Knowledge Management Problems in Paediatrics and Paediatrics Neurology Departments
A Case Study based on the Grounded Theory

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Abstract: Knowledge management means how information communication technology systems and intellectual human capital is 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 paediatric and paediatric neurology departments. The Grounded Theory approach is applied in data collection and analysis. The analysis revealed 8 thematic categories as follows: Patient, Physician, Patient Data, Nurse, ICT Systems, Patient Treatment, Diagnosis, and Learning and Experience. The categories are related to each other, and we found 13 higher levels of abstraction of statements. A conceptual framework of knowledge management categories, their relationships to each other, and propositions to our categories was developed by using the Grounded Theory approach. The relationships between the knowledge management categories enhance confidence in the validity of the categories and their relationships, and expand the emerging theory.

1 INTRODUCTION

In this study the healthcare environment, denoted as department, is referred to as a place in which medical, clinical and nursing knowledge is ingrained in practitioners (Räisänen et al., 2009). 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 (Alavi and Leidner, 2001). In spite of the definition above, there are several problems that hamper knowledge management, such as the use of ICT systems (Viitanen et al., 2011; Martikainen et al., 2012; Nykänen et al., 2012), access to patient data (Reddy et al., 2009), communication barriers (Hayes et al., 2011), resources and workload (Chadi, 2009), acute and emergency patient care situations (Nevalainen et al., 2012), coordination inside and outside the hospital (Burgess et al., 2012), appointment scheduling (Martikainen et al., 2012), treatment paths (Viitanen et al., 2011; Nykänen et al., 2012), diagnosis (Heilmann, 2010), and interpretation of patient data and information interpretation (Viitanen et al., 2011; Martikainen et al., 2012; Nykänen et al., 2012).

Thus, plenty of knowledge management problems exist in healthcare, but studies are missing from the paediatrics and paediatrics neurology area how improved healthcare quality, lowered healthcare costs, care providers' ability to offer healthcare, changes in the process of patient care delivery and improved cost efficiency by offering new ICT technologies by remote access with the patient can bring improvements to healthcare environment. Therefore 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 two hospital environments. We analyzed the collected data with the Grounded Theory (GT) approach by using Glaser and Strauss's (1967) and Pawluch and Neiterman's (2010) research approach. GT investigates phenomena in their natural context and a data analysis is used to build up a theory from empirical findings. Data collection continues until 'theoretical saturation' is reached (Glaser and

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Strauss, 1967). Our goal was to investigate knowledge management problems in detail in a paediatric department and paediatric neurology department in a central hospital located in South Karelia, Finland, and we found 401 knowledge management observations supported by empirical evidence. We categorized the observations with GT analysis (Glaser and Strauss, 1967), and the analysis revealed 8 thematic categories as follows: patient (2 observations), physician (83 observations), nurse (10 observations), patient data (61 observations), ICT systems (147 observations), patient treatment (57 observations), diagnosis (16 observations), and learning and experience (21 observations). 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

Plenty of knowledge management problems have been presented in the literature. They include for example difficulties in making a diagnosis (Tucker, 2007) and difficulties in clinical investigations, because investigations need a lot of time, experience and knowledge (Curley et al. 1990). There is lack of access to medical information journals (Norbert and Lwoga, 2013), and lack of access to patient information (Reddy et al., 2009). Reddy et al. (2009) state that there is a communication barrier in ICT systems in healthcare environments. In addition, the oral information received from a patient is not clear and the physicians can freeze in critical patient care situations (Heilmann, 2010). Martikainen et al. (2012) mention appointment scheduling and consultation problems. According to Burgess et al. (2012), there are coordination problems between different caregivers. Mandl et al. (2001) state that patient rights and parents' permission complicate physicians' work. Martikainen et al. (2012) refer to problems in ICT outcomes in patient work, as well as physicians' negative attitudes to ICT systems or to patients (Viitanen et al., 2011). Chadi (2009) mentions physicians' limited time and too many patients. Nykänen et al. (2012) state that there is lack of reliability of data or information. Dias et al. (2003) argue that physicians' work is stressful, such as late night working, many patients, or patient care cases. Martikainen et al. (2012) claim that separate subsystems need separate checking and each patient must be treated differently, and physicians are not too eager to search for follow-up data. There is malfunction in lab tests, subsystems and procedures (Viitanen et al., 2011). A lot of time is needed to give information to the patient, and making a rehabilitation plan needs a group of people from different areas (Poskiparta et al., 2000). Brixey et al. (2010) mention interruptions in daily work. Thus, despite a growing interest in knowledge management problems in healthcare, their relationships have not been recognized in the literature. Our study aims to respond to this lack of studies and to provide useful information of knowledge management in one specific paediatric department and one paediatric neurology department. Paediatrics carries out medical care of children and paediatrics neurology carries out medical care which specializes in treating nervous system problems in children. The nervous systems can be damaged permanently because the brain's development, and making the diagnosis and treatment of neurological problems need a special attention. The children's diseases also need special knowledge in order to be treated properly. Thus, this study could bring benefits both to the patients and care givers in this research context by discovering what are the main knowledge management problems and their relationships with each other. Based on past studies, we have formulated the following research questions:

RQ1: What are the main knowledge management problems in paediatrics and paediatrics neurology?

RQ2: How are the knowledge management problems in paediatrics and paediatrics neurology 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 specific healthcare environments 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 these healthcare environments, the cases were selected so that they would either predict similar outcomes (i.e. literal replication) or to produce contrasting results but for predictable reasons (i.e. theoretical replication) (Yin, 2003). 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). During the research, theoretical background knowledge was gained, which increased the credibility of the study (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 and Strauss (1967), there is no need to review any literature of the studied area before entering the field, and this is in line with our research. Specifically, each interview transcript was analysed, and major emergent themes and concepts were identified in order to form similar categories (Myers and Avison, 2002). In our case study, one paediatric department and one paediatric neurology department were the units of analysis in the Social and Health Care District of South Karelia in Finland and its central hospital (Eksote, 2013).

The definitions of knowledge management and the objectives of the research formed the basis for the interviews and data collection. In order to address the research questions, we conducted nine audio-recorded unstructured and semi-structured interviews that investigated experiences in knowledge management issues in the chosen healthcare environment. The interview rounds were carried out in March - May 2014 in the Paediatric department, and in March - June 2014 in the Paediatric Neurology department. The interviewees were the chief physician in paediatrics neurology, chief physician in paediatrics, one senior physician in paediatrics, three junior physicians in paediatrics, and three paediatric nurses. 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 periods of 6 to 14 years among the nurses and 3 to 43 years among the physicians, in different positions either in South Karelia Social and Health Care District or other healthcare environments in the private or public sector in Finland.

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 206 pages of transcripts. After transcribing the interviews, we used the Grounded Theory based on our own intuition and knowledge in fragmenting and reassembling our knowledge management problems into thematic categories (Glaser and Strauss, 1967; Pawluch and Neiterman, 2010) according to relevant terminology and past studies that were the most refereed work in categorizing concepts in the studied research area. Since each thematic category was decomposed into multiple items (traits) by using content analysis, the items were matched with actual categories (in situ). Thus, for each category a certain number of items were identified that were likely to influence the category at that point. Finally, the items were validated with past studies. An example of each of the thematic categories' observation is presented in Table 1. The problem with the thematic categories was whether there would be enough proof found in the data to derive the categories as valid and reliable, and whether the categories discovered in the data would be the correct ones.

4 ANALYSIS

After creating the chain of evidence in data categorization, the total number of 401 different empirical observations under 8 thematic 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 also based on the researchers' own intuition and knowledge. 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 paediatrics and paediatrics neurology departments. As shown in Table 1 above, eight thematic categories were formed in the study: Patient, Physician, Nurse, Patient Data, ICT Systems, Patient Treatment, Diagnosis, and Learning and Experience. The Patient category had 2 observations and 1 item; the Physician category 83 observations and 21 items; the Nurse category 10 observations and 7 items; the Patient Data category 61 observations and 14 items; the ICT Systems category 147 observations and 17 items; the Patient Treatment category 57 observations and 16 items; and the Learning and Experience category had 21 observations and 6 items. The sum total of empirical item observations (items) was 401, and the sum total of different items was 88. Our conceptual

Table 1: An example of an observation concerning each thematic category, category definition, item number (item no), item, and item definition.

Thematic Category	Category Definition	Item No	Item	Item Definition
Patient	A patient receives care and treatment by a physician or nurse	1	Patient anxiety	In patient care situations the patients can be sometimes afraid and the patient's worry about him/herself affects the physician's decision-making (in diagnosis and treatments).
Physician	A physician needs knowledge of anatomy, physiology, and medical science, as well as knowledge of how to apply this knowledge in practice	1	Negative attitudes towards ICT systems	There are negative attitudes because computer programs are a hindrance to work and subsystems are used via main systems, and physicians are very anxious about using systems this way.
Nurse	A nurse is a trained nurse specialized in patients' (children) illnesses	1	Interruptions	There are a lot of interruptions in daily work and they make the nurse to forget what she/he was doing, and also patients interrupt working in data saving etc. issues.
Patient data	Patient's personal data, medical history, treatments, tests, examinations, diagnoses, and consultation requests	1	Information is missing in the systems, paediatric ward and about patients	The systems miss task lists for staff, paper information about patients is missing, check-up lists are missing in the paediatrics ward, instructions on how to handle double time data saving and checking are missing, and acute treatment guideline books must be available.
ICT Systems	There are hundreds of ICT systems in use at hospitals, and the physicians and other professionals use them in their daily work with patients.	1	Systems are not in concord	The electronic prescription does not recognize the treatment. The patient has a third system at home, and in the university there is a fourth one and none of these are totally in concord.
Patient treatment	In the patient care process a physician makes a diagnostic decision and determines the proper treatment for the patient.	1	Treatment based on 'Käypähoito' does not work	In some clinical situations the treatment based on 'Käypähoito' does not work and it is more complicated to find the exact treatment strategies from journal sources.
Diagnosis	A process to examine the patient s and define the essence and circumstances of a disease	1	No check-up patient information in wards and paediatrics	There are no check-up lists in wards and paediatrics, check-up lists or staff used at the wards do not exist in the systems.
Learning and experience	Acting to get new knowledge or skills by experience or reading, or evaluating information or data	1	New information or data need studying, evaluation and critical thinking	The biggest problem is that medicine is such a huge concept, it has huge amount of information that cannot all be remembered, and new information needs to be studied or new results must be waited for.

framework of the discovered categories (see Figure 1 below) is grounded on empirical evidence and theories reflecting the findings in the field (Glaser and Strauss, 1967; Pawluch and Neiterman, 2010). In Figure 1, the categories are shown as ellipses, and the bold lines marked with letters (A to O) describe the relationships between the categories. The small arrows with numbered circles pointing to the categories are the multiple items (traits) to each category composed by content analysis. After the categories and relationships and items had been found, we determined the properties of the categories and propositions (hypotheses) on how the categories were related on the basis of data (See Table 2). 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 13 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.

5 CONCLUSIONS AND DISCUSSION

The qualitative, empirical case study based on the Grounded Theory approach (Glaser and Strauss, 1967) and nine in-depth interviews revealed that many knowledge management problems can be found in paediatric and paediatric neurology department.

The study is in line with past studies concerning problems in making diagnoses (Tucker, 2007), hard clinical investigations (Curley et al., 1990), lack of access to medical information journals (Norbert and Lwoga, 2013), lack of access to patient information and communication barriers in ICT systems (Reddy et al., 2009), unclear oral information from a patient, physicians freezing in emergency situations (Heilmann, 2010), appointment scheduling and consultation problems (Martikainen et al., 2012), coordination problems between caregivers (Burgess et al., 2012), patient rights and parents' permissions complicating physicians' work (Mandl et al., 2001), problems in ITC outcomes, physicians' negative attitudes to ICT systems and patients (Martikainen et al., 2012; Viitanen et al., 2011), physicians limited time with too many patients (Chadi, 2009), lack of data reliability (Nykänen et al., 2012), physicians' stress (Dias et al., 2003), systems needing double checking, physicians' not wanting to search for follow-up data (Martikainen et al., (2012), malfunctions in lab tests, subsystems and procedures (Viitanen et al., 2011), long time needed to give information to the patient and making a rehabilitation plan needing a group of people from different areas (Poskiparta et al., 2000), and interruptions in daily work (Brixey et al., 2010).

Our results validated the conceptual framework,

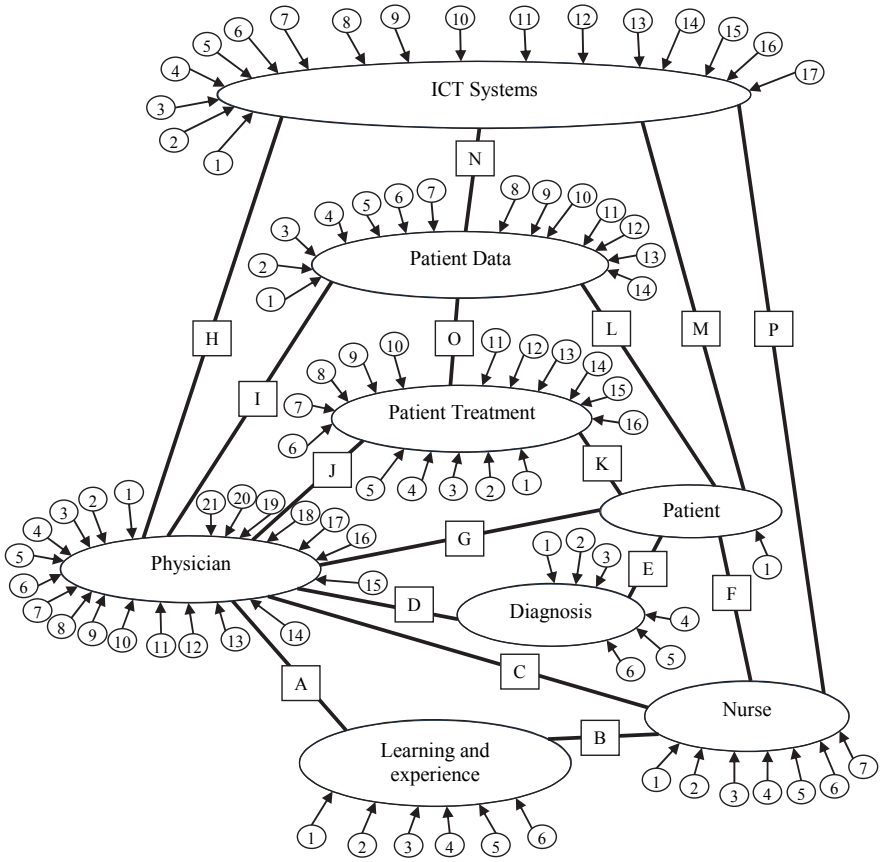

Figure 1: Conceptual framework of categories.

Table 2: 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 (lines marked with the letters A to O in Figure 1) on the basis of the data	Lines marked with letters in Figure 1
Physician, Learning and Experience	The staff make harsh comments about the patients, parents, colleagues, even themselves, and expertise is shared this way	A
Nurse, Learning and Experience	Nurses look for evidence on how a medicine has helped elsewhere, and nurses contact outside hospitals in Finland and find out how a certain disease is treated or medicine is used, and then the department makes its own guidelines on how to use it.	B
Nurse, Physician	The nurses must decide who is the best physician to decide about new medication	C
Physician, Diagnosis	A diagnosis has to be done even if the patients denies to give samples of blood or urine, and it is difficult to treat children if they refuse the tests	D
Diagnosis, Patient	In patient care situations patients can be sometimes afraid and the patient's worry about him/herself affects the physician's decision-making (in diagnosis and treatments)	E
Patient, Nurse	The nurses are checking the child patients before they meet the physician, and the physician then checks the same things again	F
Patient, Physician	A lot of time is used to give information about the disease, how it affects the patient, and about the medicine in order to make sure that the patients takes the medicine and follows the instructions at home	G
Physician, ICT Systems	The physicians have only very basic knowledge of data systems	H
Physician, Patient Data	The diagnosis must be formed in one's mind on the basis of the symptoms. The physician must react to the things she/he is expecting, such as results, and the physician must decide him or herself and on the basis of information in the computer	I
Physician, Patient Treatment	In acute situations investigations and treatments must be handled quickly, decisions must be made quickly, and handling acute situations is difficult.	J
Patient Treatment, Patient	The problem is every treatment cannot be evidence-based because there is not enough research and there are cases which cannot be based on a proper study.	K
Patient Data, Patient	It is not easy to combine patient information from different sources and people, and too much patient information can be controversial, and one must form one's own opinion about it	L
ICT Systems, Patient	The information systems slow down patient work, take time from daily patient care and take the focus away from the patient	M
Patient Data, ICT Systems	It is difficult to know what is the fastest way to find information, sometimes one cannot use one's personal codes, one has to use the clinical codes of the whole clinic to find something and things are not found from one system, but in Effica and subsystems.	N
Patient Treatment, Patient Data	In an emergency situation, electricity failure is crucial because there is not access to patient data	O

which became the discovered theory for the phenomenon. The data which confirmed the emergent relationships enhanced confidence in the validity of the relationships. 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.

Several conclusions can be drawn from this study. First, there is a huge number of knowledge management problems which affect patient care work daily. There is a real difference between acute and emergency situations and normal daily routine patient care situations. The first ones need a lot of experience and knowledge which must be learned in similar situations in a long time period. Therefore, a junior physician must not be in charge in acute and emergency situations but should work side by side with a senior physician in order to learn the right procedures. The management, leadership, and treatment paths are important tasks to be solved in departments in every situation before any patient is

involved, so that the interpretation of results and tests will go right away to the right person who is able to interpret them correctly. The several similar investigations by different patient care providers must be coordinated so that there is no need to do the same investigations all over again when the care giver changes. Physicians and nurses on every level of healthcare must be given proper education and training so that patients can rely on them in spite of who is in charge. When doing so, maybe the patients would also start telling the truth about their symptoms. The patients could also tell about all their symptoms better if they could rely on the confidentiality of the ICT systems, so that cannot misused by anyone else than the physician in charge. Finally, the physicians' and nurses' negative attitude problems towards ICT systems and child patients must also be taken care of because they can affect the patient care situation, and also the care providers themselves. The reasons for the knowledge management problems may just be too much work with too many patients with limited knowledge at hand, which makes the care providers tired, frustrated or exhausted in their work. On the other hand, they can also be a consequence of motivation problems, or missing right knowledge in the work they are currently doing. This can be seen as uncertainty in their work, which is full of restrictions and perhaps a feeling that there is no possibility to influence one's own work, but it is dictated from above.

There are several limitations in this study. First, the results may not be readily applicable to other departments, as the phenomena were atypical. Second, the use of only two departments in a central hospital affected our findings, and thus generalization of the results can be difficult, but not necessarily impossible. Third, we performed a limited number of interviews, and only the chief physician of the paediatrics neurology department was interviewed personally. Our analysis provided better understanding of the different types of knowledge management problems and their relationships with each other affecting to patient safety which lead to better understanding of problems in healthcare. This is the main research contribution of our study. Finally, our study was supported with a study conducted in medical domain (de la Tassa et al., 2013) concerning the importance of patient safety and this supports our findings of knowledge management problems.

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