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Design strategies in hospital pharmacy department: Mapping a medication system

Arina Blum, Giselle Schmidt Alves Díaz Merino, Eugenio Andrés Díaz Merino

arinablum@gmail.com, gisellemerino@gmail.com, eugenio.merino@ufsc.br

Universidade Federal de Santa Catarina. Campus Universitário Reitor João David Ferreira Lima. Centro de Comunicação e Expressão, Programa de Pós-Graduação em Design, Bloco A, 1° andar, sala 123, Trindade, 88040-900, Florianópolis, SC, Brasil

ABSTRACT

Pharmacy departments are technical and administrative units in hospitals that relate to several other departments, and thus they have a strategic status on supervising the medication system. The hospital pharmacy department has an important role on patient safety, as it can work on error prevention, avoiding mistakes on the process. If there are no precautions implemented on medication system, there will be greater risk of errors, which could unavoidably harm the patient's health. In this context, this article reports a research applied on a psychiatric hospital in the state of Santa Catarina, Brazil. The following issue was the starting point of the research: how is the configuration of the medication system in this hospital? The objective was to analyze the system, through mapping, in order to identify strategic opportunities for design. Results demonstrate that the medication system is integrated to the pharmacy, and depends on it. Results also suggests that strategic design interventions on storage, fractionation, separation and dispensation of drugs could contribute to the safety of the system as a whole.

Keywords: strategic design, hospital pharmacy department, medication system, error prevention.

Introduction

Strategic design occurs on the path which considers the system integrating a series of related factors, such as viewing and representing scenarios and developing means of solving problems by combining various forms of knowledge (Cautela, 2007). It is worthwhile, in the hospital, to consider strategic design as a means of supporting the safety of the medication system, as a set of factors must operate in order to prevent errors. The hospital pharmacy, especially, is a strategic action sector in that system (Lopes *et al.*, 2012; Anacleto, 2010), because its professionals are in a position which enables them to supervise the quality of a great part of the medication process (Guchelaar *et al.*, 2005).

As a troubling cause of morbidity and mortality, medication error is, notably, a public health issue. According to Mendes *et al.* (2014), such errors cause the death of 1 (one) in 131 (one hundred and thirty-one) ambulatory patients and 1 (one) in 854 (eight hundred and fifty-four) inpatients, which consists of a rate of medication errors varying from 4.8% to 5.3%. Reis *et al.* (2010), researchers who studied the topic in Brazilian public hospitals, identified drug administration problems in 30% of cases studied.

The research reported in this paper was applied in the pharmacy of a psychiatric hospital in the Brazilian state of Santa Catarina. It was based on the following assumptions: medication error is an issue from which no hospital is immune (Werner *et al.*, 2012); creating a safety culture is necessary to reduce the probability that mistakes will occur (Schneider, 2007); the data flow which leads to medication errors can be reduced through organizational learning routines deployed in the pharmacy (Tamuz *et al.*, 2004).

Aiming at design projects that contribute to safety by preventing medication errors, the necessity of understanding the work process of the pharmacy being studied guided the research. It was established, therefore, in face of the problem of how to configure the medication system in that hospital. The objective was to analyze the system, through mapping, in order to identify strategic opportunities for design. The study sought results that would allow viewing the activity flow from the hospital pharmacy. The system map eased the indication of key points so that design actions can be deployed in that context, strengthening the medication system's safety.

Methodological procedures

The research took place at the pharmacy of the Instituto de Psiquiatria de Santa Catarina (IPq-SC). It is part of a project designed by the Núcleo de Gestão de Design e Laboratório de Design e Usabilidade of the Universidade Federal de Santa Catarina (NGD/LDU-UFSC) (approved by UFSC's ethics committee under number 1.257.716), furnished by requests for proposal Proex (MEC/SESU) and Universal (MCTI/CNPQ) and in parallel to the Rede Pesquisa e Desenvolvimento em Tecnologia Assistiva (RPDTA). The project is entitled "Design e Saúde: da saúde do paciente às questões de saúde do trabalhador", having among

its main goals the promotion of actions that strengthen healthcare, improve quality of life, minimize risks and prevent accidents within the psychiatric hospital.

The structure of the study reported on this paper was an exploratory research of applied nature and qualitative approach. This type of research was chosen as it enabled the collection of more information about the investigation's subject, more successfully defining and outlining what is being approached (Prodanov and Freitas, 2013). Backed by bibliographical investigations, it allowed for the understanding of the hospital pharmacy context and the peculiarities of the place where the research was applied.

The technical procedure used was the participant observation, along with interviews and document investigation. The researching designers operated directly on site, experiencing on a daily basis the services provided there and exchanging information with the hospital's employees, especially those working at the pharmacy. They became, temporarily, an integral part of the sector being studied, through the "face to face relationship with the research's subjects" and, therefore, carrying out "the gathering of information, data and evidence" (Martins and Theóphilo, 2007, p. 85, my translation). The collaborative work with the employees allowed collecting and designing the mapping.

Medication dispensation systems

The Agência Nacional de Vigilância Sanitária (ANVISA), the agency that regulates and supervises the production and use of medications in Brazil, defines that "medications are special products designed to diagnose, prevent, cure diseases or alleviate their symptoms". It adds that the "effect of the medication is due to one or more active substances with scientifically recognized therapeutic properties". Such substances are called pharmaceuticals, drugs or active ingredients (ANVISA, 2010, p. 12, my translation).

In the hospital environment, the medication goes to the patient through internal logistics called "dispensation system". Dispensation is the process of distributing the medication. It is how, at the hospital, "the pharmacy sends medications to patients after previous analysis of the medical prescriptions" (Santos, 2006, p. 149, my translation). Such system is adopted, as a rule, understanding the specifics of each hospital and aiming at the safety of the process.

In that context, "choosing an adequate dispensation system will contribute to the safety and fulfillment of the drug therapy prescribed to the patient" (Braga, 2014, p. 83, my translation). In Brazil, three systems especially stand out: the collective dispensation system, the individualized dispensation system, and the unitary dose dispensation system (Braga, 2014; Juliani, 2014; Santos, 2006). What varies between them is the work course throughout the sectors, i.e., the activities performed by the professionals involved – doctors, pharmacists, nurses, among others – so that the medication can reach the patient (Figure 1).

In the collective dispensation system, the pharmacy simply sends the medications to the location where they are stored and the nursing staff performs the processes of separation, preparation and administration of the medication on the patient. In the individualized dispensation system, the nursing staff is responsible for preparing and administering the medication to the patient, and the pharmacy is responsible for separating the medications individually, according to the medical prescription. In the unitary dose dispensation system, the pharmacy aggregates the dose preparation activity, i.e., the nursing staff administers the medication prepared in the pharmacy (Braga, 2014).

Regardless of the kind of system used by the hospital, the dispensation must consider the ideal defined by the Pan American Health Organization (PAHO): reduce medication errors and increase the safety for the patient; rationalize the distribution and administration of medications; increase the control over medications with pharmaceutical access to patient information; reduce medication costs through adequate procedures (Santos, 2006, p. 150-151).

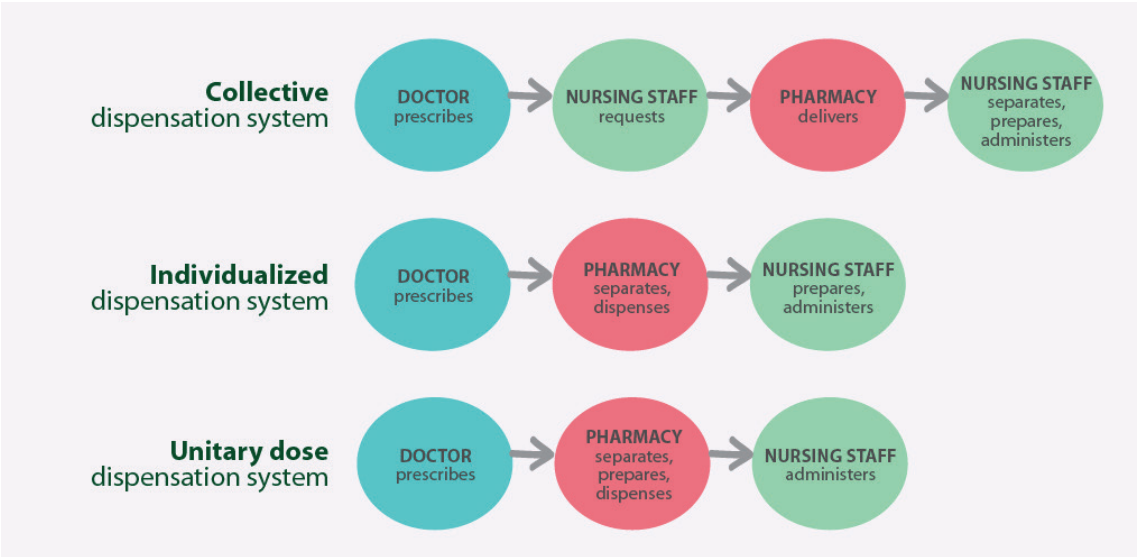

Figure 1. Hospital dispensation systems.

Source: Designed by the authors based on the research carried out.

Such ideals involve, also, hospital medication safety compliance, called the "five rights": "right patient, right medication, right pharmaceutical form, right dose and right time". This requires that the various sector of the hospital are integrated, and, especially, that the hospital pharmacy, core of the dispensation system, works with proper planning, knowledge, control, management, organization and methodology (Braga, 2014, p. 83, my translation).

Hospital pharmacy

The hospital pharmacy holds the medications, which, from the administration viewpoint, are the hospital's most expensive input. Due to the range of services under the hospital pharmacy's responsibility, it is considered as a technical-administrative unit within the hospital, with its function connecting it to many other departments of the hospital (Figure 2) and surpassing the purely technical framework (Santos, 2006).

The hospital pharmacy, according to Brazil's Ministry of Health (Brasil, 2010, p. 2) is the clinical, technical and administrative unit where activities related to pharmaceutical assistance are processed, managed exclusively by pharmacists, composing the organizational structure of the hospital and functionally integrated with the other administrative and patient assistance units.

The pharmacy hospital's focus "must be on the patient, using medication as an instrument to improve his quality of life" (Juliani, 2014, p. 16, my translation). Santos (2006, p. 119) says that we can conceptualize the hospital pharmacy as a service technically prepared to store, distribute, control, and, in some cases, produce medications and related products for use in a hospital. It is also responsible for disseminating technical and scientific information about medications and other agents used by the hospital, as well as performing quality control.

Dantas (2011, p. 7) summarizes the hospital pharmacy's technical and administrative functions describing the objectives of the processes of management, medication selection, scheduling, acquisition, storage, distribution, information, pharmacotherapy follow-up, pharmaceutical technique, and education and research:

- *Management:* Provide organizational structure and infrastructure that enable the pharmacy's actions;
- *Medication selection:* Define the medications required to meet the hospital's needs, according to criteria of effectiveness and safety, quality, posological convenience, and cost;
- *Scheduling:* Define technical specifications and quantity of medications to be purchased, considering available stock, resources and deadlines;
- *Acquisition:* Meet the hospital's demand taking quality and cost into consideration;
- *Storage:* Ensure the quality of the products in stock and provide information on stock movement;
- *Distribution:* Provide medications in proper conditions and in a timely manner, with process quality assurance;
- *Information:* Provide independent, objective and adequate information about medications and their rational usage to patients, health care professionals and managers;
- *Pharmacotherapy follow-up:* Follow up the use of medications prescribed to each patient individually, ensuring rational use.
- *Pharmaceutical technique:* Perform compound and officinal preparations, available on the market, and/or fraction pharmaceutical specialties to meet the patients' needs, ensuring quality;
- *Education and research:* Train human resources for pharmacy and pharmaceutic assistance. Produce information and knowledge that drive the improvement of current behaviors and practices.

After understanding the range of services performed in a hospital pharmacy, the study focused on its practice in a public hospital and on verifying how the field of design can make a contribution in that environment. IPq-SC's hospital pharmacy study had the immersion of the researchers in the study environment for approximately one month, from April to May 2016.

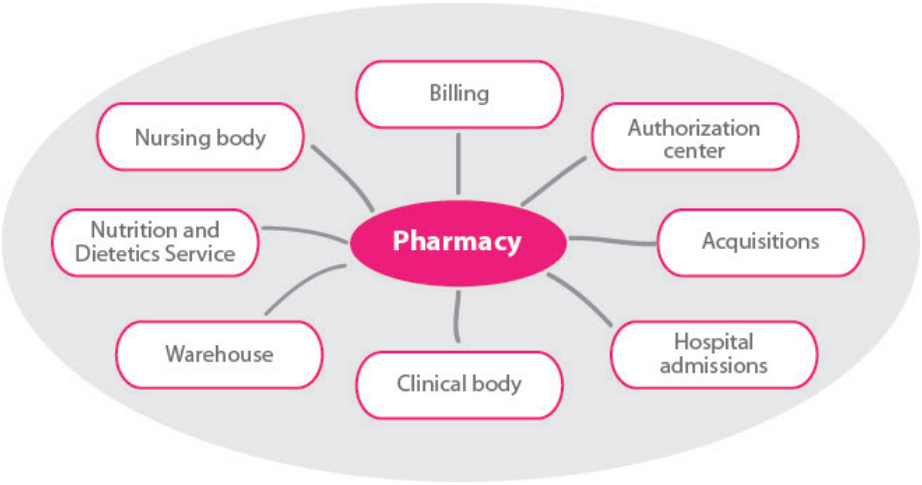

Figure 2. Pharmacy relationships in the hospital context.

Source: Adapted from Santos (2006, p. 53).

Applied research

The IPq-SC is located in the municipality of São José, in the state of Santa Catarina, and is a public state hospital for psychiatric and drug addiction treatment. It provides clinical, psychological, and dental care, and offers occupational therapy, physiotherapy, and specialized programs such as a schizophrenia care program and an affective disorder care program (Santa Catarina, 2015).

The IPq-SC was established by religious people in 1941, initially under the name Hospital Colônia Sant'Ana (HCS), with the purpose of housing 300 psychiatric patients. The HCS reached its end in 1996 and gave place to the IPq-SC, carrying out a proposal of professionalizing the service from two care units managed by the Santa Catarina Department of Health: one for the hospitalization of patients with acute psychiatric episodes and another called Centro de Convivência Santana (CCS), for short-stay patients and to house the remaining patients from the former HCS.

The IPq-SC provides care, today, to approximately 480 (four hundred and eighty) patients supported by 500 (five hundred) employees including pharmacists, physiotherapists, nurses, doctors, social workers, occupational therapists, psychologists, physical educators and pedagogues. The hospital's structure is divided especially into nine integrated areas: institutional; exams; care/treatment; community; male wards; female wards; mixed wards; services; and food.

The pharmaceutical service of the IPq-SC is centralized in an internal pharmacy that serves the entire hospital. The pharmacy, in this context, must handle a great medication flow – around 125,000 (one hundred and twenty-five thousand) pharmaceutical units per month. Immersed in the pharmacy's work environment, it was possible to observe that it operates with two means of dispensation: individualized, especially for the CCS unit, and collective for the hospital's remaining wards.

The employees that operate in the IPq-SC pharmacy, around five per shift, take turns performing the various tasks of that sector. Among them, the activities of fractioning and separation for dispensation stand out. Fractioning is the procedure that, under the supervision of the pharmaceutical professional, comprises the dispensation of medications, and is characterized by subdividing the medication in individualized fractions (Brasil, 2006). Separation is the moment when the medications, required by the nursing staff by medical prescription, are collected from the storage and separated in an organized manner to be handed to the infirmaries.

Mapping the medication system flow of the IPq-SC (Figure 3) by in loco observation and interviews with the professionals working there demonstrated that fractioning and separation are key items of the medication dispensation work. The remaining activities are directly or indirectly related to such tasks and are organized to ensure proper dispensation.

The medication system's integration became evident in the mapping. From the doctor's prescription of the patient's treatment to the moment when the patient receives the medication, a series of professionals and procedures is involved. The research focused, however, on the pharmacy's work, because its central importance in the medication

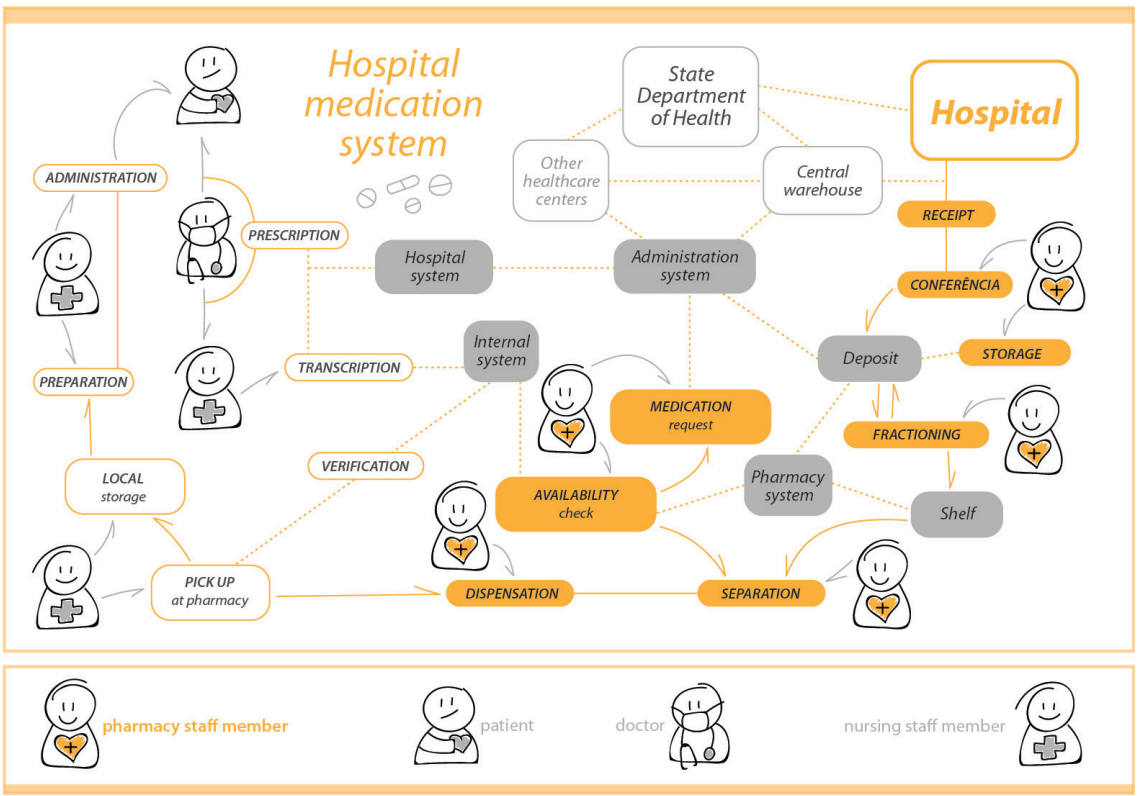

Figure 3. Mapping, from the hospital pharmacy, of the medication system at the IPq-SC.

Source: Designed by the authors based on the research carried out.

flow became evident. Among the activities carried out at the pharmacy, eight were especially indicated, named with letters from A to H:

(A) Receipt: The employee picks up the previously requested medications from the Central Warehouse. These medications are provided by the State Department of Health by means of a standardization process.

(B) Verification: As soon as the medications arrive at the pharmacy, they are verified. The list from the Central Warehouse is compared against the products that arrived in boxes. The lots and expiration dates are also verified.

(C) Storage: The medications are stocked in a deposit, waiting for the fractioning process. Storage requires product identification that makes the consumption order clear: lots with an earlier expiration date must be used first.

(D) Fractioning: Dose individualization occurs on the pills that do not come fractioned from factory. In this process, the blisters are cut and the unit is labeled. Loose medications in bottles must be packed in sealed bags prior to labelling. When the medication in blisters is too small to be labeled, it is also put in a sealed bag. The labels are produced in the pharmacy itself and contains information such as the medication's name, lot and expiration date. After the fractioning process, the medications return to the deposit or are placed on the shelves from where they will be separated for dispensation.

(E) Availability check: The medical prescriptions arrive at the pharmacy through an internal ordering system. The pharmacy's employees verify the prescriptions and check the availability of the prescribed medications in stock. Those available in stock are separated for dispensation. When a certain medication is not available in stock, the pharmacist makes the request.

(F) Medication request: Using an administration system, the pharmacy requests medications from the Central Warehouse, which is connected to the State Department of Health. Medications present on the list of standardized drugs are requested and the required quantities are specified. In case any medications are not available in the Central Warehouse, other hospitals from the state's public health network may provide the medications.

(G) Separation: According to the list of prescribed medications, the employees perform the separation of the medications. For collective dispensation, the medications are requested in specific quantities and separated by type in containers placed on a tray. For individualized dispensation, the medications are placed in a box organized with the name of each patient. Pharmaceutical forms that cannot be subdivided in an individualized manner (such as ointments and liquid substances) are separated in closed units and, in both types of dispensation, the nursing staff is who controls the fractions to be used.

(H) Dispensation: Nurses come to the pharmacy and collect the medications. All work in the pharmacy is oriented to this moment of dispensation, i.e., the delivery of the medication, because it is by this process that the medications reach the infirmaries and are administered on patients. Each infirmary verifies the dispensed medications, checking if their amount and type match what was requested by prescription. In case of doubt, they contact the pharmacy's employees. The nurses that pick up the medications dispensed in the individualized form take them in the same box in which they were separated. The nurses that pick up the medications dispensed in the collective form vary in the way they transport them to the infirmaries: some carry the tray in which they were separated, while others transfer the medications from the tray to other containers, such as boxes and plastic bags.

Observing the medication system from this hospital's pharmacy, some opportunities for design actions became evident. These actions characterize a research that is still in its initial phase. At this point, therefore, design notes were made, and, in each of the work steps mapped, possibilities for actions by designers in that context were indicated.

(A) Receipt and *(B) Verification:* Create and/or improve cards and/or systems that facilitate the process of product receipt and, especially, verification. Visually connect what is being verified and the storage process, since these actions occur simultaneously.

(C) Storage: Restructure the local furniture to support the safety of the products and of the work process. Organize for better stock identification and control by creating adequate signs. Focus on readability and on the development of standards that highlight relevant information and thereby facilitate the task of verifying and finding products stored on the deposit. Set alerts that clearly indicate the exit order by expiration date.

(D) Fractioning: Improve the set of tools used for fractioning, which includes restructuring the environment and equipment used. Formalize the tools developed by each employee. Design labels that distinguish more clearly one product from another and highlight relevant details for such differentiation. Create alerts that indicate the fractioned products or issues observed in the process – such as faulty medications noticed during fractioning. Develop the control, via system, of fractioned products.

(E) Availability check and *(F) Medication request:* Improve the system that alerts the infirmaries of the shortage of certain medications, preventing the need for a new prescription only after the process passes through the pharmacy.

(G) Separation: Restructure the furniture, prioritizing logistics, safety and optimization of the separation process. Clearly identify the areas – pills, liquids, controlled, etc. Create more efficient signs that enable quickly finding products and highlighting the most relevant and used information. Redesign tables. Improve and formalize sets of tools created and currently used by the employees in the separation process. Define alerts that indicate medications with similar nomenclature.

(H) Dispensation: Apply information design on the communications between the pharmacy and the infirmaries, such as notices about a certain medication and its compounding, and create alert labels that identify the expiration date of the products dispensed. Develop containers adequate for integrated separation, dispensation and transportation. In the identification of the fractioned product, establish alerts that indicate different medications. Restructure the furniture to ease the verification of the dispensed products. Redesign the verification tables. Improve the signs that identify the wards in the dispensation area.

It was observed that, of the eight activities performed at the hospital pharmacy studied, four (storage, fractioning, separation and dispensation) require more attention especially in terms of information design and set of tools. The mapping has allowed observing the opportunities, and then practical design actions may be implemented in practice, basing on the verified evidences.

Conclusion

In face of the issue of understanding the medication system used in the IPq-SC, mapping via hospital pharmacy has provided steps to analyze it. It allowed, through participant observation, the researchers to build a flow map that established the hospital pharmacy as a core sector in the medication system. The hospital pharmacy quantitatively and qualitatively controls the logistics of the medication in the hospital and, therefore, it is the hospital pharmacy's support that enables the other professionals to carry out the medication treatment.

It was the mapping, also, that demonstrated that strategic design tasks in the pharmacy, especially in storage, fractioning, separation and dispensation, support the medication process and, therefore, the safety of the system as a whole. Proper identification of the fractioned products, allowing for adequate separation and safe dispensation, is an example of how design actions implemented in this hospital's pharmacy can affect the system in a global and positive manner.

Though the research did not define which priority actions will be implemented – and that is this study's limitation –, the next steps shall focus on that. With strategic actions identified, it is still necessary to classify them to elect those that, in fact, can be implemented. Defining priorities, people availability and a project timeline are some of the steps that are currently being implemented based on this research.

Still, immersion in other contexts of the medication system, such as the infirmary in the direct patient care and the administrative processes involving medical prescription, are being investigated from the mapping developed. They also include the creation of detailed maps of each task performed in the sectors studied. In any of the approaches, however, design has much to contribute strategically to the healthcare area and this has been demonstrated in the various works that the NGD/LDU-UFSC, through the "Design e Saúde: da saúde do paciente às questões de saúde do trabalhador" project, has done in the IPq-SC.

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