



An analysis of the disciplines focused on radiation protection on radiology technologist degree courses in Brazil

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ABSTRACT

Undergraduate degree in technology were recognized in Brazil in the 1990s, such as the Technologist in Radiology (TecR). According to the Ministry of Education (MEC), the TecR can work in areas as Radiotherapy, Radiology and Nuclear Medicine, for instance, in addition to coordinating and supervising teams in radiation protection (RP). It was noticed that, in some areas of TecR performance, prior knowledge regarding to RP is necessary. In this sense, the aim of this paper is to analyze the syllabus of higher education institutions that offer the TecR course in Brazil and to verify the disciplines focused on RP, according to the Certification of Qualification for Acting as Radiation Protection Supervisor by the National Commission of Nuclear Energy (CNEN) – CNEN Standard 7.01. The disciplines analyzed are: Shielding Calculation, Dosimetry, Statistics, Radiation Physics, Fundamentals of Basic Physics, Waste Management and Transport, Nuclear Instrumentation, Legislation and Standardization, Nuclear Medicine, Radiobiology and Radiation Protection. With this purpose, a documentary research was carried out on the syllabus found in all educational institutions in Brazil that offer the TecR course and the presence of disciplines related to RP was analyzed. It is observed that the offer of disciplines varies from region to region, which can also occur intraregionally, so that there is a need to offer disciplines related to RP to adapt to the CNEN Standard 7.01. It is intended, with this study, to contribute to the debate about the syllabus profile on RP of TecR courses in view of the importance of this theme in their professional activity.

Keywords: radiation protection, syllabus, undergraduation in radiology technologist, CNEN Standard 7.01.



1. INTRODUCTION

1.1. Presentation

Undergraduate courses in technology were recognized in Brazil in the 1990s, such as the Technologist in Radiology (TecR). At that time, when the evolution of radiology services influenced the process of training and practice of health professionals, the first undergraduate courses in TecR were created, mainly from 1991 [1].

From that time onwards, the vision of the TecR as a professional with higher level knowledge that meets the new forms of organization and management was intensified [2].

Therefore, according to the Ministry of Education (MEC), the TecR can work in areas as Radiotherapy, Radiology and Nuclear Medicine (medical areas), Industrial Radiology, Veterinary and Dental Radiology and Tailings, for instance, in addition to coordinating and supervising teams in image diagnosis, quality control and radiation protection (RP) [3; 4]. Thus, it can be said that, in some areas of TecR performance, prior knowledge regarding RP is necessary.

However, despite this broad spectrum of activities, there are still few postgraduate courses in which TecR can specialize itself, for instance, in order to perform the most varied activities in the nuclear area [1; 5].

In this sense, the aim of this paper is to analyze the syllabus of higher education institutions that offer the TecR course in Brazil and to verify the disciplines focused on RP, according to the Certification of Qualification for Acting as Radiation Protection Supervisor by the National Commission of Nuclear Energy (CNEN) – CNEN Standard 7.01.

1.2. The CNEN Standard NN 7.01

The CNEN Standard NN 7.01 aims to establish the necessary requirements for the certification of qualification of radiation protection supervisors (RPS) [4].

To obtain certification, the candidate must have a higher-level undergraduate degree (bachelor, licentiate or technologist), recognized by the MEC, in the areas of knowledge compatible with the practice [4]:

I - exact and earth sciences;

II - biological sciences;

III - engineering;

IV - health sciences;

V - agricultural sciences; or

VI - radiological sciences.

Additionally, the candidate must have experience in safety and RP, in the intended area of activity, during the operation of the installation or the performance of the service. The minimum experience time of the candidate for RPS, in the intended area of activity, is specified in Annex I of the Standard [4].

The experience must have been acquired in the five years prior to the certification request date, and may alternatively be acquired up to one year after passing the CNEN exam [4].

2. MATERIALS E METHODS

Thus, for this paper, a qualitative (document analysis to verify the CNEN Standard NN 7.01 and the disciplines focused on RP of the courses) and quantitative (to verify the number of courses and disciplines offered) [6] was carried out as follows:

a) Qualitative research on the digital platforms of CNEN, National Council of Radiology Technicians (CONTER), MEC and at the courses found, in order to verify the legal requirements and the structure of the courses in relation to the training and activities in RP of TecR; and

b) Quantitative research on MEC's digital platforms and the courses found, in order to verify the number of courses and subjects offered.

In this context, the workload and the content were not analyzed, considering that many of the Educational Institutions (EI) did not make these data available.

3. RESULTS

3.1. The undergraduate degree in TecR in Brazil

From the creation of the undergraduate course in TecR in 1991, the role of the TecR was intensified as a professional with higher-level knowledge that would meet new forms of organization and management, with scientific domain and technological practice in diagnostic imaging [7; 8].

The TecR course is a short-term course (three years), according to the needs of the job market. The areas of work are, for instance, medical (diagnosis sector), radiotherapy (therapy sector), industrial, veterinary radiology and dental radiology [7; 8].

The higher course in TecR must have a workload of 2,400 hours, and the field of action can be in:

Hospitals, clinics, polyclinics and laboratories, in diagnostic imaging services for conventional radiology, digital, bone densitometry, computed tomography, mammography, dental radiology, interventional radiology, hemodynamics, magnetic resonance, radiotherapy, nuclear medicine, extracorporeal lithotripsy, ultrasound, radiology veterinary, industrial radiology and equipment industries and distributors, in Research Centers and Educational Institutions, through training required by current legislation. [8, s/p.].

The TecR can also work in the medical, veterinary, industry and teaching areas. Thus, according to the National Catalog of Higher Technology Courses [8], the TecR:

...performs radiological techniques in the diagnostic sector; radiotherapy, in the therapy sector; radioisotopes, in the radioisotope sector; industrial; and nuclear medicine sector. This professional can manage radiological services and procedures, acting in accordance with biosafety and radiation protection standards in radiodiagnostic clinics, hospitals, polyclinics, laboratories, industries, manufacturers and distributors of hospital equipment. The minimum workload must be 2,400 hours. [8, s/p.].

Still about the TecR is said that:

... the technologist is a professional who works in specific areas, which lack qualified labor, such as (...) medical radiology (...). Technology courses were created precisely with the aim of filling these "gaps" in the job market. (...). It is not the competence of the technologist in medical radiology to issue medical reports, an activity that is restricted to the physician. (...) [the] courses [of] Radiotechnology (...) were created in the early 1990s and are currently recognized by the MEC. (...) the market perspective for radiology technologists is very promising, especially in the area of diagnostic imaging, in view of the expansion of certain imaging modalities in the country, such as nuclear medicine with PET-CT and functional magnetic resonance imaging. [8, s/p.].

Finally, according to MEC:

Performs radiological techniques for acquiring medical images. It applies ionizing radiation as therapy in radiotherapy and nuclear medicine. Performs image acquisition procedures in industrial radiology. Executes the protocols for acquiring images with magnetic resonance.

Performs procedures for image acquisition in veterinary radiology. It monitors, quantifies and optimizes the production of radiological waste. Supervises the application of radiographic techniques. Coordinates work teams in diagnostic imaging services. Develops, implements, manages and supervises quality control and radiation protection programs. Performs quality control tests in diagnostic imaging services. Inspects, evaluates and issues a technical opinion in its area of training. [8, s/p.].

In other words, according to the MEC, the TecR is able to work in areas such as radiotherapy, radiology and nuclear medicine, industrial radiology and waste, in addition to coordinating and supervising teams in image diagnosis, quality control and RP [7; 8].

In addition, according to the CONTER [9], which represents both technicians and technologists in radiology, in instituting and standardizing the attributions, competencies and functions of the TecR, decided that:

Article 1. Establish and regulate the attributions, competencies and functions of the Technologist in Radiology.

[...] Article 8. It is the responsibility of the Technologist in Radiology to carry out supervision of radiation protection in clinical and hospital facilities and environments. [9, s/p.].

It is then verified that all these functions can be performed by a TecR, including the execution of activities provided for in the radiation protection plan.

3.2. Assessment of syllabus

118 EI were identified that offer the TecR course. However, of this total, only 79 provide the complete syllabus and workload on their pages. These 79 EI were grouped by regions, which made it possible to analyze the workload of the syllabus as well as the offer of these essential modules for training in RP (Figure 1).



Figure 1: Distribution of EI by region
Source: The authors

The RP disciplines considered are: Shielding Calculation, Dosimetry, Radiation Protection, Statistics, Nuclear Instrumentation, Radiation Physics, Fundamentals of Basic Physics, Waste Management and Transport, Radiobiology, Nuclear Medicine and Legislation and Standardization.

Next, in the Table 1, will be presented the distribution of disciplines by region.

Table 1: Distribution of disciplines (in %) by region.

Discipline	Midwest (6 HEI)	Northeast (29 HEI)	North (9 HEI)	Southeast (26 HEI)	South (9 HEI)
Shielding Calculation	0%	41,4%	11,1%	26,9%	22,2%
Dosimetry	33,3%	55,2%	44,4%	46,2%	66,7%
Statistics	50%	48,3%	44,4%	42,3%	66,7%
Radiation Physics	100%	86,2%	100%	96,1%	96,1%
Fundamentals of Basic Physics	83,3%	72,4%	44,4%	57,7%	57,7%
Waste Management and Transport	0%	3,4%	0%	7,7%	7,7%
Nuclear Instrumentation	0%	0%	0%	0%	0%
Legislation and Standardization	83,3%	48,3%	55,6%	34,6%	22,2%
Nuclear Medicine	100%	96,54%	100%	92,3%	88,9%
Radiobiology	16,7%	27,6%	22,2%	34,6%	55,6%
Radiation Protection	66,7%	93,1%	77,8%	80,8%	66,7%

In general, it is observed that in all regions of the country, the subjects Radiation Physics, Radiation Protection and Nuclear Medicine are taught; however, no EI offers Nuclear Instrumentation.

Disciplines such as Shielding Calculation, Legislation and Waste Management, Transport and Radiobiology are the ones with the lowest offer, appearing, on average, in 50% of the EI. It is also noted that Radioactive Waste Management and Transport of Radioactive Material is below 12% of EI, and in the North and Midwest no EI teaches this discipline.

4. CONCLUSION

The aim of this paper was to evaluate the syllabus profile of disciplines related to RP in TecR courses offered by EI in Brazil, related to RPS activities, according to the CNEN Standard 7.01.

It seems that the offer of disciplines varies from region to region, which can also occur intraregionally. However, the absence of a particular discipline does not necessarily mean that the content of this discipline is not offered, and may be inserted in some other discipline (or even being offered under another name).

Thus, the study had limitations, since it did not analyze which competencies, attitudes and skills are taught in the subjects researched, as well as the workload and content, given that most EI do not provide these data.

Therefore, an initial survey was made about the distribution of subjects related to RP in TecR courses in Brazil. Therefore, there is a greater need to offer some subjects related to PR to adapt to the CNEN Standard 7.01.

It is intended, with studies of this kind, to contribute to the debate about the syllabus profile on RP of TecR courses in view of the importance of this theme in their professional activity.

Finally, it is necessary to standardize the name, as well as whether or not it is mandatory, the content and the workload of the disciplines offered about RP.

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