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Radiological Protection Management: software implementation in a hospital in south Brazil

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Abstract: The exacerbated increase in the use of ionizing radiation to obtain images, and the risks and standards that exist to preserve the health of those who use it, are not properly taken into account when carrying out radiodiagnostic examinations. The professionals who work in these environments play a decisive role in the performance of their numerous activities within radiodiagnostic services, bearing in mind that any dose of radiation is associated with a probability of biological effects occurring, no matter how low that dose may be. Thus, the aim of building a software program was to optimize the work of the multiprofessional and interdisciplinary team in radiodiagnostic services, in the management of radiological protection. This is a methodological and quasi-experimental study carried out in a university hospital in southern Brazil, intentionally chosen because it has a Radiological Protection Committee. This research design was adopted for the development of technological production, in this case software for managing radiological protection. The study was carried out in the radiological protection sector of the radiology department of a university hospital in southern Brazil. The results showed that the software, called SisPRad - Management System for Radiological Protection, is a tool that helps the service's multi-professional and interdisciplinary team in terms of managing radiological protection. Finally, it aims to ensure the safety of professionals working in the service and its users, as well as reducing repetition of activities at management level, and can be adapted for other institutions. The computer registration number 512019002125-8 was obtained from the National Institute of Industrial Property for the first version of the software and the registration number 512023003116-0 for its second version.

Keywords: Health Management, Radiological Protection, Health Informatics, technology, Radiological Technology.

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Gestão da Proteção Radiológica: implementação de software em um hospital do sul do Brasil

Resumo: O aumento exacerbado do uso de radiações ionizantes para obtenção de imagens, os riscos e as normas existentes para preservar a saúde de quem as utiliza, não são devidamente considerados na realização de exames de radiodiagnóstico. Os profissionais que trabalham nestes ambientes têm um papel decisivo no desempenho das suas inúmeras atividades dentro dos serviços de radiodiagnóstico, tendo em conta que qualquer dose de radiação está associada a uma probabilidade de ocorrência de efeitos biológicos, por mais baixa que seja essa dose. Assim, o objetivo da construção de um programa informático foi otimizar o trabalho da equipe multiprofissional e interdisciplinar dos serviços de radiodiagnóstico, na gestão da proteção radiológica. Trata-se de um estudo metodológico e quase-experimental realizado em um hospital universitário do sul do Brasil, escolhido intencionalmente por possuir uma Comissão de Proteção Radiológica. Este desenho de pesquisa foi adotado para o desenvolvimento de uma produção tecnológica, neste caso um software de gestão da proteção radiológica. O estudo foi realizado no setor de proteção radiológica do departamento de radiologia de um hospital universitário do sul do Brasil. Os resultados mostraram que o software, denominado SisPRad - Sistema de Gerenciamento de Proteção Radiológica, é uma ferramenta que auxilia a equipe multiprofissional e interdisciplinar do serviço no que diz respeito ao gerenciamento da proteção radiológica. Finalmente, visa garantir a segurança dos profissionais que trabalham no serviço e dos seus utentes, bem como reduzir a repetição de atividades ao nível da gestão, podendo ser adaptado a outras instituições. O número de registo informático 512019002125-8 foi obtido junto do Instituto Nacional da Propriedade Industrial para a primeira versão do software e o número de registo 512023003116-0 para a sua segunda versão.

Palavras-chave: Gestão em Saúde, Proteção Radiológica, Informática em saúde, tecnologia, Tecnologia Radiológica.

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1. INTRODUCTION

The growing use of ionizing radiation to obtain images, and the risks and standards that exist to preserve the health of those who use it, are not properly considered when radiodiagnostic examinations are carried out. It is well known that radiological protection (RP) has been discussed in various aspects, but there is still a gap in the management of RP in a hospital environment. This can be seen in the doctoral thesis developed by Levy (2015), whose premise was the potential of information technology as a tool for communicating and disseminating knowledge about RP in radioactive facilities, with an emphasis on monitoring workers. What triggered the thesis was an accident involving a radioactive source of cobalt 60. This accident occurred in 1990 at an industrial irradiation facility for medical products and spices for sterilization purposes. The author reports that a worker entered the irradiation room and was acutely exposed to radiation, which led to his death. This accident could have been avoided if the operating procedures established by international standards had been followed. The accident began with a damaged package that got stuck in the internal transportation system and trapped the mobile source in the irradiation position, causing an irreparable error (LEVY, 2015).

Another study shows that the International Atomic Energy Agency (IAEA) has also been trying to computerize, by means of software, occupational PR standards in places that use radioactive sources. The aim of using this software was to promote an internationally harmonized approach to optimizing occupational RP through the development of safety standards for restricting radiation exposure in the workplace and for the application of occupational radiation protection techniques and the provision of services through an occupational exposure information system, since the series of RP standards consists of

fundamentals, requirements and safety guides, but does not demonstrate full efficiency and functionality (MOCANU, *et al.*, 2010).

Therefore, considering the need for specific PR management and corroborating the aforementioned results and also demonstrated in the study by Huhn, et. al (2016), which concludes that during work in hospitals, the multiprofessional health team that interacts daily with ionizing radiation (IR) knows little about the dangers of radiation and the obligation to have an updated Protection Program in radiodiagnostic services, the objective of the study was to build and test a management technology for PR in a radiology service.

1.1. Radiation protection management

The hospital radiodiagnosis service is part of the health sector and is increasingly demonstrating the need for effective and appropriate management, especially as the environment is rife with IR and it is essential that all the professionals working there are aware of the significance of using appropriate PR for themselves and for the service users. In other words, it is inevitable to live well with IR if the management of PR does not remain clear and conscious in the routine of the workers.

Hospital and clinic managers are increasingly concerned about the quality of their healthcare services. Growing competition, technological innovations, the dissemination of information and user demands have led health institutions to pay special attention to the quality of their services, given that users have easy access to information, and this can result in significant changes to health services, increasing user demands in their choices. In other words, those who use radiodiagnostic services want to give their opinion, discuss and choose the best quality service from the range of options available on the market (ROSA *et al.*, 2011).

Faced with this complexity, it is important to invest in people and in the technologies available to achieve the care that everyone wants (MELLO, 2011; HUHN, 2016). In

radiodiagnostic services, it is common for users to ask why a certain test is being carried out and not another, as well as requesting a variety of tests to detect possible pathologies.

Unfortunately, not all professionals who order tests using IR for diagnosis are aware of the consequences of its excessive use. In addition, many are unaware of common quality problems, such as the culture of waste, lack of planning, process mapping and the complex structure of radiodiagnosis, since it is an environment where professionals from different areas and specialties interact, with different routines (HUHN *et al.*, 2016).

For the development of services, it is extremely important to prioritize a culture of quality with management innovation, involving the entire organization (VIDIGAL, 2010). From this same perspective, the availability of information in a simple and unified way can effectively help institutions to scale their efforts to optimize their work, avoiding under- or over-sizing the efforts made. When underestimated, the lack of preventive measures leads to ineffective actions that can have serious consequences, even damaging the health of those involved. From another angle, oversizing efforts, even if caused by overzealousness, can be unnecessarily costly and unjustified (LEVY, 2015).

For PR management to be effective in radiodiagnosis, it is necessary to computerize the processes, following the recommendations of the legislation, with action planning, such as training, permanent updates for the multi-professional team, creation of goals and continuous presentation of results, among others. In order to computerize PR processes, it is necessary to enable technologies with the capacity to offer tools that facilitate the daily lives of services and professionals (HUHN, 2019).

Innovation is the construction and operation of an information system that seeks to deal with management processes (ROSA *et al.*, 2011). In the case of PR management, it can be seen that it is possible to incorporate methodologies and processes that were previously dispersed and fragmented, by means of some nonmaterial devices developed and incorporated into software aimed at PR management, such as: planning

methodology; organization and subsidy for multi-professional teams working in environments where IR is present; information and monthly monitoring of occupational dose control; computerization and electronic visualization of continuing education activities; system for recording events with professionals and users, among others.

2. MATERIALS AND METHODS

This is a methodological and quasi-experimental study carried out in a university hospital in southern Brazil, intentionally chosen because it has a Radiological Protection Committee. Methodological studies contribute to increasing rigor in conducting research, as they investigate the very methods of collecting or organizing data, developing, validating and evaluating research tools and methods (SANTOS *et al.*, 2017; VERGARA, 2000, p.47).

Quasi-experimental research designs are very similar to experimental ones, but without full control of the study variables (POLIT *et al.*, 2012). Although the randomized controlled trial is generally considered to have the highest level of credibility when it comes to assessing causality, in health informatics, researchers often choose not to randomize the intervention (HARRIS *et al.*, 2006).

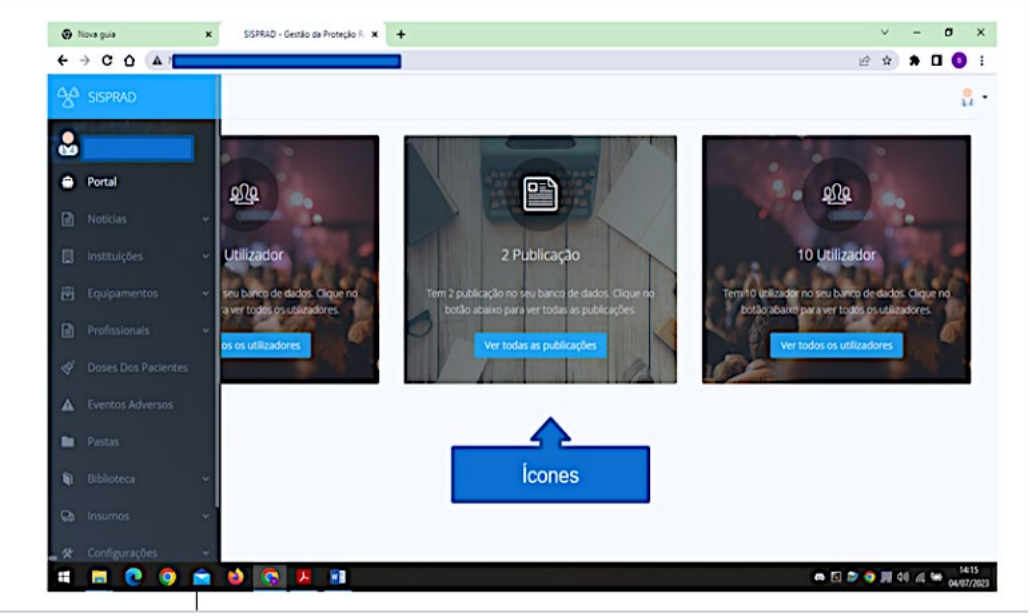
This research design was adopted for the development of technological production, in this case software for managing radiological protection. The study was carried out in the radiological protection sector of the radiology department of a university hospital in southern Brazil.

3. RESULTS AND DISCUSSIONS

The development of software for managing radiological protection was implemented to integrate tools for computerizing data relating to radiological protection. It was developed for the web environment and can be used with Internet Explorer, Mozilla Firefox and Google Chrome browsers on desktops, notebooks and tablets. This technology does not replicate the functions of other hospital management software, electronic medical records and patient flow management, but was developed to interact with the demands of the radiodiagnosis sector.

From a general point of view, innovation is the construction and operation of an information system that seeks to deal with management processes (ROSA *et al.*, 2011). In the case of PR management, it was realized that it is possible to incorporate methodologies and processes that were previously dispersed and fragmented. It was also understood that some non-material devices could be developed and incorporated into software aimed at PR management, such as: specific planning methodology; organization and subsidy for the multi-professional team that has contact with IR; monthly information and monitoring of occupational dose control; computerization and electronic visualization of continuing education activities and events; introduction of a system for recording events with professionals and users, among others. The figure 1 demonstrates the toll access screen.

Figure 1: Access screen



In this sense, it is worth highlighting that professional awareness is essential to promote the objective of a technology for managing radiological protection, which ranges from the planning of the examination, the use of inputs, knowledge of the equipment used to generate the images and the constant exchange of knowledge with the multiprofessional team working in the radiodiagnostic service, which should be provided at meetings promoted by the radiological protection committee, with a professional from each sector, as provided for in current legislation (HUHN, 2017).

As a result, it was emphasized that PR management should be a process that starts with the construction of a radiology service, involving the managers of the service, the professionals who make it up, especially the professional responsible for the technical issues that involve the radiodiagnosis service, and concomitantly, using technology that integrates with the service to manage the PR of all those involved in the process.

4. CONCLUSIONS

It was concluded that the SisPRad software is an innovative resource that needs to be constantly adapted to meet the realities of radiodiagnostic services and their peculiarities in terms of radiological protection.

It is also possible to state that the construction of software aimed at managing radiological protection can optimize the work of the multi-professional and interdisciplinary team in radiodiagnostic services.

Similar work could generate more knowledge and point to tools that ensure the quality of the programs developed, thus contributing to PR management.

Computer registration number 512019002125-8 was obtained from the National Institute of Industrial Property for the first version of the software (2019) and registration number 512023003116-0 for its second version (2023).

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CONFLICT OF INTEREST

We declare that the study has no conflicts of interest.

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