Human Health

Objective

To enhance capabilities in Member States to address needs related to the prevention, diagnosis and treatment of health problems through the development and application of nuclear techniques within a framework of quality assurance.

Training and Education for Successful Radiotherapy

Radiation oncology, radiology and nuclear medicine are three disciplines in radiation medicine that are heavily dependent on technology and require competent professional staff to ensure safe and effective patient diagnosis, treatment and management. The Agency has identified a shortage of radiation medicine professionals and a lack of training in Member States as two of the main obstacles to the successful implementation of national radiotherapy strategies. In 2011, the Agency addressed the problem by: (1) producing learning and educational materials; (2) making materials available to centres with limited resources, in their local languages; (3) organizing and conducting courses and workshops; and (4) planning long term training and education at the national or regional scale.

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The Agency also identified the need for suitable guidelines on appropriate staffing levels when seeking to initiate, expand or upgrade services. In 2011, the Agency developed three calculation tools for the areas of radiation oncology, radiology and nuclear medicine that help predict staffing requirements for radiation medicine departments in hospitals. The tools are based on the input of statistics that are commonly known or can be easily estimated.

Nuclear Medicine

The Agency strengthened its efforts to promote a sustainable and cost effective nuclear medicine and diagnostic imaging programme for Member States. This was done through the initiation of two CRPs. Involving 20 Member States, the CRPs focus on the early detection of breast cancer through imaging and on the detection of coronary artery disease (CAD) through myocardial perfusion imaging (MPI) and coronary computed tomography angiography. In addition, a publication completed in 2011, *Nuclear Cardiology: Its Role in Cost Effective Care*, issued in the IAEA Human Health Series, offers an overview of CAD as a public health problem in developing countries, the role of nuclear cardiology methods within a scenario of unprecedented technological advances, and the evidence behind the appropriateness of recommendations to apply nuclear techniques in the diagnostic process for cardiac patients. The potential expanding role of non-invasive functional imaging is also discussed in the publication, as is the need for solid training, education and quality assurance (QA) in nuclear cardiology practice.

A number of Agency publications issued in 2011 examined trends in diagnostic and therapeutic nuclear medicine. For example, *Atlas of Bone Scintigraphy in the Developing Paediatric Skeleton: The Normal Skeleton Variants and Pitfalls* was issued in the IAEA Human Health Series.

Dosimetry and Medical Radiation Physics

Applications in radiation medicine continue to increase in importance as new imaging and treatment modalities are introduced and existing technologies are enhanced. Comprehensive QA and independent dosimetry audits are thus required to ensure appropriate clinical outcomes and to reduce the likelihood of errors, accidents and misdiagnoses. In this regard, the increased use of small photon fields in stereotactic and intensity modulated radiotherapy has highlighted the need to standardize the dosimetry of such fields using procedures consistent with those for conventional radiotherapy. An expert group, established by the Agency in collaboration with the American Association of Physicists in Medicine and the Institute of Physics

and Engineering in Medicine in the United Kingdom, completed work on an international code of practice for the dosimetry of small static photon fields. The code provides procedures for reference dosimetry, including correction factors based either on experiments or on Monte Carlo simulations. The factors are tabulated for various detectors in specific machines such as the CyberKnife, the Gamma Knife and the TomoTherapy system, as well as for generic rectangular fields defined by multi-leaf collimators and circular fields defined by cones used for radiosurgery. The code also defines procedures for determining the beam quality in non-reference conditions. For the measurement of beam output factors in small fields, procedures for connecting large field measurements using ionization chambers to small field measurements using high resolution detectors are given (Fig. 1).

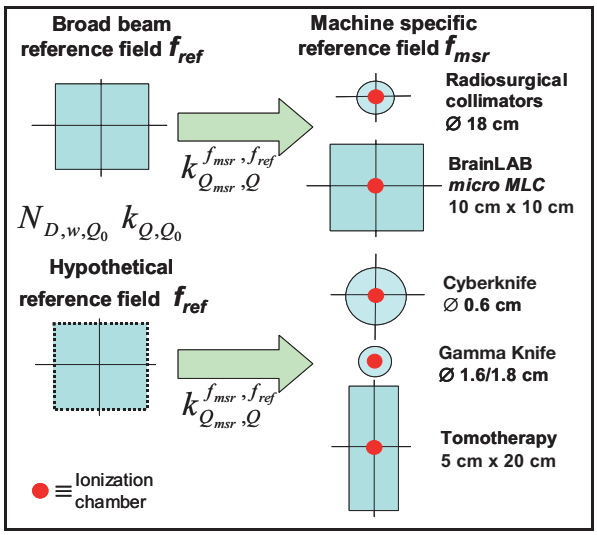

FIG. 1. Schematic overview of the dosimetry of small static fields with reference to a machine specific reference field according to the procedure of the new code of practice.

In 2011, the Agency issued a publication in the Training Course Series on the clinical training of medical physicists in nuclear medicine. With this publication, the Agency now offers a complete package of clinical training material for medical physicists in radiation oncology, diagnostic radiology and nuclear medicine.

Applied Radiation Biology and Radiotherapy

It is likely that many teachers of radiation biology in low and middle income Member States may not be radiation biologists themselves, because of the scarcity of such specialists. In such cases, radiation oncologists and medical physicists end up teaching radiobiology. To assist these teachers in conveying important radiobiological principles to their students, a series of 634 educational slides was added to the publication *Radiation Biology: A Handbook for Teachers and Students* (Training Course Series No. 42). The slides can also be downloaded from the Human Health Campus web site at *http://nucleus.iaea.org/HHW/Home/index.html.*

During 2011, a workshop was organized to consolidate the experience gained from the second cycle of train the trainers sessions for radiation therapists (RTs) in Europe. The workshop was conducted in collaboration with the European Society for Radiotherapy and Oncology. These activities generated a number of local courses for RTs in Europe. The methodology of this process has generated great interest and has become a potential model for radiotherapy technologists in other regions and even for other professional groups.

Stable Isotope Techniques in Nutrition for Improved Health

Malnutrition remains the single largest cause of child mortality. Over one third of all child deaths are due to malnutrition. Malnourished mothers often produce malnourished children, who are more likely to die before the age of five. If these children survive, they tend to start school late, are more likely to drop out and are less likely to learn in school. They are also more likely to become malnourished adults, continuing this cycle of deprivation.

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Considerable capacity has been established over the past few years in Africa in the use of deuterium dilution techniques to assess body composition and human milk intake by breastfed infants (Fig. 2). These techniques use low cost, low maintenance instrumentation (such as Fourier transform infrared spectrometry), which is particularly useful in areas with limited resources. In 2011, Botswana and Morocco were officially selected for the first two

AFRA Regional Designated Centres in the use of deuterium dilution techniques in human nutrition. Laboratories in these countries will provide on the job training, verification of calibration standards and expert services to coordinate interlaboratory tests for QA purposes.

FIG. 2. Collecting saliva samples to non-invasively quantify human milk consumption by a breastfed baby in Morocco.

A technical meeting in September 2011 sought to identify potential obstacles to, and suggest solutions for, the effective scaling up of food fortification strategies. Participants from Africa, Asia, Latin America and the Middle East gathered in Vienna to share experience from national and regional fortification programmes. They also discussed the expansion of programmes designed to improve nutritional status and health during the first two years of age.

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Programme of Action for Cancer Therapy (PACT)

The adoption in 2011 of the Political Declaration of the High-level Meeting of the General Assembly on the Prevention and Control of Non-communicable Diseases (resolution A/RES/66/2) was the second time in the history of the United Nations that a high level resolution on health issues was adopted (the first being on HIV/AIDS). The declaration highlights the importance of international cooperation in addressing the challenges of non-communicable diseases (NCDs) and calls for United Nations funds, programmes and agencies and other international organizations to work together in a coordinated manner to support national efforts to prevent and control NCDs, and to provide technical assistance and capacity building to developing countries.

The first meeting on the implementation of the political declaration recognized the ongoing efforts of the Agency relevant to NCDs, notably PACT, the technical cooperation programme, the WHO/IAEA Joint Programme on Cancer Control and the PACT Model Demonstration Sites (PMDSs). Two areas of collaboration were identified for the Agency: first, to scale up technical assistance to strengthen national cancer control strategies in developing countries, and second, to increase PMDS projects in selected countries. The Agency is also contributing to the Action Plan for the Global Strategy for the Prevention and Control of Noncommunicable Diseases (2013–2018), which is being developed for the United Nations system organizations.

The Virtual University for Cancer Control and Regional Training Network (VUCCnet) Africa pilot project entered its second year in 2011. The VUCCnet Annual Stakeholders Coordination Meeting concluded with 15 Member States recognizing VUCCnet as both a vehicle and a facilitating mechanism to enhance cancer control education and training in Africa, extending VUCCnet endorsement beyond the six Member States currently participating in the project. Member States agreed to work together under a regional cooperative approach to allow, in the short term, capacity building within

FIG. 3. An imPACT mission in the Philippines to assess cancer control capacity.

the pilot countries and, in the longer term, to pave the way for subregional cancer control workforce training hubs.

The Agency, through PACT, and in cooperation with its partners such as WHO, continues to deliver comprehensive cancer control to Member States. In 2011, 13 additional Member States officially requested an integrated mission of PACT (imPACT), and eight imPACT reviews were planned and conducted (four of them in response to new requests) to assess the national capacity and needs in Algeria, Bolivia, Colombia, Lesotho, Nigeria, Paraguay, the Philippines and Uganda (Fig. 3). All but one of the eight PMDSs in Albania, Ghana, Nicaragua, Mongolia, Sri Lanka, United Republic of Tanzania, Vietnam and Yemen have received PACT missions to follow up on the recommendations for a comprehensive cancer control approach through partnerships.

After six years of operation, assessing the outcomes of the PACT initiative in Member States is a priority, and an evaluation and monitoring methodology is being developed, notably for PMDSs, in collaboration with partners and Member States.

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