments

Different measurements and scales were used in this study because the research problems were intended to consider to several different viewpoints. The selection of the instruments is based on specific research questions and study approach.

In **phase I** computer use was assessed using the Staggers Nursing Computer Experience Questionnaire, SNCEQ (Staggers 1994). The SNCEQ is a self-report questionnaire focusing on the computer literacy of health care professionals. According to Staggers (1994) the self-report format was developed because behavioural observations of nurses' current and past computer use are rarely feasible for researchers. When computer experience categories were developed by Staggers the scored portion of the instrument was identified through a literature review and by speaking with informatics faculty and students. (Staggers 1994.) To ensure that the Finnish translation of the instrument corresponds to the original contents of the questionnaire the translation and backtranslation method was used (e.g. Jones 1987, Chang et al. 1999). The instrument includes six scales describing computer experience and participation e.g. in the design, selection, implementation and evaluation of computer systems. In this study three of the scales were used. The instrument consisted of 38 five-point Likert-type items (0 = none; 4 = extensive). Factors inhibiting the staff's optimal computer use were explored with items included on SNCEQ instrument with 12 possible reasons. (see Table 1.) The SNCEQ instrument and its modifications had been used e.g. in the USA (Staggers 1994, Staggers & Mills 1994, Staggers & Kobus 2000, Chastain 2002) and in China (Liu et al.

2000). Earlier studies indicated that the instrument is feasible and reliable in measuring nurses' computer use. Pearson's correlation coefficient varied between 0.90 to 0.97 and the alpha value for the whole instrument has been 0.94 (Staggers 1994). (Paper I.)

In **phase I** and **phase V** staff's attitudes to computers were measured by Burkes' (1991) questionnaire based on an adaptation of Vroom's (1964) expectancy theory. The term motivation has been described as a force governing an individual's behavior. Beliefs illustrate an expectation that the use of the IT application will be followed by advantageous outcomes. Satisfaction is defined as a preference for the application, and may contribute to job satisfaction. (Vroom 1964, Burkes 1991.) The instrument was translated into Finnish using the translation and backtranslation process. The attitude instrument consisted of three Likert-type scales; satisfaction (21 items), beliefs (18 items) and motivation (17 items). Answers were assigned a value of 1-5, with 1 indicating strong dissatisfaction, disagreement or unlikelihood; and 5 indicating strong satisfaction, agreement or likelihood (see Table 1). The motivation section only was used in the phase I (Paper I). Burkes' computer attitude instrument and its constructs had been used before in some studies conducted in health care environments (Burkes 1991, Marasovic et al. 1997, Liu et al. 2000). According to these studies the instrument is valid and reliable to measure nurses' attitudes toward computers. In earlier studies, the Cronbach's alpha value of the scale was 0.91 (Burkes 1991) and 0.72 (Liu et al. 2000). (Paper I, Paper V.)

In **phase II** the data were collected using both qualitative and quantitative methods. First, written essays were used; nurses were asked to write in their own words about their main learning experiences related to computer use. Second, a small-scale survey was conducted to measure nurses' computer skills using the Finnish version of the European Computer Driving Licence (ECDL) test (Finnish Information Processing Association 2004). The test is based on the degree requirements of the European Computer Driving Licence (The European Computer Driving Licence Foundation 2003). The ECDL test measures individuals' competence in six specific areas of computer use. The self-administrated instrument includes six modules: a) Using the computer and managing files (23 items) b) Word processing (22 items) c) Spreadsheets (22 items) d) Database (22 items) e) Presentation (21 items), and f) Information and communication (21 items). Respondents answer on two-point response scales (yes/no). (see Table 1.) Scores for each module can range from 0 to 5. The instrument has been used generally to evaluate Finnish citizens' information technology competencies, and it is conceivable that the test is also suitable to obtain more detailed information on nurses' computer skills related to each specific competence area. When the study was conducted there were no other instruments to measure detailed issues related to skills in computer applications. Later the ECDL Health syllabus was developed including a test for measuring health care professionals' computer skills in specific areas. The ECDL Health test is also available

in Finnish. (ECDL Finland Oy 2008a.) There was no research evidence of the validity and reliability of the ECDL test, but in this study the scales demonstrated high internal consistency across modules. (Paper II.)

In **phase III** the data were collected using a questionnaire focusing on the quality of online services; The Quality Criteria of Public Online Services (QCPOS) by The Finnish Ministry of Finance (2004). The purpose of the quality criteria is to act as a tool for constructing, developing and assessing web services, and to improve the quality of web services, particularly from the user's point of view, to increase customer satisfaction and boost the use of web services. The quality criteria are based on user analyses of web services and organisational quality evaluation models used for conventional services. In drawing up the set of criteria, evaluation criteria with various recommendations and standards for web services used in other countries were examined. (EPAN eGovernment working group 2005, The Finnish Ministry of Finance 2008.) QCPOS includes five evaluation areas; functionality, content, management, production and benefits (The Finnish Ministry of the Finance 2004). Out of these five areas, this study focuses on the quality of the functionality, content and benefits of the portal. These evaluation areas included 23 specific criteria. The evaluation of all criteria was conducted on a 6-point scale (0 = impossible to realise, to 5 = the issue is realised in an exemplary manner). (see Table 1.) The qualitative part of the study phase included written feedback on each of the three assessment areas mentioned above by an electronic evaluation form in the web-based patient support system. (Paper III.)

In **phase IV** the qualitative questionnaire with two thematic open-ended questions was used. The nurses were asked to describe in their own words 1) what kind of barriers might be found to the effective use of the web-based patient support system, and 2) what factors might support its usability in daily nursing practice. In this study phase the aim was to approach the research problem with inductive method and avoid structured configuration, so the nurses' experiences could be elicited (Denzin & Lincoln 2000). (Paper IV.)

In **phase V** three modules (using the computer and managing files, word processing, information and communication) of the ECDL test (The European Computer Driving Licence Foundation 2003, Finnish Information Processing Association 2004) were used to measure nurses' computer skills. Nurses' attitudes toward computers were measured by Burkes' (1991) computer attitude questionnaire using all three sections; motivation, beliefs and satisfaction. Computer and the Internet use were measured by two 5-point Likert-type items. (Paper V.) The instruments used are described in detail in Table 1.

Table 1. Instruments

Phase	Instrument	Scale	Number of items	Scoring	Range of the possible scores
Phase I	SNCEQ (Staggers 1994)	Use of general computer applications (GCA use) Use of hospital information systems (HIS use) Role activity Reasons why staff may not use computers	20	0-4, 0=none - 4=extensive	0 - 80
Phase I + Phase V	Computer attitude scale (Burkes 1991)	Motivation Beliefs Satisfaction	17 18 21	if yes, 1 = reason apply to me 1-5, 1=highly unlikely - 5=highly likely 1-5, 1=strong disagreement - 5=strong agreement 1-5, 1=strong dissatisfaction - 5=strong satisfaction	17-85 18-90 21-105
Phase II	ECDL test (Finnish Information Processing Association 2004)	Using the computer and managing files Word processing Spreadsheets Database Presentation Information and communication	23 22 22 22 22	yes/no yes/no yes/no yes/no yes/no	
Phase III	The Quality Criteria of Public Online Services (The Finnish Ministry of Finance 2004)	Functionality Content Benefits	14 6 3	yes/no 0-5, 0=impossible to realize 0-5, 5=realize in an exemplary manner 0-5	0-70 0-30 0-15
Phase IV	Electronic evaluation form Barriers and facilitators to use of patient support system	1. What kind of barriers might be found to the effective use of the portal? 2. What factors might support usability of the portal?	2	open-ended	
Phase V	Computer and Internet use	Computer use Internet use	1 1	1-5, 1=daily - 5=not at all 1-5, 1=daily - 5=not at all	1-5 1-5

4.3 Data collection, samples and data analysis

In **phase I** the data were collected in spring 2003 by the SNCEQ instrument (Stagers 1994). The participants in two psychiatric hospitals received a questionnaire together with an information leaflet about the study. In addition, a contact person on each study ward was informed about the nature of the data collection. The response time was one month. The study sample ($n = 470$), consisted of staff working with patients in two psychiatric hospitals, giving a response rate of 59 %. (Paper I.)

The total scores of staff's computer experience (use of general computer applications, GCA use; use of hospital information systems, HIS use; participation on implementation processes) were formed. Descriptive statistics were computed for demographic characteristics and the total scores. MANOVA with main effects and two-way interaction effects of age, gender, basic education, job position, participation in computer education, motivation to use computers were used to ascertain in which demographic variable there were significant differences between levels. Post hoc Tukey or Tamhane's test was further used to examine differences between groups. Spearman's correlation coefficients were used to examine the correlations between motivation variable and the total scores. Chi-square tests were used to determine the associations of background characteristics with the factors inhibiting computer use. (Argyrous 1997, Burns & Grove 2005, Trochim 2006.) (Paper I.)

In **phase II** the qualitative data were collected in spring 2003. An information session for the purposes of the study was held by the researcher in the hospital. During the session the participants received oral and written information about the study. The response time was three weeks. Out of the 20 eligible nurses in the sampling frame, 13 participated in the study. The data were analysed with qualitative content analysis (Morse 1999). (Paper II.)

The quantitative data in **phase II** were collected with the ECDL test (Finnish Information Processing Association 2004) in two psychiatric hospitals in autumn 2004. Before the data collection the participants received both oral and written information about the study. The response time allowed was three weeks. The response rate was quite high (99 %), because a total of 75 out of 76 eligible nurses participated in the study. The data were analysed with descriptive statistics; frequencies and percentage values (Bowling 2004, Burns & Grove 2005, Trochim 2006). (Paper II.)

In **phase III** the quantitative data were collected with the QCPOS instrument (The Finnish Ministry of Finance 2004) in two psychiatric hospitals in spring 2005. The data were collected three weeks after the nurses had participated in the education of web-based patient support system. During the education information about the questionnaire was given to the participants. Out of 76 eligible nurses 38 returned the

paper questionnaire (response rate 50 %), and in addition 17 participants completed the electronic evaluation form (response rate 22 %). In addition 16 nurses added comments to the paper questionnaire. The quantitative data were analysed with descriptive methods; frequencies, means and standard deviations (Bowling 2004, Burns & Grove 2005). The qualitative data were analysed with content analysis (Morse 1999). (Paper III.)

In **phase IV** the data were collected in spring 2006 using a questionnaire with two thematic open-ended questions. An information session about the study was organised by the researcher for those in charge on the study wards and for the nursing managers. In addition the questionnaire was accompanied by an introductory letter including information about the study and data collection. The response time allowed was three weeks. Altogether 56 nurses took part, giving a response rate of 63 %. The data were analysed with content analysis (Morse 1999). (Paper IV.)

In **phase V** the outcome measures were recorded at baseline in autumn 2004. If a new nurse started to work on the ward, a new baseline assessment was made. The follow-up assessment was realized in autumn 2006. At the baseline assessment a total of 147 nurses participated in the study (response rate 99 %), and at the follow-up assessment 112 nurses participated in the study (response rate 79 %). (Paper V.)

Attitudes to computers and to using computer and Internet were compared at baseline using T-test and ANOVA (for sum variables only). For the five-point computer and Internet use items we calculated means, standard deviations and medians. (Trochim 2006.) Mann Whitney U-test was used to group comparisons for differences between baseline and follow-up assessments (individual Likert scaled items). In addition, nurses in the IT intervention group (n = 44) were divided into two groups for each outcome variable; 1) nurses with no change or negative change and, 2) nurses with positive change in measures. These groups were compared for background variables using Chi square test (categorical background variables) and T-test (continuous background variables). Effect of drop-out and validity of analyses for complete cases were examined with full sample analyses using linear regression based imputations (Lachin 2000). (Paper V.)

The designs, participants, data collection methods and analyses used in the study are summarized in Table 2. The characteristics of the study samples in each study phase are described in Table 3.

Table 2. Designs, participants, data collection methods, and types of analysis

Phases/ Papers	Design	Participants	Methods of data collection	Type of analysis
I	Descriptive and correlational (survey)	Health care staff (N = 791, n = 470)	Questionnaire with structured questions	Descriptive statistics (Percentages, Means, SD), MANOVA with main effects, interaction effects and post hoc test, Spearmans correlation, Cohen's D test, Chi-square test
II	Descriptive	Nurses (N = 20, n = 13)	Written essays	Content analysis
	Descriptive (survey)	Nurses (N = 76, n = 75)	Questionnaire with structured questions	Descriptive statistics (Percentages)
III	Descriptive	Nurses (N = 76, n = 17)	Electronic evaluation form and Questionnaire with open-ended questions	Content analysis
	Descriptive (survey)	Nurses (N = 76, n = 38)	Questionnaire with structured questions	Descriptive statistics (Percentages, Means, SD)
IV	Descriptive	Nurses (N = 89, n = 56)	Questionnaire with open- ended questions	Content analysis
V	Randomised controlled trial	Nurses (N = 149, intervention group N = 76, n = 44, comparison group N = 73, n = 53)	Questionnaire with structured questions	Descriptive statistics (Percentages, Means, SD), Fishers' Exact test, T-test, ANOVA, Mann Whitney U-test, Chi ² -test, Full sample analyses

Table 3. A summary of the study samples

	Phase I	Phase II	Phase III	Phase IV	Phase V	
		Qualitative	Quantitative		Baseline	Follow-up
n (Response rate %)	N = 791 470 (59)	N = 20 13 (65)	N = 76 75 (99)	N = 76 56 (63)	N = 149 146 (98)	N = 141 112 (79)
Age	n = 466	n = 13	n = 73	n = 32	n = 56	n = 72
Mean (Range) years	41.5 (22-63)	37.0 (25-53)	41.2 (21-62)	43.2 (24-57)	40.7 (26-64)	41.5 (21-62)
Gender	n = 468	n = 13	n = 75	n = 32	n = 56	n = 72
Female %	72	62	65	68	58	62
Job position	n = 466	n = 13	n = 75	n = 32	n = 56	n = 72
Registered Nurse %	36	54	49	47	59	48
Practical Nurse %	33	46	51	50	41	52
Nursing Manager %	11	0	0	3	0	0
Other %	20	0	0	0	0	0
					IT intervention group	Comparison group
					n = 44	n = 53
					n = 73	n = 53
					n = 73	n = 62
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					n = 73	n = 62
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4.5 Ethical considerations

In this study ethical decisions followed general ethical guidelines and the legislation on health care research. The basic principles of research ethics were followed at every stage of the study. The ethical guidelines emphasise research utility, feasibility, propriety and accuracy (ETENE 2001, World Medical Association Declaration of Helsinki 2004, Tutkimuksen eettinen arviointi Suomessa 2006, European Commission 2007). Ethical considerations in a study start with the selection of research topic and continue to the publication of research findings (Burns & Grove 2005).

Acceptance of IT and its use was chosen for research focus because the issue is topical and the study generates benefits for both management and staff in health care organisations, and in addition, for people who use the health care services (The Finnish Ministry of Social Affairs and Health 2006). The purpose of the study was to improve the facilities of the nursing staff in psychiatric hospitals by producing knowledge to support staff competence.

Approval for the study was obtained from the nursing managers and medical directors of the two organisations. According to Finnish ethical protocol, no statement of ethical commission was needed because the study did not focus on patients (Medical Research Act 1999, ETENE 2001). Approval for use of the instruments was obtained from the developers of each instrument; for SNCEQ from Nancy Stagers in 2003; for the nurses' computer attitude scale from Marijo Burkes in 2003; for the ECDL test from the Finnish Information Processing Association in 2004. The QCPOS instrument was freely available for use in the Internet (see The Finnish Ministry of Finance 2004).

The participation of health care staff was voluntary and the data were treated in confidence (CORDIS 2008). The data were coded so that respondents could only be identified by the researcher. The principle of voluntary participation requires that people not be coerced into participating in research. Prospective research participants must be informed about the procedures and risks involved in the research so that they can give their consent to participate. (World Medical Association Declaration of Helsinki 2004, Trochim 2006, CORDIS 2008.) Responding to the questions was taken to indicate consent to participate in the research. According to Finnish ethical protocol, surveys among health care personnel do not require written informed consent. (ETENE 2001.)

Participants received oral and written information about the research. In phase I the information was only written. In phases II, III, IV and V of the study information sessions were organised by the researcher for those in charge and also for the managers of each ward. After that the people in charge and the ward managers were responsible for informing the staff about the study and data collection process. Research assistants working in the hospitals also gave information if needed. The questionnaires in each phase

were accompanied by a covering letter including information about the purpose of the study, and assurance of anonymity and confidentiality. The completed questionnaires in sealed envelopes were returned to the research assistants in the hospitals, who forwarded them to the researcher.

The researcher was an outsider in the organisations involved in the study, which contributed to a confidential atmosphere and a neutral attitude towards the research during data collections and analysis (Polit & Beck 2004).

5 RESULTS

5.1 Use of computers among staff working in psychiatric hospitals

The aims were to describe computer use and factors associated with computer use among staff (registered nurses, specialized nurses, nursing managers, practical nurses, psychiatrists, social workers, psychologists, therapists and ward secretaries) working in psychiatric hospitals, and to explore factors which may inhibit the optimal use of computers. When staff's individual associations with computer use were identified statistically significant correlations were found between staff's motivation to use computers and computer experience. Those who had more experience in general computer applications (GCA) use ($p < 0.001$), hospital information systems (HIS) use ($p < 0.001$) and participation in implementation processes of computer applications ($p < 0.001$) were more motivated to use computers than those who had less experience in these issues. (Paper I.)

Participants' age ($p = 0.047$), gender ($p = 0.001$), basic education ($p = 0.016$), participation in professional computer education ($p < 0.001$) and participation in computer application courses ($p = 0.005$) were associated with the use of GCA. However, only one statistically significant two-way interaction was revealed. Nursing managers with upper secondary education had more experience with GCA than nursing managers whose basic education was comprehensive school ($p = 0.029$). (Paper I.)

Younger respondents ($p = 0.014$), nursing managers ($p = < 0.001$) and those who had participated in computer application courses ($p = 0.029$) had used HIS more. Also, few statistically significant two-way interactions were perceived. Staff with upper secondary education and who had participated in professional computer courses were more experienced in HIS than those with comprehensive school education ($p = 0.040$). Male nursing managers had used HIS more than female nursing managers ($p = 0.037$). (Paper I.)

Males ($p = 0.001$) and those who had participated in professional computer courses ($p = 0.007$) or application courses ($p = 0.015$) had more experience with IT implementation processes than females and those who had not participated in computer courses. Younger staff had also participated in implementation processes more than older ones ($p = 0.019$). Moreover, few statistically significant two-way interactions were revealed. Staff aged under 30 years and who had participated in short computer courses had more experience of IT implementation processes than those who were older and had not participated in computer application courses ($p = 0.019$). Likewise the youngest nursing managers (under 30 years) had more experience of these activities than nursing managers over 50 years old ($p = 0.008$). (Paper I.)

When factors inhibiting staff's computer use were identified, the most frequently mentioned factors were a lack of interest in computers or not having a computer at home. Generally participants also reported that they did not have enough time to use computers at work, they had never participated in computer courses or they were afraid of losing files. The oldest respondents reported a lack of interest ($p = 0.006$) or a lack of time for using computers ($p = 0.045$) more often than younger ones. The staff with less motivation to use computers felt that computers caused anxiety ($p = 0.004$) or they were not very interested in computers ($p < 0.001$) more often than the staff with higher motivation for computer use. (Paper I.)

5.2 Nurses' computer skills and learning experiences related to computer use in psychiatric hospitals

The aim was to describe nurses' learning experiences related to computer use and evaluate nurses computer and Internet skills in psychiatric hospitals, and to develop a curriculum to support these skills. This was done by identifying different ways of learning computer use, exploring possible learning barriers, evaluating nurses' computer skills and reflecting the findings against earlier studies. The findings of qualitative and quantitative data together with a literature review formed the basis for the development process of a computer curriculum.

The ways by which nurses had learnt to use computers divided into three categories: self-education, face-to-face learning and learning in group instruction. Self-education consisted of learning by trial and error, learning by doing, reading information technology literature, applying guidelines, and playing computer games. Face-to-face learning occurred under the individual guidance of another person who might be a computer expert, a tutor, a colleague, a fellow student or a friend. Practical training under the guidance of a computer expert was counted as the most effective way to learn to use computers. Learning in group instruction included formal IT courses in computer classes supervised by a computer expert. Learning with a group required an appropriate level of learning goals and small group size. (Paper II.)

Learning barriers to computer use were related to learning circumstances, learners' abilities, emotions and attitudes. The most frequently mentioned barriers to do with circumstances were lack of computer at home, troubles with computer applications, lack of computer experts and ergonomic problems. High learning goals on computer courses was experienced as barriers to computer use if it was not possible to pay attention to learners' individual learning needs. Emotional learning barriers included negative feelings in learning situations and lack of interest. Some of the participants reported fear, horror and anxiety about computers and felt that these emotions were barriers to learning to use computers. (Paper II.)

A quantitative analysis of nurses' computer skills showed that nurses were the most capable in utilizing computer for information and communication and word processing. Advanced skills in word processing were found in 32 % of participants and in utilizing information and communication by computer in 11 % of participants. Expert level was achieved by 7 % of nurses in information and communication. However, 37 % of nurses had no skills in information and communication applications, and 25 % had no skills in word processing. Most of the nurses lacked skills related to spreadsheets (no skills = 71 %), databases (no skills = 85 %) or presentation (no skills = 84 %) applications. (Paper II.)

When nurses' computer skills were evaluated, special attention was paid to nurses' basic skills in using the computer and managing files, word processing, and information and communication applications. The nurses ($n = 40$) who had no skills in some of these areas were offered opportunities to participate in computer and Internet instruction. Training in using the web-based patient support system was offered to all nurses participating in the web-based patient education intervention. (Paper II.)

The results of the literature search, the principles used in computer education curriculum planning and a complete curriculum were described in Paper II.

5.3 Evaluation of the usability of the web-based patient support system

The aim was to describe nurses' perceptions of the functionality, content and benefits of the web-based patient support system in psychiatric nursing.

The functionality areas with best realization were that the application can be used free (mean = 3.19), and the accessibility of the system (mean = 3.16). Nurses evaluated the application easy and quick to use (mean = 3.03), and the information needed was easily located (mean = 3.00). The layout of the system was evaluated as fairly clear (mean = 2.97). The lowest value concerned the multilinguality of the system (mean = 0.83); the service cannot be used in other languages than Finnish. The qualitative data showed that the layout of the web-based was clear, neutral or pleasant. Some participants reported that the use of the system required advanced IT skills. (Paper III.)

The content of the web-based patient support system was evaluated as fairly comprehensive (mean = 2.97) and understandable (mean = 2.86). In qualitative measures the nurses pointed out that the content was factual and easy to read. More information was needed for some specific areas; e.g. mood stabilizers and health-related tests. The weakest area of the application was related to the quality of customer services, which included questions, feedback and contact to the service provider (mean = 2.29). Some participants reported that the content evaluation was difficult because of their lack of experience of using the web-based patient support system. (Paper III.)

The web-based patient support system was experienced as fairly beneficial for users (mean = 2.33). The lowest realization of the benefits were evaluated in cost savings and staff's time savings (mean = 1.96). In the qualitative part of the evaluation the benefits were related to patients' medical condition; when patients are in poor condition misunderstandings may occur. In addition, nurses were concerned about the possible negative effects of decreased face-to-face contacts with the patients and its impact on delivery of care. (Paper III.)

5.4 Implementation of the web-based patient support system

The aim was to describe barriers and facilitators in the implementation of the web-based patient support system in psychiatric hospitals. Four main categories were formed to describe the barriers and facilitators of the implementation of the web-based patient support system in psychiatric nursing. The categories were; 1) organisational resources, 2) nurses' individual characteristics, 3) patient-related factors and 4) portal-related factors. Organisational resources refers to facilitators or possible barriers related to the environments (lack of rooms, lack of computers and Internet connections, sufficient staff resources), the nature of the implementation (time for using the application, time for training), and organisational operations (financial resources, organisational strategy). The main category of nurses' individual characteristics included nurses' attitudes towards IT, nurses' capacities to use IT (computer skills and experience). Patient-related factors included patient's mental status, patient's attitudes and capacities to use IT and length of hospital stay. Nurses pointed out particularly that patients' mental status should be taken account when such applications are used in psychiatric nursing. Portal-related factors included technical and content aspects of the web-based patient support system. (Paper IV.)

5.5 Effects of the implementation of the web-based patient support system on nurses' acceptance and use of IT

The aim was to ascertain the effects of the implementation of the web-based patient support system on nurses' acceptance, attitudes and use of IT in psychiatric hospitals.

The changes in attitudes towards IT measured from baseline to follow-up did not differ significantly between the IT intervention and comparison group (motivation $p = 0.936$; beliefs $p = 0.270$; satisfaction $p = 0.462$). However, the changes in motivation to use computers were positive from baseline to follow-up in both groups (change mean in the IT intervention group = 2.65; in the comparison group = 2.84). The changes in beliefs and satisfaction with computers were slightly negative. In the IT intervention group the means of the change in beliefs were -2.32, and the comparison group -1.60. The changes

in satisfaction with computer use were -0.34 in the IT intervention group, and -1.72 in the comparison group. (Paper V.)

Frequency of Internet use measured from baseline to follow-up did not differ significantly ($p = 0.276$). Differences in the changes between the IT intervention group and the comparison group found in frequency of computer use ($p = 0.029$) where nurses' computer use in the comparison group had increased significantly more than that of nurses in the IT intervention group. When the connection of the background variables to the outcome measures was scrutinised it was found that only basic education had a statistically significant connection to motivation ($p = 0.017$). There were more nurses with secondary school education than nurses with comprehensive school education in the group where the change in motivation for use computer had increased during the intervention process. (Paper V.)

6 RECOMMENDATIONS FOR BEST PRACTICES FOR IMPROVING THE ACCEPTANCE AND USE OF IT AMONG NURSES WORKING IN PSYCHIATRIC HOSPITALS

The ultimate goal of the study was to create recommendations for best practices for improve the acceptance and use of IT among nurses working in psychiatric hospitals. The recommendations were devised using and combining the results from the five phases of the study, and reflecting the results according to the determinants of the TAM theory (Davis 1989, Davis et al. 1989). In addition Guidelines for Good Evaluation Practices in Health Informatics (Nykänen & Brender 2008) were used to structure a format of the recommendations.

At first, in light of the results of each phase researcher explored essential factors which should be taken into account in the implementation process of a new IT application in psychiatric hospitals. Second, based on the detailed factors the principles by which these factors could be supported in the IT implementation process were modified. The detailed factors and principles based on the results were described in Table 4.

Third, the factors and principles were considered in light of the Technology Acceptance Model (TAM), when the categories developed related to 1) external variables, 2) usefulness and 3) ease of use of the IT application, and 4) attitudes toward IT, which are essential determinants of the TAM (Table 5., Figure 4.).

External variables include organisational and individual-related variables. The pivotal organisational variables in the acceptance process of the new IT application are commitment of administrative personnel, collaboration in the implementation process, resources allocated to the process and organisational support. Organisational variables can improve the acceptance and use of IT among psychiatric nurses if care is taken that the administrative personnel are adequately informed about the application, its possible benefits and impacts on working practices. Teamworking and collaboration with administrative personnel and nurses is also needed. The implementation of new IT application needs an adequate resource allocation for both hardware and software, and also rooms, time and personnel. Organisational support includes organising education and training for nurses, and organising adequate technical support available for users.

Table 4. Principles for the content of the recommendations derived from the study results

Study phase	Factors based on results	Principles	
Phase I	Motivation	Ensuring individual support	
	Educational background		
	Job position		
	Participation		
Phase II	Time for IT use	Allocating organisational resources	
	IT skills	Ensuring individual support	
	Attitudes	Organising educational interventions Ensuring guidance of computer expert Ensuring small group education Generating written instructions for application use	
	Individual educational needs		
Phase III	Individual training needs		Organising sufficient training period
	Accessibility		Ensuring functionality of the application
	Usability	Ensuring adequate content of the application	
	Clear layout		
User-friendliness			
Easy to read			
Phase IV	Understandable	Ensuring benefits of the application Avoiding possible negative effects Providing participation	
	Relevance		
	Possible benefits		
	Possible negative effects		
	Users' participation	Providing participation	
	End-user evaluations	Organising evaluations	
	Adequate rooms	Allocating organisational resources	
	Sufficiency and functionality of computers	Ensuring individual support	
	Sufficiency of staff resources		
	Sufficiency of education		
	Sufficiency of time		
	Sufficiency of financial resources		
Attitudes			
Commitment			
IT skills			
Experiences with computers	Ensuring competence for patient education with IT Ensuring patient-oriented action model Ensuring functionality of the application		
Patient-nurse relationship			
Accessibility			
Technical functionality			
Phase V	Relevance	Ensuring adequate content of the application	
	Attitudes	Ensuring individual support	
	Educational background		

External variables related to individuals' skills in IT use and patient-nurse relationship when patient education is realised using IT. Computer education based on nurses' individual needs serves to improve nurses' IT skills and also their use of computers. Opportunities for practical training and the generation of written instructions for application use also support the skills, acceptance and use of IT. It is important to ensure that nurses have adequate skills to realise patient education with the IT application, and that nurses have capacities to assess patients' condition to participate in education. Nurses should also have the competence to pay attention to patients' own needs in the education process.

The ease of use and usefulness of the system was related to the functionality of the application. The application needs to be easy to access and easy to use, if the acceptance and use of the system is to be ensured. Technical support should also be available. The basic issue related to usefulness is the relevance of the content and perceived benefits. The content of the system must be ensured by collaborating in the development process and organizing evaluations by nurses. The application need to match the needs of the users, which must be ensured by collaborative teamworking in the development process and highlighting possible benefits for nurses.

External variables, ease of use and usefulness have connections to users' attitudes toward IT. Informative meetings highlighting the possible benefits of the application and nurses' participation in the implementation process support positive attitudes of users, and ensure the use of the system later. A positive attitude towards IT and towards the application ensures the acceptance and use of the system.

The ultimate principles for improving the acceptance and use of IT among nurses in psychiatric hospitals are described in Table 5.

Table 5. Principles for improving acceptance and use of IT among nurses in psychiatric hospitals reflected through TAM

Principles		Variables	Sub-variables	Methods
External variables	External variables improve acceptance and use of IT	Organisational variables	Commitment of administrative personnel	Organising informative meetings
			Collaboration	Collaborating with administrative personnel and nurses ⇒ teamworking ⇒ communication
			Resources	Ensuring adequate financial resources for equipments, connections, rooms Ensuring adequate individual resources Ensuring adequate time resources
			Organisational support	Organising education and training ⇒ content ⇒ method ⇒ use of time Organising technical support
		Individual variables	Competence	Ensuring education based on individual needs ⇒ evaluating computer skills Giving opportunities for practical training Generating supportive written instruction for application use Ensuring competence for patient education with IT
Ease of use	Ease of use of the application is ensured		Technical functionality	Ensuring usability and user-friendliness ⇒ easy to access ⇒ easy to use ⇒ organising evaluations by nurses
Usefulness	Usefulness of the application is ensured		Technical support	Ensuring adequate technical support available
			Content	Ensuring adequateness of the content ⇒ collaborating developing process ⇒ organising evaluations by nurses
			Benefits	Ensuring that the application matches with the needs of nurses ⇒ collaborative teamworking ⇒ highlighting benefits
Attitudes	Attitudes toward IT are improved		Attitudes toward IT	Organising informative meetings ⇒ highlighting benefits Enabling nurses' participation

Eight essential factors which should be taken into account in IT implementation processes in psychiatric hospitals are described in Figure 4. The questions if these factors are operational in the current process should be asked in every IT implementation process. In addition it is advisable to evaluate the entire implementation process after the implementation of the IT application. The recommendations were created mindful of the TAM theory; external variables, ease of use and usefulness. The recommendations contain measures with which is possible to improve the commitment of management and IT users and thereby ensure the acceptance and use of new IT application.

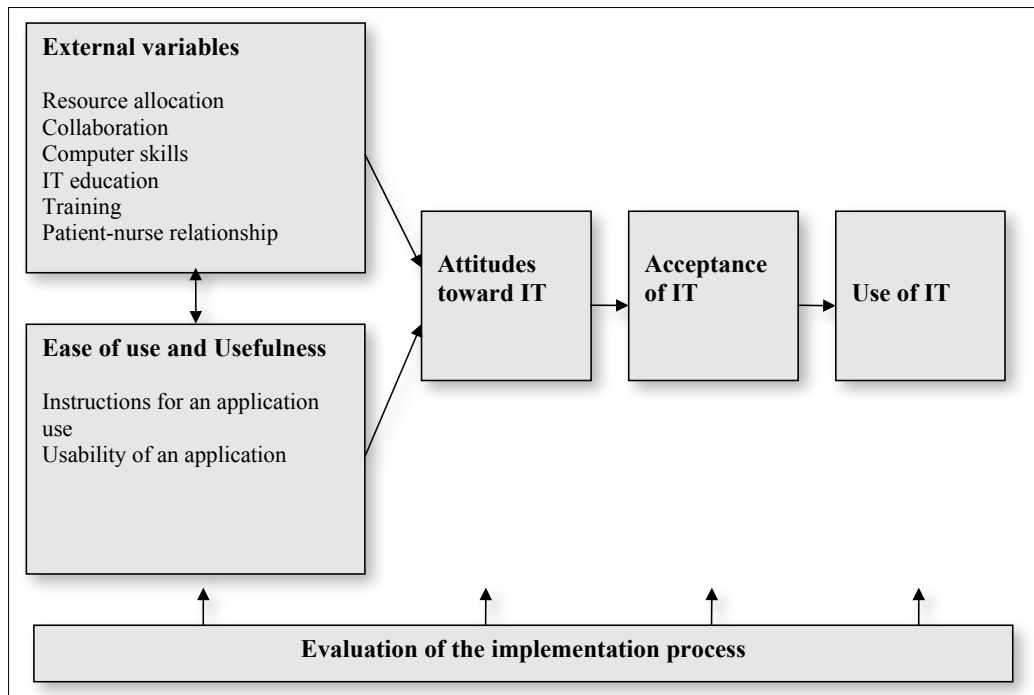


Figure 4. Factors related to the acceptance and use of IT in psychiatric hospitals reflected through TAM

At last the methods by which the principles can be put into practice were modified and the recommendations for best practices for improving the acceptance and use of IT among nurses working in psychiatric hospitals in IT implementation processes were constructed (Table 6.).

Table 6. Recommendations for best practices for improving the acceptance and the use of IT among nurses in psychiatric hospitals

Factors and principles	
1	Resource allocation
	1.1 Steering of the process
	The IT implementation process in psychiatric hospital needs a steering group consisting of a representative of the application producer, an administrative person of the organisation, technical staff and nurses. The steering group needs to meet regularly during the implementation process. The group should ensure financial resources for the implementation process.
	1.2 Equipment
	Functional and usable equipment for the use of the application in the organisation must be ensured before the implementation of the new application.
	1.3 Rooms
	Adequate rooms and spaces for use of the application must be ensured before the implementation of the new application.
	1.4 Time
	Sufficient time for the implementation process and use of the new application should be ensured for nurses during the process.
	1.5 Nursing resources
	Sufficient resources for nurses should be ensured during the implementation process.
	1.6 Technical support
	Sufficient resources for technical support should be ensured during the implementation process. Technical support should be available based on nurses' individual needs.
2	Collaboration
	2.1 Meetings
	Realisation of collaboration is ensured by regular informative meetings with varied combinations. Participation of nurses should be ensured during the implementation process.
	2.2 Teamworking
	Collaboration and systematic communication among representatives of the application producer, an administrative person of the organisation, technical staff and nurses.
3	Computer skills
	3.1 Evaluating nurses' computer skills
	If the level of the nurses' computer skills is not known, evaluation of the computer skills should be organised by surveys or interviews before the implementation of the new IT application.
4	IT Education
	4.1 Content of the curriculum
	Content of the IT education curriculum needs to be based on nurses' computer skills and individual educational needs. Results of the computer skills evaluation should be used when creating the curriculum.
	4.2 Pedagogical methods
	Pedagogical methods used in the IT education must be based on nurses' individual needs. Based on the needs, individual training or small-group instruction should be used. Use of time should also be based on individual needs. Guidance of computer experts or mentors is advisable.
	4.3 Effectiveness of the curriculum
	Effects of the training on nurses' computer skills should be evaluated by surveys or interviews. Feedback from the education curriculum should be collected and analyzed.

Factors and principles

5 Training

5.1 Individual training needs

Training for using the new application must be based on nurses' individual needs.

5.2 Time for training

Sufficient time for training should be ensured.

5.3 Technical support for training

Sufficient technical support need to be ensured during the training period.

6 Patient-nurse relationship

6.1 Nurses' patient education competence

Nurses' competences for patient education with IT have to be ensured by evaluations or discussions.

6.2 Patient-oriented operations

Possible changes in the patient-nurse relationship must be taken into account when the IT application is implemented in the daily practice of patient education. Patients' mental state should be taken into account. Patients' own needs should be taken into account.

7 Instructions for an application use

7.1 Written instructions

Written instructions to improve the use of the application must be produced before the implementation of the new application.

7.2 Usability of the written instructions

The evaluation of the written instructions on the application must be organized before and also during the implementation. Nurses' and technical staffs' participation in the evaluations should be ensured.

8 Usability of an application

8.1 Technical functionality of the application

The user-friendliness and usefulness of the application must be ensured by evaluating technical functionality. Nurses' and technical experts' participation in the evaluation process should be ensured.

8.2 Content of the application

The relevance and comprehensibility of the content of the application should be ensured by evaluating the content. Nurses' participation should be ensured in the evaluation process.

8.3 Benefits of the application

Possible benefits and possible negative effects of the new application should be analysed by nurses and administrative personnel in the organisation.

9 Evaluation of the implementation process

9.1 Systematic evaluation of the process

Systematic feedback system must be organised during the implementation process. The participation of nurses in the feedback system should be ensured.

7 DISCUSSION

Earlier studies showed that there is comparatively little earlier research into the acceptance and use of IT among psychiatric nurses (Ammenwerth et al. 2002, Austen & McGrath 2006). Therefore the need for research in this field is evident. The purpose of this study was to describe the acceptance and use of IT among psychiatric nurses. The ultimate goal is to generate recommendations for best practices for improving these issues in psychiatric hospitals.

In the discussion that follows the validity and reliability of the study are first described. In addition the limitations and strengths of the study are addressed. Second, the results obtained in this study are discussed and compared with earlier literature in accordance with the research task. The results are also reflected against the attributes of the TAM theory (Davis et al. 1989). The usefulness of the results of the study phases for the generation of the recommendations for best practices in the IT implementation process in psychiatric hospitals is also considered. Finally, challenges for nursing practice and suggestions for nursing research are presented.

7.1 Validity and reliability

The quality of the methodology of the study is formed by validity and reliability. A study is valid if its indicators actually measure what they are intended to measure, thereby giving an accurate reflection of reality. In other words, validity is the overall concept used to refer to how good an answer a study yields. (Burns & Grove 2005.) Reliability, on the other hand, describes the consistency of an instrument in measuring the concept under investigation. The concept of reliability refers to the extent to which random variation may have influenced the study results. (Nunnally & Bernstein 1994.)

Psychometric validation is the process by which the quantitative instrument is assessed for reliability and validity by statistical analyses (Bowling 2004). The consistency of the instrument refers to the homogeneity of the instrument. There are certain parameters, such as test-retest, inter-rater reliability and internal consistency, which can be assessed to ensure the reliability of the instrument. (Streiner & Norman 1995.) In this study researcher chose for the quantitative measures previously developed questionnaires which had been found to be reliable for the study focus. The internal consistency of the instruments was used to describe the homogeneity of the instruments. This was considered by statistical analyses using Cronbach's alpha values (Phase I, Phase III, Phase V) and the Kuder-Richardsson test (Phase II). (Knapp 1991, Bowling 2004.) The alpha values of the scales are described in Table 7. The alpha values of each scale were quite high. Due to the technique of calculating the alpha the greater the number of items in a scale,

the higher the alpha value. On the other hand, a small number of items in a scale may cause errors in alpha values. (Nunnally & Bernstein 1994.) In addition, the validity and reliability of the quantitative phases of the study were also considered through response rates and transferability of the results.

The validity and reliability of a qualitative study are described through the truth and accuracy of a study, and are an important concern throughout the research process. In the study validity and reliability are examined through the concept of trustworthiness, which comprises credibility, transferability, confirmability and dependability. (Lincoln & Guba 1985, Polit & Beck 2003.) Credibility refers to confidence in how well data analyses address the intended focus and how well the categories cover the data. Transferability refers to the extent to which the findings can be transferred to other groups or settings. Confirmability refers to the degree to which the results can be confirmed by others. Dependability is concerned with whether it is possible to obtain the same results if the same issue is observed twice. (Lincoln & Guba 1985, Graneheim & Lundman 2004, Polit & Beck 2004.)

Successful qualitative content analysis requires that the data are analysed and simplified and formed into categories that reflect the subject of the study in reliable manner (Graneheim & Lundman 2004, Elo & Kyngäs 2007). Content analysis must also be an objective process (Miles & Huberman 1994). However, use of researcher triangulation, face validity or a panel of experts can confirm the results of the analysis. Authentic citations can also be used to increase the reliability and validity of qualitative measures. (Lincoln & Guba 1985, Graneheim & Lundman 2004.)

In **phase I** the instrument used was the SNCEQ (Staggers 1994), a structured questionnaire with Likert type scales. In addition, in phase I staff's motivation as a background factor was measured by Burkes' (1991) computer attitude questionnaire. A questionnaire is an effective, economic and suitable tool for gathering data from a large number of people (Burns & Grove 2005), which is why the questionnaire was also used to gather data for this study phase, where the study population was the whole staff (N = 791) working with patients in two psychiatric hospitals. To ensure that the Finnish translation of the SNCEQ and computer attitude instruments corresponded to the original contents of these two questionnaires, they were translated and backtranslated (see Jones 1987, Chang et al. 1999). The translation process is described in Paper I. With the pilot study on 38 participants the translation process of the instruments led to improved reliability and validity. In the actual data collection the total response rate was 59 %, which is quite satisfactory. The staff's job positions were indeed compared between the sampling frame and the sample obtained, which confirmed that the results can be generalized to this population. The results describe the level of nursing staff's computer experiences in two psychiatric hospitals, and therefore the results cannot be generalized to other hospitals

because of possible cultural, practical and division of labour differences. Earlier studies conducted in the USA (Staggers & Mills 1994, Staggers 1994, Staggers & Kobus 2000, Chastain 2002) and China (Liu et al. 2000) indicated that the SNECQ instrument is useful and reliable in measuring nurses' experiences of computer use. In present study Cronbach's alpha value for the SNECQ instrument and the motivation scale were also rated as good (see Table 7.). (Paper I.)

In **phase II** nursing staff's computers skills were measured by the ECDL test (Finnish Information Processing Association 2004). The response rate was very high, because 75 nurses from the population of 76 participated in the study. Therefore the study gives an extensive picture of nursing staff's computer skills on the study wards. No scientific studies have been published on the ECDL test before, but it is commonly used to test people's computer and information technology knowledge and skills in Finland (ECDL Finland Oy 2008b). In the study the Kuder-Richardsson test showed that the scale demonstrated high internal consistency across modules (see Table 7.). The ECDL test is not specifically directed at health care staff, but because it is widely used for measure computer skills among the general population in Finland it may be assumed that the results are reliable in this study population. In phase II the qualitative data consisted of written essays. The response rate was 65 %. The learning and implementation of new technology could be a sensitive issue for nurses (e.g. Sleutel & Guinn 1999), therefore it was reasonable to use written material. To ensure the validity of the qualitative content analysis process, three steps were taken. First, to analyse the accuracy of the analysis conducted the preliminary categorisation was evaluated by an expert in the field of education. Second, the validity of categorisation ensured by the researcher group. Third, the final categorisation was given to be evaluated by those nurses who participated in data collection. (Paper II.)

In **phase III** the instrument used was the QCPOS questionnaire with structured and open-ended questions (The Finnish Ministry of Finance 2004). The response rate was 50 % (N = 76, n = 38), so that the sample size was quite small. In the study 16 nurses added written comments to the questionnaire. In addition, a total of 17 nurses returned written feedback in electronic form. The findings are tentative and they cannot be generalized to the whole staff working on the study wards. The instrument is commonly used to measure the quality of public online services in the web, although no statistical analyses of the validity and reliability of the instrument have been published. In the present study the Cronbach's alpha values of the sum scores were rated as good (see Table 7.). In the qualitative part of the phase the researcher analysed the data from the respondents' texts trying to maintain a neutral stance. In reporting the results direct excerpts are used to increase the reliability of the results and to show the reader how and from what original sources the categories were formed. Some nurses reported that it was difficult for them to evaluate the portal. However, it has been found that technology evaluations by end

users in the early stages of the development process are considered important to ensure that new applications are favourably received by users (Lorenzi & Riley 2003, Davis & Venkatesh 2004). (Paper III.)

In **phase IV** the data were collected by questionnaire with two open-ended questions. The participants consisted of 89 nurses. The response rate was 63 %. Attempts were made to analyse the data through participants subjective experiences of the study focuses. The purpose was not to generalize the results to other environments as such. The aims of the researcher was to maintain a neutral attitude (Lincoln & Guba 1985) toward the data and the study environment. Neutrality could be preserved because the researcher was an outsider to the organisations and psychiatric nursing. In the data similarities in the respondents' responses were perceptible. This issue might increase the validity of the results. In reporting the results, the content of different categories is described by reference to subcategories and coded expressions. Researcher triangulation was also used to ensure correspondence between data and categorization. There was complete understanding between researchers on the results. Interpretations by a researcher are always personal, which is why the use of another analyst might have increased the dependability of the study (Polit & Beck 2004). (Paper IV.)

In **phase V** the study approach was randomised controlled trial. The motivation, satisfaction and beliefs scales of the computer attitudes instrument were used (Burkes 1991). Use of IT was elicited by two Likert type questions. The response rates were quite satisfactory; at baseline 99 %, and at follow-up 79 %. However, the follow-up time (1.5 years) may have been too long, because turnover of nurses was large, and the comparison data was quite small (IT intervention group $n = 44$, comparison group $n = 53$). The effect of drop-out and the validity of analyses for complete cases were examined with full sample analyses. The drop-out did not seem to cause any extra bias to the analyses of complete cases. Cronbach's alpha values for the scales were as good both at baseline and follow-up (see Table 7.). (Paper V.)

The essential findings of each study phases were utilized when the recommendations for best practices in IT implementation processes in psychiatric hospitals were created. The study phases gave useful knowledge for recommendations and hence support the production of the recommendations. The TAM theory (Davis et al. 1989) gave basic knowledge for variables (individual characteristics, computer skills, attitudes, computer education, usability, usefulness) which were selected for study focus in each phase. Use of the TAM confirmed the results of the study and the theory proved useful in explaining the acceptance and use of IT among nurses working in psychiatric hospitals.

Table 7. Internal consistency of the instruments

Instrument and scale	Items	Phase I	Phase II	Alpha values		
				Phase III	Baseline	Phase V Follow-up
SNCEQ						
Use of general computer applications	20	0.92				
Use of hospital information systems	12	0.92				
Role activity	6	0.87				
Attitudes						
Motivation	17	0.94		0.96		0.93
Satisfaction	18			0.92		0.91
Beliefs	21			0.92		0.83
ECDL						
Using the computer and managing files	23		0.93			
Word processing	22		0.93			
Spreadsheets	22		0.94			
Databases	22		0.93			
Presentation	21		0.96			
Information and communication	21		0.94			
QCPOS						
Functionality	14			0.86		
Content	6			0.92		
Benefits	3			0.80		

7.2 Discussion of the findings

In **phase I** the goal was to describe the use of computers among staff working in psychiatric hospitals and to explore factors inhibiting staff's optimal use of computers. Responses to a structured questionnaire showed that younger respondents, nursing managers and those who had participated in computer application courses had more experiences of HIS use. Males in administrative positions and with higher educational level were more experienced with GCA than women. In addition, the study showed that males and younger administrative staff participated more often than females in the development processes of computer systems. (Paper I.) These results concur in part with earlier studies showing that ageing nurses have less computer experience than younger ones (Liu et al. 2000, Yang et al. 2004, Lium et al. 2008). Colley et al. (1994) also showed that males are more proficient at using computers than females. However, there is a lack of new studies comparing males and females. This may be due to the fact that the health care sector is dominated by women (Wickström et al. 2000) and therefore it is not possible to perform statistical analyses with a small proportion of male nurses. It is also possible that nowadays females are already accustomed IT users (Palm et al. 2006, Alquirani et al. 2007). Since neither gender or age alone explain differences in staff's computer use these need not be considered in recommendations intended to support acceptance and use of IT.

Lack of interest in using IT applications was the most often mentioned inhibitor of staff's computer use (also Ammenwerth et al. 2003, Lee et al. 2004). This may also be reason why not all staff members had computers at home, which was the second most common inhibitor of nurses' computer use. (Paper I.) However, it was found in phase V, that in 2004 under 70 % nurses participating in the study had a computer at home, whereas in 2006 over 80 % had a computer (Paper V). According to TAM technology acceptance is determined directly by attitude (Davis et al. 1989), and it can be posited that interest in IT colours individuals' attitude toward IT and motivation to use it. Therefore it is important to improve nurses' interest in using IT applications by ensuring that these applications support their work and have useful content.

Some staff members felt that they did not have enough time to use computers (Paper I) (also May et al. 2001, Lee et al. 2004). The results raise the question to what extent time is really saved if staff is not familiar with computers or a great deal of time is needed to learn the various solutions (see MacDonald et al. 2004). Therefore, effective education for computer and IT use should be arranged for health care staff. This may ensure that computer applications will offer the greatest benefits to the work process, which may in turn facilitate its better adoption (also Paré & Elam 1999, Cabell et al. 2001, Im et al. 2007).

According to the study age, gender, job position, computer education and motivation to use computers among staff working in psychiatric hospitals are significant factors related to staff's computer use (Paper I). The TAM model proposes that it is important to recognize that individual factors are considered moderators, not principle determinants (Davis et al. 1989). It has been found that all types of external variables including individual factors with perceived usefulness (PU) and perceived ease of use (PEOU) mediated on behavioral intention and actual IT use (Lee et al. 2006, Yarbrough & Smith 2007). Therefore, individual factors identified in this study are important factors associated with staff's computer use in psychiatric hospital but perhaps not the whole truth.

The results were used to modify individual variables that should be noted in the implementation process of new IT application in psychiatric hospitals. Supporting motivation, ensuring participation and taking educational background into consideration have been made part of a recommendation by which to support psychiatric nurses acceptance and use of IT. Study phase I produced information on health care staff's individual variables and barriers related to computer use, but detailed knowledge of nurses computer skills and educational needs related to computer use in study hospitals remains unavailable. Therefore, phase II of the study was constructed.

In **phase II** the goal was to evaluate nurses' computer skills and to describe nurses' learning experiences related to computer use. The ultimate goal was to develop an evidence-based curriculum to support nurses' computer and Internet skills in psychiatric nursing. The study showed that nurses' basic computer skills were not on a very high level. The best-known functions were word processing and information and communication. Presentation by computer application, use of databases and spreadsheets were not very familiar for the nurses. (Paper II.) It is clear that applications such as word processing and HIS systems, e.g. patient data entry, were more familiar than databases and spreadsheets. Therefore, nurses have more skills and experiences of these applications. However, nowadays psychiatric nursing should be based on research evidence (Drake et al. 2003), which makes it more important for nurses in this sector to be proficient in using the Internet and various databases (Garg & Turtle 2003, Gagnon et al. 2006).

Nurses considered practical training under the guidance of a computer expert the most effective way to learn to use computers and applications. They emphasised the importance of technical support and sufficient time to practice. They reported that written material related to use of the application should improve the learning process. (Paper II.) Earlier studies support the results of the present study (Shorten et al. 2001, Lee 2004, MacDonald et al. 2004, Schmitt et al. 2004). Lee (2004) found that it is important to have a sufficient training period before the implementation of a new IT application. It has also been found that the quality of education strongly influenced users' acceptance

and use of the application (Quinzio et al. 2003, Gagnon et al. 2006). Computer and Internet skills are necessary for the successful implementation of new IT applications in health care (Ammenwerth et al. 2006), because connections have been found between IT skills and acceptance (Gagnon et al. 2006, Yu & Yang 2006). According to TAM theory competences in utilising IT are among the most important external variables which can have an impact on users' motivation to use the application (Davis et al. 1989, Venkatesh 1999).

The study results show that the main learning barriers to nurses' computer use were lack of technical support, lack of interest, negative attitudes toward computers, and too demanding learning goals in relation to novices' skills. It is important that those learning and education methods that nurses felt most unsatisfactory should be avoided, because these can reduce motivation to use IT and shape attitudes more negative. (Paper II.) (also Sleutel & Guinn 1999, Miettinen et al. 2003.)

Study phase II complemented knowledge of the external variables of the TAM theory and showed that tailored IT education and support based on systematic IT capacity evaluation, should be organized for nurses in psychiatric hospitals. Care must be taken that the education corresponds to the nurses' individual needs as closely as possible. Nurses' IT competence and support for it is emphasised in the recommendations for improving the acceptance and use of IT among nurses in psychiatric hospitals. It is also very important that the usability and user-friendliness of the application implemented are ensured. Therefore, in the **phase III** the aim was to ensure the usability of the web-based patient support system by conducting usability evaluation for nursing staff before the implementation of the system in daily patient education practice.

Other studies have suggested that perceived benefit of technology use might outweigh any other factors in achieving usage goals (Davis et al. 1989, Kirkley & Rewick 2003, Zeng & Parmanto 2004, Ammenwerth et al. 2006). The nurses were overall quite positive about the structure and usability of the web-based patient support system. The content of the system was also considered relevant. These findings are important, because it is known that end users can eliminate unworkable solutions and refuse to use them (Sleutel & Guinn 1999, Schmitt et al 2004). Although the web-based patient support system was considered user-friendly, some nurses reported that the system required advanced IT skills. PEOU has impacts on the intention to use the system (Davis et al. 1989, Davis & Venkatesh 2004, Lee et al. 2006, Yarbrough & Smith 2007) and therefore the user-friendliness of the application should be ensured. It was known that some nurses lacked computer skills, and therefore individual education for portal use was arranged and technical support was daily available.

Earlier it has been found that users do not find IT useful unless they perceive clear benefits in their working practices (Kiekkas et al. 2006, Yarbrough & Smith 2007, Hyppönen &

Niska 2008). The findings in the present study are quite similar. The nurses had not been entirely convinced of the benefits of the system. They were afraid of possible negative effects of IT on their daily practices and on the patient–nurse relationship. These issues may increase negative attitudes towards an application (Davis et al. 1989, Paré & Elam 1999, Yusof et al. 2007) thus it is very important to ensure that the application is usable and beneficial. Users' needs have been taken into consideration during the development process of IT systems (Larrabee et al. 2001, Farrell et al. 2004). Although the nurses reported that it was difficult for them to evaluate the web-based patient support system, they thought that it was important to participate in the evaluation process. The evaluation was realised as soon as the training in the use of the system had been held. Therefore the nurses had no experience of using it in patient education on a regular basis.

The usability evaluation showed that it is very important to ensure during implementation that the application is useful and easy to use. Therefore these variables play a significant role in the recommendations. It is important to ensure functionality, the relevance of the content and the benefits of the application during the implementation process. The evaluation showed that there were no obstacles to implementing the web-based patient support system for patient education on the study wards. The next step was the evaluation of the barriers and facilitators of the implementation of the application, which was done in phase IV.

Study **phase IV** showed that various interconnected factors seem to influence the success or failure in implementing the IT application in psychiatric nursing. Problems with organisational resources, end users' personal characteristics and technical or content factors of the system are all significant issues in the implementation process. The FITT framework theory supports these results, because it is based on the idea that IT adoption in a hospital environment depends on the fit between the attributes of the individual users, the features of the technology and the clinical tasks and processes (Ammenwerth et al. 2006). This is not at variance with the TAM theory, because external variables may contain individual characteristics and organisational factors (Davis et al. 1989, Kim & Chang 2007, Yarbrough & Smith 2007). The application related factors, such as difficulties in use, technical functionality and the relevance of the content emerged in the study. According to TAM these factors were related to PU and PEOU, and they have very significant role in the implementation process, as has also been noted in earlier studies (McAlearney et al. 2004, Lee et al. 2006, Yarbrough & Smith 2007).

The study was a case of a patient education application for patients with mental health problems, which had certain implications for the implementation process. The patient group had severe cognitive problems and some of them had difficulties in concentrating on using the system with the nurses. The nurses reported that they did not have enough time to teach the patients how to use the patient support system. The nurses were

also worried about the patient-nurse relationship when IT is used in patient education activities. They thought that they lacked competence to take patients' IT skills and mental state into account. However, it has been shown that psychoeducational web-based programmes for people with severe mental illnesses have demonstrated the feasibility of providing support for patients (Rotondi et al. 2005). In the present study the nurses did not see insuperable barriers to using web-based patient support system. However, they emphasized that attention should be paid to organisational resources and strategy (also Lium et al. 2008), end users' computer skills (also Shorten et al. 2001, Brettle 2003) and attitudes (also Timmons 2003, Yusof et al. 2007), and the technical and content factors of the application (also Ammenwerth et al. 2006, Griffiths et al. 2006).

Study phase IV produced knowledge and understanding of the barriers and facilitators to be taken into account when new IT applications in psychiatric nursing are implemented. The results were of great use in the modification process of the recommendations. In **phase V** the aim was to assess the effects of the implementation of the web-based patient support system on nurses' attitudes toward computers and IT use on psychiatric wards. This was done by constructing a controlled trial configuration, where nurses were randomised into two groups to educate patients using either a web-based system or leaflets. Attitudes toward computers, and use of computers and the Internet were used as outcome measures.

The results showed that the implementation of the new IT application did not affect nurses' attitudes toward computers and the use of computers and the Internet as such. Earlier it has been shown that the frequency of computer usage influences the overall attitude to computers (Lium et al. 2006, Palm et al. 2006), but opposite results have also been reported. Johnson et al. (2005) found that the adoption of a computer-based documentation system in a primary care clinic did not significantly affect physicians' attitudes and satisfaction. According to TAM users' attitudes to new IT application affects users' intention to use the system (Davis et al. 1989, Yarbrough & Smith 2007). In this study the users were randomly allocated to the group which used the system and the comparison group. Attitudes between groups did not differ at baseline. Attitudes toward IT were quite neutral or positive in the whole population. The usability of the system had been ensured, training had been offered, and technical support was available. Therefore it was not very surprising that using of the system did not significantly impact on attitude.

Computer and Internet use increased in both groups. In the comparison group the use of computers increased even more than in the IT intervention group. However, it is important to note that the mean of the use measures was lower in the comparison group than in the IT intervention group at baseline. The difference was not statistically significant,

but observable. Hence, the comparison group attained the computer use level of the IT intervention group in the follow-up measure.

The results of phase V gave additional information on individual variables that should be taken into account in the implementation process of IT applications. Nurses' attitudes toward computers were quite neutral, and therefore it may be assumed that there are no explicit barriers to the implementation of new IT applications in psychiatric hospitals.

This study produced useful knowledge on the acceptance and use of IT among psychiatric nurses in two psychiatric hospitals in Finland. The existing knowledge of the study focuses was very poor. The results of the study were used in the creation of recommendations for best practices in improving the acceptance and use of IT in psychiatric hospitals. The recommendations produced new insights on the subject of interest collecting together the main factors to be taken into account in the implementation of new IT applications in psychiatric nursing.

7.3 Implications of the study

The results of the study have implications for a number of different fields related to the implementation of IT in health care, including management, education and nursing practice. The study generated new knowledge on the acceptance and use of IT, particularly in psychiatric nursing, where it had previously been much less common.

The recommendations for best practices for improving the acceptance and use of IT among psychiatric nurses can be exploited in practice when new IT applications are implemented in daily practice in psychiatric hospitals. The successful implementation of modern IT is a significant challenge for organisations and employees. The implementation processes need management and guidance because changes in working processes are always challenging for both managers and staff. The recommendations created provide tools for nurse managers to plan IT implementation so as to optimally support the introduction of the application and a more positive attitudes among nurses. Using systematically developed recommendations for managing the implementation process it is possible to improve the outcomes of the utilization of new IT applications in psychiatric nursing.

A range of factors are seen as barriers or facilitators in the implementation process of IT application in practice in psychiatric hospitals. Adequate environmental and technological resources and technical support for using IT should be provided. The study showed that computer skills and experiences with computers varied among staff in psychiatric hospitals. In the future, staff's computer competencies in clinical practice will need more attention. Computer and Internet skills are necessary for the successful implementation of new IT applications in psychiatric nursing. It is important to develop education and

training which correspond to the nurses' individual needs and meet nurses' requirements in psychiatric hospitals.

Psychiatric nurses' motivation to use IT should also be supported. Fear of possible negative effects for patients care and the patient–nurse relationship may be a significant barrier to use IT. Nurses' participation in the evaluation and development processes of IT applications should improve because this may affect attitudes toward IT by making them more positive. Nurses' readiness and competences to perform the evaluations should be paid more attention because end user evaluations have been found to be one of the prerequisites of developing useful and beneficial IT applications.

There are also implications for nursing science. The experience gained in the study of different study designs and data collection methods is extremely valuable for nursing research. The study highlights the areas that should be taken into account in any study realized among nursing staff. The study generated knowledge and experience of the use of controlled trial among nursing staff, where a high turnover of nurses proved to be a drawback in the design. However, the use of different data collection methods validated the study results and confirmed that by using different datasets relevant information about the work of the nursing personnel can be obtained and practical work can be further developed with the aid of research.

The study results also have societal implications, because use of IT in health care is also an economic and innovational question. Use of computer applications has the potential to improve information management, access to health services, quality of care and cost containment. Therefore, it is very important to utilize evidence-based knowledge in IT implementation processes thereby ensuring the acceptance and use of IT among staff working in health care.

7.4 Suggestions for further research

Research on the acceptance and use of IT in psychiatric nursing is highly desirable in the future as well. The development and use of new IT applications for supporting care and making processes more productive in health care is essential in modern society. The role of nursing staff will be a great concern in this advancement. This study produced useful information on the acceptance and use of IT among psychiatric nurses and factors related to these topics. However, more evidence is needed.

1. The study generated knowledge of individual variables related to the acceptance and use of IT among nurses in psychiatric hospitals. However, connections between IT use and job satisfaction and strain related to work should be ascertained, because new modes of operation may always be a factor in working conditions and personnel well-being.

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2. IT education merits more attention in both basic nursing education and continuing education in health care. The contents and effectiveness of IT education curriculums should be evaluated.
 3. It has been found that end users' participation in IT implementation processes (e.g. planning, developing, evaluating) is significant for the acceptance and usefulness of a new application. IT applications should also be evaluated by end users. Nurses' participation in these processes should be evaluated by systematic research.
 4. Organisational factors are a great concern in IT implementation processes. The sense of teamworking, organisational culture, knowledge sharing and management system in IT implementation processes should be evaluated more closely in health care organisations.
 5. In the study the patient-nurse relationship emerged as major concern among nurses. When IT applications are used in psychiatric nursing it is important to research possible role changes for professionals which are possibly due to the use of technology.
 6. In this study recommendations for best practices for improving the acceptance and use of IT in psychiatric hospitals were developed. In future, the content of the recommendations should be piloted and the usefulness of the recommendations evaluated in practice.

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