

Abstract

In this article, I explore what happens when general practitioners (GPs) and specialists meet using videoconferencing to collaborate on a patient's treatment. By using videoconferencing, GPs and specialists are offered opportunities to share and produce knowledge. The data corpus is 42 videotaped videoconferences wherein the treatment of one specific patient was discussed over a period of nine days in a total of five videoconferences. I describe how GPs and specialists discuss treatment strategies and exemplify how knowledge sharing creates opportunities for learning in boundary zones across activity systems as a part of daily practice. The talk about the treatment occurs by information exchange and by consultation. Information exchange without any dilemmas presented may support decisions at one activity level. Consultations wherein dilemmas are presented and solved by bridging knowledge gaps between the general practitioner and the specialist create opportunities for learning in the boundary zone between the activity levels.

Keywords

communication, medical; decision making; group interaction; health care professionals; knowledge construction; quality of care; technology; workplace

Important strategies for improving the flow of information within the health sector include electronic collaboration between levels of care to promote a continuity of care (Norwegian Ministry of Social Affairs & Norwegian Ministry of Health, 2006). Collaborative work between general practitioners (GPs) in local medical centers and specialists in hospitals is an action that supports this vision (Ministry of Health and Care Services, 2008). As Garåsen and Johnsen (2007) showed in an empirical study, written information between levels of care often is insufficient, and communication between GPs and specialists needs to be improved. The use of technology, for example, videoconferencing, makes it possible to collaborate and improve communication when the GP and the specialist are geographically dispersed. At the same time, the health care services are able to deliver patient treatment where the patient geographically resides. Instead of the patient being relocated, new tools for communication between physicians are supported, thereby moving the knowledge and expertise to the patient's location.

Collaborative work using videoconferences, i.e., real-time video communication between hospitals and local medical centers, enables knowledge sharing between professionals who are geographically dispersed. The patient receives specialized services where he or she lives, and the GP can oversee the patient's treatment with the support of a specialized team. To improve the communication and the flow of information between the levels of care, some GPs and specialists in Norway have implemented regular videoconference meetings. This collaborative work using videoconferencing led to the two research questions in this article: (a) What kind of knowledge sharing takes place in collaborative work? (b) How can collaborative work lead to learning in daily practice?

Collaboration among GPs and specialists points to a set of aspects that might affect the information exchange processes and the quality of the content in collaborative practice. Several studies have focused on the exchange of information in the referral process, for

example. Overall, GPs and specialists show mutual respect and want to collaborate and build personal relationships with each other (Marshall, 1998a). Since GPs function as gatekeepers to the specialist service, they also initiate collaboration and control referrals and patient flow to specialists (Piterman & Koritsas, 2005a). Typically, the quality of information in the referrals has served as the core of continuity for treatment. However, specialists and GPs express different expectations. Specialists expect GPs to include all relevant information about the problem, such as an adequate patient history. GPs expect a clear response regarding diagnosis, management, and a course of action (Piterman & Koritsas, 2005b). A recent study found that only half of the referral letters in the sample contained satisfactory written information, and this can pose a risk for patients. Hence, establishing consensus about the content and form of professional communication between levels of care is necessary (Garåsen & Johnsen, 2007). Mertala (2009) discussed how the care chain among physicians working in primary and secondary care breaks down because the information flow between them is uncertain. “Knowing together”—that is, sharing information about everyday routines and detailed information about a patient’s situation with a dialogic orientation—might achieve better results for the specialist and the GP. No one is expected to know everything, but cooperation gives them the knowledge they need.

Close collaboration with a more experienced physician is a source of learning that goes beyond what individuals manage by themselves and contributes to the professional development of physicians (Akre & Ludvigsen, 1997). Learning through collaboration in daily medical practice, such as through clinical instruction and interaction through written referrals, is a potential method for exchanging knowledge and learning from specialists to GPs (Marshall, 1998b). Collaboration between specialists and GPs may serve to train GPs, but specialists do not think they have much to learn from GPs (Berendsen, Benneker, & Schuling, 2006). In addition to looking at medical doctors’ (MDs’) opinions about their own

potential for learning through collaborative work, how they, as a group, may develop and how this affects the organization of medical work should be included.

Studies about collaboration in medical work using videoconferences have largely focused on the role of technology, e.g., the videoconference as an effective tool for information exchange, especially in the transfer and discharge of patients and with challenging patient cases (Mitchell, Cherry, & Kennedy, 2005). Collaborating and interacting involving referrals using videoconferencing shows that the videoconference may improve communication between levels of care and offer educational benefits for participants conducting joint orthopedic consultations (Harrison, Clayton, & Wallace, 1996). These studies, however, were concerned only with the role and potential benefits of the use of technology and did not examine the content of the collaborative work and how learning might occur.

Previous research into communication between GPs and specialists has consisted of studies that mainly reported written, asynchronous communication or compared synchrony and asynchrony in communication between caregivers (Conn et al., 2009). None of these studies focused on talking and professional knowledge sharing. This article, then, contributes an account of actual content in real-time, synchronous collaborative work. The focus is on the exchange of knowledge between the GPs and the specialists, and how collaborative work may close knowledge gaps in daily medical practice. The article differs from previous studies of the cognitive capabilities of an individual MD by focusing on how professionals in a distributed medical system collaborate to produce relevant and useful knowledge for solving the problem at hand.

The videoconference replaces or supplements the use of written or telephone referrals and second opinions by telephone between the hospital and the local medical center. A videoconference gives the opportunity for medical talk in a two-way process, which expands

the opportunities for written referrals. Medical talk between GPs and specialists about patients has, unfortunately, barely been examined (Iedema, 2006). To a large extent, studies on medical talk have focused on the dialogue between doctors and their patients (Mishler, 1984) or on talk within team meetings inside a single department (Arber, 2008). The small body of research available suggests that the content of medical talk affects the development of the diagnosis (Cicourel, 1990). Since individual medical professionals use different recourses for knowledge, the professionals promote different kinds of knowledge in medical talk (Atkinson, 1995) motivated by different collective conditions and voices (Måseide, 2003, 2006). An understanding of the processes of collaborative work through medical talk constitutes a resource for understanding learning opportunities and for the continuity of care.

My aim with this study was to explore how a distributed health service is practiced when collaborative medical work is conducted between geographically dispersed professionals. In the article, I analyze the interaction in collaborative work between GPs and specialists who shared knowledge about the treatment trajectory of a patient. The GP and the specialists exchanged different types of knowledge and competences, i.e., asymmetrical expertise, expanded the division of labor, and created situations where learning might occur. The analysis presented here is part of a larger study of learning and the exchange of knowledge in medical talk between GPs and specialists (Author, 2008). In this article, I analyze and discuss dilemmas in medical talk, as the medical treatment evolves, to explore how knowledge sharing between GPs and specialists creates learning opportunities. A close examination of the interactions through video recordings provides a deeper understanding of the collaborative work itself, the knowledge sharing, and how collaborative work over time creates situations where learning might occur. In contrast to previous studies that examined MDs' opinions about their own talk and potential for learning, this article provides insight into the medical talk and interaction when the GP and the specialist collaborate.

This article is organized as follows: I describe the organization of health service delivery in a historical and organizational context. Then, I present my account from an activity theory point of view to frame the study and to frame my understanding of the social organization of medical work. Video-recorded observations of collaborative work on the same patient in five real-time videoconferences are the main source of empirical data. In this particular example, the case of a patient suffering from kidney failure and rectal cancer exemplifies a treatment trajectory, and I demonstrate how knowledge about treatment is exchanged through talk between practitioners on different levels of care. By analyzing this trajectory, I point to knowledge sharing and collaborative work that lead to opportunities for learning in daily medical practice.

The organization of the health service

The health service in Norway is organized into two levels of care: the community health care system and specialist services. In the community health system, GPs offer services in their offices as well as in local, intermediate medical centers. Specialist services include public and private clinics and hospitals. To support the continuity of care, local intermediate care centers have been established offering decentralized specialist services where patients undergo assessment, observation, and treatment before and after hospitalization. Coupled with professional collaboration and an exchange of knowledge between these levels of care, the intermediate level offers opportunities to treat patients where they live and certainly eases transfers between levels of care when necessary.

To promote health care delivery in rural areas and the communication between levels of care, the use of videoconferencing has been established between the primary care and the specialist services. The empirical material consists of collaborative medical work and exchanges made between physicians at an intermediate medical center and specialists at a hospital. This municipality provides a successful example of the use of videoconferencing as

a communication tool that is a part of daily work practice. The setup makes ongoing medical talk about patients' treatment possible.

Theoretical framework

Understanding the continuity of care entails understanding medical talk and work. Strauss, Fagerhaugh, and Suczek (1997) provided an essential contribution to understanding the social organization of medical work. They explained an illness trajectory as a process with a past, a present, and a future—of continuous phases where the physiological representation of a disease and the organization of the treatment create a trajectory. The trajectory influences those involved and the organization as a whole. Illnesses manifest as different treatment trajectories and require different types of knowledge and resources (Strauss et al., 1997). Knowledge sharing between levels of care brings the knowledge necessary for individually adjusted treatment to the level of care where the patient resides and opens the door for professional development.

Collaborative work is an interplay between collective and individual practices. This makes communicative practices important. The language, through talk, is essential for the development of social phenomena, where reasoning develops from social interaction to the individual mind (Vygotsky, 1986). Development of the individual potential and the production of knowledge happen through interaction (Linell, 1998), and language makes access to other resources available (Bakhtin, 1986; Wertsch, 1991). Knowledge is situated, comes into being in the moment, and is constructed in and as a part of an activity (Wells, 1999). Knowledge is therefore realized through social interaction, where the use of artifacts represents and develops the understanding for others (Wells, 1999). The study of the development of knowledge is a reconstruction of knowledge between participants in common activities. Knowledge is therefore a part of the context in which the individuals participate. In

this perspective, information is what individuals communicate to others, while knowledge is thoughts developed from the social to the individual, established as performed activities.

When the patient trajectory is being followed, the historical and collective context where the work takes place is significant. Strauss and colleagues did not attach importance to the historical and social context of a medical trajectory. Cultural historical activity theory (CHAT; Cole, 1999; Engeström, 2001) emphasizes historical continuity and locally situated contingency. I used CHAT to approach and discuss how professionals at different levels of care work together and how learning can transpire through their interactions. CHAT emphasizes the importance of the social dimension regarding how individuals relate to the world and the activity they become a part of, and how historical and social contexts are important when a separate illness episode expands into a collaborative illness trajectory.

Through the empirical case, I illustrate the use of instruments to mediate action to work on a particular object to achieve an outcome. The elements in all human activity are subject, object, mediated instruments, the community, rules, and the division of labor (Engeström, 1987). In an activity system, the action of the subject is addressed toward an object, mediated by those artifacts and those humans sharing the same object: the community. The subjects' relationship to the community is mediated by rules, and the relationships between the community and the object are mediated by the division of labor. The activity is oriented through an object, which is the motive for the activity (Kaptelinin, 2005). These components constitute an activity system. When activity systems interact, they may have a potentially shared object. The object attaches one activity system to another activity system. In this context, the patient and the illness are the potential shared object and the motive driving the collaborative work embedded in the activity. The GP and the specialists represent separate activity systems, where the object attaches them collectively together (Engeström, 2009). As activity systems meet around a shared object, they create a boundary zone.

Kerosuo (2006) discussed the boundary zone as the place where asymmetrical competencies meet and where learning and development at work may happen. In this case, the boundary zone is the space where information exchange and consultations happen, where the medical problems related to the patient are discussed and worked on. The videoconference constitutes the space where the competencies meet. Contradictions are historical breaks of an activity, and are often expressed as humans have access to different resources and institutional practices across activity systems (Engeström, 2001). Contradictions are the potential for and transformation of activities. In an activity, the contradiction appears as dilemmas and tensions in the medical talk as knowledge gaps arise between the participants, when asymmetrical knowledge meet. As knowledge is exchanged, the potential for learning is in how these tensions are handled (Engeström, 2001). Opportunities for learning happen when knowledge gaps, tensions between historically developed ways of doing medical work within one activity level, meet new ways of doing medical work by sharing knowledge across levels of care (Kerosuo, 2006). The closure of knowledge gaps by the exchange of knowledge expands the activity. The expansion of the activity creates learning opportunities or the production of knowledge (Engeström, 1987). In such a view, the learning is related to the knowledge that is exchanged and what constitutes the content in the talk. Both activity systems have the potential to learn: the GPs and the specialists.

The division between specialist levels and primary health care levels has historically appeared to be stable, illustrating a traditional distribution of medical care services and division of labor between care providers. When the GP is uncertain about how to treat a patient, instead of searching for expertise, the GP refers patients to a hospital. GPs use referrals in situations when dilemmas regarding the treatment have to be solved. When health care providers collaborate, they solve these dilemmas locally instead of through referrals.

This activity, occurring between the GP and the specialists at the hospital, is boundary zone activity. This activity challenges the historical and social way of doing medical work and creates a space for learning.

Method

Design

This is a qualitative, ethnographic study of collaborative work between GPs and specialists using videoconferencing. Ethnographic studies are studies that search for an understanding of the organization of social actions through observations (Silverman, 2001). This study is an ethnographic study where video recordings of institutional behavior are the main source of data. I conducted the analysis as interaction analysis, a strategy used in empirical investigation of talk, nonverbal interaction, and the use of artifacts in the interactions among people and objects in daily practice (Jordan & Henderson, 1995). Analyzing ethnographic data makes it possible to understand activities as part of a locally situated context and institutional practices (Linell, 1998). Video data make behavior that is taken for granted visible (Carroll, Iedema, & Kerridge, 2008). Interaction analysis makes possible the exploration of medical talk between GPs and specialists.

The ethical committee approved the study. In the beginning of the study, I wanted to video record consultations in which the patient participated, to be able to observe not only the activity between the GPs and the specialists but also the completion of the treatment activity. However, observing patients suffering from serious illnesses, and in this case suffering from dementia as well, made me exclude patients due to ethical considerations. After all, the focus of the study was the interaction between the GP and the specialist, so the findings would not be weakened by excluding observation of the treatment activity.

Empirical material

I analyzed a trajectory extending over 9 days in which professionals shared information and consulted one another about medical problems to reveal how knowledge sharing may lead to learning. Videoconferencing can improve the basis for decision making or provide second opinions in the trajectory (e.g., deciding if a patient should be admitted to or discharged from a hospital). Videoconferences have historically been part of routine collaborative practice between the hospital and GPs in the intermediate care center. Over a period of 5 months in 2007, I observed and video recorded 42 videoconferences between medical professionals. The 42 videoconferences constitute the total number of videoconference meetings held during this period. The videoconferences took place four times a week and were canceled on only a few occasions due to summer holidays or a lack of personnel. The videoconferences were organized so that the GPs at the local medical center participated, by videoconference, in the morning meeting of the MDs at the hospital. The videoconferences lasted for 5–15 minutes, depending on the exchange of information or consultations. Complex consultations took longer than shorter exchanges of information about specific patients' illness developments.

I selected 1 patient for this analysis. This patient represents a traditional case where real-time collaboration between the hospital and intermediate level of care could expand the traditional use of telephone or written referrals. The case discussed also represents general characteristics for patients at the intermediate level of care: an older patient, suffering from complex illnesses that progressed quickly and who had been transferred between the levels of care several times. This patient was discussed over several days, which amounts to a trajectory. During the 9 days that the identified patient trajectory unfolded, I followed the physicians' talk about treatment during the seven videoconference meetings held about this specific patient. I selected five specific videoconferences for presentation. I excluded two

videoconferences because the content in them supports the selected five; thus, analyzing those two would not bring in any new aspects.

Although the 42 videoconference meetings constitute the total number during this period, they also represent the limitations of the study. These videoconference meetings are not representative of all videoconference meetings, because the participation and the content within such video conferences may depend on several factors, i.e., the organization of the meetings, the years in practice, age, distance to hospital, and personal knowledge of the patient and the professionals. The strengths of this study are that it represents the best practices of how successful videoconference meetings are held, and thus gives insight into how medical talk unfolds and how knowledge sharing may lead to learning. Here, the representativity is not the main core; understanding the interaction processes that expand the traditionally historical activity is.

Data Analysis

I analyzed the recorded videoconferences, focusing on interaction in the talks, the use of instruments, and turn taking in reasoning (Jordan & Henderson, 1995). The dilemmas and contradictions in the talk serve as a potential for the development of knowledge (Engeström, 2001). Dilemmas in talk can be characterized as choices in which the speakers contradict each other in their statements (Billig et al., 1988). These dilemmas often emerge as “buts” in the talk, in this case exemplified as utterances suggesting alternative treatment. In the activity, I analyzed the dilemmas as contradictions between the GPs’ knowledge and the specialists’ knowledge, i.e., knowledge gaps. Contradictions in talk may lead to a breakdown in the talk (Bødker, 1996) or to gap closing (Ludvigsen, Rasmussen, Krangle, Moen, & Middleton, 2010). Aggregations of dilemmas lead to contradictions within and between activity systems, and these processes are essential for understanding the developmental potential and the transformation of activities (Engeström, 2001). The activities in this

boundary zone, where symmetrical knowledge meets, are the interactions through which learning may happen. Learning may occur when knowledge gaps between the historical method of conducting medical talk at one activity level meets a new method of collaborating work and sharing knowledge across institutional boundaries (Kerosuo, 2006). Dilemmas without any solutions lead to breakdowns. Dilemmas being solved stabilize the object: asymmetrical knowledge parts meet, and the gaps between activity systems close. The closing of knowledge gaps represents an expansion in activity. This creates opportunities for learning (Engeström, 1987).

The medical case trajectory contained several utterances that constitute the medical framing. I analyzed and grouped these utterances according to the following categories: (a) description (of problem/diagnosis), (b) information (to give/ask for), (c) treatment (questions about, recommending and explaining effects), and (d) confirmation. I developed the categories empirically, but they were inspired by the understanding that case construction and presentation happen through an MD's collegial discourse, which is a reconstruction of the patient's history with questions regarding facts and opinions about a case and written referrals and tests (Atkinson, 1995). Video recordings enable a detailed microanalysis of collaborative work, talk, and knowledge exchange. The above categories helped in understanding and organizing the content in the videoconferences. I reported in a previous article that discussions in the meetings served three purposes: information exchange, practical organizing, and consultation (Author, 2008).

Results

Collaborative work about treatment

The present analysis is of talk concerning treatment of the shared object, an 84-year-old female patient named Kari. Traditionally, physicians solve problems classified as being on the intermediate level of care with a phone call to the hospital or by referring the patient for

admission to a hospital. However, in this case, the GP and the specialists initiated collaborative work through talk by informing and consulting, thereby decentralizing treatment rather than requiring an immediate referral for admission to the hospital. The content in this trajectory is an information exchange about transfer to the hospital, illness development, and consultation about the treatment given during the development of the illness. In the following extract, Table 1, I analyzed the talk in each videoconference according to categories, focusing on dilemmas in the talk about the patient that surface in the boundary zone between activity systems.

INSERT TABLE 1 ABOUT HERE

The specialist described the diagnosis and provides information about Kari's discharge from the hospital to the intermediate care center [Utterance (U) 1]. This activity happened on the specialist level and consisted of an exchange of knowledge based on the chosen treatment at the hospital. The specialist presented the history of the patient's health problems as the basis for further collaborative work and established a boundary zone that will be the arena for collaboration about the object. Because the specialist collaborated with the GP about the patient's treatment trajectory, this boundary zone was a place for exchanging biomedical knowledge as well as personal experiences concerning the patient.

INSERT TABLE 2 ABOUT HERE

Here, in Table 2, the GP described the problem as a dilemma between continuing the existing treatment or making a change [U2]. The specialist recommended changing the medication delivery method from oral to intravenous, followed by a biomedical explanation of scenarios [U3]. The MDs both contributed to bridging the gap in their knowledge as the GP described the problem, questioned the treatment, and proposed a change as a solution [U2]. The specialist supported the GP by describing and recommending specific treatment

methods [U3]. This activity consisted of joint contributions from both levels, as gap closing between the GP and the specialist occurred in the boundary zone between them.

INSERT TABLE 3 ABOUT HERE

In shown in Table 3, the dilemma played out in terms of Kari's response to the medical treatment, since her clinical condition somewhat improved as her C-reactive protein (CRP) level increased. The problem was manifested with a "but" as a dilemma about what to do [U6]. The GP discussed the problem with the specialist and suggested transferring the patient to the hospital. Since Kari wanted to stay at the intermediate care center, the GP also asked for advice about treatment if the situation changes. The resident asked for specific information about the patient [U7], and the GP argued for the treatment method using the previous advice and practice in the hospital [U9]. The resident only raised a question and did not recommend treatment methods or close the knowledge gap between the two physicians, and the information exchange in the meeting remained on the GP's level of activity. This is an example of a videoconference in which the GP's dilemma is not solved, consequently resulting in a breakdown in attempts to close the gap. The GP's intention was to consult the specialist; instead, the GP received only an implicit confirmation of the dilemma, which merely resulted in information exchange.

INSERT TABLE 4 ABOUT HERE

The GP elaborated on the problem with Kari's infection, shown in Table 4. The dilemma was that, although her CRP level was decreasing, it was still abnormally high [U10]. Traditionally, the patient would be referred to the hospital in a situation like this, but Kari refused. The GP proposed treatment "to continue as today" [U10], which the specialist supported [U11]. Another specialist provided supplementary information about the swollen ankle, identified another dilemma by rethinking the causes of the infection, and offered another diagnosis: arthritis [U13]. The information about the ankle that the GP gave over the

telephone was complemented by the knowledge of the specialist who had previously treated Kari in the hospital. The GP did not support the suggestion of arthritis, referring to the medical tests [U14]. In this consultation, two dilemmas constituted the knowledge gaps in U 11 and 13. The activity happened on both levels as the physicians shared information and knowledge to deal with the dilemmas and to bridge the gaps between them. Considering the specialist's descriptions coupled with the GP's information about the medical tests and experience, the conclusion illustrates joint decision making (Engeström, Engeström, & Kerosuo, 2003).

INSERT TABLE 5 ABOUT HERE

The CRP level that had gradually declined now increased, and the GP questioned this development as a dilemma in how to treat the patient [U17]. This was a query for specialist knowledge. The specialist recommended treatment, suggesting that the GP look for underlying reasons for the problem [U20]. A second specialist supplemented with general knowledge about the effect of kidney stones and the problem of getting rid of the infections and then recommended referring the patient to the hospital [U21]. This specialist explained a projection of the situation and suggested an x-ray to aid in diagnosis [U25]. This method of collaborative work included several specialists and illustrated how their talk drew upon different knowledge repertoires. The GP pointed out the existing x-ray and asked if a new x-ray would solve the problem [U28]. The specialist explained that several x-rays might not change the results, so the GP decided to reconsider the situation in a few days [U21].

The activity in this consultation occurred on two levels: the GP gave information about the patient's biomedical history and asked the specialists for information to close the knowledge gap between them. The specialist explained the effects and recommended treatment, providing the GP with the knowledge to consider the situation and make the

decision(s) to wait. They create a shared medical practice in the boundary zone where knowledge from different activity systems constituted a place for learning and development.

INSERT FIGURE 1 ABOUT HERE

In this trajectory of Kari's case, illustrated through the talk during five videoconferences, the dilemmas that the MDs dealt with can be identified as follows: (a) whether to continue the ongoing treatment as is or to change it, (b) the patient's clinical response to medical treatment contradicted biomedical tests with poorer values, (c) the biomedical test (CRP) showed a decreasing level but one that was still abnormally high, (d) rethinking causes and adjusting the diagnosis for the abnormally high CRP, and (e) the CRP was still elevated; the diagnosis and the treatment must be reconsidered. These identified dilemmas were related to choices and decisions, reflecting the need for knowledge in solving the medical problem to administer the best medical practice. As the illness trajectory evolved, new dilemmas arose, and the treatment had to be adjusted. The dilemmas, namely the knowledge gaps between the activity systems, were handled by knowledge sharing between the GP and the specialist.

Discussion

Opportunities for learning in daily practice

Collaborative work, as presented here, brings knowledge to the level of care where the patient is located. Regular knowledge exchange using the videoconference as a communication tool extends the professional community and contributes to continuity. As the illness trajectory changed, new dilemmas arose, and treatment had to be (re)considered and regulated. Through this empirical example, I illustrate how an illness trajectory develops over 9 days and how the past, present, and future require different deliberations about knowledge and resources (Strauss et al., 1997). The trajectory was only temporary, i.e., as time passed, an illness developed, new dilemmas arose, and the physicians adjusted the treatment. Through

information and knowledge exchanges, the GP and the specialist bridged their knowledge gaps about the best treatment for the patient. This made the treatment social and locally situated. As long as the dilemmas were solved, this was a process of stabilization of the object.

What are the findings related to the first research question: “What kind of knowledge sharing happens in collaborative work?” When exchanging information, the GP and the specialist selected and shared information about the development of the patient’s illness to inform or get support for decisions the MDs had already made. Here, what was being exchanged was information, which had the individual mind as a point of departure and was other humans’ interpretation of experience and meaning (Wells, 1999). When the GP and specialist discussed medical problems, the physicians exchanged knowledge, information, and experiences, to solve the problem that was presented. Knowledge construction, separate from information, is about collaborative work in order to develop and realize a collective understanding in a common activity, as a construction or improvement of artifacts (Wells, 1999). According to Engeström’s (1987) activity system, consulting happens on both activity levels. When knowledge from several activity systems is complementary, it creates an activity that promotes learning opportunities in the boundary zone between the systems.

In an answer to the second research question, “How can collaborative work lead to learning in daily practice?,” the results show that medical talk enables continuity in knowledge sharing and might close the gaps immediately. Traditional written referrals typically give rise to incomplete information, which affects the quality and comprehensiveness of the communication (Piterman & Koritsas, 2005b). However, collaborative real-time work facilitates the immediate dissolution of such gaps and dilemmas. The patient is the common point of reference, enabling the MDs to compare and contrast their interpretations. The physicians’ talk gives opportunities to inform, question, explain, and

recommend treatment, thereby bridging the gaps between the MDs in the very moment of interaction. This most likely promotes high-quality collaborative work between the professionals. Within this, greater collaborative care between GPs and specialists may improve the knowledge sharing, and the quality of the treatment and the patient outcomes.

In this empirical study, I revealed that, when collaborative work leads to learning in daily practice, the boundary zone was a place for learning and development (Kerosuo, 2006). The boundary zone is the place where asymmetrical competencies meet and where knowledge sharing is necessary for problem solving. The learning process is about stabilization as the activity unfolds, bridging the gap between the knowledge of the GPs and the specialists in the boundary zone. In the boundary zone between the two activity systems, new patterns of collaboration were constructed and led to learning opportunities. The potential in the talk was related to learning for both the GP and the specialist. As I illustrate through the analysis, both the GP and the specialist contributed to closing the gap by informing and sharing knowledge. When the activity happened as joint decisions on both activity levels, i.e., in U 11 and U 13, the use of videoconference created a possibility for learning for the GP and the specialist. However, as the GP was the one who was questioning, and thereby presented the knowledge gaps, and the specialist was the one who offered specialized knowledge to close the knowledge gaps, the GP likely was the one who was exposed to learning.

Referring to CHAT, the five dilemmas involving treatment related to rules and the division of labor. In terms of rules, the GP changed the treatment method and suggested a treatment method traditionally used in the hospital [U2]. Regarding the division of labor, it changed when the exchange of knowledge during the consultation enabled the GP to handle medical problems locally [U3, U10, U21, and U33]. The knowledge was situated, and as long as the physicians were able to close the knowledge gaps and stabilize the activity, the MDs

worked as a distributed community that offered treatment where the patient was located. Before the widespread use of videoconferencing, the historical continuity of the medical community was characterized by GPs and specialists working at different service levels, principally collaborating with professionals located at the physicians' own workplace. The treatment trajectory of patient Kari exemplifies how videoconferencing creates a historically new way of collaborating across levels of care and of practicing medical work.

In contrast to written referrals, talk about treatment, as illustrated here, offers more context and content about local treatment before referrals, since knowledge sharing contributes to redefining the traditional practice with its existing rules for information sharing, responsibilities, and treatment. This started with the GP questioning the method of carrying out medical practice and then, when analyzing the situation with the specialist, searching for an answer to “why” by giving information, recommending treatment, and explaining the effects. This was followed by an examination of the recommended treatment through questioning the limitations and, finally, by confirming the recommended treatment through implementing it in work. This new form of practice involves elements of learning while the practitioners stabilize the activity, so the way of doing medical work becomes a historically new way of conducting distributed medical practice. Today, this practice can be seen as an expansive learning cycle (Engeström, 2008), which means that the organization of work among the two levels of health care is based on new rules for communication and a new division of labor between the activity systems. From the CHAT perspective (Engeström, 2001), stabilization in a complex system like the health care system often takes from 1 to 2 years to occur. In this article, it is too soon to conclude that the historical change in the activity stabilized, and so forth that learning has happened. However, the results present the potential and opportunities for learning in such settings, which I encourage to be followed up

with further research. Thus, it is possible to conclude with stabilization and learning in the form of establishing new knowledge practices in health care.

Conclusion

Over a period of time being involved in the same illness and treatment trajectory of a chronic patient, several specialists and the GP mobilize, utilize, and combine different repertoires of knowledge and experience from their own activity systems through information exchange and consultations. Using the videoconference for information exchange between the levels of care when no dilemmas are presented may support decisions at one activity level. The videoconference where the GP's dilemma is presented but not solved leads to a breakdown in closing the gap and exchanging information. Consultation where dilemmas are solved by bridging knowledge gaps creates an activity with elements from several activity systems in a boundary zone. These are opportunities for learning between specialists and GPs.

Collaborative work also contributes to overall knowledge exchange and continuity in the treatment of a patient.

Today, historical contradictions between levels of care can be solved through regular collaborative practice, since I may analyze them as knowledge gaps and observe how they are solved in the talks. This contrasts with previous practice, wherein written referrals promoted individual treatment dependent upon the quality of the referrals. Knowledge exchange through videoconferences also represents a historical change in how treatment occurs: as an extended community independent of organizational boundaries. Learning has become a potential part of daily work practice. In contrast to previous studies examining MDs' opinions about their own talk and potential for learning, this article provides analyses of interactions that point to elements in medical talk that create learning opportunities. This kind of analysis is important for understanding processes of collaborative medical work and learning in medical practice.

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Table 1. Extract Monday, June 4

	Information exchange about the transfer of the patient	Category
1:	<p>SI^a Kari, an 84-year-old woman suffering from kidney failure, rectal cancer, pyelonephritis, proteus in the urine, and streptococcus A in the blood. She also has a swollen ankle.</p> <p>She has been treated with ciprofloxacin and penicillin. She has been transferred several times between the hospital and primary care. We will discharge Kari to the intermediate medical center for step-down care.</p>	<p>Description of diagnosis</p> <p>Information given</p>

Transcription conversations:

^aSI: specialist 1

Table 2. Extract Thursday, June 7

Consultation about treatment		Category
2	GP ^a Her CRP [C-reactive protein] is still rising.	Description of problem
	Should we change the per-oral treatment to intravenous, or ?	Question about treatment
3	S1 ^b Yes, do that, and if it still rises or she gets worse. You will have to transfer her.	Recommendation for treatment
	I hope it has not created any resistant bacteria, but you know how it is! Follow up closely. She may become terribly ill very quickly.	Description of diagnosis
4	GP Yes!	Confirmation
5	S1 Great! And please check her CRP at noon. If it does not work, we have to treat her with something else	Recommendation for treatment

^aGP: general practitioner

^bS1: specialist 1

Table 3. Extract Friday, June 8

	Information exchange about illness development	Category
6	<p>GP^a Kari has responded to intravenous drip and antibiotics, but her CRP has risen. I may transfer her.</p> <p>She does not want it. Maybe I'll call the night duty physician and discuss changing the medicine and treat her here as long as possible?</p>	<p>Description of problem</p> <p>Question about treatment</p>
7	R ^b She has proteus in the urine? Streptococcus A in her blood?	Request for information
9	GP Yes! I have treated her with the same [medicine] as you did, ciprofloxacin and penicillin. I regulated it after advice from X [specialist].	Information given

^aGP: general practitioner

^bR: resident

Table 4. Extract Monday, June 11

Consultation about treatment			Category
10	GP ^a	The first day of treatment, her CRP was 220. Today, it is 148, but the lowest in 1 week. She refuses to be admitted to the hospital. She wants to stay here.	Description of problem
		So I suggest continuing on as today.	Proposed treatment
11	S1 ^b	If she is stable, it is ok!	Confirmation
12	GP	Yes, so.	Confirmation
13	S2 ^c	He [another GP] called me yesterday, and told me about a swollen ankle.	Information given
		We do not have any focus on this streptococcus, but when she stayed here last time, we did not know anything for sure. Maybe it is arthritis.	Description of diagnosis
14	GP	She has podagra but normal urate. It is most likely not that.	Information given
		But we'll take a look at it!	Confirmation
15	S2	Yes.	Confirmation

^aGP: general practitioner

^bS1: specialist 1

^cS2: specialist 2

Table 5. Extract Tuesday, June 12

Consultation about treatment		Category
17	GP ^a The CRP, as I told you, has gradually declined from 220 to 180, to 140. Today, it has increased to 176.	Information given
	So, we're wondering why?	Question about treatment
	Her hemoglobin has dropped from 11 to 8 to 7. And the CRP increased.	Information given
20	S1 ^b Take a look at whether it is part of the morphology from the start. Maybe that is the reason why? I suggest, if no one else wants to.	Recommendation for treatment
21	S2 ^c When she has kidney stones, we should cystoscope	Recommendation for treatment
	or we'll never get rid of the infections. If we do not get rid of the stones . . .	Explanation of effects
	Try a few days, and consider it. Transfer her to the hospital.	Recommendation for treatment
25	S2 If it does not improve, I think we should x-ray the abdomen, look for concretions.	Recommendation for treatment
	These ostomies. They get disturbances in the absorption, a risk for precipitation of salt, growth of stones.	Explanation of effects
28	GP Before she came here, she had an x-ray.	Information given
	Do you think we should repeat it?	Question about treatment
29	S2 If they could not find anything the first time, the chances of seeing anything now are slim.	Recommendation for treatment
33	GP Ok! I'll take a look at her and think about it until tomorrow.	Confirmation

^aGP: general practitioner

^bS1: specialist 1

^cS2: specialist 2

Figure 1. Activity systems sharing information and knowledge through the illness trajectory of a shared object

