

# CUIDADO É FUNDAMENTAL

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PESQUISA

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## Patient and worker safety in imaging: an integrative review

Segurança do paciente e do trabalhador em Imagenologia:  
uma revisão integrativa

El paciente ser la inocuidad y del trabajador en Imagenologia:  
una integrativa revisión

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### ABSTRACT

**Objective:** To raise the scientific publications about the approaches given to the National Patient Safety Policy (NPSP) and Occupational Health and Safety Policy (OHSP) in order to integrate these observations into health care. **Method:** A qualitative-quantitative study in an integrated systematic review. The data were obtained and recorded in graphs and tables, in addition to the theoretical care basis of Florence. **Result:** The study found that about 12.8% of articles are focused on this theme. Within this theme, the sector that stands out most is hemodialysis. Florence's environmental theory, along with the proposed theme, influences both worker safety and patient safety. **Conclusion:** Articles of worker safety, patient safety and imaging are intrinsically associated. And, therefore, more articles may later include this interlaced theme.

**Descriptors:** Patient's safety, Worker's safety, imagenology

### RESUMO

**Objetivo:** Levantar as publicações científicas acerca dos enfoques dados às Políticas Nacional de Segurança do paciente (PNSP) e de Saúde e Segurança Trabalhador (PNSST) a fim de integrar estas observações ao cuidado em saúde. **Método:** estudo quali-quantitativo em revisão sistemática integrada e os dados foram obtidos e registrados através de gráficos, tabelas e quadros além da base teórica do cuidado de Florence. **Resultado:** O estudo constatou que cerca de 12,8% dos artigos são voltados para essa temática. Dentro dessa temática, o setor que mais se destaca é a hemodiálise. A teoria ambientalista de Florence, junto com a temática proposta, influencia tanto na segurança do trabalhador quanto na segurança do paciente. **Conclusão:** Os artigos de segurança do trabalhador, segurança do paciente e imagenologia estão intrinsecamente associados. E, dessa maneira, podem ter mais artigos posteriormente incluindo essa temática entrelaçada.

**Descritores:** Segurança do paciente, segurança do trabalhador, imagenologia

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## RESÚMEN

**Objetivo:** levantar las publicaciones científicas con respecto a los datos de enfoques el ciudadano de política del paciente es la inocuidad de (PNSP) y de la salud y - penoso la inocuidad de trabajo (PNSST) in order integrar estas observaciones al cuidado en la salud. **Método:** estudio - de quali cuantitativo en la revisión sistemática integrada y los datos fueron obtenidos y registrados a través de gráficos, tablas y fotografías además de la base teórica del cuidado de Florencia. **Resultado:** el estudio verificó que aproximadamente 12,8 % de los artículos estuvieran desaparecidos back to ese tema. Dentro de de ese theme, la sección eso más selecciona ser el hemodiálise. El ambientalista de teoría de Florencia con la propuesta de theme influye en so much en la seguridad del trabajador como en el patient's safety. **Conclusión:** los artículos de la inocuidad del trabajador, la patient's safety e imagenología son intrinsecamente asociado.

**Descriptores:** el patient's safety, la inocuidad del trabajador, imagenología.

## INTRODUCTION

The demands presented for nursing care with a focus on patient and worker safety have been fierce since 2007. This debate is present in the forums of education and quality of life.

The challenge of implementing health policies in the areas of patient safety and occupational safety and health policies based on safety evidence has quickly resulted in care and safety formulations in health facilities and services.

The objective of this study was to collect scientific publications about the approaches taken to the National Patient Safety Policy (NPSP) and Occupational Health and Safety Policy (OHSP) in order to integrate these observations into health care.

According to Brasil (2007)<sup>1</sup>, the risks are inherent to the work processes in a direct and indirect way. The characterization or the occurrence of a certain risk / grievance may be manifested as a momentary or permanent situational exposure according to the groups of workers or professions, and to the patient depending on the pathology or clinical investigation.

Therefore, the so-called physical, chemical, biological, ergonomic, psychosocial, mechanical risk factors, work accidents and the elements of the patient's safety axes such as safe care practice, incident notifications and the inclusion of safety theme for the teaching of the patient and health professionals broadens and offers a clearer definition of the imbricated relationship between the patient and the worker.

The possible risk that can occur within the sector will tend to reach the health team and other clients who benefit from the service. This team can be made up of doctor, nurse, nurse technician and other professionals (BRASIL, 2012)<sup>2</sup>. This team, in its daily work, carries out technical procedures and promotes a communication with the exchange of experiences and knowledge among its

members. This integrative interaction makes it possible to mitigate the inherent risks within the sector.

By observing the radiodiagnosis service of the university hospital of Rio de Janeiro, during the clinical teaching process the exposure to ionizing radiation aroused the interest of studying the clinical correlations with other pathologies and the risks of this sector, as well as the complementary activity being intrinsically linked to the most diverse sets of clinical indications and / or therapy of patients and the increasing turnover and demand for such services.

This observation has brought us concern about the active process modes and organization of work in imaging before the risk factors that interfere and generate vulnerabilities for the patient safety and worker health.

Based on this problem and the growing need to improve the quality of care and service provided, we perceive that nursing management has as its interface the promotion of the patient and worker safety.

For this intervention, it should include in its evaluations the elements of the security guards axes and promote support and material necessary and adequate for a better quality not only to patient safety, but also to the worker.

Thus, this study has, as general objective, to dialogue with the results of studies related to the topic and presents suggestions/recommendations for intervention in education for patient safety and promotion of the worker health.

## METHOD

We present the integrative review in imaging/ ambulatory radiodiagnosis applied to nursing with the use of thematic association and critical analysis for the patient and worker safety. We used the systematic review process developed by Bennett S e Bennett JW<sup>3</sup>, which seeks the practice based on evidence, with the development of an applied integrative review.

We employ seven steps for the methodological practice of this integrated systematic review. The selection of articles was based on the use of descriptors in the research bases of the Coordination of Improvement of Higher Level Personnel (CAPES in Portuguese) platform and research in nursing and public health. The inclusion and exclusion criteria were guided by the articles that had the insertion in the nurse profession.

The analysis procedures consisted of the critical synthesis of the included articles, which are inserted as a result in the description format of the review process, as detailed in the steps described below:

- 1) Formulation of the question with the issue of interest: "How can the risks inherent in the working processes and clinical research in radiodiagnostic examinations compromise the safety and health of patients and workers in health care facilities?";
- 2) Identification of the databases and articles relevant to the theme were defined as the following keywords: worker health, nursing and imaging, and the applied search strategies were as follows: publications of indexed journals and guidelines

for the proposed theme. It was used the Discover network, which has databases such as Scielo, LILACS, MedLine, Science Direct, Academic OneFile, Business Insights: Essential among others associated with this network;

- 3) We had as criteria of selection and search of articles, the publications of the last five years in indexed journals of public health and nursing. Only complete articles with results were included. For the selection of articles, we apply the following criteria: articles written by nurses, indexed articles; articles with the study population that had radiological examinations;
- 4) Justification of exclusions of articles for a sample of X articles found, therefore XX articles were included. Among the articles surveyed, those that presented the following target audience were excluded: articles aimed at the surgical center, psychiatry, emergency, Intensive Treatment Center, pediatrics and basic care. These sectors do not include radiodiagnostic services, although there is execution of imaging services by mobile radiodiagnostic equipment. Thus, the scientific academic production is focused on tests that use ionizing radiation, totalizing nine articles;
- 5) Critical analysis of the included articles: we apply the foundations of the Florence Nightingale theory for the perception of the environmental elements that favor the safety state in the work processes in health services for diagnostic radiology;
- 6) Critical summary with synthesis of information: the summaries were elaborated in the linguistic format of adverbial sentences to contain the idea of the hypothesis, cause and condition of the situation under analysis;
- 7) Conclusion: We highlight the results on the guiding question and draw up considerations about the propositions of interventions found in the articles analyzed;

This study employed quantitative and qualitative scientific approaches to proceed as a way of apprehending the dimensions of the contents produced by the results.

The quantitative results are presented by the relative frequency distribution using Excel. This basic statistical tool associated with computer science for the production of measurable data for the application of graphs and tables contemplated and generated the presented numerical results.

The critical analysis was guided by the Florence Nightingale care theory, that is based on the environment as the main scenario and that generates conditions that can externally influence and/or prevent the factors and/or elements that generate vulnerability and non-safety for the patient and the worker.

The elements of the physical environment are important for environmental theory, as they interfere with the patient's condition, such as ventilation, lighting, heat, cleaning, noise, odors and food. These environmental elements allow them to act and there is prevention and nursing care in a safety scenario for the patient and the worker.

When situations of vulnerability that lead to error, failure and idiosyncrasies occur in parts of the work processes, both patients and workers become subjects susceptible to the poor conditions of environmental sanitation and safety to perform and receive health care.

Both are exposed to what we call the "Florence Victimology", which result in high morbidity/mortality rates and affect the healing process, as well as give the nurse the feeling of impotence in the face of the need to promote a healthy environment so that nature can express the cure according to the theoretical propositions of Florence.

Nursing care is based on the nursing process that implements the observation, experience and data records that are fundamental for the better development of this work methodology, coupled with the Systematization of Nursing Care (SAE/2009)<sup>4</sup> and health promotion protocols (BRASIL, 2007)<sup>5</sup>.

These theoretical references allow the resolution of nursing care associated to OHSP (2011)<sup>6</sup> and the axes of the NPSP (2011).<sup>7</sup>

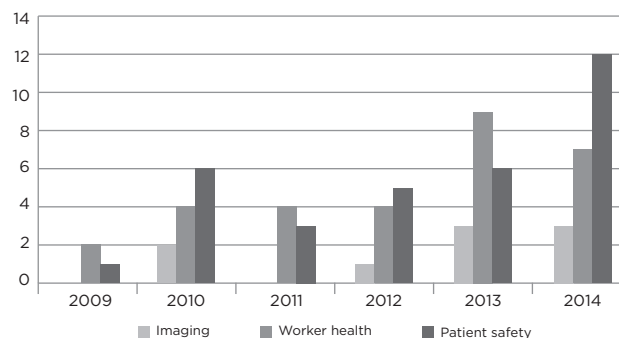
## RESULTS AND DISCUSSION

We present the results using the sequential stages of the integrative review research and use the blue color to reference the patient safety, since in the health services under study, this color is used in the patients' clothes and the green color for the workers, because this is the representative color of the health area. This representation shows the inherent aspects of non-verbal communication and the subjective reading dimension associated with the uniformed worker that performs the work activity (Daniellou 2004).

Among the scientific productions found in the universe of 70 articles, those that approached the imaging services were eight (12.8%). These eight articles focused on this theme highlighted interventional imaging sectors. In figure 1, we highlight the quantity of productions by theme.

The comparison of scientific publications between the years 2009 and 2014 has thematic diversity. The following themes were compared: worker health, patient safety and imaging, as can be seen below. Therefore, the quantitative of scientific productions in the hospital environment were selected.

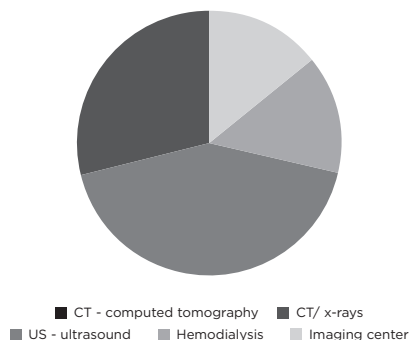
**Graph 1** - Comparative chart of scientific productions from 2009 to 2014



Source: authors

In graph 2, we visualized scientific publications exclusively targeted for imaging which deals with subtopics such as: hemodialysis, computed tomography, x-rays, ultrasound, diagnostic imaging center by area of the imaging sector.

**Graph 2** - Comparative chart of the scientific productions produced by the imaging sector



Fonte: Elaborado pelo próprio autor  
Source: authors

In Table 1, we can see that the environmental elements proposed by Nightingale can compromise both professionals and patients of health facilities. Accordingly, the patient safety guiding axes and the risk and exposure factors to the worker are associated, as will be seen in the table below.

**Table 1** - Environmental elements of non-safety and health that compromise patients and workers in health care establishments

Environmental elements	Occupational exposure / hazard factors	Patient Safety Axis
Ventilation, lighting, heat, noise, odors	Physical risk	Mitigation Factors Risk reduction actions
Food and cleaning	Biological risk	Risk reduction actions

Source: authors

In Table 2, via the critical analysis for the safety of the patient and the worker, we can find factors that permeate the safety and health of the worker and the patient allied to factors such as contributing factors of hazard, mitigation factors, detection, outcome A and care of the organization observed in table 2.

**Table 2** - Critical analysis factors for patient and worker safety

Worker / patient evidence element	Worker health and safety analysis element	Patient safety analysis element
<b>Contributing factors of hazard</b> (environmental safety of worker and patient in the face of good health practices)	<b>Occupational risk control</b> (Physical, chemical, biological, ergonomic, mechanical or work-related accidents - NR-05, NR-32)	<b>Assertiveness time</b> (Correct identification of the patient, improve communication among health professionals, improve prescription safety, use and administration of medication)
<b>Detection and mitigation factors</b> (Administration in human resources and health care management)	<b>Organization of work</b> (shifts, hours, human resources, management of tasks and activities, NR-17)	<b>Intervention time</b> (procedure/examination in correct place, reduce risk of fall)
<b>Outcomes in care and organization</b> (Worker and patient biosafety)	<b>Health surveillance</b> (standards, best practices and resolutions)	<b>Infection Control and Biosafety</b> (Hygiene of hands to avoid infection-RDC 306)

Source: authors

Table 3 shows the patient safety guiding, corroborating the NPSP and OHSP-focused policies. In the midst of this work process, the axes of these two strands are aligned in health services, as can be seen below.

**Table 3** - Safety axes for the patient and the worker in health services

Safety axes	Worker's axis	Patient's axis
Qualified care	Prevention	Identify/communicate/ensure
Conformity Standards	Promotion	Improve/sanitize
Protocols	Protection	Reduce

Source: authors

In Table 4 below, the scientific publications concerning the most diverse subdivisions in the field of imaging such as interventional procedures, tomography, resonance and among others can be found. And, finally, a synthesis of the critical analysis for each publication.

**Table 4** - Synthesis of the critical analysis

Sector studied	Analyzed articles	Adverbial sentences
X rays CT Mammography Fluoroscopy	<b>Risk Control in radiodiagnosis:</b> an approach to health surveillance.	ANVISA controls the radiodiagnosis sector in order to control the risks that the equipment can offer to professionals and users.
X rays CT	Correlation between linear measurements on panoramic radiographs and cone beam computed tomography associated with the maxillary sinus.	The correlations between the panoramic radiographs and the CT scans when associated with the maxillary sinus influence on the implantology.
CT	<b>Organization of nursing work on computed tomography:</b> erecting assignments and procedures.	Since there is an work organization, it will be described the attributions and procedures of nursing.
US, MRI, CT, Mammography, Conventional Radiology, Vascular and Interventional Radiology, Densitometry, Radiotherapy, Nuclear Medicine	<b>Nursing time in diagnostic imaging center:</b> instrument development	Due to the cross-mapping technique, they were able to classify nursing interventions according to IAS.
Ultrasonography	Assertiveness and permanence time of peripheral intravenous catheters with ultrasound guided insertion in children and adolescents	Since peripheral intravenous catheters were used, peripheral venipuncture and intravenous therapy were more successful.
Hemodialysis/use of ultrasound equipment	Occupational risks faced by the nursing worker in the hemodialysis sector	Although there are occupational hazards present in nurses' activities, there is a low adherence to the use of personal protective equipment (PPE).
Hemodynamics, Radiodiagnosis, Nuclear Magnetic Resonance, Computed Tomography and Ultrasonography.	Nurses' performance in a Diagnostic Imaging Center	When there are updates and practices based on scientific knowledge, both professional and patient safety are ensured.
Hemodialysis	Nursing diagnoses in chronic renal patients on hemodialysis.	Since they were identified by the nursing diagnosis in the hemodialysis sector, the necessary interventions could be made in the sector.
Hemodialysis	<b>Adverse events on hemodialysis:</b> reports of nursing professionals.	After surveying the risks involving professionals, continuing education and quality of care influence the safety of both the patient and the worker.

Source: authors

From the critical analysis of the articles, we created intervention propositions combined with the environmentalist theory of Florence Nightingale, with presentation of the articles analyzed previously in the critical analysis, as can be seen in Table 5.

**Table 5** - Intervention propositions were found in the articles analyzed.

Article analyzed	Article Proposition	Ambientalist Proposition
Risk Control in radiodiagnosis: an approach to health surveillance.	The radiodiagnosis sector will be evaluated by ANVISA standards so that the equipment offers the lowest possible risk to the employees and the patients.	After the equipment has been inspected by ANVISA, they will be evaluated for illumination, noise and heat in order to function correctly.
Correlation between linear measurements on panoramic radiographs and cone beam computed tomography associated with the maxillary sinus.	Implant dentistry interferes with the patient's condition when performed by conventional radiography or by computed tomography.	The conserved equipment depends on the environmental elements such as lighting, ventilation, heat and noise for its operation and without causing harm to the patient and the worker.
<b>Organization of nursing work on computed tomography:</b> erecting assignments and procedures.	The attributions and procedures to be performed in the sector within the competence of the nursing team.	Although there are risks in the industry, it is necessary to analyze the environmental conditions such as ventilation, noise, odor, heat in the place and the procedure to be performed on the patient.
<b>Nursing time in diagnostic imaging center:</b> instrument development	The nurses at the diagnostic imaging center did cross-sector mapping and classified the nursing intervention activities based on the Nursing Interventions Classification (NIC).	All of Florence's environmental elements take place in the imaging center.
Assertiveness and permanence time of peripheral intravenous catheters with ultrasound guided insertion in children and adolescents	Based on the time of peripheral intravenous catheters, assertiveness was high when guided by ultrasonography.	On ultrasound, it should be investigated with regard to heat and noise.
Occupational risks faced by the nursing worker in the hemodialysis sector	The low adhesion of the workers to the use of PPEs submits them to occupational risks, such as physical, biological, ergonomic, chemical and mechanical/accident risks.	At hemodialysis, professionals should be aware of ventilation, noise and cleaning of the sector, including equipment and products.
Nurses' performance in a Diagnostic Imaging Center	The competencies exercised by the nurse in the diagnostic imaging center.	At the imaging center, all environmental elements should be observed meticulously in order to avoid risks to professionals and patients.
Nursing diagnoses in chronic renal patients on hemodialysis.	Through the identification of nursing diagnoses in the hemodialysis sector, it is possible to promote protection / safety and nutrition.	Heat and food should be observed in the hemodialysis sector since these are the most prevalent.
<b>Adverse events on hemodialysis:</b> reports of nursing professionals.	Based on the mistakes made by professionals, continuing education and quality of care promote greater patient safety.	Environmental elements such as cleaning, ventilation, noise, odors are inherent in the work process of these professionals.

Source: authors

After analyzing the articles, it was verified that both have the patient safety axes, mainly for the correction or improvement of the assistance practice in face of the errors committed. Critically, this is an adaptation of avoiding and mediating the damage occurred in the form of intervention of this patient.

In most articles whose authors are nurses, we have seen that a good part that commit errors, such as medications and falls are present as safety axes of the patient to avoid this type of occasionally. There are also the errors related to the

health professionals that affect the patients, disagreements occurring in an insecure assistance practice.

Therefore, patient safety and worker safety go hand in hand. The damages caused by these professionals to the users of the service interfere with their care practice. Thus, it causes vulnerabilities to those professionals, who are affected or related to the work environment, exposed to biological, physical, chemical, ergonomic and occupational risks and work accidents in their relationships with other professionals and patients.

As verified in graph 1, the publications pertinent to the radiodiagnosis service are very rare within a universe of at least 70 scientific articles. The most interesting publications are patient safety and worker safety, and they are fully interconnected.

The scientific publications within this area of imaging include X-rays, computed tomography, magnetic resonance, hemodynamic, interventional procedures among others. In addition, among these imaging subdivisions, the articles focused on hemodialysis are highlighted as seen in graph 2.

In table 1, the contributing factors of danger/incident are inserted in the dangerousness or the contributing factor in the work process. Good health practices and worker safety can prevent these types of hazards that may be associated with internal and external factors.

Among those factors that may contribute to these risks are occupational risks. These risks can be dismembered in: physical, chemical, biological, ergonomic, mechanical or work accidents. Because of these risks, one must have a strict control of these occupational hazards in order to avoid damages to these workers, in accordance with NR-5<sup>17</sup> and NR-32<sup>18</sup>, and also in good health practices.

Good health practices minimize these risks for both worker safety and patient safety. For the patient, there is the assertiveness time that attenuates the effects of the damages caused before, during or after the procedure. Thus, good health practices associated with patient safety axes, such as correct identification of the patient, improve communication between health professionals, the safety of prescription, use and administration of medication.

As a way of managing health care and the administration of the sector, it is necessary to know the mitigation factors and the detection of the main problems in the unit, because these factors and detection will allow the creation of a safety plan for both professionals and patients.

This security planning allows the organization of the working process. As described in NR-17<sup>19</sup>, the shifts, journeys, human resources, task management and activities developed by nurses consists of a vision of the whole imaging unit, which will analyze the main focuses of the problems, acting in time.

As a consequence of this intervention time, the professional, during the procedure or examination in the correct place, and, then, a standard operating procedure (SOP), will reduce the risks to the patient, including the risk of the patient falling at the time of the examination.

As a result of the care and organization of the work process, the actions of health surveillance and standards of the National Health Surveillance Agency (ANVISA in Portuguese), have the function of supervising the entire technological apparatus, allowing or not the operation of the establishment. This permission guarantees worker and patient biosafety, in a way that reduces and avoids the risk of infection, one of which is hand hygiene according to the Resolution of the Board of Directors RBD-306.<sup>20</sup>

Table 2 shows that the environmental elements proposed by Florence are associated with risks to both the worker and the patient. For workers, the physical risks present,

such as lighting, ventilation, noise and odors directly affect the performance of the work and the way of operating the proposed equipment.

As a consequence of these factors the patients suffer, because the equipment does not function properly, and also the professional who is exposed to this occupational risk, interfering in the quality of care and service provided. Therefore, these factors are inherent to the operant mode of the work process.

Food and cleaning are other factors associated with mitigation factors and hazards. This is a information that apparently has no correlation. However, the biological risks present in both the contamination of food and/or dirty chemicals within the sector harm even more.

This impairment interferes with the quality of care, further jeopardize the professionals working in this area who are exposed to the risks of both the sector and the comorbidities of these patients. Allied to this, we have the environmentalist theory of Florence that permeates this process and the patient being also vulnerable to this organization and production of the service.

We can see in Table 3 and 4 that the guiding axes of patient and worker safety are intrinsically interlaced. In order to further reduce the mitigation factors and the hazards exposed to this studied population, there are promotions and actions that minimize this action as seen in the aforementioned tables.

The propositions of interventions that were found in the articles analyzed and presented in table 5 express the environmental theory of Nightingale. Although the articles present some elements of this environmental theory, environmental elements that are not preserved correctly result in non-safety factors. These factors can lead to a long-term epidemiological chain at a level of alarm that may bring correlations with genetic, molecular modifications of existing diseases and even the emergence of other diseases.

## CONCLUSION

We have seen that the quantitative of scientific productions for worker safety is vast. However, it is possible to include radiodiagnosis within the broad thematic area, because it has its risks of dangerousness, the use of ionizing radiation and other risks inherent to work and that affects the health of this professional.

In the patient's safety, we verified the diversity of articles aimed at this theme, but also, within this scientific publication, it is revealed the small scale scientific production of this subject in radiodiagnosis. Thus, it is possible to produce on a larger scale for radiodiagnosis because of the vast amount of diagnostic tests performed annually.

As a result, imaging offers an enormous amount of services that need to be explored involving workers, clients and other services. Despite having a timid scientific production in this area, there will probably be more production to benefit workers and clients of this radiodiagnosis service.

We did not identify articles mentioning the use of Personal Protection Equipment (PPE) by the patient, this

is a measure recommended by ANVISA Ordinance no 453 of 1998, which is directive for the use of radiodiagnosis in clinical exams with considerations of safety for the worker, the environment and the patient.

We do not have research that alludes to the exposure of the patient submitted to radiodiagnosis in Brazil, this should receive a dosimeter and also the plumbum protectors of exposure areas, such as the thyroid protector and gonad protector. The patient should be contemplated by the protection, employing the shortest exposure time, the lowest dose, the lower risk, the principles of ALARA (As Low As Reasonably Achievable).

## REFERENCES

1. Brasil. Conselho Nacional de Secretários de Saúde. Vigilância em Saúde. Brasília: Conass; 2007 [acesso em 10 out 2017]. Disponível em: [http://189.28.128.100/dab/docs/publicacoes/conass\\_progestores/livro\\_6\\_tomo\\_1\\_vigilancia\\_em\\_saude.pdf](http://189.28.128.100/dab/docs/publicacoes/conass_progestores/livro_6_tomo_1_vigilancia_em_saude.pdf)
2. Brasil. Caderno de Atenção Básica. Brasília: Ministério da Saúde; 2012 [acesso em 10 out 2017]. Disponível em: <http://dab.saude.gov.br/atencaobasica.php#saudedafamilia>
3. Bennett S, Bennett JW. The process of evidence-based practice in occupational therapy: informing clinical decisions. *Austral Occup Ther J* 2000;47:171-80.
4. Brasil. Resolução Cofen nº 358. Sistematização da Assistência de Enfermagem. Diário Oficial da União 15 out 2009.
5. Brasil. Documento de atualização dos protocolos de enfermagem: saúde da criança, saúde da mulher, saúde do adulto e saúde do idoso. São Paulo: SMS; 2007.
6. Brasil. Decreto nº 7.602, de 7 de novembro de 2011. Dispõe sobre a Política Nacional de Segurança e Saúde no Trabalho – PNSST. Diário Oficial da União 8 nov 2011; nº 214: seção 1.
7. Brasil. Boletim Informativo Segurança do Paciente e Qualidade em Serviços de Saúde. Brasília: Anvisa; 2011.
8. Daniellou, F, organizador. A ergonomia em busca de seus princípios: debates epistemológicos. São Paulo: Editora Edgard Blücher, 2004.
9. Navarro MVT, et al. Controle de riscos em radiodiagnóstico: uma abordagem de vigilância sanitária. *Ciência & Saúde Coletiva* 2010 [acesso em 1º out 2014];15(3):3477-86. Disponível em: <http://www.scielo.br/pdf/csc/v15s3/v15s3a22.pdf>
10. Rodrigues GHC, et al. Correlação entre as medidas lineares em radiografias panorâmicas e tomografias computadorizadas cone beam associadas ao seio maxilar. *Pesq Bras Odontoped Clin Integr* 2013 jul/set [acesso em: 1º out 2014];13(3):245-49. Disponível em: [http://revista.uerp.br/index.php/pboci/article/viewFile/1704/pdf\\_3](http://revista.uerp.br/index.php/pboci/article/viewFile/1704/pdf_3)
11. Santos SRG, Ferreira SC. Organização do trabalho de enfermagem na tomografia computadorizada: construindo atribuições e procedimentos. *Rev Enferm UFPE Online* Maio 2014 [acesso em: 1º out 2014];8(5):1423-5. Disponível em: [www.revista.ufpe.br/revistaenfermagem/index.php/revista/article/.../9158](http://www.revista.ufpe.br/revistaenfermagem/index.php/revista/article/.../9158)
12. Cruz CWM, Gaidzinski RR. Tempo de enfermagem em centro de diagnóstico por imagem: desenvolvimento de instrumento. *Acta Paul Enferm* 2013 [acessado em: 1º out. 2014];26(1),79-85. Disponível em: <http://www.scielo.br/pdf/ape/v26n1/13.pdf>
13. Avelar AFM, Peterlini MAS, Pedreira MLG. Assertividade e tempo de permanência de cateteres intravenosos periféricos com inserção guiada por ultrassonografia em crianças e adolescentes. *Rev. Esc. Enferm. USP* 2013 [acesso em: 1º out 2014];47(3):539-46. Disponível em: <http://www.scielo.br/pdf/reeusp/v47n3/0080-6234-reeusp-47-3-00539.pdf>
14. Correa RA, Souza NVDO. Riscos ocupacionais enfrentados pelo trabalhador de enfermagem no setor de hemodiálise. *Rev. Pesqui. Cuid. Fundam Online* out/dez 2012 [acesso em: 1º out 2014];4(4):2755-64. Disponível em: [www.seer.unirio.br/index.php/cuidadofundamental/article/.../pdf\\_614](http://www.seer.unirio.br/index.php/cuidadofundamental/article/.../pdf_614)
15. Sales OP, Oliveira CCC, Spirandelli MFAP, Cândido MT. Atuação de enfermeiros em um Centro de Diagnóstico por Imagem. *J Health Sci Inst* 2010 [acesso em: 25 nov 2014];28(4):325-8. Disponível em: [http://www.unip.br/comunicacao/publicacoes/ics/edicoes/2010/04\\_out-dez/V28\\_n4\\_2010\\_p325-328.pdf](http://www.unip.br/comunicacao/publicacoes/ics/edicoes/2010/04_out-dez/V28_n4_2010_p325-328.pdf)
16. Frazão CM, Medeiros AB, Silva FB, Sá JD, Lira AL. Diagnósticos de enfermagem em pacientes renais crônicos em hemodiálise. *Acta Paul Enferm* 2014 [acesso em: 1º out 2014];27(1):40-3. Disponível em: [http://www.scielo.br/pdf/ape/v27n1/pt\\_0103-2100-ape-27-01-00040.pdf](http://www.scielo.br/pdf/ape/v27n1/pt_0103-2100-ape-27-01-00040.pdf)
17. Sousa MRG, Silva AEBC, Bezerra ALQ, Freitas JS, Miasso AI. Eventos adversos em hemodiálise: relatos de profissionais de enfermagem. *Rev. Esc. Enferm. USP* 2013 [acesso em: 1º out 2014];47(1):76-83. Disponível em: <http://www.scielo.br/pdf/reeusp/v47n1/a10v47n1.pdf>
18. Brasil. Ministério do Trabalho. Portaria nº 3.214, de 8 de jun. de 1978. Aprova as Normas Regulamentadoras – NR do capítulo V, Título II, da Consolidação das Leis do Trabalho (CLT), relativas à Segurança e Medicina do Trabalho. Diário Oficial da União 8 jun 1978.
19. Brasil. Ministério do Trabalho. Portaria GM nº 485, de 11 de nov. de 2005. Norma Regulamentadora 32 - Segurança e Saúde no Trabalho em Serviços de Saúde. Diário Oficial da União 16 nov 2005.
20. Brasil. Ministério do Trabalho. Portaria GM nº 3.213, de 8 de jun. de 2005. Norma Regulamentadora 17 - Ergonomia. Diário Oficial da União 8 jun 1978.
21. Brasil. Resolução da Diretoria Colegiada nº 306, de 7 de dez. de 2004. Dispõe sobre o Regulamento Técnico para o gerenciamento de resíduos de serviços de saúde. Diário Oficial da União 7 dez 2004.
22. Brasil. Portaria nº 453, de 1998. Aprova o Regulamento Técnico que estabelece as diretrizes básicas de proteção radiológica em radiodiagnóstico médico e odontológico, dispõe sobre o uso dos raios-X diagnósticos em todo território nacional e dá outras providências. Diário Oficial da União 2 jun 1998.

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