

# Using technological innovation as a tool to monitor nursing workers' health

A INOVAÇÃO TECNOLÓGICA COMO FERRAMENTA PARA MONITORAMENTO DA SAÚDE DOS TRABALHADORES DE ENFERMAGEM

LA INNOVACIÓN TECNOLÓGICA COMO HERRAMIENTA PARA MONITOREO DE SALUD EN LOS TRABAJADORES DE ENFERMERÍA

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## ABSTRACT

The objective of the present study is to describe the development of the *Monitoring System for Nursing Workers' Health* software, a technological innovation designed to identify the health hazards caused to nursing workers' and their determinants, i.e., strain and/or strength potentials, monitoring their health using indicators. The software development comprises the phases of defining the objective, choosing the theoretical framework, organizing the content, and developing the system's architecture. It is important to socialize this process with researchers, managers, and workers interested in this subject, because monitoring the health of nursing workers is indispensable when planning strategies to minimize the occurrence of accidents and occupational illnesses, promoting better working conditions and improving their quality of life.

## DESCRIPTORS

Software  
Occupational health  
Nursing  
Epidemiologic surveillance

## RESUMO

O objetivo do estudo é descrever o processo de construção do software *Sistema de Monitoramento da Saúde dos Trabalhadores de Enfermagem*, uma inovação tecnológica desenvolvida para captar os agravos à saúde dos trabalhadores de enfermagem e os determinantes potenciais de desgaste e/ou fortalecimento, monitorando a saúde por meio de indicadores. O desenvolvimento do software englobou as fases de definição do objetivo, escolha do referencial teórico, estruturação do conteúdo e desenvolvimento da arquitetura do sistema. Considera-se importante a socialização deste processo aos pesquisadores, gerentes e trabalhadores interessados na temática, uma vez que o monitoramento da situação de saúde dos trabalhadores de enfermagem é uma ação indispensável para o planejamento de estratégias que possam minimizar a ocorrência de acidentes e das doenças ocupacionais, promovendo melhoria das condições de trabalho e qualidade de vida.

## DESCRIPTORIOS

Software  
Saúde do trabalhador  
Enfermagem  
Vigilância epidemiológica

## RESUMEN

El estudio objetivó describir el proceso de construcción del software *Sistema de Monitoreo de la Salud en Trabajadores de Enfermería*, una innovación tecnológica desarrollada para captar las consecuencias en la salud de los trabajadores de enfermería y los determinantes potenciales de desgaste y/o fortalecimiento, monitoreando la salud mediante indicadores. El desarrollo del software englobó las fases de definición del objetivo, elección del referencial teórico, estructuración del contenido y desarrollo de la arquitectura del sistema. Se considera importante la divulgación de este proceso a los investigadores, gerentes y trabajadores interesados en la temática, toda vez que el monitoreo del estado de salud de los trabajadores de enfermería es una acción indispensable para el planeamiento de estrategias que apunten a minimizar la ocurrencia de accidentes y enfermedades ocupacionales, promoviendo la mejora de las condiciones de trabajo y calidad de vida.

## DESCRIPTORIOS

Programas informáticos  
Salud laboral  
Enfermería  
Vigilância epidemiológica

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## INTRODUCTION

Technological revolution, over the last 30 years, associated with the current globalization, promoted considerable advancements in the health area. Although science has always been considered useful in many different times in history, it was industrialization that opened the doors for the economic appropriation of science, changing scientific knowledge into technology<sup>(1-2)</sup>.

Over the last decades, an accelerated process of change and technological evolution has been observed in the health area, marked by the introduction of large amounts of techniques, instruments, and diagnostic and therapeutic resources, making significant changes in everyday health practices, in diagnostic and therapeutic processes, and in how health care services are organized and reorganized<sup>(3)</sup>.

Technological innovation in health is understood as using new knowledge, which appear as new devices, ideas, or procedures and practices that make qualitative and quantitative changes in health care. In fact, the understanding of technological innovation should surpass the usual reduction of technology to equipment to the knowledge and actions required for their handling, and the application and intensity in the decision-making processes to incorporate products and programs in health services<sup>(4-5)</sup>.

In the health field, technological innovation is defined as the transformation of ideas into products, processes and approaches considered new or significantly improved, which can promote important advancements in the existing products, processes, and approaches<sup>(6)</sup>.

The current policy of the Brazilian Ministry of Health emphasized on the construction of a new association between scientific, health, social, and industrial policies. Considering the encouragement towards technological development and innovation in public and private sectors to produce priority resources for the health of the Brazilian population, it is observed there is a substantial potential for an effective implementation of scientific and technological management policies aimed at health services with a view to social wellbeing<sup>(7-8)</sup>.

In this regard, specific knowledge is required in order to operate new technologies and incorporate them into practice, ensuring increments in the quality of health care services while making substantial changes to the way health care professionals work<sup>(9)</sup>.

The introduction of new technologies in health care is guided by the demands of the sector. However, incorporating technology adds value and increases capital, as these services are included in the tertiary sector of econ-

omy – health care services. Aiming at this purpose, technological innovations are implemented as instruments to make community health care effective, and this usually has a harmful effect over workers' health.

In this historical-social context, several studies have given evidence of the unfavorable situations caused by the way nursing work is performed, due to the working conditions or to how work is organized, which has assigned an illness profile characteristic of this group of workers<sup>(10-11)</sup>.

Understanding this problem from the perspective of making a social determination of the health-disease process implies understanding and analyzing human health based on the organization of society, i.e., its economic and social structure, capturing health problem determinants from the way it is inserted in the work and lives of the different social groups and their reproduction in society<sup>(12)</sup>.

Nursing workers are included in the health production processes, and deal not only with the poor working conditions, but also with a concerning underreporting of occupational accidents and illnesses, which, alone, denounce the lack of surveillance regarding these workers' health<sup>(9,13)</sup>.

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The underreporting of data regarding work-related accidents and illnesses mask the reality lived by health and nursing workers. In 2007, reports on occupational accidents involving hospital workers accounted for approximately 6% of all accidents reported, considering a workforce of over two and a half million job positions in health care<sup>(14)</sup>.

This situation remains the same despite the formulation of the National Occupational Health Policy by the Ministry of Health, in effect since 2004, with the purpose to reduce work-related accidents and illnesses through the National Network of Comprehensive Care to Workers' Health (*Rede Nacional de Atenção Integral à Saúde do Trabalhador – RENAST*) and the Information System for Injury Records (*Sistema de Informação de Agravos de Notificação - SINAN-NET*) (Ordinance number 1.125 of July 6<sup>th</sup> 2005, Ordinance number 2.728/GM of November 11<sup>th</sup> 2009). It is observed that the referred notification instruments lack effectiveness due to the relationship difficulties of the organizations<sup>(15)</sup>.

It is emphasized that, despite the knowledge production regarding the referred issue and the public initiatives to implement comprehensive care for workers' health, difficulties still exist to execute these policies and collect the data that support intervention proposals to promote nursing workers' health. Health surveillance proposals aim at overcoming this reality.

According to Ordinance 3120, Workers' Health Surveillance consists of a continuous and systematic activity to detect, research and analyze the factors determining and

conditioning illnesses related to the processes and conditions of work, regarding the technological, social and organizational aspects, with the purpose to plan, execute and evaluate intervention regarding these aspects with a view to their reduction or elimination<sup>(16)</sup>.

Workers' Health Surveillance comprises a set of associated practices whose specificity is centered on the relationship between health and the environment and the working processes and health care, supported on the principles of health surveillance to improve the life and health conditions of the population. Furthermore, it is not an area dissociated and independent of health surveillance as a whole, but, on the contrary, it intends to add knowledge production strategies and intervention mechanisms to the set of health surveillance actions to be applied in the production processes, bringing the many objects common to health practices closer to those generated in the relationship between work and health<sup>(16)</sup>.

Considering the referred context regarding the need for instrument to collect trustworthy data about occupational accidents and illnesses, identified in the current context of nursing, the software Monitoring System for Nursing Workers' Health (*Sistema de Monitoramento da Saúde dos Trabalhadores de Enfermagem - SIMOSTE*) was created. It consists of a technological innovation tool developed to collect information regarding the accidents and illnesses of nursing workers and the determining factors that generate strain and strength potentials, as well as to monitor the health of these workers by using indicators<sup>(10)</sup>. Therefore, we believe that the socialization of the process that permitted to design the referred software is important for researchers, administrators, and workers interested in the referred theme and in using this tool.

In this sense, the objective of this article is to describe the process of developing the SIMOSTE software, a technological innovation tool used in occupational health.

## METHOD

We sought to elaborate a nursing workers' health surveillance software that would permit to characterize the profile of the institution, identify the data regarding the nursing workers and the reports of all respective accidents and illnesses of that population. The process of creating the software consisted of the following stages: defining the objective, choosing the theoretical framework, structuring the content, and developing the system architecture.

### *Stage one: defining the objective*

This stage consisted of, firstly, making a diagnosis of the health situation of nursing workers, based on a study performed at university hospitals in the five regions of Brazil. The study found that nursing workers of all five regions presented health issues, consolidating the perception that there is an important underreporting of ac-

cidents, a significant lack of knowledge regarding health issues, and their relationship with work, and, also, the lack of initiatives by the institutions or workers aimed at reverting these conditions<sup>(10)</sup>.

Based on these results and on confirming that nursing workers, the institution, and competent organizations do not see or understand the overwhelming issue, we planned to develop a product that would have the potential to change this reality based on knowing, registering, and monitoring health problems.

Considering the referred need, the SIMOSTE was developed to collect the data regarding exposures and illnesses affecting nursing workers, which permitted to outline these workers' health profile and monitor their health and work conditions, as well as to plan interventions by proposing specific preventive measures for each studied setting.

### *Stage two: choosing the theoretical framework*

The theoretical framework employed to create the software was the social determination of the health-disease process, founded on the categories: working process, work burdens, straining process, and pathological profile. Work burdens are elements of the working process that interact between each other and with the worker's body, causing burden or, more specifically, the loss of potential and/or effective capacity of their body and mind. Burdens can be grouped into: physical, chemical, biological, mechanical, physiological, and psychological<sup>(17)</sup>.

The exposure to *biological burdens* occurs through direct contact with patient fluids and secretions, by handling contaminated material during the process of disposing, transporting and cleaning materials and objects used for patient care, such as needles, dressing materials, tubes, and devices in general (scissors, tweezers, scalpels, bowls, etc.), all of which are nursing work instruments<sup>(13)</sup>.

*Chemical burdens* result from handling chemical substances. It should be emphasized that inappropriate handling of chemical residues is enough to cause serious occupational health problems, and can also affect public health and the environment<sup>(18)</sup>.

Exposure to *physical burdens* occurs through radiation, noise, humidity, electricity, and other physical agents. Changes in temperature occur mainly when moving from environments with air conditioning to other with a higher temperature, while transporting patients to other sectors and locations. In this case, the main impacts are related to the thermal discomfort and environmental imbalance, which can result in symptoms such as: headaches, irritations of the eyes, throat and nose, colds, earaches and sinusitis<sup>(10)</sup>.

Exposure to *mechanical burdens* results from tissue injuries caused by traumas, falls, cuts and tears that often result in temporary or permanent limitations, and, therefore deserve close attention<sup>(11)</sup>.

Exposure to *physiological burdens* is caused by using the body as a work instrument. In this form of exposure, several strain processes may occur, such as skeletomuscular symptoms, fatigue, general pain, and changes in the circadian rhythm<sup>(9-10)</sup>.

*Psychological burdens* refer to the exposure to the accelerated pace of work, asymmetrical relationships, divided, repetitive and tedious work, the need for workers to be constantly alert, strict supervision, communication difficulties, the dissociation from collective defenses, feminine work, stress, tension, and professional dissatisfaction, all of which cause aggressions to the workers' psychological state, generating several strains<sup>(11)</sup>.

Exposure to this variety and intensity of burdens causes straining processes that have a profile particular to nursing workers.

Therefore, the SIMOSTE was structured based on the outline of the profile of how nursing workers fall ill, considering the reports of exposures to work burdens and recurring strains, which characterize the health-disease process of this population.

### Stage three: structuring the content

Based on the proposed framework, we chose to design a matrix that would hold the previously described concepts. In order to structure this data matrix on the system, a collective questionnaire was used – a dynamic self-reported questionnaire, used to validate the information collected in focal groups, at five university hospitals in Brazil<sup>(10)</sup>. In this questionnaire, workers describe the aspects of the working process at their institution and describe the burdens to which they are exposed and the straining process that are generated.

Therefore, the software content was structured into **three** already configured for developing the system:

The *first module* contemplated open alphanumerical fields for the requested data, that was provided through direct typing, and directed answers options, which could be single or multiple, and were selected using check boxes. This model aims at characterizing the institution (name, the national register of health facilities (CNES), total number of workers, number of nursing workers, number of beds, number of outpatient clinic and emergency care, medical and nursing appointments, occupation rate) and identifying the nursing workers (age, job category, sector, number of jobs, working hour load, and average salary).

The *second module* comprises seven different tabs, distributed as follows: six tabs to describe the work burdens and resulting straining, and one tab for the consequence of the exposure. The description of the type of exposure and the resulting straining occurs by selecting one or more of the options described in the system (tabs 1-6).

To report the consequences (tab 7), the system provides open alphanumerical fields for direct input. Every tab has open alphanumerical fields for additional comments considered to be strictly necessary. This module also aims at recognizing the forms of exposure at work (biological, chemical, physical, mechanical, physiological and psychological burdens), the environment where the referred exposure occurred (contact with body fluids, falls, cuts, intense work rhythm, temperature changes, and others), the type of straining caused by the referred exposure (infection by a disease, stress, injuries, fertility problems, pain, etc.), and the consequence of that straining (accident leave, sickness leave, the number of days on leave).

These first two modules are filled in by the nursing worker who reported the exposure, or by the professional responsible for this type of report, as appointed by the institution or, yet, by workers' support services (such as the Safety Engineering and Occupational Medicine Specialist Service - *Serviço Especializado em Engenharia de Segurança e Medicina do Trabalho* – SESMT).

The *third module* is structured for the epidemiological analysis of the data, by means of specific studies that permit the interpretation of all information input into the system using indicators. The researchers and idealizers of SIMOSTE use this administrative module to evaluate any oscillations in the behavior of the institution over time regarding the health-disease process of their workers.

In order to share the information with the studied settings and the community, the data analyzed in the third module are made available on a webpage of public access. This page lists the absolute and relative frequencies of the data and the general indicators of the studied institutions.

This initiative has the purpose to disseminate some relevant information about the illness profile of nursing workers and the main determinant of this condition with the scientific community and society.

To help understand the functionalities of the SIMOSTE, a help menu was designed, which includes all the concepts that were used in the system and that support data input. An instructions manual containing detailed information for using the SIMOSTE is also available to institutions, as a document attached to the system.

After structuring the contents and the system requirements, a contract was established with Information technology experts to develop the effective software platform. At this time, the content was discussed; the form of presentation; the interactions between the data; the definition of the server and the compatible language.

### Stage four: developing the system architecture

This stage counted with frequent meetings between the researchers involved in the project and the Information Technology experts, when it was possible to present



the needs and know the available informatics resources to create the software. The previous definition and structuring of the system content, as well as the way information was presented allowed for developing the software quickly.

Therefore, the SIMOSTE was developed through a partnership between the technological and technical areas, with the latter consisting of the research group *Estudos sobre a saúde do trabalhador de enfermagem* (studies regarding the health of nursing workers), with the Department of Professional Guidance (*Departamento de Orientação Profissional* - ENO) at University of São Paulo School of Nursing (EEUSP), and with the support from the State of São Paulo Research Foundation (FAPESP).

The whole system development was followed and validated by the researchers involved in the project, who also tested it to verify the functionalities included in the established requirements.

To systemize the forwarding of data input into the SIMOSTE, a database was generated for online transfers. All the input data are stored on a specific server, located at EEUSP – the project headquarters.

As a product, the software was registered with the National Institute of Industrial Property (*Instituto Nacional da Propriedade Industrial* - INPI).

## CONCLUSION

The SIMOSTE software monitors nursing workers' health. Its development followed four stages: defining the objective, choosing the theoretical framework, structuring the content and developing the architecture of the system.

The purpose of the SIMOSTE is to collect information regarding nursing workers' health problems and their determining factors, which cause accidents, illnesses and other straining processes that can compromise the workers' quality of life at work and social life.

The maximization of the software's potentialities depends on its practical implementation, as it is a technology capable to operationalize institutional policies regarding occupational health and the valuing of human resources, considering that monitoring and analyzing the workers' health situation is an indispensable action for the planning of strategies to promote the improvement of their working conditions.

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