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The Pendulum of Standardization

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Abstract. Cooperation and collaboration are generally an inherent part of everyday practice, and particularly among nurses. However, the technologies that support these practices are still inadequate. In this study, we present and discuss the use of classifications in nursing practice, and highlight the collective re-construction of classifications that emerge over time. Specifically, we study how the negotiation between global classifications and local practice takes place with long-term use, and depict this dynamic interaction as a pendulum movement. Furthermore, we characterize this standardization as a collective re-construction grounded in everyday practice. This paper contributes *to* the body of research on this topic by doing the following: (i) characterizing the process of standardization as a pendulum movement; (ii) drawing out theoretical perspectives for standardization as a collective, emerging accomplishment; (iii) stating the practical implications of our perspective. Finally, we compare the local adjustment (local classifications) discussed in this study with social classifications (social tagging), and suggest how social classification may lead to increased flexibility in the use of classifications.

Introduction

Continuity of care is the "Holy Grail" of hospital information systems. Although such care has been widely discussed, it is difficult to carry out. Standardization is a key objective of the strategy for electronic cooperation in the health care sector in Norway. This strategy considers electronic interaction to be crucial for ensuring the free flow of information necessary to achieve the vision of continuity of care (Norwegian Ministry of Social Affairs and Health 2008, p. 72). In line

with this strategy, standardization and the use of classifications have been introduced on a large scale in Norwegian hospitals. Standardization efforts have also been discussed in the CSCW community, and standardized categories are considered to be mechanisms of interaction, in the sense that they reduce the complexity of articulating cooperative work (Schmidt et al. 1992). An extensive amount of work practice studies illustrate some of the challenges of the role, use and impact of standardized categories embedded in collaborative technologies (Hanseth et al. 2001; Ellingsen et al. 2007). It is by now well established in such studies that standardization involves a negotiation between the "global" and the "local" (Timmermans et al. 1997), and that there are implicated trade-offs and dilemmas (Bowker et al. 2000). However, there is scant evidence on exactly how these negotiated standards get constructed, i.e., the time-dependent dynamics. In our study, we focus on this negotiation process by describing the process as a pendulum movement between global standards and local classifications.

Our empirical material draws on a longitudinal and ethnographically inspired case study of the implementation and use of electronic care plans and nursing classifications in a psychogeriatric ward at the University Hospital of North Norway. The work at the ward is highly interdisciplinary, and nurses play a key role in observing and monitoring patients' needs, as well as assessing the patients' cognitive abilities to self-care. Taking care of the patients is a collective task, and requires cooperation among nurses and other health care professionals. Specifically, we ask the following research question: *How are classifications used in nursing practice, and what are the consequences when they are applied in local practice?* Our analytical approach is aimed at investigating the long-term use of classification and how this change process is handled in practice. We contribute by (i) characterizing the process of standardization as a pendulum; (ii) drawing out theoretical perspectives for standardization as a collective, emerging accomplishment; and (iii) stating the practical implications of our perspective.

The structure of the paper is as follows. The paper is organized in the following way First, we start with a brief theoretical description of both standardization in general, and standardization efforts in nursing practice. Second, we describe our methodological approach, followed by a chronological case describing the different phases of implementation and the use of nursing classifications. Third, we offer a discussion section, which investigates the collective negotiation process that takes place over time, and where new categories emerge as a result of collegial collaboration. Finally, we conclude the paper by conceptualizing social classifications in relation to healthcare, as well as the practical and theoretical implications to CSCW systems design.

Theory

Standardization

Globalization and an increased reliance on large- scale information technology have involved an ongoing transformation of modern organization and everyday life. In this transformation, standards remain the sine-qua-non in virtually all fields of information technology. Previous research has mainly considered standards as being technical artefacts, which are part of programming languages, communication protocols and exchange formats (Schmidt et al. 1998). Traditionally, there has been a technocratic, top-down approach to standardization as an objective, absolute and static state (Ure et al. 2009). The increased complexity and scope of standardization in our ”networked” world requires a conceptualization that is typically broader than past research has indicated, and involves investigation from various streams. While previous studies mostly focused on standards as being a technological development, recent studies have focus on the social shaping of technology, and consider standards to be the backbone of a socio-technical network (Hanseth et al. 2001). Fomin, Keil and Lyytinen (2003) have provided a framework for analyzing standardization as a process of design, sensemaking and negotiation. Similar studies emphasize standardization as a dynamic interaction in a socio-technical network (Hanseth et al. 2001), where a standard represents agreed upon rules for the production of the (textual or material) objects required (Bowker et al. 2000). A key feature is the dynamic interaction between both human and non-human actors in the network. Consequently, standardization is not just a technical issue, but a negotiation between technical artefacts, humans, work practice, procedures and so on. Scholars from this tradition aim at achieving more flexibility in the standardization process, to make it adaptable across diverse practice (Timmermans et al. 1997; Bowker et al. 2000; Hanseth et al. 2001).

Other studies have also emphasized the need for more flexibility in the standardization process. Hinrich, Pipek and Wulf (2005) developed the concept of “context crabbing” to assign contextual information in the form of metadata. A similar study by Simone and Sarini (2001) focused on the importance of classification schemes for intra- and intergroup collaboration. They distinguished between exogenous and endogenous classification schemes as a framework for analyzing the complexity inherent to the situated, distributed and evolving nature of collaboration, when such classification schemes are taken into account.

Collaboration and interaction are inherent properties of most work practices in hospitals, where information and knowledge need to be shared across time and space. Moreover, standardization is embedded in efforts to improve efficiency and quality in health care (Timmermans et al. 1997; Ellingsen et al. 2007). Based

on these perspectives, it is particularly interesting to study a special kind of standardization, such as standardization of nursing.

Standardization of nurses' work

Standardization in nursing is considered to be a powerful movement, and has been an ongoing process over the last two decades. National strategies for the implementation of Electronic Patient Records (EPR) in Norway consider standardization to be a means for improving quality, increasing effectiveness and achieve cost-saving through the use of information and computer technology. In the nursing community, special attention has been directed at the use of terminologies, decision support and knowledge-based nursing. Terminologies in nursing are developed to create a common language with uniform definitions that reflect nursing practice, and consider the use of classifications as a means for improving nursing documentation within and between various health care professions (NNO 2009). Health care data must serve multiple and diverse purposes, like providing day-to-day documentation of care processes, facilitating management of care, identifying best practice, triggering of clinical guidelines and facilitating communication within the health care team (Moen et al. 1999). Consequently, a number of various nursing classifications have been developed and are widely used. An increased importance of sharing clinical data among health care providers, increased focus on patients' outcomes, and the introduction of the EPR has increased the need for a well- developed language to represent nursing judgments. The application of formal models to nursing terms has aimed at developing complete and comprehensive terminology in which the phenomena are presented in a clear and non-redundant fashion (Moen et al. 1999). However, some researchers are skeptical to the oversimplified reduction of knowledge embedded in nursing practice, which are typically used in the formal classification schemes (Benner 2004). Patricia Benner questions the flattening of nursing care, and suggests that we must find alternative ways of valuing the unclassified:

> "The classifications of nursing intervention can make nursing more visible and traceable in the medical record. However, categories belie the logic of caring practices, nursing knowledge, and skill that cannot be reduced to techniques or discrete interventions. Nurses are required to trade one form of visibility to another." (Benner 2004, p. 427)

Bowker and Star express the same skepticism to make the invisible work visible by using classifications:

> "As the layers of complexity involved in its architecture reveal, however, a light shining in the dark illuminates certain areas of nursing work but may cast shadows elsewhere." (Bowker et al. 2000, p. 254)

These scholars highlight the trade-off between pre-defined categories and the cases that do not fit into formal classification systems. Similar studies have emphasized both the enabling and constraining characteristics of classifications (Orlikowski 1994), as well as the tension between interoperability and local usability (Ure et al. 2009). On the one hand, formal terminologies enable shared

meaning and comparability across different contexts. On the other hand, their use restricts activity that does not conform to the types recognized in the category systems. The enabling factor is dependent on the degree to which it facilitates their actions outweighs the difficulties created by its restrictions (Orlikowski 1994). Accordingly, the use of international classifications in nursing is not only a translation of concepts to local practice, but a process of negotiation and transformation (Carlile 2004).

Despite these challenges, nursing classifications have been nationally and internationally adopted, and there is an ongoing struggle to integrate the classifications as part of electronic nursing documentation, and to facilitate the use of nursing care plans. The uses of both classifications and care plans are closely related to each other, since classifications are often used to describe the steps of the nursing process. This is a well-known method for nursing, and consists of five phases: assessing, diagnosing, planning, implementing and evaluating. The nursing process is the basis for the use of care plans for documenting nursing. Still, as some researchers have suggested, the implementation of care plans has been slow due to the lack of a uniform and unambiguous system (Bjorvell et al. 2002). The implementation process and the use of new technology has thus generated new expectations for the use of electronic care plans as a support for information sharing and collaboration. Although some researchers fear that the use of care plans will lead to "cookbook medicine," Timmerman and Berg (1997) also elaborate on how the use of "protocol allows more complex and detailed treatment plans to become possible. Once implemented, the protocol can articulate activities and events over time and space – staff members can delegate coordinating tasks to it, transforming the nature of their work." (Timmermans et al. 1997, p. 296). Furthermore, they emphasize, "how standards manage the tensions among transforming work practices while simultaneously being grounded in those practices". Similar studies by Bowker and Star (2000) illustrate how standardized applications are an attempt to regularize the movement of information from one context to another, and how shared objects arise in the tension between locales as an ongoing relationship between different social worlds (ibid. p.292). From these perspectives, the tension between standardized care plans and local practice can be viewed as a dynamic process of naturalization. These perspectives also illustrate how standards entail new opportunities at the same time as they are challenges in a process of change.

Standardization as an ongoing change process over time

Previous studies have shown how the implementation of new technology in complex, dynamic organizations has led to a re-configuration of work processes (Hanseth et al. 2001; Ellingsen et al. 2007). Key issues in these studies have been the re-construction of standards in situated action and how working

infrastructures transform both the new infrastructure and the local practice. Bowker and Star (2000) have nicely illustrated how the use of classifications leads to a trade-off between visibility and comparability. On the one hand, nursing classifications have to be constructed broadly enough to support numerous users in diverse contexts, and at the same time be sufficiently narrow to make sense for the individual nurse in local practice. Balancing the tension between different viewpoints across various contexts, and at the same time having both local and shared meaning, is a balance of translation, integration and local configuration.

All of the above-mentioned studies have discussed the tension between global and local standards, but have paid less attention to how such negotiation developed over time. In contrast, our study focuses on standardization as a temporal process that evolves in daily practice. Furthermore, we look at the dynamic interaction that evolves as a process of change. According to Orlikowski and Hoffman (1997), change management is more of an ongoing improvisation than a staged event. They have further recognized three different types of change: anticipated, emergent, and opportunity-based. Our study is especially interested in the emergent- and opportunity-based change. These types of changes are characterized by spontaneous interaction with the new technology over time, and in response to unexpected opportunities. This model has a more optimistic attitude toward change than traditional models that consider change to be a planned event where the main goal is to regain stability as soon as possible.

One example of opportunity-based change is the gradual development of Folksonomies (i.e., user-generated metadata or tags). The origin of this "grassroots" categorization comes from social web communities, where users started to tag content on websites. It is part of a new generation of tools for the retrieval, deployment, representation, and production of information, commonly termed Web 2.0. (Peters 2009). In contrast to formal, predefined classification systems that are relatively static, folksonomies are highly flexible and dynamic. Firstly, there is a mutual dependency between the development of collaborative information services (tags), the production of user-generated content, and the increased usage of folksonomies. Secondly, users create their own tags instead of pre-defined classifications, and thereby allow users to implement their own terminology for indexing and representing content (ibib.2009 p.3). Despite the fact that there are high expectations for the use of collaborative tagging, there are also challenges, such as potential ambiguity in the meaning of tags (Halpin et al. 2007). However, an increased use of web technology for sharing information and knowledge has gradually developed the method, and has led to increasing attention and expectations beyond the internet community, such as in science and knowledge management. Yet various academic communities consider the use of folksonomies to be a useful supplement to formal, expert-created classifications. The use of a core ontology combined with folksonomies has emerged as an

approach for managing the difficulty of replicating the role of local knowledge and communication in large-scale, multidisciplinary and distributed collaboration (Ure et al. 2009, p. 423). Such bottom-up strategies are the compromise between the hierarchical meta-model and folksonomies, and they support the distribution of information to those persons who are actually doing the work (Hepsø et al. 2009, p. 444)

Methodology

Our field study focused on everyday information sharing between nurses and social workers in a psycho-geriatric ward at the University Hospital of North Norway. Patients who are admitted to the ward are 65 years or older, and their hospitalization lasts for an average of six to eight weeks. The psychogeriatric ward is an in-patient ward with 14 beds, and provides treatment and care to patients who suffer from psychiatric disorders like dementia, anxiousness, and depression. The work at the ward is highly interdisciplinary and nurses are believed to play a key role in observing and monitoring patients' needs, as well as assessing the patients' cognitive abilities for self-care. The clinical staff comprises physicians, psychologists, nurses, social workers, occupational therapists, physiotherapists, and unskilled personnel.

The empirical data was collected and analyzed following the interpretive tradition of field study in information systems (Klein et al. 1999). The study was guided by this data collection to point out the aspects that were prominent in the standardization process. It has been an iterating process where we have focused on standardization in general, and then considered different aspects of information sharing.

The primary methods of data collection were interviews and participant observation. Between 2008 and 2010, the first author carried out 200 hours of observation of the work practices of nurses and social workers to gain insight into the historical, social, and local context of information work at the ward. The first author was also given access to the EPR system during the observation study. This provided important contextual information on how they actually performed the electronic documentation. To gain additional insight into the information work, 13 semi-structured interviews and 6 open-ended interviews were carried out, which lasted from half an hour to an hour and a half. The first author also had regular meetings with key personnel at the ward during the last two years, participated in various projects at the ward and has had access to different kinds of internal documentation. All of the interviews were taped and transcribed. Along with the field notes, the transcribed interviews constituted the basis for analysis where data have been systematized in relation to key elements of the situation of inquiry.

The process of data collection and analysis has gone back and forth between fieldwork, case description, and the use of related literature to gain new theoretical insights. It has been a process in which our understanding has been constructed through the empirical data that has been analyzed in relation to theories discussed in the previous section. This has provided a new understanding, and has generated further data collection. This iterative process continued until a theoretical saturation point was reached, meaning that further data collection no longer was significant for the interpretation of empirical data.

Case

Background and motivation

Information work is an essential part of clinical work practice in hospitals, and is strongly embedded in everyday work practice. Traditionally, clinical information has been documented and stored in the paper-based patient records. Over the past decade, clinical information has been gradually digitized and become part of the EPR. In accordance with national strategies for seamless integration between clinical systems, laboratory systems and administrative systems, the University Hospital of North Norway changed to a new, modular-based EPR system in 2003. As part of the implementation of the new EPR system, the hospital also decided to introduce a nursing module, which was available in the system. During 2005, the electronic nursing module was implemented in all departments at the hospital, and the Department of Special Psychiatry was one of the pilot departments. During the implementation period, a local project team was established that was in charge of preparing the nursing module, training end-users and coordinating activities between the local sub-project and the central project at the hospital's other departments.

The nursing module has been developed by the vendor, in close cooperation with its users, and has been widely used in Norwegian hospitals since 2003. It has been developed in accordance with professional and health policy guidelines for documentation in the EPR, and facilitates the use of the nursing process as recommended by the national and international nursing community. The use of care plans has a pivotal position, and the nursing module facilitates a flexible use of such plans, and provides multiple approaches for composing a care plan. One approach is to use a standardized language, and international classifications have been translated into Norwegian and made available in the system. However, the use of classifications is just one option. It is also possible to use a free-text language instead of, or in combination with, classifications, in order to describe the various steps in the care plan. The individual user, or hospital ward, may decide himself/herself if he/she wants to use a standardized language in the

nursing plan. Another approach is to use "Standard plans/guidance plans" that can be made available in the system. Using this option allows the user to fetch a "Standard plan" in the nursing module, and choose among pre-defined diagnoses and interventions that are developed by each hospital in relation to specific illness trajectories. This is also a functionality that is optional, and it is one that each hospital may choose to use as a support in facilitating the use of the care plan.

The use of classifications and standard plans have been adopted on a large scale in many Norwegian hospitals, in accordance with the implementation of an electronic care plan module. However, the University Hospital of North Norway has chosen a mixed strategy. While the Department of Special Psychiatry has adopted international classifications, the other departments at the hospital have decided to use free text to describe diagnoses and interventions in the care plan. The psycho-geriatric ward, which was one of the pilot wards during the implementation, has particularly aimed at using a standardized language to describe nursing practice. Both during and after the implementation, a key person from the project team was also employed at the ward and completed several internal projects which focused on highlighting care plans as a key player in the nursing documentation.

In this study, we have focused on the implementation and use of nursing classification at the psycho-geriatric ward. In the further case description, we will illustrate the generation, implementation and adoption of nursing classification as an episodic, punctuated process of change that evolved over time. To illustrate this, we have divided the process into four phases that illuminate the development from free-text documentation into a collective adjustment of international classifications as well as the cyclic variation between the different phases over a certain period of time.

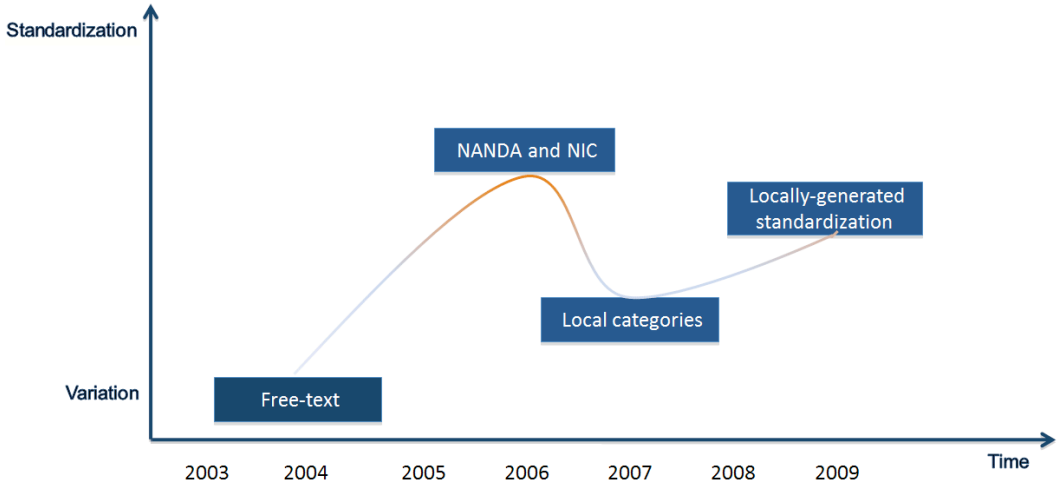

Figure 1. The phases in the local standardization process.

Phase 1. Free-text documentation (Before 2005)

Information sharing in the traditional, paper-based patient record was characterized by a chronological, sequential report of each shift, where the use of narratives, as well as an unstructured language, was prominent. Usually, the individual nurse or social worker wrote a report that reflected what had happened during the shift. There was great variation in the reports. Sometimes they were detailed narratives, yet in other cases short messages, including "The patient has been restless", "The patient has slept well". In accordance with professional guidelines for the documentation of nursing, a care plan was generally created for each patient on admission, but it was not updated or used in daily work practice. Some nurses also found it time consuming and demanding to use a care plan. Moreover, both nurses and unskilled staff were employed at the ward, and therefore had varied knowledge and experience about the use of care plans. Consequently, the content and language of the earlier paper-based reports were depended on the knowledge and skills of the individual health care workers to document nursing assessments and reflections. Two of the nurses expressed it this way:

> "A care plan was often composed when the patient was admitted, but when we turn over the pages in the Kardex, it was forgotten."
>
> "You might as well have written it in sand. It was only work you created for yourself, no one used it."

The above quotes illustrate some of the attitudes about paper-based documentation. Moreover, paper-based documentation was widely characterized as incomplete, inaccurate, and subjective, and with the use of a local jargon in the language used in the reports. In addition, they were largely dependent on oral communication for exchanging information about patients. Consequently, the staff was highly motivated to adopt the new electronic system as a step toward improving the quality of nursing documentation.

Phase 2. Mandatory use of NANDA and NIC (2005 – 2006)

As we have already indicated, the psychogeriatric ward decided to adopt a standardized language for describing nursing practice. As a strategy for the implementation of the electronic nursing module, it was decided that using classifications was mandatory. The main motivation was to provide a language for describing both planned and performed care in their daily work practices. Key users at the ward assume that mandatory use would give nurses and social workers a chance to become familiar with the classifications, as well as how they could be used in daily practice. Mandatory use was supposed to give the users a qualified choice and provide a better language for describing patient problems and planned interventions. Moreover, the care plan was emphasized as being a

key player in the daily documentation and exchange of information between nursing staff.

The implementation of the nursing module involved a major change process. First, staff had to learn to use the new electronic system. Second, they had to become familiar with a new language for describing nursing practice. The electronic nursing module is an integrated part of the EPR system, and has been developed to support the nurses' daily reporting routine, as well as a structured nursing care plan that supports assessment, planning, implementation and evaluation of nursing care.

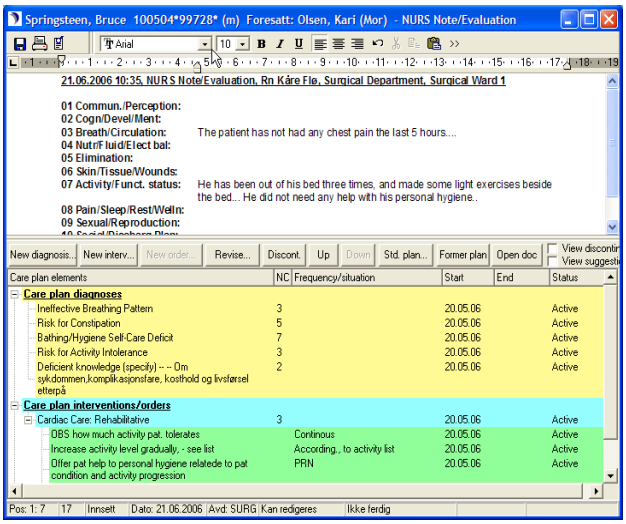

Figure 1. Screenshot of the nursing plan, where the lower part of the note contains the care plan, and the upper part shows the evaluation of the given care according to the plan. The yellow field indicates the nursing diagnoses, and the blue field indicates the nursing interventions.

The nursing module contains two separate parts that are interdependent. The lower part of the screen contains the care plan, which represents nursing diagnoses and interventions. The term nursing diagnosis has become an internationally used concept for identifying the specific nursing needs of the individual patient. These are needs that provide a focus for the planning and implementation of nursing care. At the core of the nursing plan are the international classification systems of the North American Nursing Diagnosis Association (NANDA) and the Nursing Intervention Classification (NIC) (NANDAInternational 2007; Bulechek et al. 2008). Both NANDA and NIC classifications are supported by research, and facilitate continuity of care across settings. The vendor of the EPR system, in cooperation with the Norwegian nursing community, has translated these classifications to Norwegian, and made them available as part of the nursing module. By clicking on the menu item "New diagnosis" in the action bar in the care plan, the system provides a new search window where the classifications are listed, and enables the user to search and

select a NANDA diagnoses, in order to make it available in the care plan. The same procedure is used to create an intervention, where the NIC classifications are available in the system. While the care plan represents the planning and implementation of nursing care, the upper part of the document represents evaluation of the nursing care provided in relation to the care plan. When a care plan has been composed on behalf of a patient, it is attached to the following nursing notes as part of the daily report. Consequently, the nursing note usually written for each shift is merely an evaluation of nursing care according to the plan, as a report on any deviation from the plan. The report section of the nursing note is based on free text documentation, but it is structured by function areas to facilitate the link between the care plan and daily report. Nursing diagnoses and interventions in the care plan are linked to a function area that is indicated by a number in the plan, which reflects the structure of the report section.

The use of the nursing module required new knowledge and skills, and education and guidance was a priority during the implementation period. First, users were offered an introductory course to ensure that everyone had a basic knowledge of classifications and usage of the new system. Second, six key users were trained on providing guidance in daily practice. Finally, a key person in the project team was also employed at the ward, and has been a support and driving force for further development and attention toward nursing documentation. Despite some skeptics and reluctance at the start, experiences during the first year showed that the care plans were used in daily practice and that classifications were used extensively. During this period, nursing documentation had become a central part of the interaction among the staff, as is illustrated in the below quote:

"It is great to use the care plan as a basis for discussing the individual patient." (Nurse)

Gradually, classifications became embedded in local practice and were used as a support in daily documentation, professional meetings and discussions.

Phase 3. Releasing the use of local categories (2006 – 2007)

The continuous focus on classifications and care plans involved an increased awareness of the language used in nursing documentation. Consequently, the ward gradually developed increased knowledge of classifications while they also experienced limitations and shortcomings in the use of classifications. When they experienced difficulties in finding adequate classifications, the project nurse started asking: "*What would you have written if you could use your own words?"* In cooperation with each other, they began to gradually develop their own terms to compensate for shortcomings in the system. They used NANDA and NIC as a support, but if they did not find appropriate terms, they started to choose their own concepts, as illustrated in the quote below.

"I think it is okay to work with classifications because it is easier to change something that already exists than to reinvent the wheel. If I find a classification that does not completely fit

> the situation of the patient, it is still easy to use the classification as a starting point. Instead of 'Self Care Deficit, Eating', I can write 'Self Care Deficit, All Function Areas'."(Nurse)

In this way, the use of local concepts was gradually unleashed to compensate for limitations in NANDA and NIC, in order to combine several classifications, and to facilitate the coherence between nursing diagnoses and interventions in the care plan. For example, frequently used classifications are "Risk for falls" and "Impaired Physical Mobility". If used separately, these terms represent two different NANDA diagnoses. However, some nurses prefer to link several terms into one nursing diagnosis, such as "Impaired Physical Mobility with Risk for falls". In these cases, they have become familiar with two different NANDA terms and combine them to form a local diagnosis. One problem with NANDA is that the terms are fragmented. Firstly, patients often have many different problems that are related to each other. In many cases, it would therefore be appropriate to relate to the symptoms and causes of nursing diagnosis. Secondly, many patients do have several problems, and the care plan may consequently be very long and complex if the information is fragmented. As a result, through experience and discussions, it has become common to link different problems with one nursing diagnosis.

In order to establish a nursing diagnoses, specification is recommended in relation to a PES-format, i.e., defining the problem or health state, aetiology or related factors, and associated signs and symptoms (Gordon 1998). For example, "Anxiety" is a commonly used NANDA diagnosis, but requires a more specific definition. They need to specify the symptoms related to anxiety, and aetiology or probable factors causing or maintaining the condition. Entering this information in the care plan requires intensive mouse clicking in various windows, dialogue boxes and menus in the application, and some nurses find it easier to just add the entire entry as a local diagnosis.

The adjustments of local concepts have gradually taken place in relation to both NANDA and NIC. Since these are two different classification systems, they have developed local concepts that facilitate the overview of the care plan. Some NIC concepts are often used, but in many cases, they have become accustomed to relating interventions to a nursing diagnosis.

> "In making a link between problem and intervention in the care plan, we have become accustomed to writing, for example, intervention related to anxiety. Similarly, there is a NIC classification called wound care. A corresponding NANDA diagnosis is "Impaired Skin Integrity". We are more accustomed to using the term "wound" and think it fits better in relation to the NIC classification."

In this way, global concepts have been adjusted to local needs. This adaptation was the result of collaboration with colleagues when they sat together and wrote care plans, and in discussions and meetings.

Phase 4. Gradual development of local classifications (2007 -)

Gradually, key users experienced an increasing use of local concepts, and also found a resemblance between NANDA and local concepts. In order to further explore this progress, an internal evaluation was carried out during the spring of 2008. Two nurses along with the first author were responsible for carrying out the evaluation. Reports from the EPR system formed the basis of the evaluation that included a) the incidence of NANDA diagnoses and locally developed diagnoses, and (b) whether the local diagnosis could be mapped onto a NANDA diagnosis. The study addresses the incidence of NANDA during the first period (April 2005/March 2006) and the second period (2007). The findings indicated a clear decline in the use of NANDA diagnoses. To further identify the concepts that were used instead of NANDA, a mapping between free-text concepts and NANDA was carried out. Terms from the local diagnoses were compared with terms in NANDA and characterized as "Same", "Similar", "Broader", "Narrower" or "No Match". This mapping implied that NANDA diagnoses and local diagnoses mapped onto NANDA constituted 95.5% of all the nursing diagnoses documented in 2007, a strikingly high coverage (see, Meum et al. 2010). Firstly, the evaluation showed that international classifications like NANDA and NIC had been embedded into the local language used at the ward. Secondly, it also showed that several mouse clickings were required to search for NANDA and many found it easier to just write the same diagnosis as free-text. Thirdly, it confirmed the shortcomings of NANDA. For example, nursing diagnoses related to emotion, aggression and euphoria, and the adverse effects of medication and problems related to allergy are lacking in NANDA. Accordingly, the attention was directed at the progress of a professional language.

In accordance with the increased awareness of the written documentation, interaction patterns at the ward also changed. Making the care plan a key player in information exchange among the staff has also caused that the care plan has been given a central role in the handover process and in meeting. In this context, the electronic care plan was visually projected onto a wall screen and enabled a collective reading and information seeking. Gradually, local concepts emerged, which is illustrated in the quote below.

"One day I said to my colleague – we should write down all these local terms that are 'buzzing around'. So we sat down and created a local list of terms that we often use instead of NANDA."(Nurse)

This list was first written down on paper, but then an inventive nurse suggested making the list available as a "Standard plan" in the nursing module.

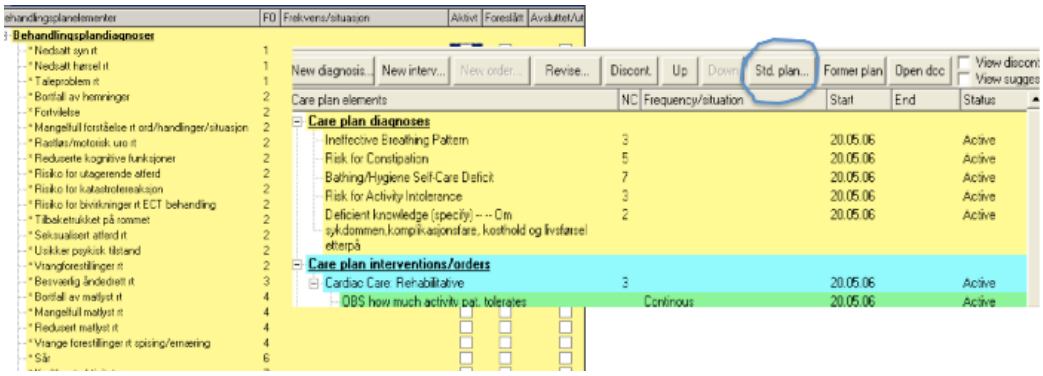

Figure 2. Screenshot of the electronic care plan and local concepts

Using this functionality in the nursing module made it easy to click on the menu item “standard plan” and then choose from local concepts. Since then, the local list has become a supplement to NANDA to attend to local needs.

Discussion

In accordance with the internal goals and motivations for adopting a standardized language, this case study illustrates a successful outcome. The psychogeriatric ward extensively use NANDA and NIC, and the nurses have acquired skills in using the system, gained an increased awareness on the use of language, and promoted the use of care plans as a major factor in information sharing at the ward. However, if we study the implementation process more closely, we see that unintended changes have also occurred. As anticipated changes have taken place, even opportunity- based and emergent changes have arisen (Orlikowski et al. 1997). These changes have not happened on a stable basis, but have been part of an ongoing process, and we illustrate this as a pendulum that moves back and forth over time. In the subsequent analysis, we will elaborate on some of these changes, including a) the gap between global classifications and local categories, and b) the collaborative creation of social classifications.

Bridging the gap between global classifications and local categories

As mentioned above, the use of classification has had a major impact on nursing language used by the ward. This progress has been influenced by several factors, not just the use of NANDA and NIC per se. A cyclic variation between global classifications, local routines, skills and the technical system have shaped the local information infrastructure. This has been an ongoing process, where increased knowledge about classifications has involved increased opportunities to improvisation. In accordance with the change model described by Orlikowski and

Hoffman (1997), many changes made during the ongoing process cannot all be anticipated ahead of time. Some changes occur as intended, while other changes occur spontaneously out of local innovation. Furthermore, the change process may also entail new opportunities in response to unexpected events, or breakdowns (Orlikowski et al. 1997). Just consider how nurses *changed* NANDA diagnoses to establish a link between diagnosis and intervention in the care plan. This shows how the use of classification has involved new opportunities, and how nurses "tinkering" with the classifications to generate coherence in the care plan. According to Timmerman and Berg (1997), this "tinkering" with standards is a kind of leeway for adjusting standards to unforeseen events, and a prerequisite for the standards to function (Timmermans et al. 1997). Similarly, Bowker and Star (2000) emphasize how the classifications have been naturalized to suit local practice. The quote below illustrates how nurses change and naturalize classification on the basis of local needs:

We have a pragmatic attitude to the use of NANDA. We use what works, and delete or modify classifications that don't fit. (Nurse)

Although NANDA is designed to support nursing practice, it also has limitations. The North American Nursing Association developed NANDA in the 1970's. It is research based, and in recent years has been internationally used in the nursing community on a widespread basis. Currently, 206 nursing diagnoses are available in the classification system, and every two years they are updated through a comprehensive review process. Consequently, many of the terms used in the system are well known in the nursing community. Bowker and Star (2000) describe this as a naturalization of categories. "*The more at home you are in a community of practice, the more you forget the strange and contingent nature of its categories seen from outside"* (Bowker et al. 2000, p. 294). A diagnosis such as "Anxiety" is an example of NANDA diagnoses that is widely utilized in local practice, as well as in the nursing community. However, NANDA is supposed to be used across geographical, cultural and disciplinary boundaries, and it covers the patient's trajectory from the "cradle to grave". Accordingly, the concept of anxiety may have a different meaning for nurses working in a psychiatric department than for those working in surgical department. In order to be useful in local practice, the classification has to be specified in accordance with the current clinical situation. Thus, in the local practice at the ward, nurses have become accustomed to adding, for example, "related to depression". The nursing community also recommends this and shows how broad terms are made to fit different contexts. However, this level of granularity entails some tension and trade-offs. On the one hand, they must be precise enough to be useful in the situation at hand and at the same time broad enough to provide a shared understanding across boundaries. This may lead to a simplification of practice, and a sorting out of gradations of nursing knowledge (Benner 2004). Just consider how they use the NANDA diagnosis "Sensory/Perceptual Alterations". As with

all diagnoses in NANDA, this has a label, a definition, defining characteristics, and related factors.

DISTURBED SENSORY PERCEPTION (Specify: Visual, Auditory, Kinesthetic, Gustatory, Tactile, Olfactory)
(1978, 1980, 1998)

Definition *Change in the amount or patterning of incoming stimuli accompanied by a diminished, exaggerated, distorted, or impaired response to such stimuli*

Defining Characteristics

- Change in behavior pattern
- Change in problem-solving abilities
- Change in sensory acuity
- Change in usual response to stimuli
- Disorientation
- Hallucinations
- Impaired communication
- Irritability
- Poor concentration
- Restlessness
- Sensory distortions

Related Factors

Altered sensory integration
Altered sensory reception
Altered sensory transmission
Biochemical imbalance
Electrolyte imbalance
Excessive environmental stimuli
Insufficient environmental stimuli
Psychological stress

Figure 4. Guide to nursing diagnoses developed by NANDA International.

Although this diagnosis may be useful in some contexts, it does not make sense in local practice:

> "I cannot stand to use this diagnosis, it sounds strange and does not fit what I want to express." (Nurse)

The above quote illustrates a general attitude to this particular diagnosis among the staff at the ward. First, they found the sound of the classification to be strange and it to be difficult to translate the classification to everyday language. Second, the classification is comprehensive and covers a wide range of problems related to nursing care. Consequently, they did not use it, and have instead developed local categories like "Impaired vision" and "Impaired hearing". The way they have made local categories available as a list in the nursing module is an achievement of neutralization and co-construction of NANDA and NIC, and a way of managing the tension between divergent viewpoints (global and situated). Thus, how has this process of "artful standardization" occurred? How are local classifications created, maintained and made sense of? These questions are particularly interesting since many of the local categories are the same or similar to NANDA. This was not planned in advance, and the alteration had not been possible without the knowledge of NANDA and NIC.

Collective development of local categories over time

The development of the local concept at the ward has been an ongoing, emerging process, and has many similarities with folksonomies (social tagging, social classification). The dynamic and structure of folksonomies are characterized by

frequency of tagging, the information value of tags, and a feedback cycle between the elements involved in the process (users, tags, resources). This process relies on human knowledge where semantic structure and folksonomies might emerge from the aggregate behavior of individual users (Halpin et al. 2007). Consequently, the system is self-evolving, self-maintaining and flexible. As with folksonomies, the local concepts have emerged through a bottom up process based on collegial collaboration. However, this collaboration has been grounded in face-to-face interaction among the staff in the process of formalizing the electronic nursing documentation.

The process of formalizing the language used in clinical nursing has not been a static state, but a dynamic ongoing process. The change process has involved new knowledge, which in turn has provided new opportunities that constantly have to be adjusted to practice. An increased focus on specifying nursing diagnoses and interventions requires knowledge, both formal and implicit know-how gained from clinical experience. Moreover, staff have to make sense of the information and translate it into written documentation in the care plan. Previously, they were more dependent on oral information sharing. They could say, for example: "You must be careful because he falls over easily, this must be followed up." In the electronic system, they must first specify the problem, such as searching for the NANDA diagnosis "Risk to fall" and then specifying aetiology and symptoms, as well as intervention to prevent falls. This information was previously more or less in the mind of the individual nurse, but the new care plan requires that they share information in a more formal and precise way. Describing this process requires both knowledge and skills. Such clinical problems are an important part of everyday work practice, where knowledge and language are constantly evolving. While NANDA and NIC are static concepts, clinical knowledge is in constant movement where reaching consensus about nursing diagnoses and intervention is a collective process, as indicated in the quotes below:

> "We have certainly been more confident in using classifications, but still we discuss the meaning of diagnoses and give feedback to each other." (Nurse)
>
> "I often look at the care plan of other patients who have the same problem, to decide what terms to use." (Nurse)

The need to formalize and discuss clinical knowledge has also been part of internal meetings and handover processes. The nursing care plan has become an important actor in this context, as a structure and guide for professional reflection. For example, a nurse may give an oral presentation of a clinical situation. At the same time, the care plan is displayed on the wall using a projector and enables collective information seeking. Together, they try to describe what the problem is and what intervention to initiate. Usually, they first search between NANDA and NIC, but if they do not find a classification that quite fits the clinical situation, they discuss other options. Just consider how they did not like the sound of the NANDA classification "Sensory/Perceptual Alterations". By discussing the clinical situation in question, everyone contributes to a common assessment, where new concepts are reviewed, and they often come up with a consensus. In

this way, local classifications emerge as a result of the professional development of the language used in local practice. This process shows how the gap between the static classifications of NANDA/NIC and the dynamic interaction in the situated practice is managed.

This is not an argument against the use of NANDA and NIC, but rather demonstrates that there are limitations that must be confronted. Instead of distinguishing between formal and informal classifications, we must look at how these constitute each other. The development of local classifications is considered to be successful at the ward. However, in the electronic system, they are handled as free-text and require the use of workarounds. This implies that we need new technologies to support this artful standardization.

Conclusion

We have presented here an innovative deployment of nursing classification. Much of this so-called ”artful standardization” can be attributed to engaged leadership, as well as skills and competence achieved in everyday practice during long-term use. First, we have illustrated how they collectively reconstructed the use of classification to manage the gap between global classifications and local practice. Second, we have showed how the re-construction of classifications has emerged over time, and describe this change process as a pendulum movement that moves back and forth. We have emphasized this pendulum movement, since the long-term use of classifications has not been well described in the literature. We have further compared the emergence of local classifications as they have collectively evolved as a supplement to formal classification. The way in which the local classifications have been used in the electronic system can be considered to be a workaround. However, we suggest that this innovative use of classification highlights local knowledge and supports a shared meaning among nurses in everyday practice. Global and local classifications used in combination both constitute each other and support professional development. Finally, we argue that we need a more bottom-up approach to standardization and believe that local classifications (folksonomies) may be a useful supplement to formal classifications, and a contribution to system design.

References

Benner, P. (2004): "Designing formal classification systems to better articulate knowledge, skills, and meanings in nursing practice." *Am J Crit Care* 13(5)Sep: 426-430.

Bjorvell, C., R. Wredling, et al. (2002): "Long-term increase in quality of nursing documentation: effects of a comprehensive intervention." *Scand J Caring Sci* 16(1)Mar: 34-42.

Bowker, G. and S. Star (2000): *Sorting things out: classification and its consequences*. Cambrigde, The MIT Press. Cambrigde, MA.

Bulechek, G., H. Batcher, et al. (2008): *Nursing Intervention Classification*. Mosby Elsevier, St.Lous.

Carlile, P. R. (2004): "Transferring, translating, and transforming: An integrative framework for managing knowledge across boundaries." *Organization Science* 15(5) 555-568.

Ellingsen, G., E. Monteiro, et al. (2007): "Standardisation of work: co-constructed practice." *The Information Society* 23(5) 309 - 326.

Gordon, M. (1998): "Nursing nomenclature and classification system development." *Online Journal of Issues in Nursing* 30.

Halpin, H., V. Robu, et al. (2007): The complex dynamics of collaborative tagging. WWW2007, Canada, ACM.

Hanseth, O. and N. Lundberg (2001): "Designing Work Oriented Infrastructures." *Computer Supported Cooperative Work (CSCW)* 10(3 - 4) 347 - 372.

Hepsø, V., E. Monteiro, et al. (2009): "Ecologies of e-Infrastructures." *Journal of the AIS* 10(5) 430-446.

Hinrichs, J., V. Pipek, et al. (2005): Context grabbing: assigning metadata in large document collections. ECSCW 2005, Springer.

International, N. (2007): *Nursing Diagnosis: Definition & Classification*. NANDA International, Philadelphia.

Klein, H. and M. D. Myers (1999): "A set of principles for conducting and evaluating interpretive field studies in information system." *MIS Quarterly* 23(1) 67 - 94.

Meum, T., G. Wangensteen, et al. (2010): "Standardization--the iron cage of nurses' work?" *Stud Health Technol Inform* 157, 85-90.

Moen, A., S. B. Henry, et al. (1999): "Representing nursing judgements in the electronic health record." *J Adv Nurs* 30(4)Oct: 990-997.

NNO (2009): NNO Strategy 2009 -2013. eHealth - Everybody's responsiblity and in everyone's interest. Norwegian Nurses Organisation.

Norwegian Ministry of Social Affairs and Health (2008): Samspill 2.0. Nasjonal strategi for elektronisk samhandling i helse- og omsorgssektoren 2008 - 2013. Nasjonal streategi.

Orlikowski, W. and D. Hoffman. (1997). "An Imporvisational Model for Change Managment: The Case of Groupware Technologies." 1997, from http://ccs.mit.edu/papers/CCSWP191/CCSWP191.html.

Orlikowski, W. J. (1994): "Categories: concept, content, and context." *Computer Supported Cooperative Work (CSCW)* 3(1) 73-78.

Peters, I. (2009): *Folksonomies: Indexing and Retrieval in the Web 2.0*. KG Saur Verlag Gmbh & Co, Berlin.

Schmidt, K. and L. Bannon (1992): "Taking CSCW seriously." *Computer Supported Cooperative Work (CSCW)* 1(1)7-40.

Schmidt, S. and R. Werle (1998): *Coordinating technology: studies in the international standardization of telecommunications*. The MIT Press, Cambridge, MA.

Simone, C. and M. Sarini (2001): Adaptability of Classification schemes in Cooperation: what does it mean? ECSCW01, Kluwer Academic Publishers, Bonn, Germany.

Timmermans, S. and M. Berg (1997): "Standardization in action: Achieving local universality through medical protocols." *Social studies of science* 27(2) 273-305.

Ure, J., R. Procter, et al. (2009): "The Development of Data Infrastructures for eHealth: A Socio-Technical Perspective." *Journal of the Association for Information Systems* 10(5) 415 - 429.