Editorial

The essential role of the Medical Physicist in Nuclear Medicine.

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Introduction

The evolution of nuclear medicine and its role in clinical medicine has varied dramatically across different countries and regions, partly driven by economics and partly by the historical development of health care facilities and access. In many countries the introduction and development of nuclear medicine has been slow and the role of nuclear medicine in support of clinical research has been limited. The adoption of well developed instrumentation in a clinical service role for widely accepted routine protocols requires minimal innovation or customised development and, as a consequence, implementation is usually a turn-key operation with vendor-supplied instruction. A consequence is that establishment of clinical nuclear medicine services can be readily achieved with minimal specialised medical physics expertise, usually involving some consultation on radiation safety aspects of department design and operation and, at times, assistance with acceptance testing of equipment. This is in contrast with countries where medical physics has been directly involved in the early development of the speciality and where established medical physics support, with relevant training and professional standing, has evolved. The aim of this summary is to further discuss the role of the medical physicist in nuclear medicine and to encourage the further involvement of medical physicists in the speciality and the associated development of regional medical physics training and education.

The role of the Medical Physicist in Nuclear Medicine.

Traditionally, the medical physicist in nuclear medicine has had multiple roles: radiation safety officer, quality control supervisor, computer manager, trouble-shooter, developer, teacher, inventor.

The safe use of radiation and appropriate handling of unsealed radioactive sources is increasingly covered by government legislation which, legally, must be adhered to. Managing radiation safety is becoming an ever-increasing drain on time, with an increasing beurocratic burden, necessitating specialised expertise. In many cases this expertise is provided outside Nuclear medicine by individuals fully occupied in this sub-field, especially as full-time involvement would only be justified in the case of very large departments. Nevertheless in-house expertise can be very useful.

Quality assurance (QA) should be an essential component of all studies and quality control (QC) for equipment should form part of the daily routine. The key to successful QA is the ability to take action in the event of identified problems, not just recording results of QC tests. In-house medical physicists can provide a point of contact for problem evaluation and in many cases can solve problems without necessitating visits of

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maintenance engineers. Their involvement can improve management of QA systems, improving overall quality of services and decreasing down-time.

Vendor-supplied equipment now tends to be delivered as an integrated solution with networked workstations and all necessary accessories. Historically much of the development in applications software and systems management was undertaken in-house, providing the flexibility necessary to support introduction of novel procedures. Having expertise in this area usually means that a department can integrate their own protocols without being totally dependent on vendor-supplied solutions. In-house trouble-shooting can help identify and solve software issues that can impact on diagnostic reliability.

Developing new protocols, often in response to very specific local demands, usually requires innovation, flexible use of available tools and a scientific approach to validation. The medical physicist has traditionally played an important role in this setting and enables self-sufficiency not only to support routine services but also to motivate clinical research. Possessing an in-house capability to undertake development strengthens a department's overall standing and encourages a self-critical approach to service delivery, consistent with modern clinical governance directives.

There is increasing sophistication of instrumentation used in Nuclear medicine and in the methods of analysis used. This is becoming even more complex with the introduction of multi-modal systems and the expanding use of PET/CT. The physicist can provide advice on these sophisticated techniques and can provide in-house training in order to maximize clinical benefit and reduce risk of misuse. There is an important role in providing on-going professional development of nuclear medicine staff as well as basic teaching of trainees.

Undertaking fundamental research on instrumentation design, image reconstruction algorithms or advanced image analysis methods in general lies more in the domain of Universities or industry. Nevertheless there is scope for individuals to contribute to this more fundamental development, especially in collaboration with non-medical colleagues, who may have relevant complementary expertise. Cooperation between clinical and academic scientific staff can harness additional resources to further enhance nuclear medicine capabilities.

Medical physicists can make a valuable contribution to the nuclear medicine management team, with potential to complement the skills of other staff. Medical physicists tend to be lateral thinkers and problem solvers and can make valuable contribution to many aspects of clinical governance and planning.

Establishing a critical mass

In isolation, it may be hard to justify employment of a medical physicist for any one of the above roles; however, an individual or small group that satisfies all the above requirements can add considerable value to a department. This of course requires investment and presupposes that a valid business case can be supported and that individuals with the necessary expertise can be attracted to the medical arena. Here-in lies the real problem with the establishment of medical physics services for nuclear medicine or diagnostic radiology; supply and demand! Where there are economic restrictions the scientist in nuclear medicine is considered a luxury rather

than a necessity, with the result that there are few positions established. This in turn means that employment opportunities for appropriately qualified individuals are limited, and in many cases the critical mass, necessary to develop a suitably recognised profession, is lacking. Likewise, as the prospective number of trainees that might be encouraged to enter the profession is small, it becomes difficult to justify specific academic courses. The result is an almost complete absence of medical physics supporting nuclear medicine and a flow-on effect on the general standard of practice and the overall research capabilities. Medical physicists have a more established career path in radiotherapy where the physicist plays a critical role in therapy planning. As a result academic courses tend to be dominated by the radiotherapy content, at times with, at best, only cursory coverage of nuclear medicine. Of course trainees are mostly attracted to areas where there are definite job opportunities, further weakening the position for nuclear medicine. There is a critical mass necessary to effectively promote the profession, to train new employees and students and to make an effective impact on national practice. Usually, academic courses only provide an academic introduction to the field rather than formal training. Responsibility for effective training rests in the work-place, placing yet another demand on already depleted numbers. Establishing this critical mass in nuclear medicine is not a trivial exercise.

The plight of medical physicists is not unlike that of radio-chemists, the other scientist group in nuclear medicine that has potential to provide an equally valuable scientific contribution. Radio-chemists / radio-pharmacists also tend to be in short supply, have limited profession-focused education and training and lack professional standing in Health Departments. Internationally there has been even less development of suitable courses and accreditation schemes, which is currently resulting in a world-wide shortage.

As the central organisation that represents nuclear medicine for the Spanish and Portuguese speaking populations, ALASBIMN should be encouraged to actively support the professional development of medical physicists and to motivate national societies and departments to stimulate the involvement of medical physicists in nuclear medicine. The long term goal should be to enhance the professional standing and career opportunities of medical physicists in the health area and to convince universities that medical physics is an attractive career that warrants the development of suitable courses. There are examples internationally that illustrate how relevant training and accreditation programmes form the basis for solid professional development (e.g. see websites for AAPM, IPEM, ACPSEM and other links listed below). Recent efforts by the IAEA to develop international curricula and to publish training manuals should certainly assist in standardising the training requirements in nuclear medicine and other sub-specialities. These documents can form the basis for regional training initiatives. The recent International Conference on Medical Physics in Brazil was an opportunity to showcase medical physics and to explore opportunities for training development in the region through Latin American and Brazilian Associations of Medical Physics (ALFIM and ABFM). It is clear that the trend towards multi-modality imaging and the increasing role of imaging in the context of radiotherapy implies a future need for multi-disciplinary expertise (not unlike trends in the medical imaging sub-

specialities). But the main drive for development of suitable training needs to come directly from the nuclear medicine profession; only with acceptance of the value-added potential will Government Health Departments provide the necessary incentives.

Conclusions.

Medical physicists are important members of the nuclear medicine team and not only provide departments with sound advice of radiation safety and quality assurance but provide a means of supporting independent development and research. ALASBIMN and its member societies should be encouraged to assist the medical physics profession in establishing suitable education and training schemes and a recognised career structure for medical physicists in nuclear medicine. A regional effort has potential to enhance the capabilities for long-term national development of nuclear medicine services.

Useful links related to the topic:

- Eudaldo T, Olsen K. The Present Status of Medical Physics Education and Training in Europe. New perspectives and EFOMP Recommendations. http://www.efomp.org/policy/ETP_report1.pdf
- Podgorsak EB. Medical Physics: A profession and science. http://www.radmed.org/Med%20Phys%20Intro.pdf
- Clinical Training of Medical Physicists Specializing in Diagnostic Radiology. http://www-pub.iaea.org/MTCD/publications/PDF/TCS-47_web.pdf
- American Association of Medical Physics (AAPM). www.aapm.org
- Institute of Physics and Engineering in Medicine (IPEM). www.ipem.ac.uk
- Australasian College of Physical Scientists and Engineers in Medicine (ACPSEM). www.acpsem.org.au