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EFOMP Policy Statement

The European Federation of Organisations for Medical Physics. Policy Statement No. 7.1: The roles, responsibilities and status of the medical physicist including the criteria for the staffing levels in a Medical Physics Department approved by EFOMP Council on 5th February 2016 ☆

Stephen Evans [a], Stelios Christofides [b], Marco Brambilla [c]

[a] EFOMP, Fairmount House, 230 Tadcaster Road, York YO24 1ES, UK
[b] SC Biomedical Research Foundation, P.O. Box 24039, 1700 Nicosia, Cyprus
[c] Medical Physics Department, University Hospital of Novara, 28100 Novara, Italy

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ABSTRACT

This EFOMP Policy Statement is an amalgamation and an update of the EFOMP Policy Statements No. 2, 4 and 7. It presents guidelines for the roles, responsibilities and status of the medical physicist together with recommended minimum staffing levels. These recommendations take into account the ever-increasing demands for competence, patient safety, specialisation and cost effectiveness of modern healthcare services, the requirements of the European Union Council Directive 2013/59/Euratom laying down the basic safety standards for protection against the dangers arising from exposure to ionising radiation, the European Commission's Radiation Protection Report No. 174: "Guidelines on medical physics expert", as well as the relevant publications of the International Atomic Energy Agency. The provided recommendations on minimum staffing levels are in very good agreement with those provided by both the European Commission and the International Atomic Energy Agency.

Preamble

Modern healthcare services are challenged with ever-increasing demands for competence, patient safety, specialisation and cost effectiveness. Medical physics services face the same demands and the medical physicist has to make decisions with consequences for the patient. These facts have to be taken into account within the organisation and management of the medical physics service.

This EFOMP Policy Statement, which is an amalgamation and an update of the EFOMP Policy Statements No. 2, 4 and 7, presents guidelines for the roles, responsibilities and status of the medical physicist together with recommended minimum staffing levels.

Introduction

Medical physics is the scientific healthcare profession concerned with the application of the concepts and methods of physics in medicine. The European Federation of Organisations for Medical Physics (EFOMP) acts as the umbrella organisation for European Medical Physics societies. The current membership (2015) consists of 33 national organisations which together represent around 7500 members.

The recent European Union Council Directive 2013/59/Euratom (the Directive) laying down the basic safety standards for protection against the dangers arising from exposure to ionising radiation (EU BSS) [1] states that the medical physicist must have a high level of competence and a clear definition of responsibilities and tasks.

The medical physicist, whose training and function are specifically directed towards healthcare, must have official recognition as a specialist professional. High standards in medical physics services are important and, particularly at a time of increasing demands on healthcare provisions, sufficient resources must be directed towards a clinically effective, safe and cost effective use

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of physical sciences in the healthcare environment for the benefit and safety of patients, staff, carers and comforters, research volunteers and members of the public.

Medical physicist

The formal entry qualification to a traineeship in the profession of medical physics is an academic degree or equivalent (i.e. level 6 on the European Qualifications Framework or EQF) in physical sciences as an essential component of the training (in certain countries (e.g. Netherlands, Italy) the formal entry qualification into the traineeship is a Master's degree). A formalised in-service clinical training scheme must be successfully completed together with a Master's degree in medical physics or equivalent at EQF level 7 before a physicist may enter the profession and proceed to a position in a hospital as a medical physicist [2]. A certificate or diploma should be given to the candidate to recognise successful completion of training for the candidate to be entitled to be called a medical physicist and to enrol in a National Registration Scheme for medical physicists. Further details on the registration scheme for medical physicists can be found in the EFOMP Policy Statement 6.1 [3].

A medical physicist is a clinically qualified individual in the field of medical physics who is competent to practice independently in one or more of the specialities of medical physics [5] e.g. radiation oncology (radiotherapy) physics, diagnostic and interventional radiology physics (including fluoroscopically guided procedures performed outside the imaging department), nuclear medicine physics, radiation protection or one of the other specialities of medical physics that involves the use of non-ionising radiation.

The main responsibility of the medical physicist is to provide a high standard of service in the hospital. Two functions can be distinguished: clinical, which is fulfilled by medical physicists through their scientific competence in the field of medical physics, and managerial, which is exercised at a senior level where the medical physicist is an administrator for the medical physics service. Medical physicists are responsible for the standardisation and calibration of medical equipment and for the accuracy and safety of physical methods used in clinical applications in close co-operation with other healthcare personnel. They also have responsibilities for service development, research, clinical oversee of the use of medical devices, health technology assessment, and in the development of new techniques and physical methods and equipment. These responsibilities affect both individual patient care and the care of patient groups. Further they have a responsibility for providing education and training in relevant medical physics for doctors, nurses, medical technical assistants, etc., trainee medical physicists and technical staff. The head of a medical physics service, or in many cases the head of the medical physics speciality, will also have responsibility for financial control and responsibilities in the general organisation of the hospital and/or the local region and will be answerable to central administration.

For further details regarding the role of the medical physicist see EFOMP Policy Statement 12.1 "Recommendations on Medical Physics Education and Training in Europe 2014" [4].

EU directives and legal requirements for medical physicists working in ionising radiation

The Directive [1] contains the following articles pertinent to the medical physicists' competence requirements:

Article 14 states "Member States shall establish an adequate legislative and administrative framework ensuring the provision of appropriate radiation protection education, training and information to all individuals whose tasks require specific competences in radiation protection. The provision of training and information shall be repeated at appropriate intervals and documented."

Further in Article 18 it states "Member States shall ensure that practitioners and the individuals involved in the practical aspects of medical radiological procedures have adequate education, information and theoretical and practical training for the purpose of medical radiological practices, as well as relevant competence in radiation protection".

The Directive also states (paragraph 29) that "A high level of competence and a clear definition of responsibilities and tasks among all professionals involved in medical exposure is fundamental to ensure adequate protection of patients undergoing medical radiodiagnostic and radiotherapeutic procedures. This applies to medical doctors, dentists and other health professionals entitled to take clinical responsibility for individual medical exposures, to medical physicists and to other professionals carrying out practical aspects of medical radiological procedures, such as radiographers and technicians in radiodiagnostic medicine, nuclear medicine and radiotherapy".

Therefore Member States must ensure that medical physicists achieve a high level of competence and that there is a clear definition of responsibilities and tasks in order to ensure adequate patient safety.

The Directive specifically details the tasks required of experts for medical exposures and radiation protection that are pertinent to the roles and responsibilities of the medical physicist; namely the medical physics expert (MPE) and the radiation protection expert (RPE).

Medical physics expert

For a medical physicist to achieve the level of and act as an MPE, demonstrable experience at level 8 of the European Qualifications Framework (EQF) is required [2]. The medical physicist must, therefore, achieve the highest level of competence to be recognised by the competent authority as an MPE having the knowledge, training and experience to act or give advice on matters relating to radiation physics applied to medical exposure. Further involvement in a programme for Continuing Professional Development (CPD) also at EQF level 8 is needed to maintain competence and hence recognition as an MPE.

The level of involvement of the MPE in the fields of radiological practice is provided in article 57 of the Directive. Article 83 of the Directive details the areas of responsibility of the MPE which is to act or give specialist advice, as appropriate, on matters relating to radiation physics. This article specifies that the MPE has responsibility for dosimetry, including physical measurements for evaluation of the dose delivered to the patient and other individuals subject to medical exposure, and has to give advice on medical radiological equipment. Article 79 requires Member States to recognise the MPE.

Further detailed guidelines on the MPE are provided in the European Commission Radiation Protection Report No. 174 "European Guidelines on Medical Physics Expert" [2] (the MPE Guidelines). These guidelines detail the tasks for which the MPE is responsible and also indicate the medical physics staffing level requirements.

Radiation protection expert

A medical physicist specialising in occupational and public radiation protection should be appointed to act as the RPE in the hospital sector [6]. Article 34 of the Directive requires Member States seek advice from the RPE on the following issues: the examination and testing of protective devices and measuring instruments; prior critical review of plans for installations from the point of view of radiation protection; the acceptance into service of new or modified radiation sources from the point of view of radiation protection; regular checking of the effectiveness of protective devices and techniques; and regular calibration of measuring instruments and regular checking that they are serviceable and correctly used. Articles 37 and 38 of the Directive require Member States to take advice from the RPE on the establishment and requirements for controlled and supervised areas respectively. Article 68 of the Directive requires Member States to seek advice from the RPE on exposures to members of the public and the suitability of monitoring equipment. Article 82 of the Directive details the advice to be covered by the RPE. Article 79 of the Directive requires Member States to recognise the RPE.

Medical physics services

The organisational arrangements of medical physics services in healthcare vary widely throughout Europe. Usually the most cost effective provision of services is achieved when services are provided by a centralized department of medical physics where the head of the department is a highly experienced medical physicist with excellent management and leadership qualities. This person will have the management skills, knowledge and integrity, together with the capacity, capability and experience, to take responsibility for professional standards, provision of scientific services and the department's budget. This person will also have the leadership qualities to ensure good governance that will motivate staff, encourage training and career advancements, ensure a positive safety culture exists and ensure staff operate in an open and transparent way with a duty of candour to inform patients when things go wrong. The management responsibilities may be limited to a large hospital or to a network of hospitals in the same locality. In some hospitals, medical physics specialities will sit in different directorates or divisions within the hospital and have no overarching head of medical physics. Here the management of these services will operate independently of each other. In such cases it is recommended that these specialities form a network partnership of medical physics within the hospital to ensure the services operate to the same governance principles as identified above. Small medical physics services may lack resources and hence be less efficient. This could reduce the quality and availability of services and the level of safety for patients. It is therefore also recommended that small services form alliances with other similar medical physics services (or larger services) to share resources and empower good governance.

Medical physics services generally serve a variety of medical specialities. In some countries the medical physics service is restricted mainly to the radiological field (radiotherapy, nuclear medicine, diagnostic & interventional radiology and occupational/public radiation protection), where the service has a long and recognised tradition. In other countries services are provided to magnetic resonance and ultrasound imaging, physiological measurements, audiology, clinical applications of non-ionising radiations (lasers, ultraviolet light and microwaves), bioengineering, electronics, information technology, general data processing and computer technology. The role of the medical physicist in these areas is expected to increase in the future throughout Europe. Because the medical physicist must have an in-depth understanding of the techniques used for examinations or treatments, a close relationship must be formed between the medical physicist and other healthcare professionals to ensure the work is focused to the benefit of the patients.

Staffing medical physics services

Generally, the total number of staff required in a medical physics service is calculated taking into account: (i) the range of applications of physics service to medicine, (ii) the scale of organisational and management responsibilities (number of hospitals, population served), (iii) the amount and complexity of equipment and procedures used in related clinical specialities, (iv) the number of patients examined and treated in the relevant modalities and the complexities of these examinations or treatments, (v) the load for formal teaching and training, (vi) the level of participation in maintenance, development, research and clinical trials. Member states should all strive to provide state-of-the art healthcare and the medical physicist's role is fundamental to the advancement of healthcare technology.

Due to differences in levels of healthcare, assigned responsibilities to medical physics, local implementation and financial resources between European countries, the present number of medical physicists per million inhabitants shows wide variations in different European countries, from around 3 per million to almost 50 per million. A summary of the minimum staffing levels per million population is given in Appendix II. Figures can be used in comparisons between countries only if they are covering the same areas of physics related activities. Those countries with fewer medical physicists than others may need additional MPE's to introduce state-of-the-art technologies in the clinic. Variations between departments in the same country also depend on the range of physics related activities together with the number and qualifications of the supporting staff. Largely for this reason, it is difficult to specify appropriate staffing levels. However in radiotherapy, nuclear medicine, diagnostic & interventional radiology and occupational/public radiation protection there are legal requirements for the services of a medical physicist, who has the status of an expert in radiation physics or radiation protection related to these disciplines. Therefore, for these services it is appropriate to make recommendations on the minimum numbers of medical physicists in a medical physics services. A procedure for the calculation of minimum staffing levels to ensure an effective and safe clinical service can be found in Appendix I which is taken directly from reference [2]. The following general points apply to the given staffing figures.

1. The staffing levels are based on the assumption that institutions already have up-to-date technological equipment and established clinical medical physics services and that most effort will be going to maintain high quality standards. *A service which is in the process of being developed would require additional staff over the first years*.
2. Additional staff are required for provision of the equipment maintenance service and more extensive computing support.
3. Staffing for BASIC occupational and public radiation protection duties directly related to routine radiotherapy, nuclear medicine or diagnostic and interventional radiology (including fluoroscopically guided procedures performed outside the imaging department) are included in the relevant sections. Staffing for a COMPLETE occupational and public radiation protection service to be provided by medical physicists needs additional human resources and staffing recommendations are given later on in this document.
4. Additional staff are required if there are research activities, major service development, advanced clinical involvement, health technology assessments, or training responsibilities. The time spent by medical physicists who have academic, education and training commitments in University Hospitals should also be taken into account.
5. Again it is emphasised that the tables in Appendix I provide a way to calculate the MINIMUM recommended number of experienced medical physicists/MPEs needed to deliver services.

6. The 'European Guidelines on the MPE' [2] staffing levels are for work involving ionisation radiation ONLY. For other services such as MRI, ultrasound imaging, cryotherapy, laser-assisted surgery, electrosurgery, radiofrequency ablation, hyperthermia and other procedures that highly depend on medical technology, additional experienced medical physicists/MPEs will be needed and a subsequent recommendation will be drafted by EFOMP.

There is some economy of scale when there are large medical physics departments e.g. employing more than 11 medical physicists, and consequently the minimum number of medical physicists calculated in Appendix I can be reduced typically by around 20% for such departments. Additionally, larger institutes may employ supporting staff that may perform specific duties under the responsibility of the MPE, reducing the number of required MPE's. This can only be achieved if tasks and responsibilities have been carefully laid down. For those European states that are below the minimum recommended levels as given in Appendix I, bare minimum staffing levels per million population for BASIC safety are given in Appendix I. Such states cannot be expected to deliver state-of-the-art medical healthcare using an advanced medical technology.

In the MPE Guidelines document [2] a catalogue of key activities for medical physics services in radiotherapy, nuclear medicine, and diagnostic & interventional radiology is given together with the required knowledge, skills and competencies. The tasks listed must be performed by a medical physicist qualified in the appropriate specialty – to the level of an MPE, by other less experienced medical physicists not yet at expert level, and in some situations other specialists supervised by a medical physicist, such as medical physics technicians and medical physics assistants.

In the calculations of minimum staffing levels (Appendix I), the term medical physicist is used to denote an experienced individual clinically qualified to at least EQF level 7 with several years' experience at an advanced level. The staffing numbers recommended must include medical physicists at EQF level 8 depending upon the speciality (refer to "Minimum Requirements" in Appendix I for details). At this level the medical physicist works unsupervised. However, this does not mean that appropriate double checks should not be carried out. Where such checks are required it would be normal for the MPE to check the work of other less experienced medical physicists and medical physics technical staff. In situations of very high risk MPEs may need to double check each other.

General guidelines are given in Appendix I for assessment of the WTE (whole time equivalent) of the total number of experienced medical physicists/MPEs working in radiotherapy, nuclear medicine and diagnostic & interventional radiology. These numbers are extracted from the MPE Guidelines document [2], simplified and updated where appropriate. The minimum number of medical physicists for an occupational and public radiation protection service are also provided in Appendix I.

It should also be noted that the additional number of staff in a medical physics service could be equal to or up to two times the number of experienced medical physicists/MPEs [2]. This could include junior medical physicists, other medical physics specialists such as medical physics technologists together with other medical physics assistants, and administrative staff. Where such staff are provided externally to the medical physics service or contained within the other sub-specialities, the total will need to be reduced accordingly.

Seven day service

In the derivation of the staffing WTE factors given in Appendix I, it is assumed that the current services are fully operational typically 8 h a day, 5 days a week with a partial service operating on weekends. However, there is a growing trend to offer a full 7 days a week service and consequently the minimum staffing levels must be increased to support the extra clinical demands required to provide such services. To account for the extra staff required the equipment dependent factors should be increased in proportion to any increase in the frequency of equipment checks required and the patient dependent factors should be used with the appropriate increase in the number of patients being treated or examined.

Summary and recommendations

The guidelines presented here outline the criteria that should be applied to individuals entitled to hold the status of 'medical physicists' together with the appropriate qualifications and/or the specialisation required for the recognition of MPEs and RPEs. Recommendations on the minimum staffing levels of experienced medical physicists within the specialities of radiotherapy, diagnostic & interventional radiology, nuclear medicine, and occupational/public radiation protection are provided. In addition, the principles that should be considered for good governance arrangements within medical physics services for the health and safety of patients, staff and members of the public are outlined.

The number of experienced medical physicists employed would ideally be more than the minimum numbers identified in the tables in Appendix I. In European states with advanced healthcare systems, medical physicists are involved in the management, leadership and development of services; they have a consultative role in advising medical colleagues of the studies and techniques available and assist in the presentation and interpretation of results. The skill-mix and total number of staff in a medical physics service will depend upon such local arrangements and can only be determined by the head of the medical physics speciality (in collaboration with the head of the medical physics department).

It is recommended that this policy is adopted by the national member organisations (NMOs) of EFOMP to ensure the status, training, responsibilities and governance arrangements of medical physicists, MPEs, RPEs and medical physics services are harmonised across Europe.

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Appendix I

The WTE numbers in the radiotherapy, nuclear medicine and diagnostic & interventional radiology tables have been based on the European Commission report RP 174 [2] and are reproduced here in summary form. For a complete listing please refer to this report. It should also be noted that only the factors associated in the above Guidelines for the MPE have been reproduced here.

Staffing for medical physics in radiotherapy

1. Only experienced medical physicists who have had an approved course of training in medical physics related to radiotherapy to

at least EQF level 7 should be included in the staffing level of these medical physicists.
2. Staffing levels should be calculated from factors depending both on equipment load, number of patients treated, sophistication of treatments and other factors.

Subjects	Medical physicist (WTE)
Equipment dependent factors per item	
Linear accelerator (multi-mode) (per unit)	0.6
Linear accelerator (single-mode)/cobalt (per unit)	0.2
Major items (per unit)	0.2
Minor items (per unit)	0.1
Other items (per unit)	0.05
Patient dependent factors	
Conventional (2D) external beam radiotherapy (per 100 procedures)	0.05
3D conformal radiotherapy (per 100 procedures)	0.2
Special techniques (per 100 procedures)	0.4
Brachytherapy (per 100 procedures)	0.4

Notes

a. Major items include: TPS, IMRT, CT simulator, HDR/PDR, data network and equivalent.
b. Minor items include: IGRT, SABR, advanced TPS features, LDR, simulator and equivalent.
c. Other items include: EPID, MLC, automatic outlining, block cutting, orthovoltage/superficial units and equivalent.
d. Special techniques include: SABR, IMRT, TBI, total skin electron techniques and equivalent.
e. For a list of frequently asked questions visit the EFOMP website (www.efomp.eu).

The above WTE's have to be multiplied by the number of units and an appropriate factor depending on the number of procedures and summed to calculate the total minimum number of medical physicists required.

Minimum requirements

MPEs must be on site during the standard working day and available for consultation during extended working days and weekends. At least 2 medical physicists at MPE level must be on-site to provide this level of cover. Outside normal working hours and for satellite sites, a MPE must be available for consultations at all times the service is operating, and if circumstances require, can be on-site quickly.

Staffing for medical physics in nuclear medicine

1. Only experienced medical physicists who have had an approved course of training in radiation physics related to nuclear medicine to at least EQF level 7 should be included in the staffing level of these medical physicists.
2. Staffing levels should be calculated from factors depending both on equipment load and patients examined or treated and other factors. General guidelines are given below (WTE = whole time equivalent) for assessment of minimum medical physics staffing levels for routine clinical work in nuclear medicine.

Subject	Medical physicist (WTE)
Equipment dependent factors per item	
Planar Gamma Camera (per unit)	0.02
Multi-head SPECT/CT Gamma Camera – Tc-99m only (per unit)	0.05
Multi-head SPECT/CT Gamma Camera – range of radionuclides (per unit)	0.1
PET/CT (per unit)	0.1
Minor items (per unit)	0.01
Patient dependent factors	
Procedures with no data processing (per 100 procedures)	0.001
Procedures with data processing or tomographic reconstruction (per 100 procedures)	0.02
PET/CT imaging procedures (per 100 procedures)	0.02
Outpatient radionuclide therapy (e.g. 131-iodide thyrotoxicosis) (per 50 procedures)	0.01
Simple inpatient radionuclide therapy (e.g. 131-iodide for ca. thyroid) (per 10 procedures)	0.005
Complex radionuclide therapy (e.g. 131-mIBG, 177Lu, 90Y) (per 10 procedures)	0.07
Risk assessment for pregnant patients (per 10 calculations)	0.02

Notes

a. Minor items include: workstations, automatic gamma counters, radionuclide calibrators, thyroid probe, SLN probe, network IT support and equivalent.
b. The factor for procedures with no data processing assumes that the medical physicist is involved in continuing optimisation (i.e. at a frequency of 1 day per year for each procedure). Where the frequency is different the numbers must be adjusted accordingly.
c. The factors for procedures with data processing assume the medical physicist has an active (i.e. weekly) role in the initial introduction, setup and continuing QC - optimisation/validation of procedures, user training, and documentation. Where the frequency is different, or if only partial checks are carried out, the numbers must be adjusted accordingly.
d. Adequate provision must be made to cover for absences.
e. Imaging procedures involving data processing include renograms; tomographic reconstruction includes SPECT, SPECT/CT.
f. Cyclotrons need to be considered separately.
g. The manufacture of radiopharmaceuticals will need to be identified separately.
h. For a list of frequently asked questions visit the EFOMP website (www.efomp.eu).

The above WTE's have to be multiplied by the number of units and an appropriate factor depending on the number of procedures and then summed to calculate the total minimum number of medical physicists required.

Minimum requirements

In all departments there must be at least one MPE on-site with experience in diagnostic nuclear medicine physics and one in therapeutic nuclear medicine to be able to respond appropriately to individual patient-specific issues, to assist in matters of organisation and for consultations with the other healthcare staff. In small hospitals where the medical physics service employs only one medical physicist at MPE level formal written arrangements must be made with an external MPE to provide cover for periods of annual leave and sickness. Again it is emphasised that if the department has responsibilities related to therapy with radionuclides a second MPE specialised in radionuclide therapy may be necessary.

Staffing for medical physics in diagnostic & interventional radiology (including fluoroscopically guided procedures performed outside the imaging department)

1. Only experienced medical physicists who have had an approved course of training in radiation physics related to diagnostic & interventional radiology to at least EQF level 7 should be included in the staffing level of these medical physicists.
2. The number of medical physicists needed will vary depending on the quality assurance programme performed in the department, the involvement of medical physics technicians, medical physics assistants, radiographers or other staff in that programme and the involvement of the manufacturer. It is emphasised that with respect to medical physics services such staff are to work under the direction of an MPE.
3. Physics input to diagnostic imaging technique using non-ionising radiation must be considered separately.

General guidelines are given below (WTE = whole time equivalent) for assessment of the minimum number of medical physicists required for clinical work in diagnostic and interventional radiology.

Subject	Medical physicist (WTE)
Equipment dependent factors per item	
CT scanners (per unit)	0.04
Interventional fluoroscopy & digital mammography units (per unit)	0.02
Fixed units (per unit)	0.01
Portable units (per unit)	0.004
Dental X-ray equipment (per unit)	0.002
Image display device (primary/reporting per pair) (per unit)	0.001
Patient dependent factors	
Patient dosimetry in interventional radiology and cardiology (per 1000 procedures)	0.02
Estimation of skin dosimetry and follow up (high doses) (per 5 procedures)	0.005
Patient dosimetry in CT (per 1000 procedures)	0.02
Risk assessment for pregnant patients (per 10 calculations)	0.005

Notes

a. Fixed units include: permanently installed radiography, film mammography, fluoroscopy and radiotherapy imaging equipment and equivalent.
b. Portable units include: mobile radiography and fluoroscopy systems. They also include CR readers and equivalent.
c. The above numbers assume complete range of quality control checks are carried out annually with full patient dose audit. Where the frequency is different or if only partial checks are carried out the numbers must be adjusted accordingly. For instance, mammography systems may have full quality control checks twice a year – then the relevant factors need to be doubled. However, where these checks are split into two six monthly sessions the above factors still apply.
d. The equipment dependent core tasks are: quality control checks, quality assurance (analysis and reporting), optimisation, troubleshooting, dose audit/calculation, acceptance testing/commissioning, setting up exposure protocols, examination of safety features of newly installed equipment, together with other support/advice.
e. For staff working at multiple locations, an additional WTE component may need to be factored into the calculated staffing levels to account for the time it takes staff to travel to the different locations.
f. For a list of frequently asked questions visit the EFOMP website (www.efomp.eu).

The above WTE's have to be multiplied by the number of units and an appropriate factor depending on the number of procedures and then summed to calculate the total minimum number of medical physicists required.

Minimum requirements

All diagnostic and interventional radiology departments (including fluoroscopically guided procedures performed outside the imaging department) should have available to them the services of MPEs with experience in diagnostic and interventional radiological physics to respond appropriately to individual patient-specific issues, to assist in matters of organisation and be available for consultations at all times the service is operating. In small hospitals where the medical physics service employs only one medical physicist at MPE level formal written arrangements must be made with an external MPE to provide cover for periods of annual leave and sickness.

Staffing for complete occupational and public radiation protection services in hospitals

1. Only experienced medical physicists who have had an approved course of training in radiation physics related to radiation protection to at least EQF level 7 should be included in the minimum staffing level of these medical physicists.
2. The responsibilities cover general protection aspects against ionising radiation in a hospital such as dose monitoring of entire staff and structural protection.
3. The factors also include the need for the experienced medical physicist/MPE to act as a radiation protection expert (RPE) to provide advice on measures to comply with national regulations and advise on other health and safety matters connected with ionising radiation.

General guidelines are given below (WTE = whole time equivalent) for assessment of medical physicist staffing levels for routine clinical work in occupational/public radiation protection.

Subject	Medical physicist (WTE)
Department dependent factors per department	
Radiology department*, catheter lab (2 labs)	0.05
Nuclear medicine department (4 major imaging units)	0.1
Radiotherapy department (4 linear accelerators)	0.05
Patient and staff dependent factors	
Staff dosimetry reviews (per 100 staff)	0.01
Staff/patient exposure incident evaluations (per 10 cases)	0.005
Staff/patient overexposure incident evaluation (per case)	0.005
Risk assessment for staff or patients (per 10 cases)	0.01

* Radiology department consisting of 3 CT scanners and 10 X-ray rooms. For much larger or much smaller departments adjust factors accordingly.

The above WTE's have to be multiplied by the number of subjects and summed to calculate the total minimum number of medical physicists required.

Minimum requirements

A medical physicist acting as RPE must be able to respond appropriately to individual staff and patient specific radiological protection issues and be available for advice at all times the service is operating. Formal written arrangements must be made with an external RPE to provide cover for periods of annual leave and sickness.

Medical physics service dependent factors

For each speciality of medical physics, there will be additional staffing required for management, development and governance of the service. There will also be a requirement for practical radiation protection support from the MPE and also MPE support to the RPE within each area. Research and development as well as education and training will be required both internally and externally to the service as well as continual professional development (CPD) of staff. The additional number of medical physicists associated with these requirements for radiotherapy and nuclear medicine physics is shown below.

Subject	Medical physicist (WTE)
Service dependent factors	
Ongoing service development	0.2
Clinical governance including ongoing audits	0.2
Practical radiation protection support	0.1
Management of scientific service	0.1
Research and training dependent factors	
Education and training of staff within service (CPD per MP)	0.025
Research and development including clinical research (per department)	0.2
Delivering training – internal (per trainee)	0.2
Education and training within service (per department)	0.04
Clinical trials with trial specific QA requirements (per trial)	0.1

In the case of very small diagnostic and interventional facilities, radiology physics services are usually provided externally by medical physics departments in larger hospitals or private medical physics services. Different factors will need to be applied to these services.

The additional staffing levels associated with diagnostic & interventional radiology physics is shown below:

Subject	Medical physicist (WTE)
Service dependent factors	
Equipment specification (per procurement)	0.01
Equipment acceptance testing (per procurement)	0.01
Radiation protection advice for new installations (per installation)	0.01
Practical radiation protection support (per service)	0.05
Testing protocol development (per service)	0.08
Research and training dependent factors	
Education and training of staff within service (CPD per MP)	0.025
Lead MPE for Research Ethics Committee (per project)	0.004
Local MPE review of approved research studies (per project)	0.002
Delivering training – external (per attendee)	0.0007
Delivering training – internal (per trainee)	0.2
Delivering academic teaching (per attendee)	0.003
Carrying out research lead by the service (per project)	0.08
Support provided to external research projects (per project)	0.02

It is common for the RPE to be situated within one of the other medical physics specialities. Where this is not the case, additional departmental resources will be required to provide a complete radiation protection service.

In a medical physics department there should be a head medical physicist within each specialty who assumes responsibility for the service provision in that specialty. The number of additional staff in the medical physics service together with the skill-mix of staff should be determined by the head medical physicist for that speciality in collaboration with the head of medical physics (or other senior manager with overall responsibility).

Appendix II. Summary staffing levels per million population for states below the levels recommended in Appendix I

The table below provides a summary for the number of medical physicists in radiotherapy, nuclear medicine, diagnostic & interventional radiology (DR&IR) and occupational/public radiation protection per million population produced from the IAEA/EFOMP survey (2015) and the recommended minimum number of medical physicists from EFOMP.

Medical Physics Sub-speciality	IAEA/EFOMP Survey (medical physicists per million population) (2015)				EFOMP (medical physicists per million population)
	Minimum No.	Maximum No.	Average No.* (wpop**)	Median No.	Recommended minimum No.*
Radiotherapy	3.8	22	9.6 (9.1)	8.2	9
Nuclear medicine	0.3	6.9	2.6 (2.0)	2.2	2
Diagnostic & interventional radiology	0.1	25	5.0 (3.0)	3.5	5
Radiation Protection	0	5.0	1.8 (2.2)	1.5	2
Total			19 (16.3)		18

* For hospitals in Europe that provide the average level of healthcare per million population as derived from the IAEA/EFOMP survey 2015.
** wpop – weighted population mean is the average obtained after weighting each country's value by their percentage contribution to the total European population.

References

[1] Council Directive 2013/59/EURATOM. Off J Eur Union 2014;L 013.
[2] Guidelines on medical physics expert Radiation protection 174. European Commission; 2014.
[3] EFOMP Policy Statement 6.1 recommended guidelines of national registration schemes for medical physicists, 2015.
[4] EFOMP Policy Statement 12.1 recommendations on medical physics education and training in Europe, 2014.
[5] IAEA safety standards for protecting people and the environment, radiation protection and safety of radiation sources: International Basic Safety Standards. Vienna: IAEA; 2014.
[6] EFOMP declaration of 6th of June 2015 regarding the role of the medical physics expert as the radiation protection expert in the hospital environment, 2014 [available from <http://www.efomp.org/images/docs/EFOMPDeclaration.pdf> accessed 7th August 2015].