Knowledge Management Problems in Healthcare
A Case Study based on the Grounded Theory

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Abstract: Knowledge management describes how information communication technology systems are applied to support knowledge creation, as well as in the capturing, organization, access, and use of an organization's intellectual capital. This paper investigates knowledge management problems in healthcare. The major conclusions regarding the problems identified are: access to patient data in ICT systems or lack of data, complex medical data, and problems in saving data to ICT systems; ICT system integration, architecture, cost and regulations by political decisions and knowledge transfer problems; tacit knowledge missing in ICT systems; communication and communication barriers between primary and special healthcare; ICT security and trust problems; negative attitude or limited support from "peers" or superiors; patients' resistance to recommendations; physicians' stress and control-sharing problems, too short time in the policlinic to search for patient information, limited personnel resources, and work pressure. A conceptual framework of knowledge management is developed by the Grounded Theory approach. The data validates past studies, and reveals relationships between categories. The relationships between the knowledge management categories enhance confidence in the validity of the categories and relationships, and expand the emerging theory.

1 INTRODUCTION

The concept of healthcare, as referred to in our study, includes medicine, nursing, and rehabilitation (Koskinen, 2010). In this study the healthcare environment is referred to as a place in which medical, clinical and nursing knowledge is ingrained in practitioners (Räisänen et al., 2009). Knowledge refers to the ways that information can be made useful to support a specific task or make a decision (Stair and Reynolds, 2006), personalized information (Alavi and Leidner, 2001), awareness, experience, skills, and learning (Suurla et al., 2002), tacit knowledge (Polanyi, 1966; Nonaka, 1994), explicit knowledge (Puusa and Eerikäinen, 2010;) as well as the medical, clinical, and nursing knowledge of physicians and nurses (Hill, 2010). Knowledge management is defined as a process where information communication technology (ICT) systems are applied to support the activities in organizing knowledge, expertise, skills and communication (Suurla et al., 2002). Knowledge management can be further defined as a collaborative and integrated approach to the creating, capturing, organizing, access and use of an organization's intellectual capital (Dalkir, 2005). There exists collective knowledge in organizational networks (Alavi and Leidner, 2001), and people learn by working with each other in practice, and transfer and receive knowledge on best practices (Grover and Davenport, 2001). In spite of the above definitions and past studies, there are several problems that hamper knowledge management. These problems include communication and understanding problems between ICT professionals and healthcare professionals (Martikainen et al., 2012). One reason for this communication problem can be the fact that the working communities do different things and work differently, they have different terms and vocabularies, and therefore they do not understand each other (Dalkir, 2005). Viitanen et al. (2011) argue that physicians have problems with searching for the right data. The patients' resistance to recommendations, limited

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time and limited personnel resources, work pressure, negative attitude or limited support from "peers" or superiors can be causes for not following the guidelines (Heilmann, 2010). Using the ICT system can also take a lot of physicians' work time, they have problems with accessing patient data, and they are highly critical towards ICT systems (Martikainen et al., 2012; Nykänen et al., 2012). Finally, Kothari et al. (2012) claim that physicians' and nurses' tacit knowledge cannot be found in ICT systems.

As past studies have shown, a lot of knowledge management problems exist in healthcare. We have applied past studies and empirical evidence to carry out a qualitative in-depth case study (Benbasat et al., 1987; Yin, 2003) that identifies problems in knowledge management in one healthcare environment. We analyze the collected data with the Grounded Theory (GT) approach, and develop a conceptual framework with categories and relationships between the categories (Glaser and Strauss, 1967; Pawluch and Neiterman, 2010). Our goal is to investigate knowledge management problems in detail in a Social and Health Care District and its central hospital, both located in South Karelia, Finland. We explore strategies that healthcare organizations deploy while learning about their knowledge management problems, to what extent these problems are shaped by the organizational context, and how these potential problems influence both ICT system development work and patient care work in practice. We have made 103 knowledge management observations supported by empirical evidence.

We categorized the observations with GT analysis (Glaser and Strauss, 1967), and the analysis revealed 23 categories: Patient, Patient Data in ICT Systems, Patient Data Transfer in ICT, Patient Data Transfer on Paper, Lack of Patient Data Transfer Control, Permission Denial of Patient Data Transfer, Patient Care Process, Nurse, Nurse's Lack of Time, Physician, Physician's Attitudes, Physician's Stress, Physician's Lack of Time, Physician's Tacit Knowledge, Physician's Medical and Clinical Decisions, ICT Systems, ICT Systems Vendor, ICT Systems Legislation, ICT Systems Technology, ICT Systems Development Resources, ICT Systems Communication Barriers, Primary and Special Healthcare Services, and Social Issues.

The above categories were related to each other, and we found six higher levels of abstraction of statements based on our conceptual framework, propositions to our categories, and relationships between the categories.

The rest of the paper is structured as follows. Section two describes related research, section three presents the research method, and section four outlines the data analysis. Finally, section five contains conclusions and discussion.

2 RELATED RESEARCH

According to Fisher (2013), healthcare ICT systems contain too much data, and the healthcare professionals are not able to find the required information and data of the patients. Viitanen et al. (2011) and Martikainen et al. (2012) also claim that it is difficult to find the previous patient records because the search functions in the ICT systems and their usability are poor. Physicians and other healthcare professionals have difficulties in finding the relevant data on time, they do not know what kind of data to search for, and they are critical towards ICT in general (Martikainen et al., 2012; Nykänen et al., 2012; Viitanen et al., 2011). The contextual aspects behind ICT system design are difficult to understand, and therefore there is a problem of how to involve healthcare professionals in ICT system development activities. There are also problems to visualize which different technologies can be integrated together in ICT, and how to use healthcare professionals' knowledge in ICT (Martikainen et al., 2012). When physicians are requested to participate in healthcare ICT system development, they find such activities quite pointless (Martikainen et al., 2012). Viitanen et al. (2011) claim that ICT systems lack suitable features to support typical clinical decision-making, and ICT systems are not able to provide the physicians with the features and functionalities which are required to perform clinical work on patients, for example to analyze the state of the patient, make decisions about the actions required, and perform the actions. Young et al. (2000) state that junior physicians miss proper ICT systems, which are robust, time neutral, and need a short time to learn, because they need ICT systems frequently in their work. Greig et al. (2012) claim that it is difficult to share knowledge and to know what knowledge exists in the working organizations because the access is restricted. Furthermore, verbal knowledge in mentoring and formal or informal meetings is not stored in ICT systems (Lin et al., 2008). It is not always known, either, what other colleagues have not written down in the ICT system (Nykänen et al., 2012). Kothari et al. (2012) claim also that the tacit knowledge of healthcare professionals is not found in ICT systems. Accordingly, ICT systems, guidelines and divisions

of work, specializations, organizational structures, cultural models and attitudes vary between public primary, private primary and special healthcare service environments (Viitanen et al., 2011). Burgess et al. (2012) state that information transfer and communication between primary and special healthcare services fail. Primary healthcare takes place in municipal health centres, private clinics, working places, schools, and defence forces. These organizations have their own type of patients and only if the patient requires special healthcare, she or he is guided to it, such as to a central hospital or university hospital (Niskanen, 2002). One problem is that proper coordination tools, such as medical information about the patient in ICT systems between private health centres and public healthcare are lacking, and information is transferred on paper or by fax, and some important data can be lost when transferring it (Reddy et al., 2009). There is no control in data transfer, and the staff must start the programs manually (Häyrinen et al., 2008). The healthcare ICT systems are expensive, regulated by political decisions, not standardized, include complex medical data, it is difficult to save data to the systems and do statistics, and there exist security and trust problems (Grimson et al., 2000). There are also problems in integrating the separate ICT systems in social care and healthcare because of the laws concerning them (Niskanen, 2002; Laki 159/2007, 2007; STM, 2013). The systems are not standardized, and healthcare organizations are forced to take new versions of systems in use regularly (Laki 159/2007, 2007; STM, 2013). Central governments are shifting the social and healthcare laws to local authorities in order to arrange better social and healthcare for the citizens, and healthcare service systems are divided into primary, special healthcare, tertiary healthcare and social services, which are supervised by the municipal authorities of social and healthcare districts. In Finland these services are supported by the National government (Hämäläinen et al., 2013). Finally, the integration of ICT systems is not prepared for the future needs of patients (Linthicum, 2004). One problem is that patients will advise or guide physicians towards other options for their condition, and this will cause stress to the physicians (Edwards et al., 2012). According to Blakeman et al. (2006), physicians have problems in patient care with patient involvement and sharing the control of the patient's health. Ammenwerth et al. (2006) state that a physician has too short time in the policlinic to search for patient information in the systems, and he or she does not want to move back and forth between systems, as for instance the X-ray pictures have to be looked at in viewers. According to Gupta (2009), integration is difficult due to a lack of integration standards, and hospitals have currently a lot of computer systems installed or built at various periods of time by different vendors. Suomi and Salmivalli (2002) argue that in paper-form prescriptions one of the biggest problems is the difficulty of reading the physician's handwriting. Kaye et al. (2010) claim that the barriers between primary and special healthcare services are lack of knowledge and skills, and poor communication. The barriers are a result of non-recognition of health professionals' roles and responsibilities, and inadequate communication between primary and special healthcare services. One problem and challenge in managing resources and service improvement is due to complex healthcare operations if an enterprise architectural solution is missing, and the ICT systems' architectural descriptions within organizations lack the three layers of business, application and technology (Jonkers et al., 2003). Nilakanta et al. (2009) also claim that business processes are more important than clinical and diagnostics care, and knowledge management capabilities and the organization's commitment and focus on knowledge support the business processes. Thus, despite a growing interest in knowledge management problems in healthcare, their relationships have not been recognized in the literature. Rather, past studies have focused on knowledge management problems and ICT systems in healthcare in general. Therefore, our study aims to respond to this lack of studies and to provide useful information of knowledge management in one Social and Healthcare District and its central hospital. Based on the past studies, we have formulated the following research questions:

- RQ1: What are the knowledge management problems in healthcare?
- RQ2: How are the knowledge management problems in healthcare related to each other?

3 RESEARCH METHOD

This study utilizes both qualitative and quantitative research processes and theory building approaches. It takes an in-depth case study, theory building and Grounded Theory (GT) perspective involving a specific healthcare environment in which knowledge management problems are studied (Glaser and Strauss, 1967; Benbasat et al., 1987; Eisenhard, 1989; Yin, 2003; Cresswell, 2007; Pawluch and

Neiterman, 2010). In this healthcare environment, the case was selected so that it would either predict similar outcomes (i.e. literal replication) or produce contracting results but for predictable reasons (i.e. theoretical replication) (Yin, 1994). Theory triangulation was applied by interpreting a single data set from multiple perspectives to understand the research problems (Denzin, 1978). The concepts and their relationships were validated with the grounded theory approach (Glaser and Strauss, 1967; Eisenhardt, 1989; Glaser, 1992). During the research, theoretical background knowledge was gained, which increased the credibility of the study (Glaser, 1992; Miles and Huberman, 1994). According to Eisenhardt (1989), the combination of case study with the grounded theory approach has three major strengths: it produces a novel theory, the emergent theory is testable, and the resultant theory is empirically valid. In the GT approach the theory emerges from the data. According to Glaser (1992), there is no need to review any literature of the studied area before entering the field. This is in line with our research, as we started collecting the data before developing our conceptual framework. Specifically, each interview transcript was analyzed, and major emergent themes and concepts were identified in order to form similar categories (Myers and Avison, 2002). In our case study, a social and healthcare district and its central hospital were the units of analysis. The sample was limited to one district and its central hospital, because the goal of the study was to gain deep understanding of the selected environment and to identify the knowledge management problems at this specific site. The target of the study was the Social and Healthcare District of South Karelia in Finland and its central hospital (Timonen, 2013; Eksote, 2013). The district has about 133 000 inhabitants, and the total number staff employees in the district is 3 843, of which 1 711 work in the health services. In the central hospital, 17 special medical areas cover scheduled clinical appointments in ward care, urgent care and emergency. The number of scheduled clinical visits, urgent care and emergency is approximately over 80 000 a year (Timonen, 2013; Raudasoja, 2013; Eksote, 2013).

The knowledge management definitions and objectives of the research formed the basis for interviews and data collection. The interviewees were also presented with the research problem, and they were chosen because their role was to use, create and transfer healthcare-related medical and ICT information, and translate it to knowledge relevant to the healthcare situation at hand. In order to address the research questions, we conducted seven audio-recorded unstructured and semi-structured interviews that investigated experiences in knowledge management issues in the chosen healthcare environment. The interviews included three individual interviews and four group interviews, and they took place between June 2012 and November 2013. The interviewees were the communications manager, ICT director, the central hospital's medical director (who was also the chief physician in the internal medicine and endocrinology department), the central hospital's chief physician in the obstetrics and gynaecology department, the central hospital's junior physician in the emergency department of the district, and the development manager of the National Archive of Health Information (KanTa Services) project (STM, 2013) of the Ministry of Social Affairs and Health. The interviewees had been involved in many knowledge management issues and processes in their own fields of expertise during their working careers that extended over a period of 10 to 30 years in different positions either in South Karelia Social and Health Care District or other healthcare environments in Finland. The development manager of the Ministry of Social Affairs and Health was interviewed about the past and future health development in Finland, because the KanTa project (STM, 2013) affects the healthcare development in all social and healthcare districts in Finland. Archival material was also studied, representing a secondary source of data, and it included public news and internal material of the development of the Social and Health Care District, and public news of the KanTa project of the Ministry of Social Affairs and Health. Triangulation involved checking different data sources simultaneously to improve the reliability and validity of the data.

3.1 Data Collection and Categorization

The interviews included frequent elaboration and clarification of the meanings and terms, they were audio-recorded, and the recordings were transcribed, yielding over 100 pages of transcripts. After transcribing the interviews, we categorized the data under the main categories, knowledge management problems according to relevant terminology and theories, which were the most often refereed work of categorizing concepts in the studied research area. The problem with the main categories was whether there would be enough proof found in the data to derive the knowledge management categories as valid and reliable, and whether the categories discovered in the data would be the correct ones.

Table 1: Categories and total number of different empirical observations.

Category	Definition	Total number of observations
Patient	A patient receives care and treatment by a physician.	42
Patient Data in ICT Systems	Patient's personal data, medical history, treatments, tests, examinations, diagnoses, and consultation requests in the ICT systems.	16
Patient Data Transfer on Paper	Patient's personal data, medical history etc. are transferred on paper.	7
Patient Data Transfer in ICT	Patient's personal data, medical history etc. are transferred in ICT systems.	6
Lack of Patient Data Transfer Control	In many ICT systems' areas the transfer of the patient's personal data, medical history etc. is not controlled and the staff must start the programs manually.	3
Permission Denial of Patient Data Transfer	A patient can deny her or his personal data, medical history etc. to be transferred with ICT or on paper.	2
Patient Care Process	In the patient care process a physician makes a diagnostic decision and determines the proper treatment for the patient.	8
Physician	A physician needs knowledge of anatomy, physiology, and medical science and knowledge of how to apply this knowledge in practice.	17
Physician's Tacit Knowledge	A physician's tacit knowledge is related to how she or he is able to use his or her biomedical knowledge, intuition and experience.	4
Physician's Attitudes to ICT and Patients	Physicians' attitudes towards ICT systems are negative because of lack of time. Physicians have attitude problems towards patients who know about their own diseases.	4
Physician's Stress	Patients cause stress to physicians.	2
Physician's Medical and Clinical Decisions	ICT systems do not support the clinical and medical work of the physician.	5
Physician's Lack of Time	Physician has lack of time in the policlinic to search for patient information.	2
ICT Systems	There are hundreds of ICT systems used in hospitals, which physicians and other professionals use in their daily work with patients.	31
ICT Systems Vendor	ICT systems' vendor implements the ICT systems and ICT products.	7
ICT Systems Technology	ICT system technology connects the healthcare treatment process in which different people and technologies work together.	19
ICT Systems Legislation	The laws prevent the integration of social and healthcare issues in ICT systems. The social and healthcare laws have been transferred from the Finnish national government to local authorities.	4
ICT Systems Development Resources	System developers are not qualified enough to implement ICT systems to healthcare due to their lack of training in biomedical informatics. ICT development lacks money.	4
ICT Systems Communication Barriers	The barriers between primary and special healthcare services and ICT professionals are lack of knowledge and skills, and poor communication.	1
Nurse	Nurses work together with physicians, therapists, other healthcare staff, families and patients.	6
Nurse's Lack of Time	Nurses are busy, and do not have enough time to input data to the ICT systems.	6
Primary and Special Healthcare Services	Healthcare guarantees sufficient social and healthcare services for all residents in the district.	4
Social Issues	Patient's social issues.	3
Total number of observations		**103**

Table 2: An example of an observation concerning the category "Physician's Tacit Knowledge".

Knowledge management problem	Definition	Source	Empirical evidence	Interviewed person, specialized area/ expertise
Physicians have to interpret the results of special tests by special devices by themselves using their tacit knowledge	The ICT systems are not able to provide the physicians the features and functionalities which are required to perform clinical work on patients, for example to analyze the state of the patient.	Puusa and Eerikäinen, 2010; Heilmann; 2010; Hill, 2010	For example, in special treatment, the information systems may control some devices like the x-ray machine, e.g. by collecting the data and analyzing it. Then the doctor has to make the analysis of what the data is, and then write it down to the main system.	Junior physician, specializing in gynecology and women's diseases

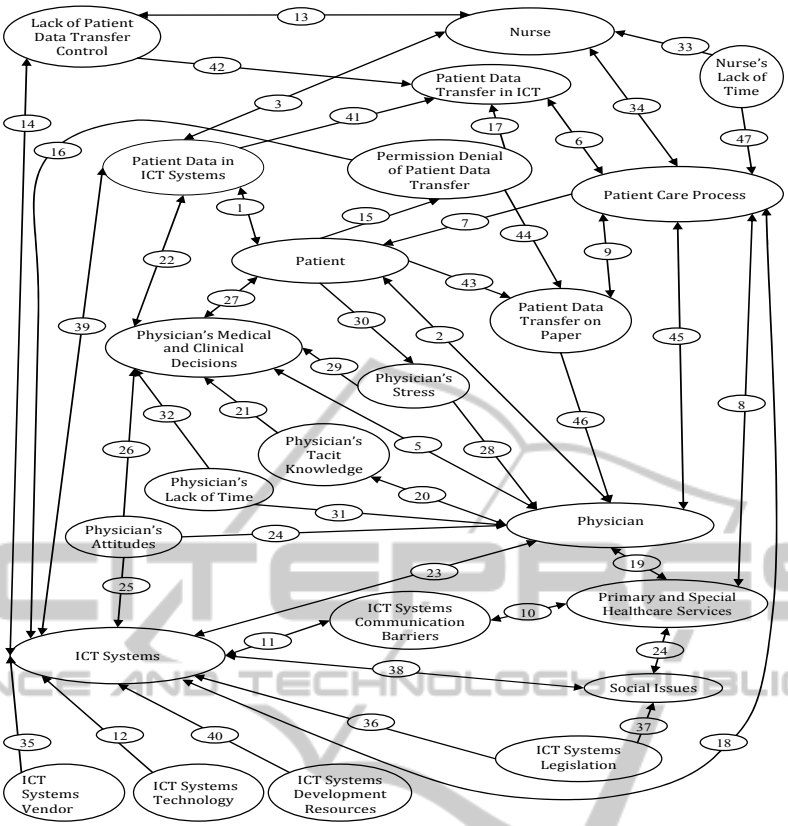

Figure 1: Conceptual framework of categories.

Based on our intuition and knowledge we made a table 1. In table 1 the first column includes a specific knowledge management problem discovered in the empirical data; the second column includes the definition of a knowledge management problem based on the empirical data; the third column includes evidence from the literature to the problem in the first column; the fourth column includes the name of the literature source of the third column; and finally the fifth column includes the transcript number and the interviewed person's name and occupation. By doing this we have created a chain of evidence: from empirical data we have derived all the knowledge management problems and validated them with past studies. This table is available on separate request from the authors.

4 ANALYSIS

After creating the chain of evidence in data categorization, a total amount of 103 different empirical observations under 23 categories (see Table 1) were found by using Glaser and Strauss's (1967) and Pawluch and Neiterman's (2010) grounded theory analysis instructions, which support the finding of categories grounded on data and based on the researchers' own intuition and knowledge. An example of an observation concerning the category "Physician's Tacit Knowledge" is presented in Table 2.

Our conceptual framework of the discovered categories (see Figure 1) is based on empirical evidence and theories reflecting the findings in the field (Glaser and Strauss, 1967; Pawluch and Neiterman, 2010). Specifically, we have involved fragmentation and reassembled our data into thematic categories by trying to capture a broader social system of ideas from the experience of the social actors (Glaser and Strauss, 1967; Pawluch and Neiterman, 2010), in this case the actors working in the Social and Health Care District. After the categories had been found, we determined the properties of the categories and propositions (hypotheses) for how the categories were related. In Figure 1, the categories are shown as ellipses, and the solid, numbered arrows describe the relationships between the categories. These relationships based on empirical data are presented in detail in Table 3.

Table 3: Properties of categories and propositions (hypotheses) on how the categories are related on the basis of the data.

Category/Categories	Properties of categories and propositions (hypotheses) on how the categories are related (arrows in Figure 1)	Arrow number
Patient Data in ICT Systems, Patient, Nurse, Physician, ICT systems, Physician's Medical and Clinical Decisions	Physicians and nurses must document all care treatment in order to follow up how the patient has been treated.	1, 2, 3, 4, 5
Patient Data Transfer in ICT, Patient, Patient Care Process, Primary and Special Healthcare Services	The patient moves back and forth between primary and special healthcare services, because the patient data does not move between services.	6, 7, 8
Patient Data Transfer on Paper, Patient, Patient Care Process, Physician, Primary and Special Healthcare Services, ICT System Communication Barriers, ICT Systems	Primary and special healthcare services transfer patient data on paper not by ICT systems even if they use the same ICT systems.	9, 7, 8, 10, 11, 43, 46
Patient Data Transfer in ICT, Lack of Patient Data Transfer Control	It is possible that other complications will appear because the data transfer is not controlled.	13, 14
Lack of Patient Data Transfer Control, ICT Systems, Patient Data in ICT Systems, Patient Data Transfer in ICT	In ICT systems' areas data is distributed between heterogenic and autonomous ICT systems, and there is no data transfer control.	14, 41, 42
Permission Denial of Patient Data Transfer, Patient, ICT Systems	The denial of patient information permission affects the ICT system architecture, and data transfer is restricted.	15, 16, 17
Patient Care Process, Physician, Patient, Patient Data in ICT Systems, Primary and Special Healthcare Services	Physicians cannot track a patient's location in the patient care process in the ICT systems because of a large amount of data.	18, 7, 2, 1, 19, 45
Primary and Special Healthcare Services, Patient Care Process, Patient, Physician	Right healthcare is not provided by the health centers and thus the patients need hospital care.	19, 8, 7, 2
Physician's Tacit Knowledge, Physician's Medical and Clinical Decisions, ICT Systems	A great deal of tacit knowledge is not transferred from healthcare professionals via ICT systems to other healthcare professionals.	20, 21, 22, 23
Physician's Tacit Knowledge, Physician, ICT Systems	Healthcare professionals use "tricks" called as hidden knowledge in ICT systems and computers.	20, 23
Physician's Attitudes, Physician's Medical and Clinical Decisions, ICT Systems, Patient, Physician	Junior physicians have attitude problems to patients who know about their own diseases. The healthcare personnel's attitudes towards ICT systems are negative.	24, 25, 26, 27
Physician's Stress, Patient, Physician's Medical and Clinical Decisions, Physician	Patients cause stress to the physicians by giving them advice about their illnesses.	2, 28, 29, 30
Physician's Lack of Time, Physician's Medical and Clinical Decisions, Patient Data in ICT Systems, ICT Systems, Patient, Physician	Physicians have too short time in the policlinic to search for the patient data in the ICT systems and other special systems and devices.	31, 32, 22, 23
ICT Systems, Physician's Medical and Clinical Decisions, Patient, Physician	ICT systems do not guide medical decision-making.	23, 5, 27
Nurse's Lack of Time, Nurse, Patient Care Process, Patient	Physicians and nurses do not have enough time to input data to ICT systems.	33, 34, 3, 47
ICT Systems Vendor, ICT Systems	The ICT vendor has problems in the change management of ICT systems, and it takes years to implement the changes.	35
ICT Systems, ICT Systems Legislation, Social Issues	Integration of social and healthcare issues in ICT systems is not possible because of laws.	36, 37, 38
ICT Systems, ICT Systems Legislation, ICT Systems' Technology, Social Issues	Psychosocial support for the future needs of a patients is missing from ICT systems and their integration.	36, 37, 38, 12
ICT Systems, ICT Systems Technology	The usability of ICT systems is poor because of many new ICT versions, and too much unnecessary data must be saved in the ICT systems.	12, 39
ICT Systems, ICT Systems Technology, ICT Systems' Vendor	It means huge work to implement a new interface to an old fashioned application environment (ICT system environment).	12, 35
ICT Systems, ICT Systems Development Resources	Qualified ICT personnel who know about biomedical knowledge in the healthcare ICT systems area is lacking due to the growing importance of ICT system integration.	40
ICT Systems, ICT Systems Communication Barrier, Primary and Special Healthcare Services	A knowledge and communication barrier exists between primary and special healthcare services for patients. Communication and understanding between ICT professionals and healthcare professionals are poor.	11, 10,
ICT Communication Barrier, Primary and Special Healthcare Services, Social Issues, ICT Systems, ICT Systems' Legislation	Laws regulate the communication of ICT systems between social workers and healthcare patients with social problems.	36, 11, 10, 38

Finally, in our in-depth case study, we took carefully into consideration beforehand who to interview, what to do next, what group to look for, and what additional data we should collect in order to develop a theory from the emerging data. The constant comparison between the data and concepts in past studies in order to accumulate evidence convergence on simple and well-defined categories led us to a higher level of abstraction of statements about the relationships between the categories. This theorizing was in line with Pawluch and Neiterman's (2010) suggestions of creating a grounded theory with Glaser and Strauss's (1967) approach. The higher level of abstraction of the statements is presented in the conclusions and discussion section.

5 CONCLUSIONS AND DISCUSSION

This qualitative, empirical case study based on the Grounded Theory approach (Glaser and Strauss, 1967) revealed that many knowledge management problems can be found in knowledge and information-intensive environments in the healthcare domain. Based on seven in-depth interviews, the study described knowledge management problems in the South Karelia Social and Health Care District in Finland and its central hospital. As the data collection point of view we used the director level of the central hospital, the ICT director, the communications manager, and the junior and senior physician level of the central hospital in the district, as well as the development manager level of the Ministry of Social Affairs and Health in Finland. This multi-perspective point of view gave us rich data for solving our research problems.

Our study is in line with the studies of Martikainen et al. (2012), Viitanen et al. (2011), Nykänen et al., (2012), and Fisher (2013) concerning problems with patient data in ICT systems. Studies of problems in ICT system development, technologies, integration and ICT systems' lack of clinical decision-making (Martikainen et al., 2012; Young et al., 2000) are also in line with our study. The problems in knowledge transfer and lack of data were also verified (Greig et al., 2012, Lin et al., 2008). The claims by Nykänen et al. (2012), and Kothari et al. (2012) for tacit knowledge missing in ICT systems, and the lack of data transfer control (Häyrinen et al., 2008) were also confirmed. The claims by Polanyi (1966), Nonaka (1994), Puusa and Eerikäinen (2010), Heilmann (2010), and Hill (2010) concerning the use of tacit knowledge in decision making were also proved to be valid.

Attitude problems (Viitanen et al., 2011), failures in information transfer, and communication and communication barriers between primary and special healthcare services (Burgess et al. 2012; Niskanen, 2002, Reddy et al., 2009; Kaye et al., 2010) were also found. Difficulties in carrying out statistics from the current data in ICT systems due to their structure was confirmed (Grimson et al., 2000). We also discovered that ICT systems are expensive, regulated by political decisions, not standardized, and include complex medical data, it is difficult to save data to systems, and there exist security and trust problems (Grimson et al., 2000). Integration problems exist in healthcare and between social care and healthcare because of laws (Niskanen, 2002; Laki 159/2007, 2007; STM, 2013; Hämäläinen et al., 2013; Linthicum, 2004; Gupta, 2009). Physicians' stress and control-sharing problems (Edwards et al., 2012; Blakeman et al., 2006) were also confirmed. The statement of Ammenwerth et al. (2006) about too short time in the policlinic to search for patient information, and Suomi and Salmivalli's (2002) argument for paper problems were found to be valid in our case as well. The claim for difficulties in healthcare operations if an enterprise architectural solution is missing (Jonkers et al., 2003) is in line with our study. The claim of Nilakanta et al. (2009) about business and knowledge management processes being currently more important than clinical and diagnostics care was corroborated. The patients' resistance to recommendations, limited time and limited personnel resources, work pressure, negative attitude or limited support from "peers" or superiors were also confirmed (Heilmann, 2010).

In this study we discovered a higher level of abstraction of statements based on our conceptual framework, propositions to our categories, and relationships between the categories as follows. First, physicians' tacit knowledge and experience, technological skills to use ICT systems, and knowledge of medical issues affect their medical and clinical decisions, which are also affected by the physicians' lack of time, stress and attitudes towards patients and ICT. Second, medical and clinical decisions are influenced by patient data in the ICT systems, because a physician has no time to go through every detail of the patient's past medical history. Third, the patient data in the ICT systems is affected by the patient her or himself, the physician, permission denial of patient data by the patient, lack of patient data, missing patient data, lack of patient

data transfer control, or too much data transfer control by the laws. Fourth, the physician's medical and clinical decisions influence the patient care process and patients who are affected by right or wrong diagnoses, treatment and patient care. Fifth, ICT systems' communication barriers and legislation, communication and knowledge barriers and misunderstanding can prevent proper healthcare of a patient, which is also affected by nurses' lack of time and the available primary and special healthcare services. Sixth, the ICT systems' vendor, technology, legislation, and lack of development resources both at the ICT systems' healthcare organization and ICT system's vendor side, together with ICT systems' communication barriers, physician's negative attitudes towards patients and ICT systems, and reluctance to participate in ICT systems' development due to lack of time, combined with lack of right medical and clinical decisions due to lack of right data, as well as attitudes and physician's tacit knowledge and experience in the decision making situation all affect patients' health and can prevent the right patient care to be carried out. All this also causes a lot of stress to both the physician and the patient and forms a barrier to right patient diagnoses and treatment. In the patient care process, too many patients and data are directed at the same time to one physician to be treated at a too short notice and time. On the other hand, the ICT systems in healthcare suffer from a lack of resources, money and qualified personnel, and are therefore affected by several issues at the same time. The ICT systems also need integration and modernization, and the ICT development personnel needs a basic level of biomedical information knowledge in order to understand the ICT systems in healthcare and the healthcare professionals better, but because of the lack of money both at the ICT system vendors' side and the healthcare organization's side, the resources must be focused very carefully on time in order to meet the rising costs of the patient care itself. The physicians and nurses must also be given a basic level of ICT education so that they are able to understand old and new ICT systems, in addition to patients' needs.

In our case study the purpose of the grounded theory analysis (Glaser and Strauss, 1967) was to find out categories and relationships between the categories in one specific healthcare environment with the inductive research approach. The concepts were sharpened by building evidence from empirical data describing the conceptual categories which according to Glaser and Strauss (1967), and Pawluch and Neiterman (2010) are the building blocks of the grounded theory. Constant comparison between the data and concepts was made so that the accumulating evidence converged on simple and well-defined categories. After the categories were found, we defined the properties of the categories and propositions (hypotheses) of how the categories were related. In our in-depth case study, we took carefully into consideration beforehand who to interview, what to do next, what group to look for, and what additional data we should collect in order to develop a theory from the emerging data. Finally, a conceptual framework of the categories was developed, and the categories were grounded on empirical evidence and theories reflecting the findings in the field. The most fundamental components in this conceptual framework were its categories and the relationships between the categories. This comparison with past studies led us to six higher-level abstractions of statements about the relationships between the categories. This theorizing was in line with Pawluch's and Neiterman's (2010) suggestions for creating a grounded theory with Glaser and Strauss's (1967) approach. We also found empirical data which was not supported by past studies, and we regard this data as expansion to knowledge management in healthcare. The expansion covers the following issues. First, in the current ICT systems the same patient data must be saved several times. Second, the challenge is the attachment of private sector admission notes (called internal referral notes or an internal consultation request) such as X-ray pictures, which must be sent on paper by post, or brought along by the patient to the physician. Third, other social and healthcare districts do not send feedback forms about patients to the sending district of the admission. Fourth, the guidelines about the process are in written format, and can be viewed on web pages ("Fair Treatment", Käypähoito in Finnish), but it is not known whether they are used. Fifth, the ICT system vendors have difficulties in giving price to the implementation and maintenance of e-services of ICT systems. In this study, a special status in theory building was given to the focal categories, the social and healthcare district and its central hospital. In our theory the ancillary category was the knowledge management problem. We took care of the boundary conditions in our theory creation, because the phenomenon was so atypical that it held only in this specific contextual healthcare environment. Our results validated the conceptual framework, which became the discovered theory for the phenomenon. The data which confirmed the emergent relationships enhanced confidence in the

validity of the relationships. The data which disconfirmed the relationships provided an opportunity to expand and refine the emerging theory. The results which did not get support from past studies resulted in expansion to the theory. The non-conflicting results strengthened the definitions of our categories and the conceptual framework. The past studies with similar findings were important because they tied together the underlying similarities in phenomena not associated with each other, and stronger internal validity was achieved. There are, however, several limitations in this study. First, we had limited knowledge of the central hospital and the social and healthcare district because access to secondary sources was limited. Second, the results may not be readily applicable to other districts and central hospitals, as the phenomena were atypical. Third, the use of only one social and healthcare district and its central hospital affected our findings, and thus generalization of the results can be difficult, but not necessarily impossible. Fourth, we performed a limited number of interviews, and the nurses were not interviewed personally. Fifth, the interviews were conducted in multiple languages, which made the interviewing, transcribing, coding and analyzing the material very demanding. The translation made by the first author from one language to another may have limited the analytical strategies because the analysis was carried out only of the interviews in the original material, and only for conceptualization into the conceptual categories and their meanings.

In the future, a large sample of data will be collected in multiple case studies (Yin, 2003) with several hospital departments and units of analysis (Eisenhardt, 1989). Glaser and Strauss (1967) also claim for both qualitative and quantitative data in creating theory. Qualitative and quantitative data can supplement each other and their comparison can result in new theory.

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