The role of locally-designed organizational artifacts in supporting nurses' work: an ethnographic study on the wards

Il ruolo dei "Locally Designed artifacts" nel lavoro infermieristico: Uno studio etnografico in reparto

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RIASSUNTO

Introduction: This paper aims to describe how nurses' planning and coordination work is performed through the use of locally designed tools (i.e., diaries, planners, reminders, and organizers). These tools are investigated as the materialization of organizational work, thus offering a complementary perspective on nursing practice to that proposed by the professional mandate and supported by official artifacts in use.
Method: Ethnographic study.
Results: By analyzing locally designed artifacts, the rationale that enables nurses to make the flow of activities work is highlighted and explained. Evidence is provided by a description of how nurses' tacit knowledge is reified and embedded into objects produced by the nurses themselves. Implications for the design of digital systems supporting nursing practice are discussed.
Conclusion: The analysis of these artifacts has allowed an understanding of practices used by the nurses to manage the workflow in the wards.
Keywords: locally designed artifacts, organizational artifacts, nursing, ethnography.

ABSTRACT

Introduzione: il presente contributo si propone di descrivere le funzioni di alcuni strumenti "locally designed", non sostenuti istituzionalmente, che supportano il lavoro quotidiano degli infermieri nei reparti ospedalieri. Questi strumenti, concepiti come artefatti organizzativi, possono essere considerati come "prodotti" del lavoro degli infermieri per la gestione del reparto nella sua complessità organizzativa. Tali artefatti sono dunque in grado di offrire una diversa prospettiva circa le pratiche lavorative degli infermieri in reparto, che potremmo definire "complementare" rispetto a quella "tradizionale" proposta dal mandato professionale degli infermieri (centrata sulla relazione di cura con il paziente) e sostenuta da artefatti istituzionali (es. la cartella clinica).
Metodo: studio etnografico.
Risultati: i risultati, discussi alla luce dell'Activity Theory, hanno evidenziato la necessità di sviluppare un nuovo dialogo in merito al lavoro degli infermieri in reparto, che tenga conto delle reali attività svolte, per la progettazione di nuovi strumenti organizzativi a supporto delle medesime.
Conclusioni: l'analisi di questi artefatti ha consentito, da una parte, l'emergere delle logiche e dei significati co-costruiti e attribuiti al "fare" organizzativo, dall'altra la comprensione delle prassi di cui si avvalgono gli infermieri per gestire i flussi di lavoro in reparto.
Keywords: artefatti "locally designed", artefatti organizzativi, professione infermieristica, etnografia.

INTRODUCTION

By the 1980s, a worldwide push toward the professional standing of nursing was devoted to the improvement of autonomy, power, and respect for the occupation (Goodrick, & Reay, 2010; Iley, 2004; Aiken, Clarke, Sloane, & Sochalski, 2001). A new occupational mandate for nurses was built up, mostly under the influence of North American theorists, based on a holistic biopsychosocial model of nursing that places the quality of the relationship with patients at the heart of nursing's claim to specialist expertise. This model of nursing as a profession that relies on a dual professional–client intimate relationship (Dingwall, Rafferty, & Webster, 1998) has not been received uncritically (Leong & Crossman, 2015; Wall, 2010; Scott, 2008). Despite this, the idea of nursing as a profession founded on an intimate relationship with the patient (see Liberati, Gorli, & Scaratti, 2015; Newman, 1986; Parse, 1981; Watson, 1979) remains the dominant ideal, and the process of "to care" is considered the core of the profession (Currie, Finn, & Graham, 2010; Allen, 1997, 2014). The importance of the context in which nurses work, as well as the intertwining of nursing work with that of other professionals they interact with, has not always been considered in defining the actual nurse's role on the ward. Indeed, this "dominant" view of the nursing profession provides an idea of nurses as professionals engaged mostly in dual therapeutic relationships with their patients, which actually does not reflect nurses' experience in hospitals. Most contemporary organizational literature on nursing is focused on professional roles and identities in relation to the new professional building and equipment (for a review see Johnson, Cowin, Wilson, & Young, 2012), while there is just a fragmented body of literature based on studies of nurses' work practices. These kinds of studies remain crucial to obtaining a wider perspective on nurses' work (Dingwall et al., 1998). A key reference here is a review of ethnographic studies on nursing work carried out by Davina Allen (2004). The review stresses the fact that, together with patient care, nurses have a pivotal position in healthcare systems, which "naturally" place them in the role of organizers and mediators. Based on ethnographic research, Allen (2001, 2002, 2004, 2014) identifies eight bundles of activities performed by nurses that show a different perspective on nursing work with respect to the organizational literature: 1) managing and mediating multiple agendas and discourses; 2) visiting patients; 3) articulating individual patient needs with hospital routines; 4) organizing the work of others; 5) managing information flows; 6) performing a record-keeping function; 7) prioritizing care and rationing resources; and 8) mediating occupational boundaries.

Substantially, all these bundles highlight the role of nurses as intermediaries between individual needs and organizational constraints. Nurses are presented as the professionals who seek to reconcile the uniqueness of tailored patient care with standardized protocols and institutional procedures (Dingwall & Allen, 2001). Far from the mission of a profession built on a dual relationship with the patient, these studies highlight nurses' competence at flow management: they are presented as mostly dealing with populations of patients and being in charge of making different agendas (patients', relatives', organizational) fit together (Allen, 2001, 2002, 2004, 2014; Dingwall & Allen, 2001). In these studies, nurses' work on the wards is presented as quite divergent from the statements of the nursing professional mandate. Allen (1997) pointed out that, if the professional mandate focuses exclusively on the professional–client relationship, the crucial elements of nurses' work, which are executed beyond the therapeutic relationship, would be ignored. In light of this, we hypothesized in this study that nurses' dual perspectives (and differing "hats") lie at the core of clinical efficiency. A good way to reflect on this "identity-related" issue is by investigating the use nurses make of artifacts.

The role of artifacts in the nursing profession

The concept of the "artifact" is very well known in the organizational literature for the role it plays in understanding how professional communities and professionalism are developed (Norman, 1988; Simon, 1986; Wartofsky, 1979). Halverson and Zoltners (2001) stress the role of artifacts in shaping procedures and policies or in reforming existing practices in an institutional context. Halverson (2003) proposes a classification that defines three types of artifacts according to their origin: received artifacts, inherited artifacts, and locally designed artifacts. According to this classification, received artifacts are adopted and implemented at a local level and are based on professional policies. They are received from identifiable external sources, such as state and regional authorities or professional development providers. Examples of received artifacts include policies regarding assessment, reporting, and budgeting (e.g., the medical record). The use of received artifacts is usually never optional in the healthcare domain; local professionals often wield their power by refusing the artifacts they do not wish to implement. Inherited artifacts are those that have shaped and institutionalized certain working practices over time. Although at some point the meaning of the decision made to introduce them has been lost, they keep being considered the "formal medium" through which to accomplish a specific professional action. Lastly, locally designed artifacts are designed by local actors to address emergent concerns in the organization. Over time, they can come to be recognized as inherited artifacts through turnover in leadership or staff composition. The network of received, inherited, and locally designed artifacts embeds both the contingencies of daily practice and the professional license of their users. The interplay between artifacts within the system of practice reflects the interlinking of institutional, social, and local instances in professional activity. As long as received/inherited artifacts mostly respond to the instances raised by nursing, locally designed artifacts fulfill the accomplishment of professional needs that are not included in official documentation and professional mandate. It is relevant to point out that received and inherited artifacts (generally introduced on the wards by hospital management) and locally desi-

gned ones (produced by nurses) tend to exploit different work practices, all critical to nurses.

Therefore, we propose the following:

P1. Locally designed artifacts are used by professionals to fill the gaps in official documentation, which—in the case of nurses—is to articulate, anticipate, and coordinate work by focusing on building a bridge between patient needs and ward requirements.

Within nursing practice, locally designed artifacts can be also conceptualized as organizational artifacts. The concept of organizational artifacts has been described in the field of computer-supported collaborative work (CSCW), created by Button and Sharrock (1997) to describe how the production of order, and the order of production, was managed in a printer production factory by embedding pieces of tacit knowledge in the workflow of artisanal locally produced tools. Under the label of organizational artifacts, these authors include a specific type of object: "the devices through which questions as to the various ways in which the sequential integrity of the process of production and the smooth flow of work can be answered" (Button & Sharrock, 1997, p. 11). By matching this concept with that of locally designed artifacts as described by Halverson (2003), the very nature of these artifacts and their role in the distributed cognition system emerges: "Locally-designed artifacts aim to shape practice either through developing a repository of appropriate responses to emergent issues […] or by instituting procedures that routinize practice around intended goals" (Halverson, 2003, p. 6). More formally,

P2. The production and use of these tools is strictly connected to the management of situated recurrent emergent issues.

These objects make it evident that the work of managing flow is an ongoing accomplishment, the details of which are attended to during the course of the flow itself. This concept of locally designed organizational artifacts merges the two definitions and can be viewed in relation to another core concept of CSCW—namely, the articulation of work (Strauss, 1985). This relationship allows us to further our understanding of how locally designed artifacts sustain nurses' work on the wards. In fact, articulation is described by Strauss (1985) as the work of ensuring due processes. This concept was further developed by Gerson and Starr (1986, p. 266), who emphasized its contingent and situated nature. The concept of articulation has been widely used in the literature to describe contingent issues related to the management of wards in healthcare. Bardram and Bossen (2005) split the concept into coordination and anticipation, focusing on the use of a range of interrelated organizational artifacts (such as work schedules, care records, and post-it notes) to support this work. Moreover, there is a significant discussion in healthcare, related to organizational literature, regarding the anticipation of activities management and assembling information from multiple artifacts into a common information space (Bardram, 2000).

This paper analyzes informal artifacts observed via an ethnographic approach. All the artifacts presented below are locally designed by nurses and therefore embed nurses' professional vision of activities, that have a key role in coordination through their function in displaying and distributing relevant information. For the reasons stated above,

P3. They constitute a privileged point of observation to deepen the understanding of the leading criteria that organize nurses' work.

The objective of the analysis of these tools is to make the rationale organizing nursing practice visible and to reveal the complexity of nurses' work.

Context

Our data were collected in the complex operative unit (COU) of a hospital in Italy. The unit is considered a center of excellence for the treatment of burns and complex injuries and is composed of two departments (an intensive care unit and a reconstructive plastic surgery ward with a total of 28 beds) plus a day hospital, an emergency room for first aid, and two operating rooms. The staff includes the head physician, 12 physicians, two head nurses, 54 nurses, four auxiliary personnel, and one pediatric social worker. In addition, various external physicians are often required to visit the wards and give their expertise to the COU, which usually entail daily collaborations. Furthermore, as is ordinary practice in most hospitals, other consultants from other wards are also required occasionally, depending on a patient's specific clinical state.

A peculiarity of this context is that the nurses are trained to work in both the intensive care and the reconstructive surgery wards. Given the more challenging workload on the intensive care unit, the nurses are required to switch between the wards every two to three months.

The research context

Over the years, the theme of accessing the field has been widely discussed in the ethnographic tradition. More recently, the postmodern literature on qualitative and ethnographic methods has reframed this topic by focusing on the need for an epistemology whereby research practice coherently reflects the "reciprocity of perspectives" (Atkinson et al., 2001, p. 256) among all the social actors (both researchers and participants) involved in research activities during fieldwork. This perspective redefines the nature of the ethnographic situation as "cooperative" and "collaborative" (Tyler, 1986, p. 126). Many scholars indicate that access may provide reflective accounts of research (Duke, 2002; Harris, 1997; Murphy & Dingwall, 2001, Hill, 2004; Mulhall, 2003), but, as Reeves (2010) points out, these accounts are often only used to amplify the researcher's reflective practices. To enter the field of this research, we have adopted the interorganizational perspective (Duranti, 1992; Hill, 2006; Hunt, 1984; Suchman, 1987), which introduces the idea that, from the outset, research is made possible by a process of co-construction, which works through the development of a completely new activity system arising around the encounter between researchers (external to the organization) and participants (internal to the organization). It is the balance between improvised actions and the co-creation of boundary objects that makes interlacement possible

between the two activity systems. The concept of "knotworking" (Engeström, 2007) is adopted to interpret specific actions by all actors involved in the research process, who are intended to build interstitial stances where the research system takes place. Lundby (2007) stresses that research into natural contexts and into real organizations should be conceived as co-construction, as a networked activity involving research institutions and partner institutions. Lundby's work drew on Engestrom's definition of the concept of "knotworking" to describe the relationships that develop between two organizations working together on a specific objective. Knotworking is based on the capacity of both organizations to tie and untie activities to collaborate on achieving a common goal. Knots are contingent joint configurations of performances put in place for this purpose: "the notion of knots refers to a rapidly pulsating, distributed and partially improvised orchestration of collaborative performance between otherwise loosely connected actors and activity systems" (Engeström, Engeström, & Vähäaho, 1999, p. 201).

METHODS

Methodological notes and contextual issues

Hospitals are definitively complex contexts in which to carry out fieldwork. Due to this issue, the majority of the data collected in the health domain, and therefore those on which the main findings in the literature are based, come from interviews (Mulhall, 2003). The literature shows that, due to the difficulties in gaining access to the field and in the collection of field notes, ethnographic observation is rarely used to collect data in the medical and nursing fields. At the root of this type of data collection are generally legal issues connected to the request for authorization (to be admitted on the wards, to take notes, to take pictures, to videotape). Moreover, there is the legal/ethical issue of patients' privacy. This has produced a particular attention to the explicit part of the nurses' work, conversely has made tacit knowledge and situated practices less noticeable, which instead they can be found in the contingent activities. Furthermore, this has produced, over time, an "organizationally oriented" representation of the health domain, to the detriment of those that are "activity oriented" (Sachs, 1995). Observations have been focused on the four topics proposed by Jordan (1996) as those that can assure a good ethnographic design. These are the person-oriented record (POR), achieved through the use of shadowing methodology; the object-oriented record (OOR), researched by shadowing the artifacts in their interactions with spaces, persons, and other artifacts; the setting-oriented record (SOR), fulfilled through ethnography and the specific choice of spaces and points of observation; and the task-(or process)-oriented record (TOR), which guided one of the two organizations of data during collection.

Together with a daily field diary, the field notes were organized into key working processes to have similar tasks grouped together for further analysis into bundles of practice. This obviously had an impact on the choice of the spaces used as points of observation. In fact, since the observations took place in those spaces where documentation and communication activities took place, the nurses' work and its artifacts relating to patient assistance were not investigated in depth. This focus of observation is also relevant when discussing the research outcomes—the artifacts described in the research results are all documentation/coordination artifacts (modules, requests, sheets, etc.) rather than artifacts related to the implementation of nursing. Given the focus of the research and the will to not observe patients for ethical and legal reasons, most of the observations were performed in those areas that are considered shared spaces by the personnel of the wards.

The spaces used as key points of observation are the ones where the most part of organizational and collaborative processes took place. Their role in the organization of practices can be summarized as follows:

-The nurses' room in the plastic surgery ward and the shared inter-professional workspace in the intensive care unit (together with the corridors) are the principal arenas where the organizational work is performed. They are the spaces where personal computers, telephones, modules, and screens together with most of the organizational materials are located. These places form the context of almost all the inter and intra professional communications (within and between departments).

- The laboratory and the rooms where the most of the medical equipment is located (i.e., medical aids or drugs) have been a privileged point of observation for what concerns the physical management and organization of the equipment within the wards' spaces with the purpose of sustaining and facilitating the work to be done.

- The so-called "tea rooms" are the traditional relaxation spaces, usually equipped as kitchens and with the primary role of having the daily meals. Access to these places became possible only after a certain period of observation time due to the confidential and informal nature of the discourses that take place therein in the moments of break from work. The observations that took place inside the tea rooms offered a complementary vision to that of the working practices and usually addressed their relational dimension.

Data collection

The data presented in this article are part of a data corpus composed of field notes and pictures collected on two wards of an Italian hospital. They were collected during 20 observation (i.e., shadowing; 10 in each ward) sessions of about four hours each (for a total of 80 hours of observations) and were carried out between February and December 2012. The type of data collected are based on a negotiation/agreement both with the management of the hospital (authorization for research was signed by the Health Department—U.S.L. Roma C, in January 2011) and with research participants (nurses of the wards). Due to the impossibility of videotaping inside the wards, according to privacy regulations, the research is mainly based on field notes. The result is an ecological methodological choice, where, although it was also impossible

to officially interview participants, field notes were collaboratively constructed with them and shared during fieldwork to produce a common sharing of the process in the making, to clarify issues related to the presence of the researcher in the field, and to define, with the participants (nurses), the objective of the research—specifically, the role of locally designed organizational artifacts used in the wards.

The research started with the objective of supporting the introduction of the electronic nurse record (NR) but changed along the way, as the nurses had a strong opposition to its introduction. The opposition was due to the lack of support the NR would have provided them in relation to management-related tasks, where the focus is not on the patient but on the ward as a whole. In agreement with the nurses, the research was re-focused on local informal artifacts aimed at supporting management tasks and on the complementarity of these tools and the NR. As social psychology researchers, we were interested in understanding why nurses deem most functional the use of "locally designed organizational artifacts" compared to the electronic NR.

The data were collected by a PhD student in social psychology and supervised by a professor associate, director of IDEaCT—Interaction Design and Communication Technologies Lab, at the Department of Social and Developmental Psychology of Sapienza University of Rome.

Basically, the researcher noted (i.e., shadowing) and transcribed (field notes) the behaviors adopted by the nurses while they used these artifacts, asking them (when possible) to tell her how and why these tools were used. Conversely, the nurses asked the researcher what she had written about the observation conducted.

The researcher had the task to respond them, reading the passages of the field notes that had been already written and giving them a brief explanation of her theoretical perspective, thus reframing the importance of that task for her research activity. Some passages were not fully understood by the nurses ("if you say so..."), because they introduced a point of view on the researcher's work, which was completely different from that of the participants. But the interest of the staff and the willingness of the researcher to discuss her goals constituted the springboard for the collaboration between the researcher and participants. Once the two parties involved understood the meaning of the reciprocal activities and had braided their practices, they had to take a step forward to create the knot. In fact, the knotworking requires more effort than just open-mindedness aimed at understanding other party's goals; it requires a new co-configuration of the system activities to able to extend itself beyond those in which the two organizations (i.e., University and Hospital)—with their participants (i.e., researchers and nurses)—are usually positioned. This new system arose at the intersection between the main activity systems to which the actors involved belonged, and the field notes served as the instrument through which the shared meaning became visible, concerning the role of the locally designed artifacts that support nurses' work.

Data analysis

Given the purpose and the focus of the research, we analyzed those tools that aim to support organization and articulation (such as diaries, planners, reminders, and organizers for different activities) among the most widely observed tools that are related to the nursing profession (i.e., technical instruments). Three informal artifacts will be discussed below, since they are crucial for explaining how articulation and organization take place in nursing: the patient overview, the medication organizer, and the blood-sample planner. They were analyzed within their context of use as well as in the interaction with received and inherited artifacts to show how nurses' "system of practice" works and the criteria they use to organize their daily work. According to Bjorn and Hertzum (2011), for each artifact, we focus on physical structure, functions (primary and secondary), interactions with other formal and informal tools, position in the work space, and peculiarities in displaying information. The findings will be discussed in the light of a post-cognitivist approach (i.e., activity theory) to the study of activity (Engestrom 1990, 1993, 1995; Engestrom, Miettinen, & Punamaki, 1999), thus aiming to build a bridge between the analysis of activity and the design of new tools to support that activity (e.g., Bodker, 1991; Nardi, 1996; Engestrom et al., 1999; Bertelsen & Bodker, 2003; Kaptelinin & Nardi, 2006; Kaptelinin, 2013; Talamo et al., 2016).

RESULTS

The patient overview: Contingent spatial references

A common peculiarity of these locally designed objects is that they use spatial or temporal criteria to provide references about patients for the workers. To do this, they often use the number of the bed as a direct reference to the patient. Although this is a very common patient identification modality in the medical and nursing domain, it embeds some criticalities with respect to safety issues.

The limits of this specific organizational criterion, based on the bed number, are stressed in those situations when the bed number can fail to be associated with a single patient. The most frequent case is that of the contingent resignation of a patient and the admission of a new one to the same bed.

To fill this gap, a local artifact has been designed that characterizes the "backstage" organization of nursing: the nurses call it the "patient overview." This is a streamlined representation of the ward itself, where patients are represented by the lines, corresponding to the ascending number of the bed they occupy on the ward. Proceeding from the first column, the information reported includes number of bed, surname, first name, date of birth, date of admission to the hospital, percentage of body injured, weight, height, previous admissions (y/n), and referrals.

As shown in Figure 1, the sheet is never entirely filled; just the most relevant information related to organizational tasks is reported. This information, grouped together, aims to provide unambiguous criteria for patient identification.

Figure 1. Overview sheet

BED	SURNAME	NAME	BIRTH	ADMITTED	% OF BODY BURNT	KG	H.	P.R	P.A.
1									
2									
3									
4									
5									
6	Bianchi	Mario	13/5/63	4/5/11	15%				
7	Rossi	Piero	05/06/80	6/5/11	1%				
8									
9	Verdi	Andrea	06/12/74	30/4/11	8%				
10									
11									
12	Gialli	Maria	23/11/32	5/5/11	10%				
DH 13									
DH 14									
DH 15									

In this tool, patients are listed according to their physical position on the ward. In fact, the numbers in the first column are those of the beds used by the respective patients, and the grey stripes physically represent the doors of the rooms where the beds are located, thus supporting a "spatial" visualization of the ward on the overview sheet. The overview sheet is hung on a magnetic whiteboard in the nurses' room in a key position near the desk with the telephone and computer, where communications, document compilation, and interactions with external departments take place. It is also positioned near the sheets that provide telephone numbers of external structures, staff rotation, and so on (see Figure 2).

This position is crucial for accomplishing the two main functions nurses attribute to this tool: it is used both to check who the patient in each specific bed is and to have patients' personal details available for booking exams, requesting consultancies, and so on. A nurse of the ward explains how the tool is used and the reasons why she dedicates time to its daily updating:

As soon as I close a patient record, and also when I open a new one, I update this sheet and hang it up again. This way, the doctor or the nurse that arrives at the ward can immediately see if there are any new patients. And then when I take telephone appointments, I have it here, and it gives me all the information I need without having to open the patient record. (Field notes, May 5, 2012)

Figure 2. Overview sheet positioned on a magnetic board

The staff therefore uses this tool as the primary reference to know who the patient in a specific bed at a specific moment is. The need for collaborating actors to have a common vision on their work context has been approached at a micro-level by several authors (e.g., Heath & Luff, 1992; Heath, Svensson, Hindmarsh, Luff, & Vom Lehn, 2002). They have described the ways in which co-located professionals are able to make aspects of their activities visible. In these studies, it is pointed out that awareness is generally accomplished by pauses, gazes, and other moment-by-moment means, but it rarely involves dedicated artifacts. As opposed to other contexts, the use of dedicated artifacts is almost a must for what concerns hospital staff, where different professionals are not continuously co-present. In our case, the patient overview sheet is necessary for communicating the interwoven states of the trajectories of the admitted patients. In fact, as a "tool in use", it provides the date of admission of the patient to the ward (marked in the fifth column) as well as enhances the level of awareness of the staff of changes occurring on the ward. Moreover, it is also has all the patient-related information needed to properly interact with external structures (e.g., request a consultancy or an X-ray). Together with other tools hung on the whiteboard, it provides distributed information at key points in the workspace. The overview sheet works then as a transitional element that aims to create a sort of fil rouge between the patient and his/her "positioning" on the ward. It thus allows the staff to maintain a dual vision of the patient and the ward.

The medication organizer: Merging all relevant information about a single task

As already mentioned in the previous paragraphs, nurses usually deal with the scheduling of ward activities in relation to the agendas of other structures of the hospital with which the ward interacts. Transversal planning is then a key element for building continuity between different interlinked moments of patients' treatment (see also the blood-sample agenda in the following subsection). In addition to transversal planning, nurses need to keep together all the information that relates to a specific relevant activity for contextual planning and to have an updated report on the accomplishment of that activity.

In our context, this relevant activity, given the nature of one of two departments (reconstructive plastic surgery), is that of medicating patients:

Medications for each patient are made up every day, every two days or every three days, depending on the case. For some patients with severe injuries—such as those who have had most of their body burned—dispensing medications can take between two and three hours of a nurse's daily work. These patients are medicated 'per part.' This means that every day one or more parts of the body are medicated, with the result that each part of the body is medicated every two to three days. When a new medication is prepared, the old one is discarded, and this is when one can see the status and the course of the wound. At

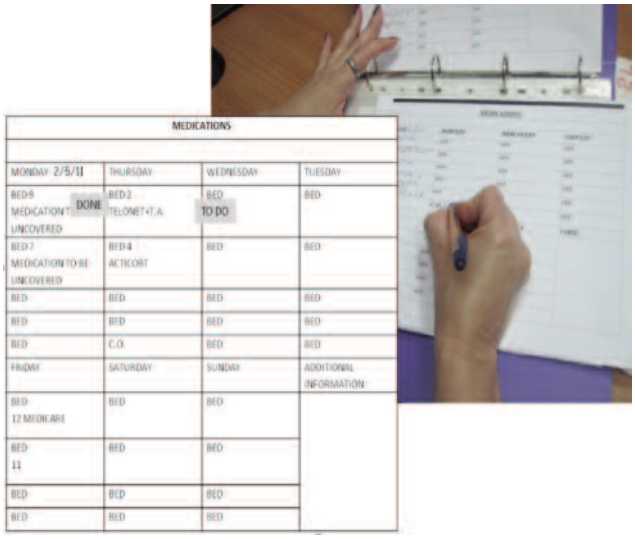
this point, the patient is in a status called 'exposed' (because the wound, during dressing changes, is exposed to possible infections), and the doctor is usually asked to monitor the treatment progress and to make changes to the medication or therapy. (Field notes, May 24, 2012)

The medication organizer (Figure 3) is composed of weekly sheets that allow nurses to report three types of actions that relate to medications: 1) note down the medication given (with indication of the drug used), 2) plan medication that should be given within the week, and 3) provide a reminder of when the patient has to be "exposed."

It is relevant to note that in this tool (as well as in most locally designed tools) the number of the bed occupied by the patient on the ward is used as the key reference for identifying the patient. Essentially, the medication organizer works as a weekly planner, displaying on a single page the medications already given and those to be given. It frames together the work done and what is still left to do, thus helping the nurses to figure out the weekly workload of medications, one of the most time-consuming tasks on the ward.

By amassing and broadcasting selected information about the collaborating actors' joint work into a single tool, the nurses contribute to supporting awareness (Schmidt, 2002) regarding the specific procedure for medications (i.e., avoiding medicating a patient already medicated or forgetting to "expose" a patient) for all the professionals involved in the task. The coordination function of the medication organizer relies on the actors' awareness of the relevance of its content and of their joint commitment in keeping the information provided always updated (Schmidt & Simone, 1996). Together with the blood-sample agenda (see next subsection) the medication organizer highlights a strong nurse commitment to keeping other professionals informed about the state of key tasks to plan and pass on extra information not covered by the handover record. This tool is positioned on the medication cart. In fact, since its utility is associated with the medication process, it is strategically positioned in contiguity with other tools that support the same process; therefore, when the cart with the drugs and aids is moved to patients' rooms, the medication organizer is moved, too.

Figure 3. Medication organizer with nurse working on it



The blood-sample planner: Time management in hospital work

As with the previous artifacts, time management is a central issue in nurses' organizational work. Nurses spend a lot of their time making the planner of the ward fit with those of the other structures of the hospital to guarantee the correct functioning of the system. This is done in a complex organization, where each department has a personal planner and a specific time schedule. An example of this complexity relates to the schedule of laboratory exam procedures, a key task performed daily by nurses.

In this procedure, specific temporal windows have to be considered: there is a pre-defined and institutionalized time window for requesting the exams with the laboratory. It depends on issues related both to the electronic system for sending out the applications and to the internal organization of the analytical laboratory (i.e., its opening hours). Another time window is that of taking blood samples, which involves the ward's internal organization and has to be set up in relation to that of the analytical laboratory. A third pre-defined time window is that needed by the laboratory to analyze the blood samples and to upload the results into the electronic database so that the doctor can use them to inform his or her decisions on treatment. These organizational planners have to be kept in consideration when activities are scheduled to make coordination possible and working procedures fluid. To do this, a locally designed artifact has been created: the blood-sample planner.

The blood-sample planner is a simple planner. It becomes an organizational artifact when nurses write in pen on the cover the name of the ward (reconstructive plastic surgery) and the main function (blood exams) of the artifact. Its primary function is to take note of the dates booked for the blood exams and to organize the events related to this task (e.g., the day before the sample, the nurses need to remember not to order breakfast for the patients that will go in for the sample). Essentially, it is used by nurses to remember when a patient will have a blood test with enough time in advance to anticipate and organize the work to be done. This organization is performed by a very "standard" unofficial procedure that combines institutional and local tools in a way that is functional for the accomplishment of the task but that cannot be traced if only the official documentation in use is considered. To understand how the planner is used, it is necessary to describe the typical procedure for requesting blood tests. All blood tests are required to go through the hospital's dedicated electronic system, which sends the applications to the laboratory for patient X on day Y. Once the request is complete, the system automatically generates labels to be printed. Each of the printed labels identifies the patient, ward, set of exams, and the date set for the sample (see Figure 4). Labels are placed on the corresponding test tube; the color of the tube caps helps nurses to identify the right one at a glance, different colors being related to different types of requests.

In addition to the labels that go on the tube caps, the system prints an adjunctive label called the "blood-sample identification label," where the identification number for the sample is reported together with the date and the name of the patient (see Figure 5). This label is printed to provide the ward with a reference number for the sample, which is used to communicate with the laboratory if necessary. The unofficial part of the procedure occurs when this identification label is printed as well as the others; but instead of being used on official reporting tools (i.e., the clinical record), it is placed on the blood-sample planner on the day on which the blood test is scheduled.

Every day, nurses check the planner for the subsequent day to organize the blood samples according to the schedule, as it helps them to anticipate the upcoming activities. This allows the nurses present during the morning (when blood tests are usually carried out and invoices to the cafeteria are sent) to always be aware of the samples that need to be taken and the activities to be planned. This routine procedure brings up some issues regarding the borders between formal and informal documentation in healthcare, where informal but stable procedures (such as the one that states that the label printed by the official electronic system should be placed on an informal planner) and the mesh of official and unofficial practices reveal gaps in the institutional documentation.

Intrinsic difficulties related to this process are reflected in the planner's physical position within the ward: it is locked in the drawer at the nurses' station (see Figure 6), for which only certain nurses have the key, reflecting the difference between primary and secondary users. What we are witnessing is the creation of an organizational artifact ("blood-sample planner—plastic surgery"), which is not for public access in the ward but rather is rhetorically and situationally treated by the whole staff as private or organizational, based on contingencies.

Secondary uses of the planner derive from the lack of official tools specifically devoted to planning and communication. In addition to the primary function, nurses use the planner to take note of appointments that involve the arrival of external professionals at the ward, patients' movements, appointments with the ward physicians (or other non-nurse professionals), or a specific task to carry out some days later (e.g., to wake up a doctor at 6:00 a.m. for the medication of a patient the following week). This is due to the fact that having the information presented patient by patient in the clinical record does not help in managing the flow of activities of the whole ward and easily leads to nurses forgetting key information (e.g., consultancies in the clinical record are not reported on the day of the appointment but on the day on which the appointment was required). Moreover, it may also happen that key information already reported in the handover notes is transcribed on the planner so that it is visible in different places. This fact has several implications for daily practice and generates ambiguities related to who is in charge of managing this necessary but invisible practice (for which nurses have the real responsibility rather than the formal responsibility of the doctors). In this way, issues of power and the crossing of borders arise and, day after day, have the effect of re-negotiating inter-professional relations.

Figure 4. Label to be stuck on the corresponding test tube depending on cap colour

Figure 5 A blood sample identification label stuck on a blood sample planner

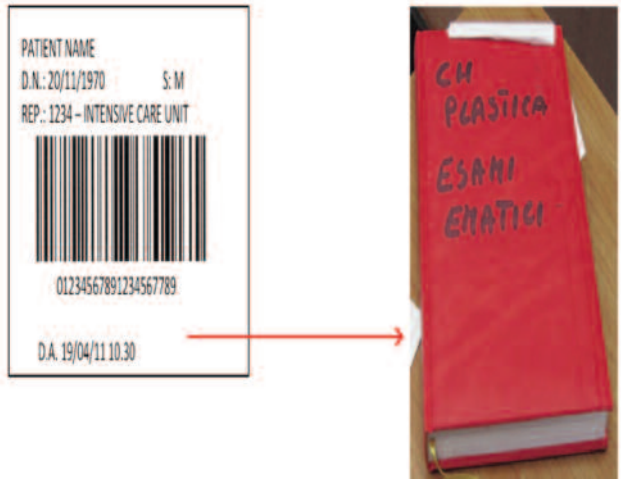


Figure 6. A planner near the drawer where it will be locked away

DISCUSSION

The ethnographic study presented in this paper highlights the complex interplay between daily practices and planning artifacts in nursing. Far from the mission of a profession built only on a dual relationship with the patient, the research describes a different core competence, which remains invisible to official representations of nursing: ward management. While institutional documentation covers the part of the work related to individual patients, the latter perspective related to their work on ward management is not sustained by any official tool in use on the wards. Moreover, although nurses are required to accomplish tasks that need frequent shifts of perspective on a daily basis, no official mediational artifact is offered to support them in this task. This issue is informally solved by the nurses through the creation and use of locally designed organizational artifacts (Button & Sharrock, 1995), which help them in managing and breaking down complex information to efficiently schedule and coordinate work. These tools, designed by the nurses themselves, ensure that the shifts of focus between "the eye on the patient" and "the eye on the ward" needed by nurses occur, as they sustain awareness (Heath & Luff, 1992) and situate planning (Bardram, 1998). Through these informal tools, a visual and conceptual management of relevant work-related information is provided, and a twofold vision that shifts continuously between the single patient and the ward as a whole is maintained. It is relevant to note that to fill the gaps of the official documentation in ensuring work efficiency, nurses invest their time in designing and managing their own organizational tools. For this reason, the rationale behind these tools can be used as a starting point for considering the characteristics that artifacts supporting nursing should have to be effective. In line with Gerson and Starr (1986), we think that without an understanding of the articulation work accomplished through locally designed tools, the gap between work requirements and the actual work process will remain inaccessible to the analysis since, first, it will always be the case that in any local situation, actors "fiddle with" or shift requirements to get their work done in the face of local contingencies. We argue here that such articulation is not extraneous to requirement analysis but rather central to it (Gerson & Starr, 1986, p. 258). Starting from this idea, some design-related findings are summarized below in the form of implications for the design of IT-based tools to support the invisible work done daily by nurses. The first consideration to be made is that wards are not stand-alone structures. They have to refer to the wider structure of the hospital and to the regulatory bodies, such as the local health district (Azienda Santaria Locale, or ASL) and referring region. A dialogue with external structures is at the core of wards' work to get the resources needed to accomplish nursing tasks. This assumption implies that nurses have to coordinate between their agendas and those of the external resources providers to get their job on the ward done.

The second consideration is that some of their practices are inter-professional and interpersonal. This implies that to accomplish some parts of their work, nurses have to coordinate with other nurses, physicians, auxiliary operators, physiotherapists, and so on. To do this, the work to be done (and how to do it) has to be planned, coordinated, and shared among professionals to make visible to all the persons that have to accomplish it (together or separately) what is needed to guarantee the continuity of nursing and to prevent mistakes.

The third issue is related to the previous two. Due to the fact that different agendas (of structures and professionals) have to be merged to best facilitate nursing, some practices lose their natural continuity. The necessity of dealing with strictly related practices that are temporally discontinuous imposes the need for continuous information that broadcasts only selected information to the professionals involved in that process.

These instances are partially solved by locally designed organizational artifacts, which specifically aim to make nursing work flow. Below, we present some design implications for the organizational criteria used by nurses to articulate work across locally designed artifacts. They offer relevant information for the future design of IT-based technologies, since they embed the rationale behind the key leverage points used to organize work.

Implication 1: Patient versus ward and the need for ward-centered documentation

It has been already pointed out that locally designed artifacts seek to reconcile the twofold perspective that nurses need to have—that on the single patient and that on the ward as a whole—to make nursing effective. This issue is solved via the use of local tools merging a patient's individual needs with those scheduled activities that involve hospital structures external to the ward. This way, a ward's activity schedule, which acts as a conceptual bridge between the patients' needs (and the patient-related documentation) and the agendas of the rest of the hospital (external agendas, resources needed, and infrastructures available), is created.

This is in opposition to the current stream with the introduction of e-health tools, which seeks even more patient-centered documentation. In fact, the way local tools are structured and used outlines the need for ward-centered documentation to efficiently coordinate patient care and make it flow in fixed paths where external instances related to hospital organization are envisioned and considered in terms of explicit resources and constraints.

Implication 2: Report versus anticipation and the need for planning devices

The second issue is that daily activities are efficiently coordinated mainly because nurses are able to anticipate others' actions or external events by keeping under control several agendas and modifying their behavior in advance so that the work is accomplished even in situations where the normal schedule is not possible. Such anticipatory behavior requires nurses to take into consideration several aspects that may have an impact on the efficiency of the

ward, and certain locally designed artifacts help in this task (e.g., the blood-sample planner or the medication organizer). The need for anticipation opens up another key issue with respect to digitalization in hospitals.

At present, the most commonly used e-health tool is the data entry concept. It sustains the digitalization of the patient record and has the capacity to store a huge amount of patient data for further analysis. This concept, which is at the core of the digital record, has as its main goal archiving what has already happened (i.e., information already acquired) and making information available in the future for several purposes (clinical, economical, legal, and statistical). However, locally designed organizational artifacts are based on anticipation: they focus on the present and future. They serve to set up activities and to anticipate possible issues that may have an impact on work organization. Therefore, the information input in these tools has no value apart from the flow of work in which they are inserted: they are information in situation and information in perspective, which have relevance only if taken together with the whole context and within the practice in which they are needed. The massive use nurses make of locally designed tools is strictly related to their nature as planning devices and outlines the nurses' need for tools where information is not fixed nor stored but rather fluid and contextual.

Implication 3: The need to provide a fil rouge to link different activities

An alternative visualization of some core task-related information seems to be crucial in helping nurses understand the situation regarding the more complex and dispersive tasks. This also highlights that there is a need for a dedicated visualization to support the planning of activities. This task-oriented display of information helps nurses to see at a glance the progress of a specific activity, what the task is about, which professional is entitled to perform it, what it is needed for the task, and when it has to be completed.

Implication 4: The importance of spatial references and key positioning

The last issue outlines the fact that spatial references are crucial for quick-to-read information, such as in the overview sheet. The visualization of space-oriented information supports nurses in always having an updated view on the major issues related to all the patients present on the ward and increases their awareness of specific key events. An additional consideration is how local tools are best positioned in strategic places of the ward to make them easily visible (as per the patients' overview) or sometimes invisible (as per the blood-sample planner) while remaining contingently usable. This opens up for reflection on how the digitalization and transfer of information should carefully take into account where information needs to be positioned to be effectively available to specific actors at specific times.

Implication 5: On the need for integration and interoperability: pros and cons of digitalization

The strongest point in favor of digitalization is the ease of selection, adaptation, and use of key information it allows. In fact, if integrated and interoperable IT tools could be introduced, they would fill the gap in official documentation that is, at the present moment, addressed via a "quick fix" by locally designed tools. Through interoperability it will also be easy to have automatic shifts in the visualization of key information according to the specific aims/tasks that have been identified—and this seems to be crucial to guarantee the efficiency of working practices.

By default, the automatic adaptation of the visualization of official information for different purposes will decrease nurses' workload. In addition, the possibility of embedding organizational tools into official documentation will produce positive effects in regard to risk management by reducing the risks connected to information transcription and ensuring that official documentation has no gaps (e.g., the official label stuck on the unofficial and locked planner). Last but not least, with respect to the discussion on nurses' professional mandate and actual practice, the possibility of having the different activities performed by nurses supported by the use of integrated documentation will exploit a complex professional role from a professional empowerment perspective. These are key objectives both for professionals and for health organizations.

CONCLUSION

This study examined the complex interplay between institutional factors, daily practices, and artifacts through defining what nursing is about and provided insights based on evidence regarding key issues to consider when developing and introducing digital tools for nursing into the wards. The study confirms the international literature (Dingwell & Allen, 2001) regarding the fact that in addition to just handling the single patient, nurses also handle the ward in situ, dealing with populations of patients and trying to make different planners (patients', relatives', and organization planners) fit together. Therefore, if we focus too closely on the professional–client relationship, we may ignore those elements of nurses' work that are performed apart from the therapeutic relationship but make a vital contribution to clinical efficiency (Allen, 1997) and are crucial for defining what nursing is about and for supporting it adequately. If a patient-focused approach to nursing is fully embraced and reflected in the official documentation (i.e., the clinical record), the latter ward-centric perspective becomes increasingly less visible and disregarded over time. The fact that there is a lack of support for this perspective is reflected in the lack of official documentation supporting it. It is through the creation and use of informal artifacts that nurses seek to reconcile these apparently dichotomist professional ideas of assisting the patient and organizing the ward. These locally designed organizational artifacts help them to manage and break down complex information to efficiently schedule work and accomplish several activities that require coordina-

tion. The way local artifacts are designed, positioned, and used in practice by nurses contributes to our understanding of the way nurses work.

In conclusion, the data presented in this paper are part of a data corpus composed of field notes and pictures collected during 20 sessions of observation of about four hours each and carried out in approximately one year of work. The data follow the different phases of accessing the field described in the organizational ethnography literature and also experienced by the researchers: from institutional access to negotiation with the hospital staff of their presence within the wards. Whilst the warp had been formally established at an institutional level, the weft was constantly woven within the interstices between each party's key practices. There, the actors suspended their institutional activities to understand and collaborate with each other. In this way, they improvised openings on situated and peripheral tasks and intertwined the threads for further co-configuration. Data gathering was therefore negotiated, and the data themselves were co-constructed, inasmuch as they became accessible in a meaningful way for the researcher only once the "knots" had been tied with participants. Data gathering was thus the result of the co-creation of a new activity system where rules, objectives, artifacts, and values were shared between the representatives of both organizations.

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