

# Human Health

## Objective

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

## The IAEA Nobel Peace Prize Cancer and Nutrition Fund

The IAEA Nobel Peace Prize Cancer and Nutrition Fund was created in response to the Board of Governors' decision that the Agency's share of the 2005 Nobel Peace Prize should be used to fund fellowships and training to improve cancer control and childhood nutrition in the developing world. In 2006, the fund supported two regional special events in support of the Agency's Programme of Action for Cancer Therapy (PACT), on human resources development in radiation oncology in the context of cancer control programmes in the Asia and Pacific region (in Bangkok) and in Africa (in Cape Town).<sup>1</sup> The Agency's 'Schools for Nutrition' – part of the

<sup>1</sup> Activities related to PACT are discussed in detail in the chapter 'Issues and Events in 2006' at the beginning of this document.

IAEA Nobel Peace Prize Cancer and Nutrition Fund – provide an important opportunity to disseminate information on the use of stable isotope techniques in the development and monitoring of nutritional interventions to combat malnutrition in infants and children. Two of these training and information events were held, in Guatemala City and in Kampala (Fig. 1).

## Quality Assurance in Radiation Medicine

The Agency convened an international conference on Quality Assurance and New Techniques in Radiation Medicine in November in Vienna. Marking the first time that quality assurance (QA) has been discussed in all aspects of radiation medicine – diagnostic radiology, nuclear medicine and radiotherapy – the conference examined QA issues related to the implementation of new technologies, education and staff training. It was recognized that there is a need for a more systematic approach to the adoption of advanced technologies, and the socioeconomic impact of introducing such technologies in settings of limited resources was addressed. The participants felt that milestones were needed to guide the adoption of advanced techniques and equipment in developing Member States.



FIG. 1. Announcement for the IAEA Nobel Peace Prize Fund Schools for Nutrition, held in Latin America and Africa in 2006.

## Nuclear Techniques in Nutrition

The use of nuclear techniques, in particular the use of stable isotope techniques, can assist in the development and evaluation of nutritional interventions. During 2006 the Agency contributed to capacity building in the use of stable isotope techniques in nutrition, particularly in Africa. Seven new laboratories were equipped with specialized equipment for analysis of deuterium to assess body composition and to measure intake of human milk in breastfed infants. In addition, three laboratories in Africa and Asia were equipped with isotope ratio mass spectrometers dedicated to studies for nutrition projects. Emphasis was given to the training of young investigators in the application of stable isotope techniques in nutrition; for example, participants from 13 African countries were trained during a one week training course organized by the Agency in collaboration with the Centre for Human Nutrition Research, University of Cambridge, United Kingdom.

The Agency continued its collaboration in nutrition with UNICEF, WHO and PAHO, with representatives of these organizations participating in Agency meetings on the preparation of advocacy documents and guidelines on the use of stable isotope techniques in nutrition studies. The Agency contributed to a UNICEF/WHO meeting on programmatic aspects related to the prevention and control of iron deficiency in children.

A regional technical cooperation project for Africa is evaluating the efficacy of supplementary food for people living with HIV/AIDS. A technique known as the deuterium dilution method was used to assess body composition, particularly to estimate fat mass and fat free mass in people living with HIV/AIDS and to validate other field methods for the assessment of nutritional status. Capacity building in Africa has been strengthened through the implementation of this project, resulting in nine participating countries now having the capability of using nuclear techniques to assess body composition. In addition, the isotope ratio mass spectrometer purchased within this project (located in Dakar, Senegal) will increase the analytical capacity in the region significantly.

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## Nuclear Medicine

The Agency's first major activity on clinical PET, a powerful medical imaging procedure that non-invasively shows the function of organs and tissues, was initiated during 2006. Molecular imaging procedures are a safe, effective means of gathering medical information that would otherwise be unavailable, require surgery or necessitate more expensive diagnostic tests. A new CRP on the application of <sup>18</sup>F-fluorodeoxyglucose (FDG)-PET and molecular gene profiling for the treatment of diffuse large B cell non-Hodgkin's lymphoma in different ethnic populations aims to assess the independent prognostic value of two techniques, namely PET and molecular biology gene profiling.

Treatment of diffuse large B cell non-Hodgkin's lymphoma has evolved to a point where the disease is curable in many patients, and the availability of PET has made a significant contribution to disease assessment when it is detected and at the end of treatment. The synergistic combination of these sciences and technologies will facilitate understanding of the basic characteristics of the disease.

Changing lifestyles, as well as other factors, are expected to lead to a large increase in diabetes, especially in developing countries. A CRP was started on the 'Role of Nuclear Cardiology Techniques in Ischaemia Assessment with Exercise Imaging in Asymptomatic Diabetes'. Diabetes mellitus is a disorder characterized by varying or persistent elevated blood sugar levels and is a strong risk factor for cardiac disease. This study will contribute to the development of guidelines and to patient management.

To encourage and assist Member States in adopting quality management systems in their nuclear medicine practice, a meeting was convened to develop a publication, *Quality Assurance System in Nuclear Medicine (QANUM)*, as a tool for quality improvement and as a basis for establishing an auditing programme aimed at raising the level of nuclear medicine practices in Member State hospitals.

In related work, the Agency, in cooperation with WHO, began developing 'International

Pharmacopoeia Radiopharmaceuticals Monographs', which aim to improve quality in the preparation of radiopharmaceuticals in Member States, and also enhance the quality of nuclear medicine practice. The monographs will feature specialized studies and descriptions of standard procedures for the preparation of radiopharmaceuticals in hospitals.

## Radiotherapy for Cancer Treatment and Palliation

The Agency initiated a CRP for the comparison of two different radiotherapy techniques for patients following mastectomy. This is in response to statistics (Fig. 2) that show that breast cancer is the most common cause of cancer related death in the world among women, accounting for 11% of all female cancer deaths. Post-mastectomy radiotherapy substantially reduces the risk of a recurrence, but the optimal treatment is as yet unknown. The study includes, among other factors, a QA survey of the ability to implement and document the technical guidelines for treatment delivery. The International Network for Cancer Treatment and Research is among the collaborators in this project.

Earlier Agency sponsored research on palliative radiotherapy for oesophageal cancer led to the initiation of a new CRP involving radiotherapy centres in China, Croatia, India, Pakistan, South Africa and Thailand. Patients were randomly selected to receive a treatment that places a radioactive source directly inside the oesophagus (intraluminal brachytherapy), with or without the addition of external beam radiation therapy (EBRT). This trial showed that there was an improvement in the ability to swallow with the addition of EBRT, which is safe and tolerated well by patients. The new trial will explore a resource-saving approach to EBRT.

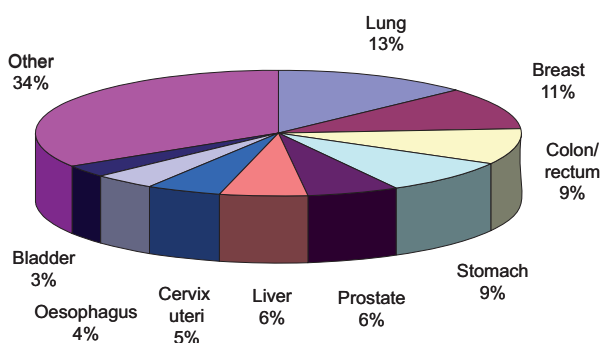


FIG. 2. Incidence of cancer around the world: 11 million new cases per year are predicted (estimates from the Globocan 2002 database).

Educational packages for developing Member States were developed on 'evidence based radiation oncology' for the optimal treatment of common cancers using cost effective modalities. The packages were on clinical research, which describe the methodology and implementation in resource limited settings, education and training guidelines for radiation oncologists, medical physicists, radiation therapy technologists and nurses, and emerging techniques in radiotherapy planning and delivery, which describes clinical advantages and disadvantages, cost-benefit considerations and implementation. Close liaison and coordination were also maintained with other international organizations, including the ICRU for ion beam therapy, the ICRP for deterministic effects in tissues after high radiation doses, and WHO for treatment guidelines.

## Medical Physics and Dosimetry

The Agency has created the QUATRO service (Quality Assurance Team for Radiation Oncology) to conduct missions that review and evaluate the quality of the various components of the practice of radiotherapy at a specific cancer treatment centre, with the aim of improving overall quality. QUATRO workshops were organized in Austria, Morocco and South Africa in 2006 both to explain the concept to counterparts from radiotherapy centres and to train experts in the audit methodology through regional technical cooperation projects. Altogether, 12 QUATRO missions were completed in 2006, to Armenia, Bosnia and Herzegovina, China, Cyprus, Indonesia, Malaysia, Mongolia, Poland, Serbia, Sri Lanka, Thailand and Vietnam. Individual radiotherapy centres received recommendations on quality improvement in several areas.

At a technical meeting of medical physicists and radiation oncologists, guidelines were prepared on the development and implementation of intensity modulated radiation therapy (IMRT) to assist developing countries in the use of this technique. IMRT presents challenges that are significantly more complex than traditional forms of radiation treatment, and its implementation requires substantial resources. To facilitate the systematic introduction of IMRT in radiation oncology departments in Member States, a set of guidelines was also prepared.

A publication entitled *Quality Assurance for Radioactivity Measurement in Nuclear Medicine*

(Technical Reports Series No. 454) was issued to assist in the administration to patients of properly constituted radiopharmaceuticals that are free of impurities and possess the prescribed quantity of radioactivity, both of which are important for the safety and clinical efficiency of diagnostic and therapeutic procedures in nuclear medicine. The publication provides information on the measurement procedures for the routine measurement of radioactivity, including maintaining the necessary documentation, as well as guidance on implementing the ISO/IEC 17025 standard on quality assurance.

The Agency extended its dosimetry calibration and auditing services facilities in response to increased demand from Member States. The newly expanded facilities of the Dosimetry Laboratory, inaugurated in June 2006 in the Agency's Laboratories, Seibersdorf, allow an increase in the

training capabilities for fellows. A new cobalt-60 machine for instrument calibration was installed and commissioned, and in October the Agency's quality management system in the Dosimetry Laboratory was formally accepted by the Joint Committee of the International Bureau of Weights and Measures and the regional metrology organizations in accordance with the ISO 17025 standard.

Collaboration with external organizations continues to be a priority. A publication — *Prescribing, Recording and Reporting Proton Beam Therapy* — was prepared in collaboration with the ICRU. Additionally, information exchange with the American Association of Physicists in Medicine and the European Federation of Organisations for Medical Physics was strengthened by the appointment by these organizations of designated liaison staff for promoting closer collaboration with the Agency. ■