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The impact of specialization on knowledge transfer

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Abstract
Innovations in the form of best practices are not always easy to transfer within and across organizations. The major barriers have been discussed in the research stream of knowledge transfer, such as knowledge-related factors (Szulanski, 1996) and social and cognitive boundaries between and within professions (e.g. Ferlie, Fitzgerald, Wood, & Hawkins, 2005). However, how these barriers affect knowledge sharing and transfer under the condition of increased specialization has been underexplored in literature. Using empirical data from six hospitals, this qualitative study investigates how specialization affects knowledge transfer in specialized organizations. The results show that that specialization in terms of specialized knowledge, specialized learning competence, and specialized units can either impede or facilitate the spread of innovation or best practices under different conditions. This paper contributes to the literature of knowledge management and organizational innovation by examining the interaction of specialization and knowledge barriers, and proposing the conditions that facilitate knowledge transfer.
Abstract
Innovations in the form of best practices are not always easy to transfer within and across organizations. The major barriers have been discussed in the research stream of knowledge transfer, such as knowledge-related factors (Szulanski, 1996) and social and cognitive boundaries between and within professions (e.g. Ferlie, Fitzgerald, Wood, & Hawkins, 2005). However, how these barriers affect knowledge sharing and transfer under the condition of increased specialization has been underexplored in literature. Using empirical data from six hospitals, this qualitative study investigates how specialization affects knowledge transfer in specialized organizations. The results show that specialization in terms of knowledge, individuals, learning competence, units, and organizations can either impede or facilitate the spread of innovation or best practices under different conditions. This paper contributes to the literature of knowledge management and organizational innovation by examining the interaction of specialization and knowledge barriers, and proposing the conditions that facilitate knowledge transfer.
Innovation is dependent on the availability of knowledge to a great extent (du Plessis, 2007). The process of innovation in organizations includes identifying the problems, defining them correctly and solving them actively (Nonaka, 1994). This requires collective intelligence, learning and knowledge creation that are shaped by social interaction and group dynamics within organizations (Lam, 2005). Knowledge-intensive organizations seem to be a good place for innovative activities thanks to the richness of their science bases (Berwick, 2003) and the competence on problem solving owing to the existence of diverse multidisciplinary teams (Edmondson, 2012). However, several social and structural forces hindering and undermining innovation are also at work. Knowledge-intensive organizations are especially prone to obstacles because their increasing specialization and standardization, which serve the purpose of higher quality and efficiency, can turn professional groups into self-sealing groups that impede sharing knowledge (Ferlie et al., 2005). The self-sealing group phenomenon can be illustrated by the true story of two departments in a hospital, gastroenterology and orthopedic surgery, operating in neighboring operating rooms. The gastroenterology department developed a process innovation that gave an increase from 3 to 5 surgeries of one specific procedure per operating room per day, and a 40% increase in overall productivity. This happened without increasing the number of personnel or working hours of the team members. Despite efforts by the gastro surgeons to persuade the orthopedics to adopt the new process, the orthopedics deemed the innovation inappropriate for them and made no attempt to implement it, ignoring clear evidence of tremendous efficiency gains. They went to ask their colleagues who work in orthopedic surgery in another country and ended up learning the similar suggested innovation process. Instead of learning from their neighbors, they learned the same lesson from colleagues across national borders!\(^1\)

Although professional boundaries have been examined as a constraint for spreading innovation (e.g. Brown & Duguid, 1991; Ferlie et al., 2005) as in the abovementioned story, the role of specialization in knowledge transfer process has been underexplored. Our evidences show that specialization in terms of specialization in terms of knowledge, individuals, learning

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\(^1\) The story recounted here was told to the first author personally by staff at a hospital in Norway, in 2012.
competence, units, and organizations can either impede or facilitate the spread of innovation or best practices under different conditions.

Knowledge-intensive organizations are not only employing knowledge but also need to focus on creating knowledge towards generating innovations which require the activities of sharing and integrating knowledge. However, knowledge is “both a source of and a barrier to innovation” (Carlile, 2002, p. 442). Deterring effects of knowledge on innovation can result from its path-dependent nature which may have negative consequences on exploring new practices. Thus, deterring effects can come from the increasing specialization and differentiation which pose challenges to knowledge transfer and knowledge integration (Lawrence & Lorsch, 1967). Such specialization can isolate knowledge users into their specialized zone which make them blind to new knowledge or consider such knowledge irrelevant. This dismisses the benefits of sharing knowledge because such sharing has no real value to individuals and organizations unless those people who are in need of useful knowledge receive it, accept it, and also (re-)apply it. The impeding effect of specialization on knowledge sharing, thus knowledge transfer, is an interesting and important phenomenon which deserves to be examined carefully by research and studies.

The concept of specialization is generally taken for granted without being scrutinized in details despite that it plays an important part in knowledge-intensive organizations. Specialization can be implied under the different terms, such as competence (Santos & Eisenhardt, 2005), or novelty (Carlile, 2004), or complexity (Damanpour, 1996). To access its impact in organization, our paper focuses on investigating the role of specialization in knowledge transfer by posing the research question “How does specialization affect the transfer of knowledge within and across specialized organizations?”. Using empirical data from six Norwegian hospitals in Norway, we explore the mechanisms through which specialization hinder or facilitate the diffusion of knowledge, innovation or best practices. Our findings contribute to the understanding how specialization affects the transfer of knowledge and under which conditions specialization can help spread best practices. This topic is particularly important for knowledge-intensive organizations. Knowing such mechanisms, organizations can manage knowledge more effectively and design their structure in a way that innovation and best practices can flow more easily.

The paper is structured as follows: We start with addressing literature that is relevant to our research topic and address the theoretical framework that we use to design our research study. Then we elaborate our methodology to answer the research question, from case selection, data collection
and data analysis. Finally, we present our findings and discuss them in the connection with extant literature and propose suggestions for future research.

THEORETICAL BACKGROUND

Knowledge – definition and forms

There is no unified understanding among researchers about the definition of knowledge or where it resides. Some researchers differentiate between knowledge and information (e.g. Huber, 1991; Nonaka, 1994; Starbuck, 1992), whereas others consider knowledge to include all type of information and also know-how (e.g. Bartol & Srivastava, 2002; Kogut & Zander, 1992). Some researchers assert that knowledge resides only within individuals (e.g. Nonaka, 1994), whereas others believe that it is the equipment, routines and cultures that constitutes knowledge (e.g. Starbuck, 1992; Tsoukas, 1996). In our paper, we adopt the definition of knowledge from Nonaka (1994) in which knowledge is “justified true belief” (p. 15). This definition emphasizes the justification nature of knowledge, either by individual understanding or by collective understanding.

In order to be able to create and share knowledge, it is critical to understand the different forms of knowledge. A cornerstone in organizational learning and knowledge management theory is the distinction between tacit and explicit knowledge. The concept of tacit knowledge is inspired by Polanyi’s (1966) alternative view of the scientific enterprise in his assertion that “we can know more than we can tell” (p. 4). Tacit knowledge is described as knowledge that is “unarticulated and tied to the senses, movement skills, physical experiences, intuition, or implicit rules of thumb” (Nonaka & von Krogh, 2009, p. 635), and thus hard to be formalized and communicate (Nonaka, 1994). Explicit or codified knowledge refers to knowledge that can be captured in writing and drawing, and thus is easy to transfer (Nonaka, 1994). An important premise for this conceptualization is that knowledge cannot be distinct divided into only explicit or only tacit knowledge, as all knowledge has an element of tacitness (Polanyi, 1966). Knowledge is thus best distinguished along a continuum in which knowledge ranges from mostly tacit to mostly explicit (Nonaka & von Krogh, 2009)

Knowledge transfer – its role and its barriers

According to Argote (2013), organizational learning occurs through the mechanism of individual learning, but only if the individual shares this acquired knowledge with the rest of the organization.
Knowledge sharing can facilitate innovation within and across communities (Brown & Duguid, 1991).

In knowledge management theory, misconceptions and confusions regarding the terms knowledge transfer and knowledge sharing have been evident due to overlapping content and blurriness of concepts (Paulin & Sunesun, 2012; Tangaraja, Rasdi, Samah, & Ismail, 2016). However, some dividing lines between these two have been identified, including level of analysis (Argote & Ingram, 2000), and directional effect (Wang & Noe, 2010). Knowledge transfer can be defined as “the process through which one unit (e.g. group, department, or division) is affected by the experience of another” (Argote & Ingram, 2000, p. 151). Knowledge transfer is an outcome of knowledge sharing and manifests itself through changes in the recipient unit, either in knowledge or in performance (Argote & Ingram, 2000). Knowledge sharing is thus a central part of knowledge transfer, and even a defining element in actual transfer of knowledge because codification has taken place before being shared (Tangaraja et al., 2016).

There are developed several different conceptual models for studying knowledge transfer or knowledge sharing. However, many models are complex and/or context specific or are only focusing on interorganizational knowledge transfer. Among those, Szulanski’s model has been widely used to explain why knowledge transfer is challenging. Szulanski (1996) suggests that the difficulty of knowledge transfer is likely to be influenced by four sets of factors, including characteristics of the knowledge transferred, characteristics of the source, characteristics of the recipient, and characteristics of the context in which the transfer takes place. This difficulty of transfer is referred to as internal stickiness, and primary variables that act as origin of internal stickiness are described below.

**Characteristics of the knowledge transferred.** Causal ambiguity is suggested to mainly be related to the presence of tacit knowledge that makes it difficult to transfer knowledge and to assert the precise reasons for success or failure in the transfer. Unprovenness refers to the lack of evidence of past usefulness, which makes the transfer more difficult.

**Characteristics of the source of knowledge.** Lack of motivation includes the reluctance to share knowledge because of lack of rewards or unwillingness to support the transfer due to fear of losing ownership or not wanting to devote efforts. The source can also not be perceived as reliable if they are not seen as a trustworthy or knowledgeable source, which impedes knowledge transfer.
Characteristics of the recipient of knowledge. Lack of motivation of the recipient of knowledge is also a barrier for knowledge transfer, which may be caused by the not-invented-here syndrome (Katz & Allen, 1982). Lack of motivation is visible through behaviors like ignorance, passivity or outright rejection. Lack of absorptive capacity is a result of preexisting stick of knowledge that makes it difficult to exploit the received knowledge. Lack of retentive capacity refers to the ability of the recipient to utilize the new knowledge by discarding old routines.

Characteristics of the context. A barren organizational context refers to a context that impedes the inception and development of knowledge transfer. Contextual factors include formal structure and systems, sources of coordination, and organizational support. An arduous relationship refers to the difficulty of communication between units because of having a distant and laborious relationship, which impedes knowledge transfer.

Specialization and its manifestation
There are numerous ways that researchers refer to specialization, dependent on level of analysis and research context. Terms used that may imply the presence of specialization includes competence (e.g. Santos & Eisenhardt, 2005), expert (e.g. Boland & Tenkasi, 1995; Starbuck, 1992), professional (Starbuck, 1992), core capabilities (Leonard-Barton, 1992), novelty (e.g. Carlile, 2004), and complexity (e.g. Damanpour, 1996). Specialization is seldom defined, only mentioned and assumed to be fully understood by the reader, although being one of the main concepts. The following text describes how the concept of specialization manifests itself in different ways.

Specialized knowledge. Research has rarely defined specialized knowledge. One of the exceptions is the study of Sumelius and Sarala (2008, p. 246) in which they define specialized knowledge as “knowledge that is superior to knowledge available elsewhere in the organization”. This definition is derived from a definition of specialized resources by Birkinshaw, Hood, and Johnsson (1998). However, superiority is a vague concept to grasp. Carlile (2004) argues for distinguishing between types of knowledge into common and domain-specific in order to better understand the challenges of innovation across boundaries. Although not clearly defining domain-specific knowledge, Carlile (2004) asserts that “the difference in the type of domain-specific knowledge accumulated, such as specialization in different problem-solving domains”, which implies that domain-specific knowledge is closely related to specialized knowledge, and an
outcome of focused learning. Furthermore, the concept of bounded rationality by Simon (1957) inevitably connects specialized and domain-specific knowledge, as individuals’ cognitive limits restrain the ability to specialize on everything. Thus, individuals acquire specialized knowledge within specific knowledge domains. Specialized knowledge has been referred to as “esoteric expertise” (Starbuck, 1992, p. 716), which is further elaborated as “unusual”, “exceptional and valuable expertise” (p. 716).

The opposite type of specialized knowledge is general or common knowledge. Common knowledge is referred to as “those elements of knowledge common to all organizational members: the intersection of their individual knowledge sets” (Grant, 1996, p. 115). The common knowledge between actors enables communication and assessment of other’s domain-specific knowledge (Carlile, 2004), and has also been referred to as widely shared knowledge (e.g. Starbuck, 1992) and general knowledge (e.g. Yang, 2005). Types of common knowledge include language, different forms of symbolic communication, commonality of specialized knowledge, shared meaning, and transactive memory (i.e. recognition of individual knowledge domains) (Grant, 1996).

Specialist. A specialized individual, or more commonly referred to as a specialist, is an individual that possesses specialized knowledge. Other similar terms to specialist can be expert, or professional. An expert is defined as “someone with formal education and experience equivalent to a doctoral degree” (Starbuck, 1992, p. 719). Not all experts are professionals, because a professional not only has “specialized expertise” gaining through training or experience but also conforms to “ethical code”, and “collegial enforcement of standards” as well (Starbuck, 1992, p. 717). In this sense, the term professional better captures the essence of specialist than the term expert does.

Specialization of learning competence. As learning “presumes interpretation of experience” (Levinthal & March, 1993, p. 97), the learning process is unpredictable and complex (Pisano, Bohmer, & Edmondson, 2001) and the rate in which organizations learn from experience varies significantly (Reagans, Argote, & Brooks, 2005). Therefore, organizations use two types of learning mechanisms to reduce the complex and confusion of experience in order to facilitate learning from experience: simplification mechanism that simplifies experience, minimizes interaction, and restricts effects in terms of nearby actions, and specialization mechanism that focuses attention and narrows competence in different units, thus avoiding simultaneously adaptation within the system that might cause confusion (Levinthal & March, 1993). The outcome
of the second mechanism is “specialization of learning competence” in the units (p. 99). The specialization learning ability can be towards exploitation learning or exploration learning (March, 1991). Specialization in exploitation learning in a unit can help it deepen the specialized knowledge, and become more efficient. Favorable performance outcomes from specialization of exploiting learning competence may lead the organization to continued accumulation of experience on this routine, as opposed to acquiring experience from another superior routine. This is known as a competency trap (Levitt & March, 1988), which is also closely related to path dependency (Kogut & Zander, 1992). On the other hand, specialization in exploration learning can result in more flexibility and innovation. Cattani (2005) asserts that prior experience may in fact be a source of adaptation if the knowledge is used to spur the emergence of a new domain, or if the knowledge is similar to that knowledge needed in the new domain. However, specialization in exploration learning can result to failure trap (Levinthal & March, 1993), when failure in exploring new knowledge lead to more search which feeds to new failure. This shows that although highly preferable in many situations, specialization either in exploration learning or exploitation learning thus also has its’ downsides, which relates to a higher cost of learning (Demsetz, 1988). This is a good way to conceptualize specialization therefore, knowledge specialization need to be independent of task definition (Postrel, 2002).

**Specialized units.** Simplification mechanisms decompose organizations into domains or units (i.e. functional differentiation) and create hierarchies, in order to reduce the interaction effects of simultaneously learning in complex knowledge-intensive organizations and to enhance learning in each part (Levinthal & March, 1993). These units focus on specific domain that related to different types of specialized knowledge. Under the specialization mechanisms, these units obtain specialization of learning competence and become specialized units which possess unique expertise or professionals. On the one hand, these specialized units become experts in their field as their focus on specialized knowledge reinforces their specialization of learning competence of these units even further. On the other hand, these specialized units are subjects to self-sealing by their social and cognitive boundaries that block them from externally oriented sources of change and learning (Ferlie et al., 2005). Such boundaries have been studied under several terms. As one of the first, Fleck (1979) argued that different interpretive schemes formed thought collectives which affected the development of innovations. This was later termed as “thought worlds” by Douglas (1986), and can be described as “a community of persons engaged in a certain domain of activity
who have a shared understanding about that activity” (Dougherty, 1992, p. 182). Other related research includes labels as communities of practice (Brown & Duguid, 1991) and communities of knowing (Boland & Tenkasi, 1995), in which individuals are thought to be members of several communities that also reach beyond departmental and organizational boundaries. In contrast, specialized units are a result of organizational simplification and specialization mechanisms and thus dictated by the knowledge-intensive organization rather than the individual self-interest like in the cases of communities of practices, or communities of knowing.

**Specialized organizations.** Organizations possess specialized knowledge and specialists. Following the definition of knowledge-intensive firms from Starbuck (1992), we assert that specialized organizations should have specialists at least one-third of the personnel. Some knowledge-intensive firms can be specialized organizations, but not all. As explained before, not all experts are professionals (Starbuck, 1992) or specialists, therefore, only knowledge-intensive firms that have specialists can be considered specialized organizations. Another term for specialized organizations can be found in literature as professional service firms (von Nordenflycht, 2010), in industries such as healthcare, law, accounting, education, etc.

However, literature has not examined the mechanisms of how specialization in terms of knowledge, individual, learning competence and units impede the knowledge transfer in organizations. This is the gap where our paper contributes to when answering the research question “How do specialization affect the transfer of knowledge within and across specialized organizations?”. In the next part, we explain our methodology to study this topic and use hospitals as the context of specialized organizations.

**METHODOLOGY**

This study employs a multiple-case design in order to increase the possibility of direct replication (Yin, 2009). Based on contacts and publicly available information about Norwegian hospitals, 6 public hospitals where chosen as research sites, comprising 2 mid-sized local hospitals and 4 university hospitals. We explain the rationale why we choose hospitals as case study in the next part. The main unit of analysis were surgical departments, as the processes and flow of patients have many similarities within these departments, despite differences in discipline.
Research context

Hospitals face many barriers in the process of enhancing organizational innovation. One of the important reasons is that “few industries have more at stake when teams learn – or fail to learn – than health care” (Nembhard & Edmondson, 2006, p. 942), as failing processes put human life at risk, creating understandable risk aversion against engagement in change processes. The professional organization is created for the purpose of persistence and order, and the prevailing mindset is therefore stability-oriented rather than change-oriented (Mintzberg, 1979). According to Bate (2000), the competing cultures of managerialism and professionalism in hospitals have underlying mindsets like tribalism, conservatism and individualism. Tribalistic cultures are actually found to be anti-innovative cultures (Kanter, 1983), conservatism does not drive change, and an individualistic mindset stands as a contrast with the emphasis of innovation being a collective achievement (Van de Ven, 1986). Moreover, typical starting points of an innovation process may involve performance gaps, which in hospitals may lead to severe causes like permanent discomfort, disability, or death (Huntington, Gillam, & Rosen, 2000).

Hospitals require much coordination, and several vertical and horizontal structural mechanisms are necessary to provide the best patient care, due to diverse levels of competencies among different professions and units (Daft, 1998). Formal implications will therefore ensure that the appropriate medical expertise is available in each functional unit, that the decisions about the patient are made by the right individual, and that the present professions in each department have congruent understanding of the patients’ best possible treatment. Informal implications of this type of hierarchy include power and politics, culture and social networks (Scott & Davis, 2007).

Labeling an organization as specialized implies that specialized knowledge has highest importance of the organizational inputs (Starbuck, 1992). The difficulty of speaking across professional boundaries is closely related to the well-entrenched status hierarchy in medicine, which is already being fostered from the early years of medical training that emphasizes autonomous over collaborative problem-solving (Institute of Medicine, 1999). Therefore, studying the impact of specialization on knowledge transfer in hospital can shed light on both benefit and liability of specialized knowledge.
Sample
The sample logic is convenience sampling and snowball sampling, as interviewees were interviewed during office hours and thus needed to find available time during a busy and sometimes unpredictable workday. In order to include sufficient variation to explore factors related to knowledge transfer, it was aimed to get a fair distribution of individuals in the sample in terms of profession, level of authority and discipline. The sample was thus not selected to ensure a representation of the population of all surgical departments. Due to research ethics, and policy and resource constraints within health care organizations, the department leader was always the first one to be contacted. This leader recommended possible interviewees within the department based on the study’s need for variation and availability of workers. After interviews, the interviewee could give further recommendations to increase the sample. Besides time restrictions for data collection, the sample was increased until the interviewees started replicating answers said by others, which indicated small marginal improvement of interviewing more individuals, and that theoretical saturation was in reach (Eisenhardt, 1989). The non-health background of the author helped to minimize some of the sampling bias in this process.

A total of 47 interviews were conducted over a three-month period. The final sample consists of 20 specialist physicians, 4 physicians, 21 specialist nurses, and 2 assistant nurses, in which their positions are presented in table 1. The interviews had a duration between 30 and 75 minutes.

Table 1: Job positions in sample

<table>
<thead>
<tr>
<th>Education</th>
<th>Job position</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specialist physician</td>
<td>Head of clinic</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Head of department</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Head of section</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Chief physician</td>
<td>5</td>
</tr>
<tr>
<td>Physician</td>
<td>Attending physician</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Resident</td>
<td>2</td>
</tr>
<tr>
<td>Specialist nurse</td>
<td>Head of department</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Head of section</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Head nurse</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Anesthetic nurse</td>
<td>2</td>
</tr>
<tr>
<td>Nursing assistant</td>
<td>OR nurse</td>
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<tr>
<td>-------------------</td>
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<td></td>
</tr>
<tr>
<td>Assistant anesthetic nurse</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Assistant OR nurse</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>47</strong></td>
<td></td>
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</table>

The interviewees got sparse information about the topic in forehand in order to minimize the risk of getting a sample of self-selected group of individuals with high interest and skills in knowledge transfer processes.

**Data collection**

This paper is a result of a larger study on knowledge transfer and innovative behavior in hospitals. Based on the acquired knowledge about the organization and empirical studies on innovation and knowledge sharing and transfer (Szulanski, 1996; Edmondson, 1999), a semi-structured interview protocol was developed for the overarching study about knowledge management in hospitals. Questions were designed to encompass 6 major areas: (1) Need for change/improvement, (2) Knowledge exchange and cooperation within and between departments, (3) Inspiration and incentives for change/improvement, (4) Acceptance of contributions and to speak out, (5) Known spread of change/improvements, (6) Knowledge form of change/improvements. Due to the nature of the study, specific questions (e.g. asking for specific instances of change initiatives) were mitigated in order to be able to compare and see relations between the answers from interviewees with such variety in background. However, the interviewees where encouraged to provide examples of specific cases to clarify or elaborate on their general answers. Some of these specific cases were also used in subsequent interviews to clarify questions for the interviewee. The interview guide is shown in Appendix A.

The first interviews showed that the in forehand logical order of questions were in need for a reorder in order for the questions to give the most meaning for the informant and to get the most information out of each category. By allowing for more deviation of the order of the questions in the beginning of the interview process, the final order of themes and questions fell natural in place after some time and stuck throughout all of the interviews. Indeed, the interview style was rather informal and semi-structured. However, it became clear that by following the relevant topics as much as possible, one more easily could compare and differentiate between the informants’ answers.
Most of the interviews were conducted at the research site, however, some were done over telephone due to the informant’s lack of free time during the workday. Each interview was tape recorded and conducted by two researchers in order to minimize the risk of leaving out questions or identifying instances were follow-up questions were needed. Extensive notes were also taken whenever potential ambiguities or relations were detected by the researchers, which could not be spoken out in front of the informant. These notes were discussed by the researchers after each interview, and the interview was transcribed and added these notes within the following day.

Data analysis
As mentioned, this paper is a result of a larger study on knowledge transfer and innovative behavior in hospitals. Therefore, data analysis for this paper is based on the question of how specialization might affect the transfer of knowledge within and across specialized organizations.

All of the interviews were transcribed and inputted into Nvivo which greatly facilitated the first round of data analysis in particular. Each of the two authors analyze the data independently and looked particular for instances that described how specialization might affect the knowledge transfer process. Tangentially, we developed our own understanding on this phenomenon and discuss our findings together until we can get consensus on our interpretation.

We look at how specialized knowledge which is new, valuable, already implemented can or cannot flow from one unit to another unit that locates within or across hospitals. Information from the interviews relates to failed transfer will be grouped into barriers, while information relates to successful transfer will be group into facilitators. After that, the data was analyzed and grouped into different dimensions from Szulanski’s (1996) model of factors influence knowledge transfer.

FINDINGS
Innovation in hospitals is both top-down and bottom-up, and findings illustrate that the innovations growing from the bottom of the organization is both important and necessary.

“We may have some minor changes and smaller innovation going on from the bottom, and maybe more on the local level. Ergo how to work a bit like this, unpopularly, "smarter and faster". And it often comes from the bottom, because those in production know where the shoe pushes much more than our top managers. And there we can get a lot of innovation. Creation.”

Head of department 2, specialist nurse
However, hospitals as knowledge-intensive organizations with long-standing institutionalized practices have inherent inertial forces that affects their innovative capacity.

There is an inertia and conservatism in the system which in a way is healthy, a healthy skepticism, while being resistant when trying to think in new ways.

Head of section 7, specialist physician

**Specialization in the context of hospitals**

As mentioned in the theory part, hospitals are specialized organizations. All knowledge related to the different professions working at hospitals are related to their medical education. Specialized knowledge in the context of hospitals is a result of professionals with higher academic education, which mainly concerns physicians but also other type of professionals.

A surgery department, the unit of analysis of this study, can be considered as a specialized unit since it contains specialists with specialized knowledge related to surgery. After being employed at the hospital, the surgeons acquire even more domain-specific knowledge through practicing and learning routines, resulting in specialized learning competence. Although the doctor has specialized knowledge, it does not mean that he knows a specific surgical operation. He may have done it before but he does not have a routine on it because of too little experience with the specific operation. Hence, if something goes wrong during the surgery, it is difficult to know whether the failure was a result of the patient’s health or because the surgeon did not have the needed surgical skills. As explained by a specialist physician:

“Why did this [surgery] go wrong? Was it because the patient was half dead and eighty years old and was full of disease from before - or was it because the surgeon did not know what he was doing? (…) when you are a specialist, you have full approval within gastro or urology (…) But if a urologist for example does an operation that he might have done only once before, and does not really have a routine at all, but just goes with any routine he does not know well even though he is a specialist, it does not mean that he knows the surgery.”

Chief physician 2

This specialized learning competence helps the surgeons refine their knowledge and practices which focus only on surgery. As a result, the department develops its specialization in exploitative learning competence, exploiting the surgery knowledge domains.
In brief, specialization is present in our cases in many ways: specialized knowledge of surgery, specialist (as surgeons), specialized learning competence towards exploitative, specialized unit (surgery department). We analyze the impact of specialization to see how this affects knowledge transfer of best practices in the following.

**Specialization as barrier for knowledge transfer**

The difficulty of knowledge transfer is likely to be influenced by the four sets of factors including characteristics of the knowledge transferred (causal ambiguity, unprovenness), characteristics of the source (lack of motivation, not perceive as reliable) characteristics of the recipient (lack of motivation, lack of absorptive capacity, lack of retentive capacity), and characteristics of the context (barren organizational context, arduous relationship) in which the transfer takes place (Szulanski, 1996). The analysis of empirical data related to specialization shows that: (1) specialized knowledge increase the causal ambiguity, unprovenness characteristic of knowledge; (2) specialists lack motivation to share and to receive, they are not perceived as reliable source by other specialists from different domains, they also lack of absorptive and retentive capacity due to the unique nature of specialized knowledge and the exploitative nature of specialization in learning competence; (3) the context of specialized units in specialized organizations are barren and results in arduous relationship. The following text explains the results from data analysis.

**Specialization increases the barriers come from knowledge characteristics.** Barriers for knowledge sharing depicted by Szulanski (1996) is evident by the data. Specialized knowledge is itself a barrier to knowledge transfer. However, not only lack of evidence accounts for unprovenness in a specialized context, but also the presence of evidence, as what constitutes sufficient proof of usefulness is affected. The importance of transfer of both explicit and tacit knowledge, and to have evidence is illustrated by a team acquiring knowledge from another hospital regarding use of a new drug related to children.

Exactly this was simply because it was about treatment of children, and then you want to see how the children react, how does the system work, thus... What should we call it? The human factors around. So you can get it down in a procedure on "how to do it" and so on. But those soft things around are hard to get into a routine.

Head of department 1, specialist nurse
Causal ambiguity. The level of tacitness of the knowledge transferred is one of the main factors in causal ambiguity that makes the knowledge difficult to transfer. This is evident in the dilemma of the transfer of complex best practices entailing specialized knowledge in a context with high safety requirements, as the system requires codification of implemented changes, which is more difficult with higher level of tacitness. Highly tacit knowledge is thus difficult to transfer because it is difficult to codify it, as stated by a chief physician developing a standard technique for specific procedure.

The way we will do it is by demonstration and by tutoring. There is no other way. We can write a procedure in text and deliver, but we are not able to do that.

(Chief physician 1)

Furthermore, a prominent factor related to the complexity of knowledge transferred in the specialized context is found to be related to the amount of different professions that the knowledge affects, and whether the new knowledge implies movement of responsibilities.

Unprovenness. Unprovenness is the lack of proven record of successfulness of the knowledge transferred. It is extremely important that innovations implemented in health care is backed by evidence. Evidence-based medicine has a strong foundation in all communities, and the quality of care and patient safety is the highest priority for all interviewees, as explained by a specialist physician.

You know it takes ten years before a professional news is being implemented. It’s a professional saying. And that is because we are raised to say "why" all the time. We are not good at going and implementing things that are new. I think other occupational groups are better at that because they do not require the same scientific documentation and are not as concerned with the critical attitude and critical thinking we are.

Head of department 7, specialist physician

Lack of evidence is thus related to high difficulty of knowledge transfer. However, it is clear that lack of evidence is not sufficient to explain the difficulties of knowledge transfer in a specialized environment, as also knowledge that has a proven record of past usefulness is difficult to transfer. This should not be confused with the source being not perceived as reliable.

What actually constitutes as good evidence in a specialized context is dependent on several factors related to the evidential knowledge itself. First, specialization entails the presence of
different scientific communities, and thus epistemological differences that affects the analysis of the evidence. Second, personal opinions are also highly present because of learning from direct experience in a problem-solving focused environment, which can be difficult to separate from actual science. This was explained by a physician also holding a professor title as follows.

I find the term knowledge very interesting. Because first you have to know if it is real knowledge, based on science. And this is something vastly different from someone having a strong opinion. The latter is what I define as "religion". Today 30% of what we do is science, and 70% is religion.

Head of section 2, specialist physician and professor

Third, the amount and type of evidence required differs based on type of knowledge/innovation (i.e. level of specialized knowledge). Evidence about medical improvements (i.e. more specialized knowledge) need to be well grounded and explicit and/or experienced by the recipient themselves, whereas improvements related to organizational practices (i.e. less specialized knowledge) do not need the same level of evidence in order to be allowed to be implemented, although strongly preferred and related to knowledge transfer effectiveness. However, the specialized context makes the individuals also require more evidence for more common knowledge than necessary, or devalues or distrusts evidence for usefulness of organizational improvements. Especially when they are regarded as simple improvements or involving complex knowledge. Thus, it is necessary with evidence that proves a significant improvement in performance to be attractive for the recipient. Furthermore, evidence that proves the knowledge/innovation to be exceptionally good may also be rejected because the specialized knowledge at the unit is assumed to be so good that an innovation with much higher performance results compared to status quo is deemed as not possible. Then observation is necessary to prove the evidence.

Specialization increases the barriers related to source of knowledge. The source’s level of specialized knowledge is found to further amplify (i.e. positively moderate) the barrier of lack of motivation and perception of unreliableness.

Lack of motivation. Several motivational factors of the source have been found to affect knowledge sharing due to increased specialization. First, the most prominent reason for why individuals do not share is because they feel that they are so special, and that others also are special, as explained by a head of department in a large hospital.
I think the main reason, if you are asking about the main reason why I think that we are not good to share, is that everyone believes that they are so special. That it is difficult ... That they think that it is impossible to generalize. And that what they themselves find being a good initiative perhaps is something that no other think is a good initiative.

(Head of department 1, specialist nurse)

Specialization also make individuals not realize about the possibility of sharing innovations related to generalizable knowledge when they have a different medical specialty than the possible recipient, although they work in neighboring operating rooms. This even when they do not have highly specialized competence relative to other employees. Second, specialization creates fear of speaking up in presence of status difference. Third, knowledge sharing between different medical specialties, but within the same profession, is impeded because of a culture of respect for others’ specialized knowledge and competence. This is more evident the more specialized the individuals are. Fourth, specialization creates competing forces which makes the source afraid to loose ownership and a position of privilege. Such forces are also evident at arenas that could have facilitated knowledge transfer across knowledge domains like the acute are, in which different medical specialties have different resource demands (for example urgency of treatment of patient). Fifth, increased specialization makes actual work time within specialized domain more valuable because few individuals can replace this individual, which gives incentives to not using time on knowledge sharing across domains.

**Not perceived as reliable.** Several interviewees referred to incidents in which they shared knowledge about improvements that they had personal experience from in other work relations, but got rejected because they were not seen as trustworthy or knowledgeable. This were evident in three different cases. First, when the source had different medical expertise than the recipient (i.e. lack of appropriate specialized knowledge according to the knowledge transferred).

My job in the armed forces makes me learn a little about pain management in war. And I have tried to get that into [hospital name] or asked for advice if it could be implemented [at the hospital], and it was very adverse. (…) “[Own name], who works at the orthopedics is a cowboy”, it was said from the highest level. So I was told by my boss that he had to calm down.

Resident 2, not an anesthetist
Second, when the source had the same medical expertise, but were positioned lower in the hierarchy (i.e. lower/lack of specialized knowledge). Third, when the source had the same medical expertise, but had had the job position a relatively short amount of time. This was independent of position in hierarchy and level of relevant specialized knowledge, but still connected to specialization in that seniority implies more reliable specialized knowledge.

**Specialization increases the barrier related to the recipient of knowledge.** The recipient’s level of specialized knowledge is found to amplify the lack of motivation, and lack of absorptive capacity.

**Lack of motivation.** Several motivational factors by the recipient have been found to affect knowledge reception. First, they are not motivated to learn from others because they do not understand what they do in the other specialized units, besides having different work processes. Second, increased specialization and seniority is related to conservatism that impedes motivation.

No, I am quite sure that 50 years from now as they will do exactly the same. It is conservatism. They are not used to anything else. They have not seen anything different.

They are born and raised in this system.

Attending physician 1

Third, they may feel no sense of urgency of need for improvement of organizational practices. Fourth, the specialized recipient thinks that simple innovations are not necessary (like checklists), because they do this sort of anyway. Fifth, they are so specialized and highly competent in their field that they show signs of elite values and get offended when someone offers new knowledge.

It's the profession. It is the different professions’ feeling of safeguarding their territories in a way. You have to carry your own profession on a gold chair and it should not be disturbed by others.

Chief physician 1

Sixth, specialization is related to individualism. Seventh, the more specialized individuals are, the more academic responsibility for the patient they have. They are thus more motivated to receive more specialized than common knowledge related to organizational efficiency. Eight, specialization makes individuals blind towards other superior routines. Ninth, the motivation to receive knowledge need to be present for several different professions.
Lack of absorptive capacity. Lack of relevant stock of knowledge is only the case for specialized expertise, as the individuals are able to share general knowledge with other individuals in this case (i.e. in terms of professional education and/or medical expertise/specialization).

Lack of retentive capacity. The more specialized and institutionalized routines, the more difficult is it for the individuals to utilize new knowledge and discard old routines.

What is so marvelous is that when I present this and stand in auditoriums with hundreds of people and representation from all professions and it’s an almost jubilant consensus to everything I tell, just about everyone totally agrees; “this is super-smart”, We want it. Then they fail to implement it. It's incomprehensible, almost incomprehensible…

Chief physician 1

Specialization increase the barriers related to organizational context. Common organizational responses to specialization affects the individuals’ perceived alienation from other specialized units, and impedes knowledge transfer.

Barren organizational context. Specialized knowledge and specialization of competence (i.e. specialized units) manifests itself by hierarchies and functional differentiation. This affects knowledge transfer in several ways. First, specialized units separate knowledge domains geographically which impedes interaction and understanding between specialized individuals.

They believed that all operating professions could go horizontally in the organization. That people who worked on the orthopedics could equally help in neuro or women-children and so forth. Then we see that in reality we have become so specialized, and people are not enough into that loop (...) to make them secure and good at the interdisciplinarity.

Head of department 2, specialist nurse

Second, extensive use of hierarchies dictates knowledge flow which impedes direct communication between different type of professionals and specialized domains and favors knowledge flow according to the motivations of the hierarchy.

The top management consists of 20 clinic managers and all 20 are physicians. So the nursing service is in a way eradicated - there are no one who speaks their case, nobody is ensuring transfer of competence.

(Chief nurse 4)
Use of hierarchies for communication across units also make individuals falsely believe that their knowledge is being transferred. Third, increased specialization reduces the ability of being rotated to other departments, and thus reduces the ability to know what other departments do. This yields for all professions. Fourth, specialization narrows focus within units and impedes formation of cross-functional forums and arenas for knowledge sharing. Fifth, specialization makes it harder for top management to represent every profession in transferring knowledge. Sixth, specialization creates cohesive units which impedes knowledge transfer.

**Arduous relationship.** Arduous relationships are present in hospitals between specialized units that share very little generalizable and specialized knowledge. Findings show little knowledge transfer between these departments about best practices.

The summary of these effects and selection of corresponding quotes is presented in Table 2.

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**Specialization as a facilitator of knowledge transfer**

Although specialization adds more difficulty for specialized knowledge to transfer, the data reveals supporting evidence for showing that specialization facilitates knowledge transfer within and across hospitals under certain conditions.

**Specialized knowledge as facilitator of knowledge transfer.** The main barriers related to the characteristics of the knowledge transferred were found to be related to increased complexity and tacitness, and that requirements for evidence were heightened, both for specialized and general knowledge (often unnecessary). However, knowledge about innovations that are line with the organizations’ core values and performance measures, like safety and quality, spreads more easily, as explained by a specialist physician.

The simplest knowledge to spread to other departments is when new instruments arrive that we experience has increased safety and enable us to operate in a more easy and reliable way. That is by far the simplest. It spreads like wildfire.

*Head of department 3, specialist physician*

Furthermore, scientific evidence is more valued and more easily shared than knowledge that comes from own experience when the knowledge is relatively new, especially when the source has lower
or unknown level of experience related to the recipient. This is also the case across specialized domains. Within specialized domains, specialized learning competence is more valued and facilitates transfer.

**Specialists as facilitator of knowledge transfer.** Many different barriers were related to specialized individuals and some of the main ones was found to be lack of motivation because a feeling of being special/unique, not realizing presence of generalizable knowledge, and interpersonal barriers including higher threshold for considering individuals as reliable sources, and status difference. Being a specialist implies to be up to date on specialized knowledge in the relevant field, and thus always being able to perform their best. The recipients are more motivated when they see an opportunity that knowledge can become even more specialized and being able to give the patients a treatment with increased quality.

> The best incentive is when the individual experiences that the quality of the job done increases. It is not necessarily salary, it is not necessarily that you get a more comfortable working day. But it is when you can get an understanding that the quality of what you do gets better.

Head of department 3, specialist physician

This focus is one of the most prominent conditions for specialists actively sharing and receiving knowledge, and the efforts are directed both within and across organizational borders within the same specialized knowledge domain. In the same vein, the source is more motivated to share knowledge when they know their knowledge is relatively unique and highly needed by others, both within and across hospitals. This transfer was especially evident from larger to smaller hospitals, within the same specialized knowledge domain. Furthermore, more specialized individuals are also perceived as most reliable sources.

Interestingly, the findings indicate that the most knowledge transfer across specialized domains is when the obvious specialist does not find a solution for the patient, and when a hospital receives a patient with an especially complex case. Then the specialists are more open for the solution not lying in their own knowledge domain, and shares and receives knowledge far more easily. Hence, a specialist is more likely to identify when the solution to a task lies outside own specialized knowledge domain, and thus facilitates knowledge transfer across domains.
Specialized learning competence as facilitator of knowledge transfer. According to the findings on barriers, organizational innovations in specialized organizations are often so tied to local considerations (i.e. staff, buildings, other resources) that specialization in exploitation learning creates barriers for specialists realizing transferability between specialized units. Also, such specialized learning makes it difficult for the specialized units to retain new knowledge.

Most surgical departments focus on specialization in exploitation in order to improve performance. However, specialization in exploration learning is found in hospitals which receive complex cases that other hospitals have not managed to solve. Here, the specialists are more exploratory and knowledge flows more easily, as mention in the section of specialists.

Specialized units and specialized organization as facilitator of knowledge transfer. The findings show that formal mechanisms including functional differentiation and use of hierarchies are significant barriers to knowledge transfer across specialized units and knowledge domains, which further amplifies specialists’ lack of motivation and reliability. However, formal mechanisms in specialized organizations are also facilitating knowledge transfer across specialized units in the following manner.

First, some operations require specialized knowledge from several domains. This is the case for the acute area and patient pathways across several specialized units, creating distinct networks for knowledge transfer within hospitals. The degree of interdependence between specialized units is varying, depending on task type and patient flow. The higher interdependence, the more contact areas and higher possibility that knowledge transfers across domains.

Second, specialization on tasks that involves job rotation across specialized units is one of the most important factors for knowledge transfer across knowledge domains. Job rotation enables individuals to acquire direct experience from other departments which they subsequently share with their home departments if they perceive the knowledge as improving own performance. This yields nurses and anesthetics which have specialized knowledge that can be used in surgery in many knowledge domains.

Third, the formal system of communication simplifies knowledge flow within units, and serves as good foundations for discussing improvements, and for implementing top-down innovations. However, this formal system also makes transfer of knowledge across units more difficult. Only selected individuals with specialized knowledge and high hierarchical positions (mostly specialized physicians) are included in formal arenas that function as bridges between
different specialized units, in which departmental improvements are discussed. Triggered by the exclusion from these formal arenas, Chief Nurses at different units are found to create their own informal network for experience exchange across domains, without management support or knowledge. These informal channels ease the acquisition and transfer of general relevant knowledge across departments within hospitals.

When I discover things that we could do differently or think differently about, I believe informal channels are more important [than formal channels]. Because then I can set the agenda I want, enlighten the problem definition I want, and initiate the interaction I want.

Chief nurse 5

Moreover, the lower the individual is in the hierarchy, the more informal mechanisms of knowledge acquisition are found to be present. This is a result of personal relations established through job rotation. Interestingly, these are channels are only used for asking about needed knowledge, but never for telling about knowledge that can be of use.

**DISCUSSION**

It is argued that most innovation happens in interface between disciplines and specializations (Leonard-Barton, 1995), in which specialized organizations should be a good context for knowledge creation and knowledge integration. However, such organizations are also especially prone to obstacles because their increasing specialization which is suggested to impede knowledge sharing (Ferlie et al., 2005).

The findings in this study indicate that specialization leads knowledge-intensive organizations to miss out on attractive possibilities for spurring innovation and transferring best practices. The presence of well-known barriers for knowledge transfer (Szulanski, 1996) is clearly evident in this study. However, specialization is found to amplify the impeding effects of these barriers, in addition to making the barriers reinforce each other.

**Specialized knowledge crowds out generalizable knowledge**

Specialization increases the complexity of knowledge related to organizational improvement, especially when several professionals are involved, and when the improvement dictates changes in
responsibilities. However, findings in this study show that the biggest concern is related to motivational factors, because specialization is found to make specialized knowledge crowd out generalizable knowledge, which manifests itself in lack of motivation to share and acquire new knowledge across specialized domains, even if the knowledge is purely general.

Human actors are not scientific or rational despite close association with knowledge (Alvesson, 1993). Lack of motivation to share or receive knowledge is related to the crowding-out effect in several ways. First, independent of level of specialization, individuals in specialized units are less able to realize the existence of general knowledge that may benefit themselves or other parts of the organization to improve their practice. This resembles what Starbuck (1992) denotes as perceptual filters. This is one simple but forcefully barrier that impedes synergies among the units that are operationally similar. Second, specialists favors specialized knowledge. Specialization makes specialists prefer to acquire specialized knowledge rather than general knowledge which can spur organizational innovation. Third, specialization also increases the requirements of proving the usefulness of general knowledge on the same or higher level than for specialized knowledge, which creates higher barriers for both sharing and acquisition.

**Informal mechanisms facilitating knowledge transfer**

Specialization facilitates knowledge transfer of specialized and general knowledge within the same knowledge domain, and impedes knowledge transfer of both types of knowledge across different knowledge domains. Thus, knowledge exchange across organizational boundaries is frequent within the same specialized domain. However, the findings indicate that because of the crowding-out effect, motivation for knowledge sharing and acquisition between individuals across specialized domains does not increase without formal mechanisms that actively forces interaction between these domains and thus increases their cross-functional understanding for generalizable knowledge.

Previous research have identified several factors that decrease barriers of specialization, including common ties (Hansen, 1999), knowing who knows what (Orlikowski, 2002), and shared processes (Eisenhardt & Santos, 2002). Ferlie et al. (2005) also assert that social and cognitive boundaries between communities of practice can only be overcome through social interaction, trust, and motivation. In line with this literature, this study finds that increased knowledge transfer across units is only found between individuals that have established personal relations. The inefficiency
of channels for knowledge exchange and sources of alienation that lies in the differentiated and hierarchical system of knowledge-intensive firms triggers individuals to seek informal communication channels for the acquisition of new knowledge. This urges for attention for developing increased understanding between individuals across specialized domains in order to spur innovation and the transfer of best practices.

CONCLUSION

Our study found that specialization prevents knowledge-intensive organizations from attractive possibilities for organizational synergies in terms of spurring innovation and transferring best practices. Specialization is found to crowd out general knowledge, and trigger informal mechanisms for the acquisition of knowledge. By examining specialization, this paper contributes to both theory and practice. Theoretically, the concept specialization is explored in different ways of manifestation - from specialized knowledge, specialization of learning competence to specialized unit structure of organizations – and different effects on knowledge transfer – from impeding to facilitating. The practical implication calls for the importance of organizational support for increased cross-functional understanding across specialized domains in order to spur innovation and the transfer of best practices.

Like the natural systems perspectives view organizations as first and foremost collectivities; innovation is a collective achievement (Van de Ven, 1986). Innovation is a social-political process of pushing and riding new ideas into good currency, where the individuals need to devote energy and commitment, which is more an informal than formal process (Van de Ven, 1986). By being incorporated into the formal structure, innovation is routinized and regularized, which eliminates the need for surpassing talent (Scott & Davis, 2007). Without leadership supporting a change in the criteria of evaluation (double loop learning), formal structures and systems focus the attention of the individuals to routine (single loop learning), not innovation (Van de Ven, 1986). In creating an infrastructure that is conducive to innovation, the organization’s character or culture is the central responsibility of institutional leadership (Selznick, 1957). This emphasizes the need for informal practices that break out of the rational systems key elements (but not exclude) to render and encourage innovation in organizations.
References


The interview guide used in the interviews is presented below:

**Description of the project:**

- Clarify with the interviewee: We have no interest of patient sensitive information. You and your hospital will be anonymized in the study. We will only highlight the characteristics of the hospital. The interview will be recorded, but neither recording or transcription will be distributed to anyone other than us and our supervisor without your consent.
- Working methods and procedures are emphasized in terms of improvement and knowledge flow. If factual knowledge (what the various professions know) are relevant for the flow of information, this can be included by the interviewee.
- Point out that "you" implies the same subdivision. If all info about the entire surgical department of interest, this is pointed out that in question.
- No questions are related to flow of knowledge within the department, only about work environment and improvement processes.
- By "subdivision" means those under surgical department.
- By "department" means the department of surgery.
- By "departments" means all departments at the hospital.
Table 2: Specialization as barrier of knowledge transfer

<table>
<thead>
<tr>
<th>Characteristics of the knowledge transferred</th>
<th>Effects of specialization</th>
<th>Quotation exemplifying the effect of specialization</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Causal ambiguity</strong></td>
<td>Specialization increases tacitness</td>
<td>The way we will do it is by demonstration and by tutoring. There is no other way. We can write a procedure in text and deliver, but we are not able to do that. (Chief physician 1) You would want to write down a complex change. It is almost a requirement that you must document why you do it. (Head of department 7, specialist physician)</td>
</tr>
<tr>
<td>Causal ambiguity - Ambiguous knowledge</td>
<td>Specialization makes knowledge complex because of increasing number of individuals affected</td>
<td>The more different departments and workgroups that are involved, the more complex it becomes. The latest example was a non-complex change, because it only involves nurses. They did not go to different sections, departments or other working groups. Patient pathways [including standardized guidelines] is extremely complex because it includes both many academic departments and workgroups. It almost becomes a three-dimensional image in a way. (Head of section 4, specialist physician)</td>
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<tr>
<td>Unprovenness</td>
<td>Specialization makes knowledge complex when it dictates changes in responsibilities</td>
<td>I believe that complex changes are those in which you move responsibilities. (Head of department 7, specialist physician)</td>
</tr>
<tr>
<td>Unprovenness - Lack of proven record of successfullness</td>
<td>Specialized context demands evidence</td>
<td>Exactly this was simply because it was about treatment of children, and then you want to see how the children react, how does the system work, thus... What should we call it? The human factors around. So you can get it down in a procedure on &quot;how to do it&quot; and so on. But those soft things around are hard to get into a routine. (Head of department 1, specialist nurse)</td>
</tr>
<tr>
<td>Unprovenness</td>
<td>Specialization may entail epistemological differences</td>
<td>For example, we see crisscross medicine and surgery that there is a lot of different thinking about this with treatment and that part there. And medical doctors think differently about their subject areas and their duties. (Chief nurse 4)</td>
</tr>
<tr>
<td>Difficulty to separate opinions from actual science for specialized knowledge</td>
<td>I find the term knowledge very interesting. Because first you have to know if it is real knowledge, based on science. And this is something vastly different from someone having a strong opinion. The latter is what I define as &quot;religion&quot;. Today 30% of what we do is science, and 70% is religion.</td>
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<tr>
<td>(Head of section 2, specialist physician and professor)</td>
<td>Specialization increases requirements for amount and type of evidence</td>
<td></td>
</tr>
<tr>
<td>You must have seen that it is a smart thing to do. And you must have experienced yourself that it is working.</td>
<td>(Anesthetic nurse 2)</td>
<td></td>
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<tr>
<td>Specialization makes evidence of obvious improvements be distrusted</td>
<td>This is more about structural changes, not professional. How we organize our everyday lives. How we organize our communication and interaction. And if it seems very banal, it may be that it's too simple for us to think that it works.</td>
<td></td>
</tr>
<tr>
<td>(Head of department 7, specialist physician)</td>
<td>Specialization makes evidence of improved performance devalued if the knowledge is complex</td>
<td></td>
</tr>
<tr>
<td>Although it would be a gain [from implementing], it sure is the organizational changes that are most difficult to transfer.</td>
<td>(Head of department 3, specialist physician)</td>
<td></td>
</tr>
<tr>
<td>Specialization makes evidence with significantly performance improvement being distrusted</td>
<td>I think it is most effective [for spreading a specific practice innovation] to see that it works. Because no one believes that one can do five operations [of a specific type of procedure] consecutively in the operating room. Without having seen it.</td>
<td></td>
</tr>
<tr>
<td>(Chief physician 1)</td>
<td>Characteristics of the source of knowledge</td>
<td></td>
</tr>
<tr>
<td>Lack of motivation to share knowledge</td>
<td>Specialization makes individuals feel special/unique</td>
<td></td>
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<tr>
<td>I think the main reason, if you are asking about the main reason why I think that we are not good to share, is that everyone believes that they are so special. That it is difficult ... That they think that it is impossible to generalize. And that what they themselves find being a good initiative perhaps is something that no other think is a good initiative.</td>
<td></td>
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</tr>
<tr>
<td>(Head of department 1, specialist nurse)</td>
<td>Specialization makes individuals think that others are special/unique</td>
<td></td>
</tr>
<tr>
<td>Yes, they are special, very special. Not least all the new technology they are using.</td>
<td>(OR nurse 10)</td>
<td></td>
</tr>
<tr>
<td>Specialization makes individuals not realize presence of generalizable knowledge</td>
<td>I do not know. Now... We work in a very special way, we are a very closed ward at the hospital.</td>
<td></td>
</tr>
<tr>
<td>(OR nurse 4)</td>
<td></td>
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</tbody>
</table>
| Specialization creates fear of speaking up | The threshold is high. And it is very often that you do not dare to say anything wrong about another profession. There are quite a few barriers. It hangs deep for a nurse to criticize a doctor, but it is also quite a matter of a doctor to criticize a nurse.  
(Head of department 7, specialist physician) |
| Specialization creates respect that impedes sharing | But it’s quite a good example of the old good grub school, said with a bit of respect  
(Chief physician 3) |
| Specialization creates competition | If someone does not tell that he does something [new and good], he is able to do it very much himself and will become personally very good in the procedure. It is bad for the exchange of experience, but good for him who keeps it for himself. Then he can publish if he has enough patients or...  
(Resident 2) |
| Specialization makes work time in own domain more valuable | It is difficult to motivate colleges to meet because they think it [interdisciplinary meeting] is a waste of time.  
(Head of section 4, specialist physician) |
| Not perceived as reliable by recipient | My job in the armed forces makes me learn a little about pain management in war. And I have tried to get that into [hospital name] or asked for advice if it could be implemented [at the hospital], and it was very adverse. (...) “[Own name], who works at the orthopedics is a cowboy”, it was said from the highest level. So I was told by my boss that he had to calm down.  
(Resident 2, not an anesthetist) |
| Specialization favors high hierarchical position | It is certainly not the residents, it’s the chief physicians [that are enough trusted] to carry out.  
(Resident 2) |
| Specialization favors seniority | Yes, they listen [to my suggestions], but after I have come up with 50 proposals they say "oh well, but you began here two weeks ago, and [you think] we are supposed to turn everything upside down..."  
(Attending physician 1) |
| Characteristics of the recipient of knowledge | Specialization makes individuals not realize presence of generalizable knowledge |
| Lack of motivation to receive knowledge | They have completely different challenges so basically I do not think it is appropriate to learn from their processes. But I really do not know because I do not know what they do!  
(Head of section 4, specialist physician) |
Specialization and seniority is related to conservatism

No, I am quite sure that 50 years from now as they will do exactly the same. It is conservatism. They are not used to anything else. They have not seen anything different. They are born and raised in this system.

(Attending physician 1)

Specialization makes individuals not realize that change is needed

And then finally when he has listed a whole bunch of [organizational] measures which are standard platitudes, in my opinion, I said “what about the flow in the surgery department? There you can gain a lot, there is a lot of effect to gain there?” “Yes, that's true, yes” (...) He has been named one of the better leaders in health care and yet it is so far away to grab this old way of working that you almost do not even think about it, even though you've heard that it's wise [to do]. It's amazing ...

(Chief physician 1)

Specialization makes individuals assume that they already apply simple improvements

You do not think that you need to do it because you always do it anyway. It is precisely the difference between practice and perception.

(Chief physician 2)

Specialization creates elite values

They think that “why should I roll on a bed when I have worn the h* out of me six years in school. I am better than that”.

Some groups of doctors are very for that they should have free flow of their own whims, because they are kings, after all. “I can do as I want and what I do is the cleverest of all.” Many think like that.

(Chief physician 1)

Specialization is related to individualism

There is also a lot about culture and who decides and who really feels they have the authority to define their own working day.

(Head of clinic 2, specialist physician)

Specialization may down-prioritize general processes

Knowledge about more day-to-day activities that maybe are far from our professional specialty, like knowledge about the organization, health, environment, and safety, and so on, is much harder to spread. Plainly because it does not spontaneously interest us. There are many other things we would rather do than learn about organizational charts and such.

(Head of clinic 1, specialist physician)

If a department does not consider themselves to have significant challenges around a situation, then it will always be like "yes, but this we have resolved this ourselves." ”This actually works perfectly fine with us.”

(Head of department 3, specialist physician)

Specialization makes individuals blind towards other superior routines

If you do something new that the others have spent 20 years on developing, then you say indirectly that what you have done for 20 years is not quite right anymore. And many of the elderly do not realize that they have not done anything wrong, because with the knowledge they had 20 years ago it was the right thing to do.
### The Impact of Specialization on Knowledge Transfer

#### Specialized units require the inclusion of several individuals

We had been working with these things [a new procedure for patient handling] for quite a while before we actually realized that it would not be of any help if we just chanted that this is how they do at other hospitals. Everyone in the value chain had to join the observation and see the process with their own eyes. Surgical nurses, anesthesia nurses, and definitely anesthesiologists had to be present and actually see that things could be done differently. Only then were we able to do improvements.

(Head of department 5, specialist physician)

#### Lack of absorptive capacity

Lack of relevant stock of expertise  
Specialization creates unique stock of expertise and makes it difficult to exploit knowledge from other knowledge domains

We operate with completely different diseases. So when it comes to the disease itself it is so distinctive to that department that it is not possible to learn other departments.

(Head of section 3, specialist physician)

#### Lack of retentive capacity

Lack of ability to discard old routines  
Specialization makes it more difficult to discard old routines

It is harder to do something new than to do the old. And that applies to very much. It applies to both the simulation training and other types of patient care where there are established routines.

(Chief physician 2)

**What is so marvelous is that when I present this and stand in auditoriums with hundreds of people and representation from all professions and it's an almost jubilant consensus to everything I tell, just about everyone totally agrees; “this is super-smart”. We want it. Then they fail to implement it. It's incomprehensible, almost incomprehensible...**

(Chief physician 1)

### Characteristics of the context

#### Barren organizational context

Lack of supporting infrastructure  
Specialization leads to geographical separation

We are [gathered in] a department, but for example, radiology has been split into five. I have heard from them that it has become a problem that knowledge exchange has been reduced because they have been split like that up.

(Head of section 4)

Specialization leads to use of hierarchies which dictates knowledge flow

The top management consists of 20 clinic managers and all 20 are physicians. So the nursing service is in a way eradicated - there are no one who speaks their case, nobody is ensuring transfer of competence.

(Chief nurse 4)

Specialization leads to use of hierarchies that make people falsely believe that knowledge is transferred

How much it has spread further I do not know. I do not know. But we are going to be ISO-certified, so I assume it's one... They spread the idea from above. (...) I have informed up in the system and we have had teaching in the division and so on. But I have not followed up if the rest of the hospital does it.

(Head of department 1, specialist nurse)
Specialization reduces the flow of personnel between units

I see that the specialization of daytime operations, when you get to shield the operating room and so on, can be very good. That things become more effective when there are the same people who do the same things. So I see that. As regards to professional development and the subject as a whole, I think it’s bad. I almost never seduce anymore with cranatomy, i.e. in the head of major neurosurgery, for example. And there’s really no reason we could not do it.

(Chief physician 3)

They believed that all operating professions could go horizontally in the organization. That people who worked on the orthopedics could equally help in neuro or women-children and so forth. Then we see that in reality we have become so specialized, and people are not enough into that loop (…) to make them secure and good at the interdisciplinarity.

(Head of department 2, specialist nurse)

Specialization narrows focus within units and impedes formation of cross-functional forums and arenas

Surgical departments like urology, otorhinolaryngology, plastics and gastroenterology have a very small professional common denominator, which in turn makes it difficult to collaborate. But when it comes to things like patient flow and the way to organize the outpatient clinic, for example, it may be good to cooperate, but there is no forum for it.

(Chief physician 2)

Specialization makes it harder for top management to represent every profession in transferring knowledge

The board of directors today consists of a director of communications who has nothing to do with the operations, a CEO who tries to keep an eye on everything, a director of economics who keeps track of the economy. There is also a director of interactions, and so is an organizational director who does not been at the inpatient ward. Other than when he has walked through. That’s how it is. And you cannot expect that they know it either.

(Chief nurse 4)

Specialization creates cohesive units

I imagine that you do not have to reinvent the wheel every damn time you try something, everywhere. But that is what characterizes health care, especially public health care. All units are very independent and feel that they are most important.

(Chief physician 1)

**Arduous relationship**

Laborious and distant relationship

Specialization impedes relations between units

So there might be more acceptance for them coming up with ideas, but the others, we do not know them. We do not know who is working there, we have no clue. So they live in their bubble, and so do we.

(OR nurse 9)

It depends on if you have good contact with another department, then I do not think it is so difficult. If you know the other people you are asking for help or know the other department well I do not think it is hard. But if you are trying something new with someone you do not know then I think it might be a bit difficult.

(Resident 2)