

ARTICLE

# Requirement for diagnostic medical physicists in Vietnam

T-Q. Nguyen<sup>1,2,\*</sup> , T-M. Nguyen<sup>1</sup> and H-N. Tran<sup>3</sup>

<sup>1</sup> Bac Ninh general hospital, Nguyen Quyen Street, Vo Cuong ward, Bac Ninh city, Bac Ninh province, Vietnam.

<sup>2</sup> Faculty of Physics, VNU University of Science, 334 Nguyen Trai, Hanoi, Vietnam.

<sup>3</sup> Faculty of Fundamental Sciences, PHENIKAA University, Hanoi 12116, Vietnam.

Received: 4 October 2023 / Accepted: 11 December 2023

**Abstract** – This paper mentions the status of diagnostic medical physicists, estimating the lack of this work in Vietnam. The evaluation method is based on International Atomic Energy Agency documents and typical hospital models in Vietnam. In 2021, there were no diagnostic medical physicists. The roles and responsibilities of diagnostic medical physicists are currently performed by radiologists, biomedical engineers, and medical physicists in radiation oncology or nuclear medicine. This job is still a potential profession in Vietnam.

**Keywords:** Medical Physics / medical physicist / classification / ISCO-08 / 34/2020/QD-TTg

## 1 Introduction

Following International Organization for Medical Physics (IOMP) Policy Statement No. 1, medical physics is a branch of Applied Physics, pursued by medical physicists, that uses physics principles, methods and techniques in practice and research for the prevention, diagnosis and treatment of human diseases with a specific goal of improving human health and well-being (IOMP, 2010). Medical physicists (position code according to the International Standard Classification of Occupations 2008, unit group 2111) has been classified in the sub-major group 21 ‘Science and Engineering Professionals’ (ILO, 2012). They are not belonging in the sub-major 22 ‘Health professionals’ but their occupation are recognized in the note as an integral part of the health work force alongside those occupations classified in sub-major group 22 (ILO, 2012; Prime Minister of Vietnam, 2020).

In Vietnam, pursuant to the Prime Minister’s Decision No. 34/2020/QD-TTg dated November 26, 2020 on Introducing classification list of occupations of Vietnam, medical physicists are recognized under the name ‘Nhà vật lý y tế’ (Prime Minister of Vietnam, 2020). At hospitals, medical physicists mainly work in the radiotherapy and nuclear medicine departments. The responsibilities of these staff are specified in the Decision No. 1895/1997/QĐ-BYT dated September 19, 1997 of the Minister of Health on Hospital Regulations, only in radiation treatment and nuclear medicine departments (Vietnam Ministry of Health, 1997). The

regulations do not mention diagnostic medical physicists. The role and responsibilities of the workforce are shown in International Atomic Energy Agency (IAEA) Human Health Service Series No. 25. The growing medical imaging applications require increasingly professional human resources. Following Hoang *et al.*, 2018, there is a certain growth in the number of medical physicists in Vietnam (Hoang *et al.*, 2018a, 2018b). However, diagnostic medical physicists have not been mentioned clearly.

The purpose of this paper is to study the current status of medical physicists in diagnostic departments in Vietnam and estimate the lack of a workforce based on the IAEA methodology, which requires increasingly professional human resources. This is of outstanding importance since medical imaging is one of the main sources of patient exposure and contributes to a significant part of population exposure (Bourguignon, 2021). This asks for optimization procedures in the form of establishment of DRLs for instance (Bertho and Habib-Geryes, 2023). This is one of the main roles of medical physicists as underlined in IAEA recommendations (IAEA, 2013)

## 2 Material and method

A detailed algorithm to describe the required numbers of medical physicists in a diagnostic imaging department has been developed by the IAEA. The components of the algorithm include input variables, weighting factors and an output variable, with the output being the total number of medical physicists ( $N_{MP}$ ) needed to deliver the service (formula 1) (IAEA, 2018):

\*Corresponding author: [nguyentienquan189@gmail.com](mailto:nguyentienquan189@gmail.com)

**Table 1.** The number of input parameters obtained from are district health center and provincial general hospital models.

Hospital types Input parameter	District health center	Provincial general hospital
<b>EQUIPMENT DATA</b>		
Computed tomography scanners	1	2
Fixed Radiographic units	2	6
Mammography units	0	1
Specimen Cabinet units	0	0
Fluoroscopy units		1
Interventional Fluoroscopy units	0	1
Portable radiographic units	1	2
Intra-oral dental x-ray units	1	1
Dual x-ray absorptiometry equipments	1	1
Computed radiography Detectors	2	8
Digital radiography Detectors	2	4
Image display devices (primary/reporting per pair)	2	0
Magnetic Resonance scanners	0	1
Ultrasound units	2	4
Reading and Printing devices	3	8
Dark rooms – wet processors	0	0
<b>PATIENT DATA</b>		
Interventional radiology and cardiology procedures	0	400
Patient dose calculations for high dose procedures	0	0
Computed tomography procedures	5000	10000
Planar procedures	27000	50000
Pregnant patients	2	5
<b>ORGANIZATION DATA</b>		
Diagnostic radiology departments	1	1
Interventional radiology departments (catheterization labs)	0	1
Number of clinically qualified medical physicists	0	0
Number of medical physicist supportive staff	0	0
Occupationally exposed staff	15	100
Complex staff exposure incidents evaluation	0	1
Risk assessment for staff	0	1
Equipment renewal per year	1	1
Development of new testing protocols	1	1
<b>TRAINING DATA</b>		
Number of continuing professional development units required for clinically qualified medical physicist	0	0
Total hours of training delivered to staff annually	40	165
Number of medical physics residents	0	0

$$N_{MP} = N_{sum}\varepsilon = \left( \sum_{X=1}^6 N_X \right) \varepsilon, \quad (1)$$

where  $N_1$  to  $N_6$  are the estimated number of full time equivalent (FTE) of a clinically qualified medical physicist required to adequately provide these services for each of the following six factors. These factors are: equipment dependent, patient dependent, radiation protection related, service related, training related and academic teaching and research related. The factor  $\varepsilon$  compensates for the efficiency of scale (formula 2) (IAEA, 2018):

$$\varepsilon = \begin{cases} 1 & \text{if } N_{sum} \leq 4 \\ \frac{4 + (N_{sum} - 4)RF}{N_{sum}} & \text{if } N_{sum} > 4 \end{cases}, \quad (2)$$

where  $RF$  is the reduction factor that can be applied to the additional medical physicists required and depends on the skill and expertise mix of medical physics staff. This factor could be of the order of 0.6–0.8, leading to a reduction of up to 40% for any  $N_{MP}$  exceeding 4.

Each  $N_X$  value is calculated individually according to the formula 3 (IAEA, 2018);

**Table 2.** Number of medical physicists obtained from different departments in Vietnam (Vietnam Society of Medical Physics, 2021).

Department	Radiation therapy	Nuclear medicine	Radiotherapy and nuclear medicine	Radiation safety	Materials & equipment supplies	Diagnostic imaging
Number of medical physicists	103	17	25	6	6	0

$$N_X = \sum_i w_i n_i, \quad (3)$$

where  $w_i$  is the relevant weighting factor in terms of FTE per input quantity and  $n_i$  is the associated input parameter including equipment, patient, radiation protection, service data, training, academic teaching and research data (IAEA, 2018).

In Vietnam, the diagnostic imaging department is separate from the nuclear medicine department. Each department has different facilities, but in the same level hospital, basic facilities are equivalent. To estimate medical physicist requirements, the calculation method is based on a typical diagnostic imaging department from two different categories of health structures following Circular 08/2019/TT-BYT (Vietnam Ministry of Health, 2019). Tu Son District Health Center is a medium-sized hospital (240 beds). Bac Ninh General Hospital is large (~1200 beds). The input parameter is shown in Table 1.

The current results of the medical physicists' force are based on the 2021 statistics of the Vietnam Society of Medical Physics. This statistic is based on the supply of staff at participating hospitals.

### 3 Results and discussion

The results of the district health center workforce require ~0.6 diagnostic medical physicists. So, their workload is lower than their ability. For district and provincial hospitals, the mandatory recruitment of medical physicists is not regulated. District hospitals should consider recruiting a diagnostic medical physicist. This employee can work in the Materials & Equipment Supplies Department additional tasks on medical equipment or in the most appropriate radiology department with technician duties. In another way, two district hospitals can hire a diagnostic medical physicist, but managing staff is difficult under Vietnamese law.

For the provincial general hospital model, the results require 1,2 diagnostic medical physicists. The recruitment medical physicist requirement is obvious because there are many complex image displays, procedures for imaging, intervention, radiation safety management, and large and diverse patients. Their workload is higher than their ability, so their job needs to be shared by radiologists or technicians.

According to the Health Statistics Yearbook, Vietnam has 20 central general hospitals, 20 central special hospitals, 162 provincial general hospitals, 177 provincial special hospitals, 712 district general hospitals, and 228 private hospitals

(Vietnam Ministry of Health, 2021). Ideally, to estimate the lack of diagnostic medical physicists, by mechanical calculation, Vietnam needs 912.6 diagnostic medical physicists. At the present, Vietnam urgently needs 202 employees (20+20+162).

According to the survey of the Vietnam Society of Medical Physics, there are 157 medical physicists (table 2). There are no diagnostic medical physicists. From clinical practice point of view, diagnostic medical physicist duties are performed by radiologists, technicians, supply engineers, or medical physicists in other departments. We notice that 12 employees (7.6%) are in charge of radiation safety inspection, repair, and maintenance of medical imaging equipment, although they are not in diagnostic imaging departments. This is a good premise for this workforce to develop in the future.

### 4 Conclusions and recommendations

The shortage of diagnostic medical physicists in Vietnam is huge. This job is still a potential profession in Vietnam. The recruitment depends on the characteristics of each radiology department as well as the hospital. For province hospital level, the recruitment for a medical physicist is reasonable and very urgent.

In the process of developing the Vietnam hospital regulation, we suggest that the Ministry of Health considers adding roles and responsibilities of Medical Physics in the diagnostic imaging department.

### Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

### Funding

The authors declare that no financial support was received for the research, authorship, and/or publication of this article.

### Ethical Approval

Ethical approval was not required.

### Informed Consent

This article does not contain any studies involving human subjects.

## Authors contributions

T-Q. Nguyen: Conceptualization, methodology, writing original draft, writing – review & editing. T-M. Nguyen: acquisition, analysis data for the work, writing original draft. H-N. Tran: Supervision, writing-Reviewing and editing.

## Acknowledgements

The authors wish to thank Vietnam Society of Medical Physics for the updated statistics.

## References

- Bertho JM, Habib-Geryes B. 2023. Radiation protection is an attitude. *Radioprotection* 58 (2): 77.
- Bourguignon M. 2021. Excessive patient doses through computed tomography imaging: new concerns. *Radioprotection* 56 (2): 89.
- Hoang KTT, *et al.* 2018a. Medical physics in Vietnam: the current status of equipment, workforce and education, *Med Phys Int J* 6 (2): 264–267.
- Hoang KTT, *et al.* 2018b. The development of medical physics in Vietnam: the past, the present and the future. In: 6th *International Conference on the Development of Biomedical Engineering in Vietnam (BME6)*. BME 2017. IFMBE Proceedings, vol 63 (T. Vo Van, T. Nguyen Le, T. Nguyen Duc, Eds.) pp. 341–344. Singapore: Springer. [https://doi.org/10.1007/978-981-10-4361-1\\_57](https://doi.org/10.1007/978-981-10-4361-1_57)
- IAEA. 2013. Roles and responsibilities, and education and training requirements for clinically qualified medical physicists, *Human Health Service Series No. 25*, Vienna, 88 pages.
- IAEA. 2018. Medical physics staffing needs in diagnostic imaging and radionuclide therapy: an activity based approach *IAEA Human Health Reports No. 15*, Vienna, 40 pages.
- ILO. 2012. *The International Standard Classification of Occupations 2008 (ISCO-08) (2012)* Vol. 1. Structure, group definitions and correspondence tables, Geneva, Switzerland, 433 pages.
- IOMP. 2010. The Medical Physicist: Role and Responsibilities, *Working Group on Policy Statement No. 1*, York, UK, 5 pages.
- Prime Minister of Vietnam. 2020. Decision No. 34/2020/QĐ-TTg dated November 26, 2020 on introducing classification list of occupations of Vietnam.
- Vietnam Ministry of Health. 1997. Decision No. 1895/1997/QĐ-BYT dated September 19, 1997 on promulgating hospital regulations.
- Vietnam Ministry of Health. 2019. Circular No. 08/2019/TT-BYT dated May 31, 2019 on Guidance on standards and norms for using specialized machinery and equipment in the medical field.
- Vietnam Ministry of Health. 2021. *Health Statistics Yearbook 2019–2020*.
- Vietnam Society of Medical Physics. 2021. *Statistics on Human Resources and Equipment*.

**Cite this article as:** Nguyen T-Q, Nguyen T-M, Tran H-N. 2024. Requirement for diagnostic medical physicists in Vietnam. *Radioprotection* 59(1): 26–29