Chapter 2
Standardizing Work in Healthcare Through Architecture, Routines and Technologies

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Abstract This chapter presents an in-depth longitudinal study of hospital work. It discusses standardization after the introduction of a computer-mediated nurse–nurse/interdisciplinary handover in a cardiology ward and its effect on collaborative work activities. The standardization also plays out in the physical architecture adopted by the hospital, which impact on the "who" and "how" collaboration progress—the impact of standardized spaces. The chapter focuses on the constant strive in health care to make work practice more effective by employing an increasingly broader approach towards standardization. The number of involved standards is central. Typically for this have been the introduction of the electronic patient record (EPR) system and a following chain of standards made feasible through possibilities from using an EPR system. Sociomateriality is used to illuminate the fact that standardization efforts cannot be investigated as isolated efforts, rather as one of several social and material interconnected ones. Particular to the case was how the physician–nurse handover was made computer mediated, which involves or alter interdisciplinary collaboration in the handover process. Although increased efficiency has been successfully achieved, the chapter discusses how altering some work impacts other processes, especially interdisciplinary collaboration, social relations, and informal learning. Further, architecture has gained sparse attention in the standardization of work processes in health care. Architecture contributes to standardized work practice when striving for efficiency and also become a conflicting standard in interdisciplinary collaboration.

2.1 Introduction

Standardization of work processes in hospitals has developed from particularly focusing on a single standard of various material or social status, towards focusing on several interconnected ones growing from the outset of the EPR and organizational changes making the process of standardization even more cumbersome [1].

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The standardization of work processes is typically carried out with the objectives of improving efficiency, safety, and quality. However, the effort to standardize the work of, for instance, physicians and nurses has proven difficult to achieve [2–4]. One central work process in hospitals is that of the handover, i.e. when information about patients and work responsibilities is transferred from one shift to the next. The handover is particularly interesting because it is typically time-consuming and also crucial for patients' safety and the quality of care [5, 6]. The standardized nurse-nurse, and nurse–physician computer-mediated handover (pre- rounds meeting) became the focus of attention, where individual readings of the electronic patient record (EPR) system have replaced the oral pre-rounds meeting. The pre- round meeting is the process where all interdisciplinary information is merged to get an overview of the patient trajectory (the way patients are communicated between departments and personnel) through the hospitals, followed by the rounds where the physician and the nurse consult the patient. Further, the physical architecture (standardized space) of the hospital is given considerable attention as this impact on the way nurses and physicians collaborate.

With this as a backbone, we need a broader view on standardization based on the increasing number of installed standards, where success on one area of standardization tends to bring about consequences in other areas. Therefore we have asked: How does the variety of standardization initiatives shape healthcare work and particularly the collaboration between the professionals?

Recently, and parallel to the change from written accounts to an EPR system, efforts has been made at Akershus University Hospital (AHUS) to improve the nurse–nurse handover and the interdisciplinary pre-rounds meeting in an effort to overcome these presupposed efficiency and quality problems. Regardless of claimed project success, measured from user satisfaction, reduced overtime, and improved quality of the written documentation, there are concerns on the subject of increased standardization. Although increased efficiency has been successfully achieved, the chapter discusses how altering some work-oriented processes impact others, especially interdisciplinary collaboration, social relations, and informal learning.

Theoretically, the chapter draws on standardization literature and literature from Computer Supported Cooperative Work (CSCW) on collaboration, and sociomateriality as a tool to understand organizational work. Further, standardized architecture is discussed which confines and/or substantiates work process-oriented standardization.

2.2 Theory

Standardizing the work of healthcare personnel, for instance physicians and nurses, has proven extraordinarily difficult to comprehend [2, 4]. A fundamental characteristic of this work is its pragmatic fluid character with complex work activities that requires ad hoc and pragmatic response [7]. Healthcare work is further characterized by its distributed decision making, by 'multiple viewpoints' and by its

'inconsistent and evolving knowledge base'. The need to curb large and seemingly ever-increasing healthcare expenditure is an explicit feature of managerial agendas for increased standardization of healthcare work. The core activity is to manage patient trajectories of collective and cooperative enterprises [7] where standardization of information systems and work process-oriented standards are of increasing importance.

Traditionally, standardization in information systems (IS) has a history with a focus on technical issues like communication protocols, exchange formats and programming language [8]. There is an even stronger historical tradition of de facto standards for applications, operating systems, and file formats [9]. The Science and Technology Studies (STS) and CSCW literature [10, 11] promotes an approach where standardization is seen as a negotiation process between heterogeneous actors in a socio-technical network, consequently not just a technological issue, but rather a negotiation between technical artefacts, humans, work practice and procedures [2]. In this sense, there are several activated standards in one specific setting. Further, collaboration and interactions are essential properties in hospital work practices where information needs to be shared across time and space. Standardization is embedded in an effort to improve efficiency and quality in healthcare [2]. Hence, and despite the obvious potential for improvements, standardization efforts seldom meet their objectives [12]. Schaper and Pervanen [13] claim that it is clear that much of the work healthcare professionals do cannot be captured in procedures (standardization), as much is being done ad hoc and tailored to the patients' needs. The background for this is that hospitals are regarded as highly specialized, and despite the fact that some work follows routinized paths the never fully predictable nature of patients' reactions increases the complexity of the organization [14].

In healthcare, we see a move towards an increased number of standards [1] where the EPR system is one distinguished 'triggering' effort. EPR systems have a central function in accumulating and coordinating the extensive flow of the various kinds of information that is needed for providing 24/7 patient care. Compared to the paper-based record, the EPR system functions as a hub for coordinating a wider range of professionals, specialties, and in assembling information from different sources within a single system [15]. From the outset of standardizing hospital work through to the implementation and use of an EPR system, other standards have emerged, or have been shaped by the EPR, and have become mutual dependants. One way is through making the shift handover standardized, moving from oral to written accounts making the handover computer mediated and individual.

Handover is important when considering the continuity of care, and a hospitalized patient's demands, which extends beyond the resources of a single nurse or nursing team. In such 24-h work contexts, a shift handover mechanism is required to allow personnel changes with minimum disruption of the functioning of the ward or unit [16]. The traditional oral handover has been criticized for being inefficient, especially because many people are given information that is not directly relevant for their assigned tasks [6, 17, 18]. Further, efforts related to the nurses' handover has a scattered history between success and failure (see for instance [18, 19] that describes standardized handover as successful), and Arora et al. [20] has on the

contrary shown that standardized handover tools not always lead to better outcomes or improved results. Further, Munkvold et al. [21] suggest that, despite a proclaimed success formalizing nursing handover, like reduced overtime, improved quality of the written documentation, and eliminated redundancy, a continuous urge to standardize increases the possibility for a collapse somewhere else in the system.

This chapter seek to find out what actually takes place in face-to-face reports between healthcare workers, which is invariably more than a simple transmission of information, and further interlink this to the development of the new standards. Hartwood et al. [22] claim that these interactions have a constitutive role in arriving at some shared sense of what the meaning of information actually is. Further, and in the same direction, Hughes [23] has documented how experienced nurses often help inexperienced residents by suggesting the way towards the diagnosis, or by hinting towards the necessary treatment. This makes it important that nurses and physicians have arenas to meet, and time to share information. Traditionally there has been a close relationship between written and oral accounts while organizing medical work [24]. Consequently, it is difficult to find a straightforward solution on how much this practice can be formalized and how much should remain oral.

In the prolongation of focusing on the human factors it is important to view them up against material factors. Architecture has for instance not been inherently explored as important for the standardization of work processes in hospitals, or seen as important for the relation between the EPR—information sharing—architecture. Information technologies are often depicted as possessing the potential to correct social inequalities by democratizing information access and economic opportunities. This view overemphasizes virtual spaces against the material and social conditions of technological infrastructures [25]. Further, when researchers eschew a substantive interrogation of materiality, they effectively 'black box' technologies as neutral artefacts, ignoring that these technologies, for instance, establish social order [26]. Orlikowski [27] claims that researchers in Information Systems (IS) have overlooked the ways in which organizing is bound up with the material forms and spaces through which humans act and interact. Therefore, the social and material are considered to be inextricably related, there is no social that is not also material, and no material that is not also social. In this broadened perspective on standardization, also the physical layout where hospital work is a part of the socio-material ensemble. Orlikowski [27] has suggested a shift in the conventional framing of organizational practices as 'social practices'. Instead she sees it as 'sociomaterial' which allows us to explicitly signify the constitutive entanglement of the social and the material in everyday organizational life. Even the most influential studies of IS and organization focus primarily on social dynamics or how people interact with each other, rather than providing evidence of what specific features people use, why they use them, and how and why their pattern of use shift over time [28]. Accordingly, the physical layout of the hospital wards—the architecture–becomes a key element of the sociomaterial and thus essential in integrated standardization efforts.

As listed above sociomateriality denote that standardization effort cannot be listed as isolated efforts, rather as one of several social and material interconnected ones, that overlap with each other, and increasingly become mutually interdepen-

dent, which curbs progress and may ultimately cause failure. This kind of "system accidents" are unforeseen, hard to diagnose, and have an interactive complexity that causes two components to interact in an unexpected way [29].

2.3 Method

The importance of social issues related to computer-based information systems has been increasingly recognized in IS, which has led researchers to adopt empirical approaches that focus particularly on human interpretation and meaning [30]. In practice, the movement of healthcare work activities is frequently much less linear than it is in other arenas, as it has flexibly defined roles. Interpretive research can help the IS researcher to understand human thought and action in a social and organizational context [31]. Further, interpretive studies assume that people create and associate their own subjective and inter-subjective meanings as they interact with the world around them. The interpretive researcher thus attempts to understand through accessing the meanings participants assign to them [32]. Our study adheres to an interpretive research tradition of this nature. In general, qualitative research methods, such as interviews and observations, are optimally suited to understand a phenomenon from the participants' point of view, and in particular the social and institutional context. Qualitative research techniques can provide deep insight, identify problems and answer the "why" and the "how" questions that quantitative studies cannot answer [33].

2.3.1 Data Collection

The data set consist of four modes of data collected during a period from Sept. 2009–March 2011: observations, semi-structured interviews, document analysis of central logs with general numbers on the use of nursing care plans. In total, the author conducted 170 h of observations and 12 semi-structured interviews with an average of 80 min at the Cardiology Department at AHUS in the period. The length of the observations varied from 1 to 8 h, and included tracing patient trajectories through the hospital to understanding the adoption and use of IT-based information carried out by nurses and physicians in different circumstances. The observations were done during the day, evening, and night shifts.

2.3.2 Data Analysis

The overall process of collecting data has been open-ended and iterative, with a gradually evolving focus on specific situations from work practice. The interviews

were conducted using a tape recorder, and only a few open-ended questions that were semi-structured and shaped according to how the interviews evolved were posed. Crucial to the evolving questioning was interviews with experienced nurses, novices, and physicians. The analytical categories emerged from internal discussions and reading of field notes. Primarily nurses with varying experience from the department were interviewed; in addition a few residents were asked questions about the interdisciplinary collaboration and the lapse of the pre-round meeting. The interview guide consisted of a few structured questions about the routines at the ward, including a few on the topic of nursing handover, interdisciplinary collaboration, and the rounds. Handwritten field notes were transcribed shortly after the data was gathered. All transcriptions of the interviews were done immediately subsequent to the interviews themselves, as, according to Malterud [34], early transcription is crucial in order to clarify uncertainties and the meaning of unclear sentences. The findings have been discussed among fellow students, as well as between the author of this chapter and my supervisor who have a thorough understanding of and experience in working with IS studies, and also more specific with nursing plans and handovers.

2.3.3 Context of Study

The research was conducted at AHUS, which has approximately 4,700 employees and a total of 820 beds. The hospital has embarked on an ambitious effort aimed at a level of standardization of healthcare work unprecedented in Norway, and is built over a model from Johns Hopkins Hospital in Baltimore US. The Johns Hopkins Hospital is globally acclaimed for its exceptional services and programmes. For 19 consecutive years, it has topped US News & World Report's "Honour Roll" in the magazine's annual ranking of America's Best Hospitals. AHUS is one of the first and biggest hospitals in Northern Europe to follow this model. In November 2008, AHUS moved to its new $ 1.5 billion premises with the explicit objective of utilizing new and familiar technology to improve work practices.

2.4 Case

Important to this case was the implementation of a new large-scale EPR system delivered in 2005, which generated and contributed to new standardization efforts in work practice, which included technologies as well as artefacts and work practice-oriented standards. Nursing plans were standardized at the same time, and a computer-mediated handover between nurses was implemented at the Cardiology Ward followed by a nurse–physician computer-mediated handover in the same period of time. The EPR system used at AHUS included a module for nursing, a module for physicians, laboratory, and radiology. Care plans for nurses was intro-

duced to replace the use of free-text in the documentation to establish a more common formalized language based on good clinical practice and global accommodated classification systems, named Nursing Intervention Classification (NIC) and North American Nursing Diagnosis Association (NANDA). Basically, the nursing plan is an overview of nurse-related diagnoses for a particular patient group combined with relevant interventions (NIC interventions, following the NANDA diagnosis). The diagnoses are represented by the international classification system of the NANDA, consisting of 206 nursing diagnoses [35]. The interventions are represented by the classification system, NIC, consisting of 486 interventions [36]. The care plan has been organized such that each diagnosis, dimension and action is firmly attached to the plan with a start and a stop date. When standardizing these plans, the nurse can easily choose several actions from a pre-defined list for the applicable diagnosis. By doing this, the nurse saves time, and at the same time the standardized sentences work as a quality indicator.

2.4.1 The Standardization of Nurses' Routines: And the Computer-mediated Nurse–nurse Handover

The success of a computer-mediated handover implementation was dependent on an effective EPR system for documentation in nursing practice. With the introduction of a collaborative EPR system in 2005, information work changed from a chronological status annotation into a process-oriented, structured document. The introduction of the EPR gave possibility for a change in the nursing handover process from oral handover to written handover. Further, the implementation of the EPR system increasingly led to a systematic use of standardized care plans. Previously, too much time was used on documenting unessential information such as, for example, 'eaten two slices of bread with jam and cheese,' and 'been for a walk' etc. Certainly, this also was a way to categorize information, making it more transparent for others to read, which shaped the documentation towards the prospective computer-mediated handover.

Standardized plans and a computer-mediated handover were introduced as a "package" late in 2005 in the Cardiology Ward. *"We wished to pursue a computer-mediated report for several reasons, our goals were to use less time compared to the oral report, hence there would be more time with our patients and improve quality of the documentation" (Administrative nurse)*.

The nurses interviewed in this study were generally positive to the computer-mediated handover between nurses, as one experienced nurse pointed out: *"We spend much less time on the reports now than before when we had the oral handover. We spent too much time on small talk. The socialization aspect is important, but we always find time to socialize during the shift or during the lunch break."*

The nurses at the Cardiology Ward worked in accordance with a group nursing system divided in three shifts where one of the nurses took the leader position, and

was thereby responsible for the care of six to eight patients, including the dispensing of medication, blood specimen collection, and participating in the physician's round. The same nurse was also responsible for the written nursing documentation on the patients, drawing on oral and written input from the other nurses throughout the day. The nurses were divided in the four units on a weekly basis, and they had a function of overlap where one nurse on the day shift arrived 1 h later with an overlap with the afternoon shift. The overlap secured a smooth change-over and foremost a possibility for the nurses on shift to read from the EPR without interruption. The whole staff of nurses had a common briefing in the morning where common information was delivered by the head nurse. Secondly, the nurses attended their selected unit and started out by reading the EPR (the computer-mediated handover procedure), while the night nurse watched over the patients. In addition to the formalized handover the nurse that went off shift gave an oral summary of the most important plans for the day including anything that might have happened during the last 30 min between shifts (information that not was entered into the EPR system). In general, some information had to be delivered orally between shifts because of the heterogeneity of work practice. The day shift was further divided as follows; one nurse had the coordinating responsibility. In the morning handover the nurses have approximately 20 min to read from the EPR. Different artefacts such as the chapter-based work schedule, appointment folder and EPR system were used in the search for information. Further, the nurse responsible at the unit normally had several days during the same week being responsible to uphold continuity. This nurse was responsible for the rounds, and thereby the communication with the physicians. The second and the third nurses were responsible for taking care of the patients throughout the shift, and ensure that everything that was ordered was executed. Further, the nurses had several small oral handovers, both to inform the coordinating nurse that was responsible for the documentation, and other information that varied between discussions about the patient trajectories, and cooperation within the unit. The number of small oral messages was not seen as interruptions of practice, as one nurse said; *"We have a small transparent unit, and it is never difficult to reach the nurse that is working by your side."*

2.4.2 The Computer-mediated Nurse–physician Pre-rounds Handover in Practice

The disestablishment of the oral interdisciplinary handover and thereby the change to a computer-mediated handover came in the same period of 2005 as the computer-mediated handover for nurses. Traditionally, nurses and physicians have had an oral meeting ('pre-visit') before the physicians did the rounds, usually together with the nurses. The purpose of this meeting was for the nurses to update the physicians on the status of the patients, and to discuss some patients in more detail before the rounds. At the Cardiology Ward, the oral pre-visit meetings could last for 1 1/2 h.

The advantage with the pre-visit was that both the physician responsible for the rounds and one or several more experienced physicians were present. In addition, both the responsible nurse and the primary contact for each patient were attending. Although much time was used, the discussion around each patient trajectory had several advantages. The advantages were two folded, firstly this was an arena for learning, and secondly the oral presentation of the patient trajectory on an interdisciplinary level were often clarifying towards details, for instance concerning medication or postponing examinations due to patient needs.

The physicians were expected to update themselves by reading the necessary information in the EPR, presuming that the physicians also read the nursing documentation. The physicians that were interviewed pointed out that the computer-mediated nurse–physician handover was successful in some respects, i.e. much time was now saved, and the sharing of information had never been better. Further, the use of EPRs in the nurse–physician handover process had made oral interdisciplinary communication more sporadic. Although the physicians and the nurses communicated orally and discussed patients throughout the day, the regular meeting point of the pre-visit meeting was no longer in place, and the chain of interdisciplinary work had become vulnerable (nurses' interpretation). The problem with this model was that the meeting activity between collaborating groups became unscheduled or not mandatory which, on the other hand, made it possible to choose where or when to "ask that particular question with great importance to the patient trajectory". In addition, the physicians used the previous interdisciplinary meetings to get an oral update on the nurses' documentation. Most of the residents asked agreed that the time used on oral handovers earlier often fluctuated, but reciprocal to that, the educational effect was highly valued by young residents. The advantage with computer-mediated handover was the time aspect (efficiency), but several pointed at some kind of face-to-face oral contact with the nurse as crucial while using a computer-mediated handover to get the complete overview. In some cases the physician responsible had problems obtaining the right picture of the patient trajectory just by reading the EPR in these cases it was important to consult the nurse. In addition, the physicians still had their morning meetings where new and complicated patient trajectories were discussed in a plenary session. This was crucial because the physicians work much more singlehandedly during the shift. Hence, the physician responsible for the rounds, often residents, typically discussed their patients face to face with the more skilled physicians during the shift, and before the rounds.

The group of interviewed physicians were all young residents with sparse clinical practice, and they had no complaints about the social relation between nurses and other healthcare personnel. The system, the computer mediated handover, and the architecture could according to the nurses make it easy not to meet, be social, and communicate. In contrast, the experienced physicians that had worked in the department over time and through different layers of standardization had a different viewpoint. These physicians had, according to the experienced nurses "a better social relation" with nurses and other healthcare personnel because of their long term relation to the department. Still, these physicians could from time to time take a professional liberty to take the rounds without the assistance of a nurse.

2.4.3 Outlining the Physical Space

Physical architecture and artefacts is central to our case, since the nurses are bound to their work stations, and the physicians are foremost located outside the ward. A standardized architecture contributed to a small, intimate and transparent work environment for nurses and physicians (the ones responsible for the rounds). This is central for this case, describing the establishment of the new AHUS premises in 2008. According to the nurses, there are both positive and negative implications towards small, intimate work stations. It is beneficial to have all patients and equipment gathered within a small area. This keeps all attending personnel within sight which makes the working environment more transparent for the nurse in charge and for the physician responsible for the rounds. Hence, what has been pointed out as the most negative effect is the absence of privacy, especially in terms of maintaining ethical and privacy rules, and the way physicians are less visible in the environment. In general, this solution makes the nurse and physician (the one responsible for the rounds) highly visible which is calming for the patient and their relatives, but it is also challenging because of continuous interruptions this causes for the personnel.

The department was modelled as follows: the four units were symmetrically gathered in a long, broad corridor with units from A to D (see Fig. 2.1). In the middle, dividing two and two units, there was a dining room and common area for patients and personnel, a separate area for garbage and laundry, and a cargo area. The four units were symmetric, meaning that they had the same facilities, three single-bed rooms and two double rooms and one open-based area where all other "daily activity" for personnel took place. In addition to a modern and standardized architecture a set of modern technological artefacts was introduced as a means of fulfilling the targeted standardization. This was everything from an intelligent IP phone system, to a fully automated medication system, and multifunctional patient screen systems.

The architecture puts efficiency first, and the structure of each unit reflected this very well as the two or three nurses on duty seemed to have a complete overview of their patients and their surroundings. The nurses could easily stay and work at the unit throughout the whole shift without crossing outside its perimeter. As one of the nurses noted, *"We have no overview outside the unit we are working on, and our focus is centred there throughout the shift"*. The physicians were physically located outside the department, with a conference room and their offices, which was structured as an open environment. Each week, one physician was associated to each of the four units. In this period, they used different facilities at the department for preparing the patient rounds, undergoing work tasks with the nurses, performing clinical examinations, and for completing documentation. These environments were situated around the ward, and were in immediate proximity to the patients and the work station. The physicians were, in general, positive towards how the architecture has structured their environment, although there was some initial resistance towards the common office premises.



Fig. 2.1 The architecture, showing one of the units. The ward had four equal units divided with two on each side of a common area for both patients and personnel. SENG = bed, ARB.ST = work station, and NISJE = niche. There is further a common are in the middle, dividing two and two units

2.5 Discussion

2.5.1 The Broad Approach Towards Standardization, a Portfolio of Interconnected Standards

The purpose of using sociomateriality to frame the discussion is to illuminate the fact that standardization efforts cannot be investigated as isolated efforts, rather as

one of several social and material interconnected ones [25, 27, 28]. The AHUS case includes an ambitious level of standardization with a portfolio of social and material standards that are interconnected. Orlikowski [27] sees organizational life as 'socio-material' which allows us to explicitly signify the constitutive entanglement of the social and the material in everyday organizational life. The effect of this is a physical layout where hospital work is a part of the socio-material ensemble, there is no social that is not also material, and no material that is not also social. The small, intimate units enable transparency, with three nurses restricted to the unit, and better knowledge about a limited number of patients, the EPR, the physical architecture, other artefacts, e.g. phone systems, and the computer-mediated handover. The effort has been ambitious: Increased focus on standardization of work processes in hospitals has developed from particularly focusing on a single standard of various material or social status, towards focusing on several interconnected standards of material and social character [1]. Winman and Rysted [15] claim that the nature of the gap between formal information and the demands of locally interpretive work depends on the nurses' oral presentation in handover meetings for putting information into practical use. This suggests that a computer-mediated handover has to be followed by a face-to-face oral meeting activity. In this chapter, work practice has changed from time-consuming handover conferences to a computer-mediated one. In addition to this, short oral handovers happen occasionally throughout the shift, something that should be considered as normal regardless of a standardized handover or not. The advantage here is that these "short conferences" are possible due to the physical architecture that provides a transparent working environment at this hospital. The nurses' work closely together, often three with one coordinating nurse, they are always within sight, and are also equipped with an IP phone system so that they are contactable for patients, their relatives, and other healthcare personnel. Further, the nurses share information about their patients by producing one document on each patient which is signed by the two or three nurses in the EPR system.

2.5.2 Suboptimal Effects of Standardization

The broad approach [25, 27, 28], and the increasing number of standards [1] increases the possibility of sudden or unpredicted events, which in terms (in this chapter) has been listed as 'suboptimal effects' of standardization. The suboptimal effects created become visible in the breakage point between gained success (efficiency) and unforeseen pitfalls as the interdisciplinary collaboration, and informal learning. The discussion is hinged in the fact that increased standardization is considered a success (on an in- house organizational level) measured in the primary goal, namely increased efficiency of the nurse–nurse handover. Also the standardization of the pre-round meeting is considered a success seen from a top-down organizational level. The nurses for instance value the computer mediated handover as a tool that has increased efficiency (time used on oral handover), and it has shaped and improved the written EPR based documentation. Based on this,

and the case this chapter elaborate on the changes in social structure focusing on interdisciplinary collaboration caused by overly standardized routines, and a standardized physical architecture. The physicians are satisfied with the time spared on not having the oral pre- round meeting. Particularly, the case presents some unintended consequences, the loss of learning abilities and social relations on an interdisciplinary level. In turn this interdependency could, according to Perrow [29] turn in to unintended, unsuspected, and unsolvable accidents. In this segment we investigate how several standardization efforts tend to escalate, overlap with each other, and increasingly become mutually interdependent, which curbs progress and may ultimately cause failure. This kind of "system accidents" is unforeseen, hard to diagnose, and have an interactive complexity that causes two components to interact in an unexpected way [29]. Hughes [23] has for instance documented how experienced nurses often help inexperienced residents by suggesting the way towards the diagnosis, or by hinting towards the necessary treatment. Given the introduction of the computer-mediated nurse–physician handover, the most important arena for sharing documentation had vanished according to several nurses. Some examples from the case illustrates this: One aspect was the fact that the physicians in general were less visible in the work environment, therefore residents and inexperienced nurses could become uncertain about "how to accomplish interdisciplinary work" if they were executing it together: *"When the good clinical interdisciplinary relation disappears, so do the social and educational aspects. The relation created by interaction is crucial" (Experienced nurse).*

Architectural forms provides a particular register for social and professional discourses, within architectural theory social use is robustly connected to functionalism, and there is an on- going debate on the appropriateness of concepts such as function and utility among contemporary critics of architectural thinking [22]. In practice, this implies that the ones (in this case the residents) that were under education were under the impression that it was permitted to ignore social relations, and thereby the important formal learning that rests in this interdisciplinary collaboration. One experienced nurse had worked at the department for more than 10 years, and had been a vital part of the education of young physicians. She emphasized that young residents needed to be educated clinically and needed to obtain clinical experience, and that nurses contributed to this in particular.

Further, skilled physicians with years of experience in the ward have stated that the architecture was challenging in terms of upholding social relations.

2.5.3 Conflicting Standards

Recent research in IS are putting focus on an increasing number of interconnected standards in health care that in the next face could complicate the process of standardization to become even more cumbersome, see for instance [1]. This and the fact that all these standards don't stand substantially alone but are interconnected Orlikowski [27] is the basis for the arising of conflicting standards. The conflict of

standards arises when nurses versus physicians as professional groups (different standardized work patterns and movement in the ward) fail to collaborate because of a 'restricting architecture'. The architecture separates nurses and physicians, and thereby the shaping of interdisciplinary learning and social relations. Some of the nurses were concerned about the possible effects of the physical and work-related separation of nurses and physicians: *"Some physicians are under the impression that it is suitable to work in this organization without having contact with nurses. The most experienced physicians value the interdisciplinary collaboration, but we have residents that pass through during their specialization…" (Experienced nurse)*. What actually takes place in face-to-face reports between healthcare workers is invariable and more than a simple transmission of information [15]. Hartwood et al. [22] claim that these interactions have a constitutive role in arriving at some shared sense of what the meaning of information actually is. The social aspect was frequently mentioned by the nurses, and they agreed that the social relations between the nurses and the physicians had grown weaker over the years. There were several reasons for this, not only the computer-mediated report system, but also the standardized architecture which in some interest had decreased the possibility for social connections between the professions. The physicians had their offices outside the ward, and the nurses were very strongly attached to the small units, which were vulnerable (in terms of interdisciplinary collaboration) because of the small number of personnel attached to each unit. Another aspect to this was the simple fact that the possibility of having shared lunch and larger social gatherings had vanished since they no longer had a social meeting point.

2.6 Conclusion

Sociomateriality is used to illuminate the fact that standardization efforts cannot be investigated as isolated efforts, rather as one of several social and material interconnected standards. The number of standards is essential, and recent research in IS shows that standardization of hospital work includes increasingly more interconnected standards, which makes research in this area increasingly cumbersome [1]. The case has further pinpointed how physical architecture or "space" contributes to standardized work practices when striving for efficiency and how it further become a conflicting standard in interdisciplinary collaboration. Further, the physical architecture is a new interesting augmentation to the increasing number of standards involved. In the case of the computer-mediated nurse–physician handover, some aspects were described as successful in relation to efficiency. However, interdisciplinary collaboration has been reduced, and the social relations between nurses and physicians and informal learning may have been affected. We suggest that these practical implications should be taken into account in future implementations of interdisciplinary computer-mediated handovers.

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