

---

## RADIATION PROTECTION AND THE ATTITUDE OF NURSING STAFF IN A CARDIAC CATHETERIZATION LABORATORY

*Rita de Cássia Flôr<sup>1</sup>, Francine Lima Gelbcke<sup>2</sup>*

<sup>1</sup> Ph.D. in nursing. Faculty of the Instituto Federal de Santa Catarina – Campus Florianópolis. Santa Catarina, Brasil. E-mail: flor@ifsc.edu.br

<sup>2</sup> Ph.D. in nursing. Faculty of the nursing post-graduate program of the Universidade Federal de Santa Catarina (UFSC). Director of Nursing at the University Hospital of UFSC. Santa Catarina, Brasil. E-mail: fgelbcke@ccs.ufsc.br

**ABSTRACT:** A qualitative study conducted in a hemodynamic service in Santa Catarina, Brazil. The objective was to analyze the attitude of nursing staff in relation to the use of radioprotection measures during interventional procedures. The psychodynamics of work approach was utilized. Such a method has been developed in different stages, namely: demand and pilot study, the research itself, the research material, interpretation method and validation. Altogether, 36 meetings were held between March and November of 2009, totaling approximately 54 hours of observation. Results showed that staff used defensive strategies to justify the misuse, lack of knowledge, or even the failure to use some measures of radioprotection, that were evidenced by the allegations of discomfort and the weight of the lead clothing. It was concluded that certain attitudes adopted by the staff also referred to the lack of a continuing educational program which addressed this issue.

**DESCRIPTORS:** Ionizing radiation. Radiation protection. Interventional radiology.

---

## PROTEÇÃO RADIOLÓGICA E A ATITUDE DE TRABALHADORES DE ENFERMAGEM EM SERVIÇO DE HEMODINÂMICA

**RESUMO:** Estudo qualitativo realizado em serviço de hemodinâmica de Santa Catarina, Brasil. Objetivou-se analisar a atitude dos trabalhadores de enfermagem em relação ao uso das medidas de radioproteção em procedimentos intervencionistas. Utilizou-se a Metodologia da Psicodinâmica do Trabalho. Tal método se desenvolveu em diferentes etapas, a saber: a demanda e a pré-pesquisa, a pesquisa propriamente dita, o material da pesquisa, o método de interpretação e a validação. Ao todo foram realizados 36 encontros, no período de março a novembro de 2009, totalizando aproximadamente 54 horas de observação. Os resultados mostraram que os trabalhadores utilizam estratégia de defesa para justificar o uso incorreto, o desconhecimento ou mesmo a não utilização de algumas medidas de radioproteção, que foram evidenciadas por meio da alegação do desconforto e do peso das vestimentas de chumbo. Conclui-se que certas atitudes adotadas pelos trabalhadores referem-se também à falta de um programa de educação permanente que aborde essa temática.

**DESCRIPTORIOS:** Radiação ionizante. Proteção radiológica. Radiologia intervencionista.

---

## PROTECCIÓN RADIOLÓGICA Y LA ACTITUD DE TRABAJADORES DE ENFERMERÍA EN EL SERVICIO DE HEMODINÂMICA

**RESUMEN:** Estudio cualitativo realizado en el servicio de hemodinámica de Santa Catarina, Brasil. El objetivo fue analizar la actitud de los trabajadores de enfermería en relación al uso de las medidas de radioprotección en procedimientos intervencionistas. Se utilizó la Metodología de la Psicodinámica del Trabajo. Ese método se desarrolló en diferentes etapas, a saber: demanda y preinvestigación, investigación propiamente dicha, material de investigación, método de interpretación y validación. En total, fueron realizados 36 encuentros en el período de Marzo a Noviembre del 2009, totalizando aproximadamente, 54 horas de observación. Los resultados mostraron que los trabajadores utilizan estrategias de defensa para justificar el uso incorrecto, el desconocimiento o mismo la no utilización de algunas medidas de radioprotección que fueron evidenciadas por medio de la alegación de incomodidad y del peso de las vestimentas con plomo. Se concluye que ciertas actitudes adoptadas por los trabajadores se refieren, también, a la falta de un programa de educación permanente que aborde esa temática.

**DESCRIPTORIOS:** Radiación ionizante. Protección radiológica. Radiología intervencional.

## INTRODUCTION

Hemodynamic services are also called the Cardiac Catherization Laboratory (CCL) in the directives of the Brazilian Cardiology Society (SBC), and to understand that this area of knowledge is part of the health services, the concept of CCL was adopted here.<sup>1</sup>

Techniques in this service are guided through the use of fluoroscopy, with the primary objective of diagnosis and treatment of diseases of the cardiovascular system. This technique renders the minimally invasive procedures and benefits to the patients who need to undergo: implantation of a pacemaker, cardiac stent placement, cardiac catheterization, angioplasty, among others. However, the use of fluoroscopy is generally what contributes most to occupational exposure to ionizing radiation.<sup>2-3</sup>

Considering the praxis of nursing in the CCL, it is worth noting that in order for these employees to perform their activities, they generally have a higher workload than other healthcare workers recognized as performing activities with ionizing radiation, as is the case of the technical professionals in radiology, radiologists, and also interventional cardiologists.<sup>4</sup> Moreover, in his academic development, the nurse in Brazil, regardless of the level of education, whether technical or higher, generally does not receive qualification about the principles of radiation protection for working in this knowledge area.<sup>5</sup>

It should be remembered that technological advances regarding the use of ionizing radiation have revolutionized health practices and consequently the work of nursing. However, it is clear that the incorporation of these technologies did not bring the end of hard and dangerous work, in contrast, inequalities and social injustice accentuated themselves and caused forms of qualitatively more complex and subtle suffering, so that they are not always perceived by employees,<sup>6-7</sup> notably when it comes to exposure to ionizing radiation. The employees who work in the CCL suffer damages arising from ionizing radiation, without having preparation to minimize the radioactive effects, which brings an important concern when considering the health of these employees, this being one of the questions in this study.

The question arises, therefore, what do employees who work in the CCL do in order to protect themselves from ionizing radiation? Do they know the effects of such a workload? What

can be done to minimize such damage? These are some of the concerns that led to the development of this research.

Incidentally, it is worth mentioning the example of Spanish law that determines that all health professionals likely to be exposed to ionizing radiation have education in radiation protection. This legislation also establishes workload for some health professionals, such as the nuclear medicine physician, the radiologist, and others.<sup>8</sup>

Therefore, considering these aspects, this study had as its objective: to analyze the attitude of nursing staff related to the use of radiation protection measures in the interventional procedures.

## MATERIAL AND METHOD

We used the psychodynamics of work approach, which, according to its epistemological nature, favors the qualitative aspects in relation to the quantitative.<sup>9</sup> This methodology deals with the relationship between pleasure and suffering at work, emphasizing the important role that the work organization exerts over employee health. Such a method has been developed in different steps, namely: demand and pilot study, research, the research material, the method of interpretation, and the validation of data.<sup>9</sup>

In the psychodynamics of work, demand and pilot study constitute the first stage of research and certain criteria established by Dejours to develop the method must be followed. These include answering: who demanded the research? What is the demand? And, to whom was this demand directed?

Therefore, to attend to these criteria, the research was demanded by nursing professionals in seven CCLs in the state of Santa Catarina, Brazil.

In relation to demand, the research considered, above all, the concerns of these professionals, such as, among other inquiries: who must remain in the exam room to assist the interventional physician? How should I use the dosimeter? How should the occupational monitoring of employees occur within this work process? Thus, the acknowledgment of this demand, performed through the pilot study, was essential to ensuring the chain of other steps established by this methodology.

The research itself came from data previously identified and treated in the pilot study, that is, data of the CCL that demanded research. With the information of the seven services that demanded research, the research itself was then begun.

Given this demand, the research was conducted in a CCL headquartered on the premises of a private philanthropic hospital accredited to provide assistance in the area of interventional cardiology in Santa Catarina, Brazil.

The research material was extracted from the observations, collective interviews and documentary analysis. Altogether 36 meetings were held during the period from March to November of 2009, totaling approximately 54 hours of observations.

The meetings occurred during the morning and afternoon shifts, usually at the times scheduled for cardiac catheterization exams and angioplasty, with a duration of one to two hours.

At each meeting, a mean of four to five employees participated. The meetings were recorded with the consent of workers, for later transcription and validation of the data.

In the document analysis, monthly reports of individual dosimetry in the past two years (2008 and 2009), the frequency of the occupational examinations, and documents concerning the organization of work were analyzed, such as: work schedules, norms, routines instituted and reports of the demand for examinations in 2008 and 2009. Institutional documents were also analyzed, such as: service contract for dosimetry, among others.

Data validation occurred in two steps. The first was in the course of the observations, and the second with the inclusion of other employees of the CCL who did not participate in the field research. Data analysis considered the experience of the researchers who interpreted the research material in light of the theoretical corpus proposed in this study, being conducted by the statements of subjective experiences of the employees.

The research was submitted to the Committee on Ethics in Research of the *Instituto de Cardiologia de Santa Catarina* (ICSC), through CAAE n. 0020.0.145.145-08, receiving a favorable review for its publication, conforming to Protocol n. 101/2008.

## RESULTS AND DISCUSSION

When conducting the research, one must start with some questions, such as occurred in this case. But it must be stressed that in addition to concerns present in the development of this study, this was also demanded by seven CCL in the southern region of the state of Santa Catarina, based on the application of a research poll during the pilot study, which made the composition of what Dejours calls the ad hoc collective of employ-

ees possible,<sup>9</sup> for whom this research was directed, that is, employees in these services.

The results of this study are the outcome, therefore, of observations and of the word of the collective of employees, and the data presented here refer principally to the observations.

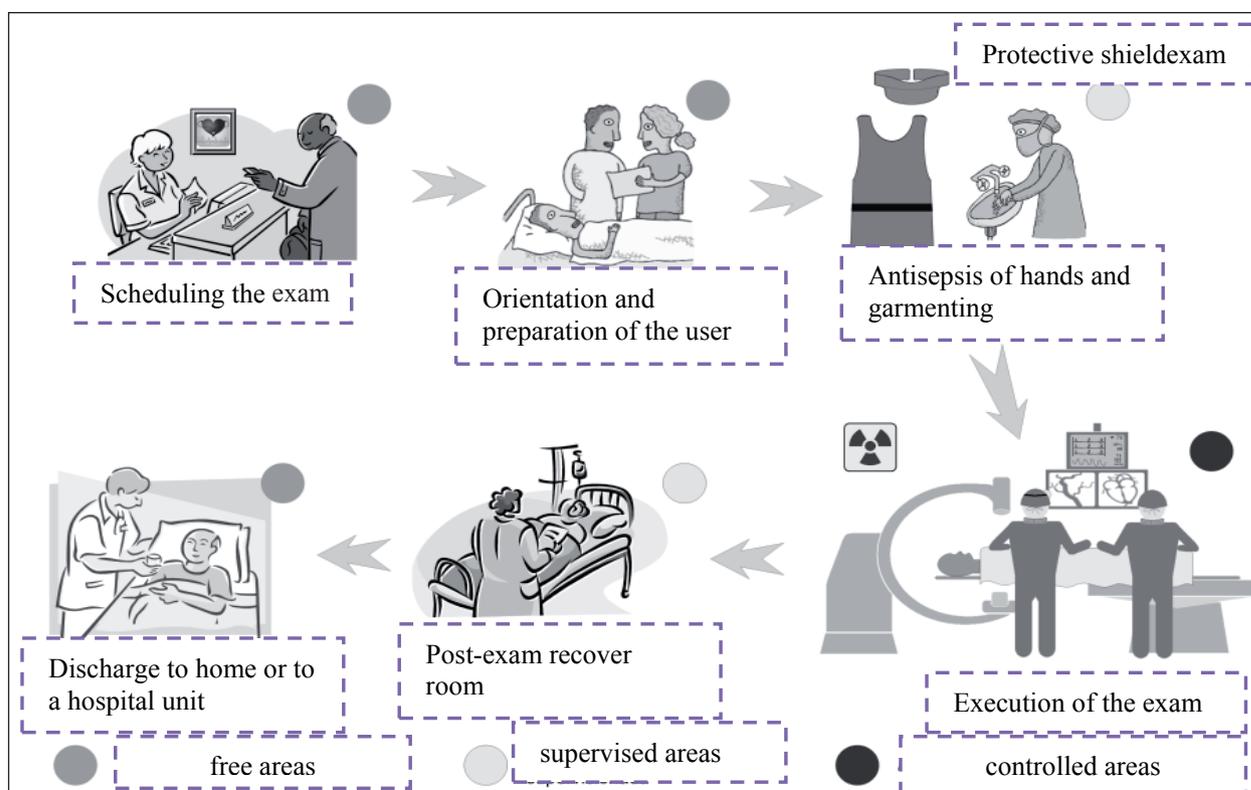
Based on the observations, the process of working in CCL and nursing participation in actions involving exposure to ionizing radiation are represented in figure 1. In this figure, activities performed in free areas, supervised and controlled, from the point of view of radiation protection, can also be identified. In the work process, patients and employees are exposed to ionizing radiation.

In addition to nursing, activities in this service involve other health professionals who compose the team, as an example, the radiologist and the radiology technician professionals, among others.

It is important to remember that the exam room in the CCL is an environment that closely resembles an operating room in which the primary instrument of work is equipment that emits radiation.

In this work process, health workers perform actions involving pre-, intra- and post-interventional procedure care, as well as patient reception, preparation, guidance, and acquisition, recording, interpretation and archiving of images, among others. It is in this context that the employee, often lacking in specialized knowledge, is exposed to ionizing radiation. Thus, knowledge about radiation protection constitutes an essential working tool for those employees. It is worth noting that, in the observation of these work processes, noncompliance to the legislation that refers to the qualification to conduct these activities and also in the use of radiation protection measures was verified.<sup>10-11</sup> Such measures, when not utilized adequately, contribute to damages to the employee resulting from physical work load, or ionizing radiation.

Using the Dejours methodology to discuss the damages that occurred with exposure to ionizing radiation, although its adaptation was necessary given that the available reference addressed the manner of psychological loads, it was possible to give visibility to the diverse workloads present in the daily work in the CCL. This was especially true of the physical loads, which constituted the primary concern, especially in the speech of employees who recalled those who had been exposed to an excessive physical load of ionizing radiation in the past, since radiation is cumulative and may take time to manifest itself, namely, five to ten years after the interaction with the body of the employee.



**Figure 1 - Work process in hemodynamics and nursing praxis**

Working without the minimum protective conditions revived situations that preoccupied them, because the research led them to reflect upon their health and radiation safety.

Thus, investigating nursing praxis in CCL, and the attitude of nursing staff regarding the need for radiological protection was not an easy task. In addition to the fact that this load was invisible and required time to manifest itself, added to this was the difficulty that employers presented in relationship to such manifestations of this physical work load, and also because this type of damage may occur as a function of other variables, such as the nature of the human being.

Associated with the fact that this load was invisible, there was a "right" to disregard the continuing education of employees, such that in Brazil, the Federal Council of Nursing (COFEN) in 2004 issued Resolution n. 290.12 which regarded the nursing specialties, denominating this as Nursing in Diagnostic Imaging. Long before that Resolution, in 1998, COFEN had edited the Resolution n. 211, which deals with the work of these employees in this area of knowledge.<sup>13-14</sup> However, this resolution did not address the issues of mandatory qualification of this professional for activities in this area.

Because they do not know how to protect themselves, these professionals utilize defense strategies to justify not using some measures of radioprotection, a fact identified in the observations of that praxis. Such strategies could be evidenced by the claim of the discomfort and weight of lead clothing, and the lack of the need to use certain equipment, such as lead glasses and gloves. Yet it was evident that the measures relating to distance from the radiation source and the exposure time were not always adopted, with forgetfulness alleged.

Such defense strategies were evident in the dialectical relationship that was maintained throughout the research process, the method itself, realizing that the ad hoc collective of employees was afraid to talk about these issues, as if this problem was not happening with them and, when asked, the answers were hollow and almost always loaded with apologies.

"The purpose of the collective strategy of defense is the denial of danger; it is the transformation of the subjective situation into its opposite. Potential victims passively exposed to risk [employees] become provocateurs of a purposeful challenge, becoming the challengers to their own peril. They deny reality."<sup>15:204</sup>

The analysis of the dosimetry reports showed that employees were being monitored regularly, however, the following issues were frequently noted: the incorrect use of monitors, the forgetfulness within the exam room, and the non-use by employees. When questioned about why these behaviors occurred, employees claimed

forgetfulness. Thus, the values found in the reports do not faithfully represent the actual values of radiation doses received by these employees. Figure 2 shows the distribution of individual doses of only five workers that used the dosimeters with some regularity.

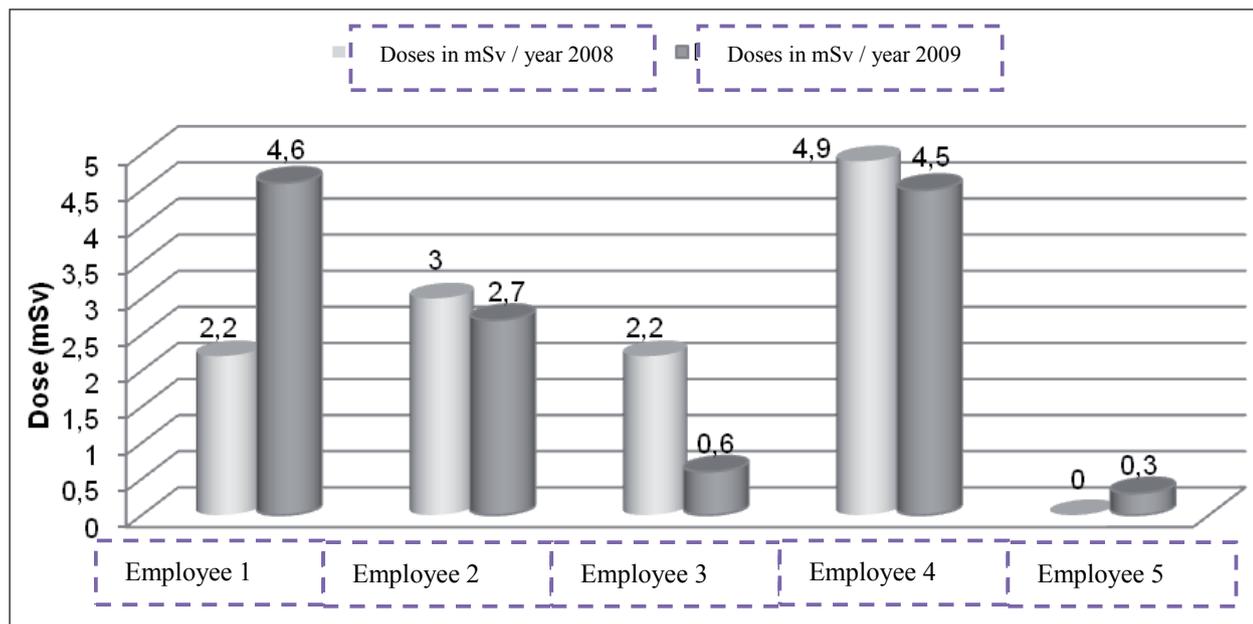


Figure 2 - Distribution of individual doses expressed in mSv (milisievert) relative to 2008 and 2009

In this figure it is observed that the doses were within the permitted values, or 20 mSv. However, it is worth clarifying why some employees have relatively higher doses compared to other workers performing the same functions, as is the case for workers 1 and 4, respectively. During this period these employees effectively fulfilled their workday in controlled areas, not reporting departure for any reason. This was in contrast to worker 5, who did not effectively meet his workload in this area in 2008, and did not present a dose of radiation, and in 2009 the dose was 0.3 mSv for a single month in which he effectively enforced his workday. In the remaining months, although he had worked in this area to cover gaps or absences due to illness, the dose remained below the threshold for reading. Thus, it is important to clarify that the radiation dose received by one employee is proportional to the time that he is exposed to ionizing radiation.<sup>15</sup>

The documentary analysis of occupational exams in the last two years (2008 and 2009) revealed that in 2008 monitoring was conducted every six months, as the law prescribes, but this

was not maintained regularly in 2009, thus not complying with what the law prescribes.

With regard to this occupational control, the Nuclear Standard 3.01, of 2005, of the National Nuclear Energy Commission (CNEN), as well as Ordinance 453, of 1998, stipulated that rightholders and employers should implement a program for initial and periodic occupational health assessment of employees occupationally exposed to ionizing radiation.<sup>10,16</sup>

This program should be based on the General Principles of Occupational Health, with reference to Regulatory Standard NR n. 7, of the Ministry of Labor and Employment, which provides for the Medical Control Programme of Occupational Health (PCMSO). This program mentions the parameters for the monitoring of occupational exposure to certain health risks, including the risk of exposure to ionizing radiation.<sup>11</sup>

However, the laws and regulatory standards are not sufficient, if the employees are not aware of them.<sup>17</sup> How can one protect oneself adequately, without having this knowledge? Thus, this study made reflections of the nursing staff who worked

in the CCL possible, and such a theoretical and methodological framework aims not only to give voice to the employee, but to make it possible to be an active subject in the work process. The findings encountered in this study reaffirmed the conviction that employees engaged in the praxis in the CCL should do it consciously, and that continuing education is a way to enable them to protect themselves from the damages resulting from the work process.

## CONCLUSION

To analyze the attitude of nursing staff related to the use of radiation protection measures in interventional procedures was not an easy task, because in addition to being an invisible risk and taking time to manifest itself, employees are reluctant to relate with exposure to ionizing radiation.

However, it was revealed that employees did not associate with exposure to ionizing radiation, making use of defensive strategies expressed by denial and relating them to family inheritance, the fact of being a woman, and even to chance. In short, they trivialized such manifestations and adapted to the situation as if it were something normal, perhaps for fear of losing their jobs, or even one of their jobs, as there are employees who work in two places, both with radiation.

Such defensive strategy was evident in the dialectical relationship that was maintained throughout the method in the research process itself: it is noticed that employees were afraid to talk about these issues as if the problem was not happening to them, and when questioned, the answers were evasive and often laden with excuses.

The majority of employees made reference to discomfort regarding the use of individual lead clothing and the omission of the department to provide some of these, such as glasses and lead gloves. It was also evident that the department did not offer qualification for work in this area, despite the desire of these employees for greater security with qualification of this work process.

Given this evidence that employees are exposed to ionizing radiation, especially, through ignorance, not only of the use of radiological protective clothing, but also the basic measures of how to protect themselves from the radiation, Continuing Education (CE) is a way to change this reality. Listening to the employees talking about their needs and problems experienced in the daily work was crucial, because we can then understand

the real needs of the employees, based on problems encountered in practice. In this context, the CE should be designed to generate in employees attitudes consistent with the principles of radiation protection in the CCL.

## REFERENCES

1. Saad JA, Garcia JC, Guimarães JI. Diretriz para realização de exames diagnósticos e terapêuticos em hemodinâmica. *Arq Bras Cardiol*. 2004; 82 (sup. 1):1-6.
2. Canevaro L. Aspectos físicos e técnicos da radiologia intervencionista. *Rev Bras Física Médic [online]*. 2009 [acesso 2011 Ago 20]; 3:101-15. Available at: [http://www.abfm.org.br/rbfm/publicado/RBFM\\_v3n1\\_101-15.pdf](http://www.abfm.org.br/rbfm/publicado/RBFM_v3n1_101-15.pdf)
3. Arias CF. La regulación de la protección radiológica y la función de las autoridades de salud. *Rev Panam Salud Publica [online]*. 2006 [cited 2010 Jun 17]; 20(2/3):188-97. Available at: [http://www.scielo.org/scielo.php?pid=S1020-49892006000800004&script=sci\\_arttext](http://www.scielo.org/scielo.php?pid=S1020-49892006000800004&script=sci_arttext)
4. Flôr RC. O trabalho da enfermagem em hemodinâmica e o desgaste dos trabalhadores decorrente da exposição à radiação ionizante [tese]. Florianópolis (SC): Universidade Federal de Santa Catarina, Programa de Pós-Graduação em Enfermagem; 2010.
5. Santos PR. Study of the process of work of the nursing in hemodynamics: wastes, workloads and factors of risks to the workers' health. Rio de Janeiro (RJ): Fiocruz; 2008.
6. Lancman S, Sznalwar LI. Christophe Dejourns: da psicopatologia à psicodinâmica do trabalho. Rio de Janeiro (RJ): Fiocruz; 2008.
7. Silva LP, Maurício CLP, Canevaro LV, Oliveira OS. Evaluation of exposure of physicians to radiation during hemodynamic interventional procedures. *Radiol Bras [online]*. 2008 [accessed 2010, Jan 26]; 41(5):319-23. Available at: [http://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S0100-39842008000500010&lng=pt&nrm=iso](http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0100-39842008000500010&lng=pt&nrm=iso)
8. Arranz L. A organização da física médica e da proteção radiológica na área médica na Espanha. *Radioproteção [online]*. 2009 Dez - 2010 Mai [acesso 2011 Mai 26]; 2(16-17): 33-41. Disponível em: [http://www.sppcr.online.pt/revista\\_2010.pdf](http://www.sppcr.online.pt/revista_2010.pdf)
9. Dejourns C, Abdoucheli E, Jayet C. Psicodinâmica do trabalho: contribuições da escola dejouriana à análise da relação prazer, sofrimento e trabalho. São Paulo (SP): Atlas; 2007.
10. Ministério da Saúde (BR), Secretaria de Vigilância Sanitária. Portaria n. 453, de 1º de junho de 1998: diretrizes de proteção radiológica em radiodiagnóstico médico e odontológico. Brasília (DF): MS, 1998.

11. Ministério do Trabalho (BR). Portaria 3214 de 08 de junho de 1978: aprova as Normas Regulamentadoras - NR do Capítulo V do Título II da Consolidação das Leis do Trabalho, relativas à Segurança e Medicina do Trabalho. In: Manual de Legislação. 44<sup>a</sup> Ed. São Paulo: Atlas; 2004.
12. Conselho Federal de Enfermagem (BR). Resolução n. 290/2004: dispõe sobre as especialidades de enfermagem. 2004 [acesso 2010 Jun 16]. Disponível em: <http://portalcofen.gov.br>
13. Conselho Federal de Enfermagem (BR). Resolução n<sup>o</sup> 211/1998: dispõe sobre as a atuação dos profissionais de enfermagem que trabalham com radiação ionizante. 1998 [acesso 2010 Abr 26]. Disponível em: <http://portalcofen.gov.br/sitenovo/node/4258>
14. Conselho Federal de Enfermagem (BR). Resolução n<sup>o</sup> 226/2000: dispõe sobre o registro para especialização de Técnicos e Auxiliares de Enfermagem. 2000 [acesso 2010 Abr 26]. Disponível em: <http://portalcofen.gov.br/sitenovo/node/4268>
15. Tauhata L, Salati IPA, Prinzio RD, Prinzio MARRD. Radioproteção e dosimetria: fundamentos. Rio de Janeiro (RJ): IRD/CNEN; 2003.
16. Ministério da Ciência e Tecnologia (BR), Comissão Nacional de Energia Nuclear. Resolução CNEN n. 27/2005: Norma CNEN NN-3.01 - Diretrizes Básicas de Proteção Radiológica Brasília (DF): MCT; 2005.
17. Brand CI, Fontana RT, Santos AV. A saúde do trabalhador em radiologia: algumas considerações. Texto Contexto Enferm [online]. 2011 [acesso 2011 Jun 30]; 20(1):68-75. Disponível em: <http://www.scielo.br/pdf/tce/v20n1/08.pdf>