The International Atomic Energy Agency (IAEA) is an independent, intergovernmental science and technology-based organization, in the United Nations, that serves as the global focal point for nuclear cooperation. Article II of the IAEA Statute states: "The Agency shall seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world. It shall ensure, so far as it is able, that assistance provided by it or at its request or under its supervision or control is not used in such a way as to further any military purpose" [1].

In the particular area of radiotherapy, the IAEA has as its objective to enhance Member States’ capabilities to establish sound policies for radiotherapy and cancer treatment, and to ensure the effective, efficient and safe utilization of current and future radiotherapy technologies.

Epidemiological projections indicate that if current trends continue, the global cancer burden will increase from 12.6 million new cases per year in 2008, to 16.9 million by 2020 [2]. Remarkably, 70% of these cases will be in the developing world where the number will grow from 5.2 million/year to 8.8 million/year by 2020 [3]. The Division of Human Health keeps a Directory of Radiotherapy Centres (DIRAC) [4] which contains data on centres providing radiotherapy services worldwide. This data base lists equipment (teletherapy and brachytherapy), imaging and dosimetry, staffing and number of patients treated annually. According to our database, there are currently a total of 13,265 teletherapy machines operational worldwide. Of them 245 are in low-income countries, 4,109 in middle-income and 8,911 in high-income countries. This disparity points to the fact that, according to current projections, the largest increase in cancer incidence will occur in countries and regions of the world that are poorly prepared to cope with it, even at current levels.

Technical cooperation programme

IAEA Technical Cooperation projects include for example the establishment or upgrading of radiotherapy facilities, the initiation of a HDR brachytherapy unit, the QA and training support for a 3D-conformal radiotherapy or intensity modulated radiation therapy (IMRT) project, initiating radiotherapy technologists or radiation oncology education programmes and others. In all these projects, the IAEA provides technical advice on radiotherapy issues, equipment and training required to bring the project to a successful completion.

Technical support to the Programme of Action for Cancer Therapy (PACT)

Cancer is a global problem and should be on the international health agenda because it affects millions in every country around the world. Tackling the problem requires significant resources. The international community has become aware that it is necessary to have better cooperation and coordinated efforts among all national and international stakeholders.

In response to the developing world’s growing cancer crisis, the IAEA established the Programme of Action for Cancer Therapy (PACT) in 2004 to fully realize the public health impact obtained through technology transfer in radiation therapy and nuclear medicine. PACT was launched as an IAEA initiative, but its vision is for a global public–private partnership to confront the cancer crisis, including the signature of a joint programme for cancer control with the World Health Organization (WHO). This joint programme will allow close collaboration with WHO and other key international health organizations through a coordinated global response in developing strategies and specific plans for working with low and middle-income (LMI) Member States in the design and implementation of comprehensive cancer control programmes.

Research under Coordinated Research Projects (CRPs)

The IAEA is currently conducting 12 Coordinated Research Projects (CRPs) in radiotherapy/radiobiology. The majority are clinical radiation oncology research projects of relevance to the radiation oncology community at large and of particular applicability in countries with limited resources exploring resource-sparing strategies.

In IAEA clinical trials, the accrual, treatment and follow-up of patients takes place in selected radiotherapy centres around the world. The data is managed centrally by a data-management and statistics centre and the results are analysed by a professional team that includes IAEA Staff. CRP methodology adheres to the principles of the Helsinki declaration and Good Clinical Practice guidelines for clinical research. Three of the 12 CRPs currently deal
with radiation biology topics; stem-cell research (aiming to decrease radiation-induced normal tissue damage), radiation sterilization for tissue-banking and biological dosimetry. The results of IAEA CRPs and expert meetings are often published as IAEA documents freely available to Member States [5–7] and/or in scientific peer-reviewed journals including Radiotherapy and Oncology [8–14].

The importance of training and education in the radiation medicine disciplines cannot be overemphasized. We have identified the lack of radiation medicine professionals—in numbers and training—as one of the main obstacles for the successful implementation of national radiotherapy strategies in countries and regions.

The problem is addressed at various levels: (1) producing learning and educational materials, (2) making existing materials available to centres with limited resources, in their local languages, (3) organizing and conducting training events such as courses and workshops, and (4) planning long-term training and education at the national or regional scale. A particularly successful output has been the “Applied Sciences of Oncology” distance-learning course which had 2000 downloads in three years [14].

The IAEA has published a full series of syllabi for the training and education of radiotherapy professionals. The series includes syllabus for radiation oncologists (endorsed by ESTRO and ASTRO), medical physicists, radiation therapists, radiation oncology nurses and radiation biologists. In these and other publications, careful attention is paid to modern concepts in education and education QA working with education specialists who are part of the Staff.

Recently a “Human Health Campus” webpage was launched aimed at radiation medicine professionals [15]. The Human Health Campus is an educational and resource website for health professionals in radiation medicine (nuclear medicine, diagnostic imaging, radiation oncology, and medical radiation physics) and nutrition. The Division of Human Health aims at becoming a “learning organization” in ways that foster a collaborative learning environment. Because medical and scientific knowledge evolves rapidly, this website is updated regularly to ensure the quality of our teaching/learning materials. Didactic materials have been designed to integrate the entire curriculum in radiation medicine, with the expert advice and support from physicians, physicists and nutrition and educationalists as well.

The main goal of our website is to provide specialists from Member States with information for strengthening and improving their clinical practices and quality management through the use of up-to-date educational materials provided by experts in the field. It is divided into 5 sections (tabs): Nuclear Medicine, Radiopharmacy, Radiation Oncology, Medical Physics and Nutrition. Additional sections dedicated to Technologists teaching and diagnostic radiology are in progress. The establishment of these learning resources was founded on sound educational principles using a student-centred approach with active learning achieved through the use of lectures, interactive case studies and videos containing guide questions and answers, which are essential educational tools geared towards a self-directed learning process.

Auditing beams and radiotherapy centres

The IAEA/WHO thermoluminescent dosimetry (TLD) postal audit programme has been used for over 8000 radiotherapy beams throughout the world over four decades of operation. Records are kept of the results of TLD audits since the inception of the programme. Analysis of these data has yielded much valuable information. In the early years, the TLD service recorded approximately 50% audited beams having adequate calibration. This percentage of acceptable results has now increased to 96%. Clearly, regular participation in dosimetry audit stimulates an improvement in dosimetry practices in radiation therapy in many hospitals worldwide. Another dosimetry audit programme for treatment planning (TPS audit) in external beam radiotherapy, which has been developed by the IAEA, assesses the radiotherapy workflow for conformal techniques, from patient data acquisition and computerized treatment planning to dose delivery. The IAEA supports national and sub-regional TPS audit activities to improve the quality and safety of dose calculation in radiotherapy.

Another audit modality operated by the IAEA within the framework of the Quality Assurance Team for Radiation Oncology (QUATRO) is a comprehensive audit that reviews radiation oncology practices with the aim to improve quality. To date more than 60 QUATRO audits and follow-up missions have been organized by the IAEA in radiation oncology centres in Europe, Africa, Asia and Latin America. QUATRO audits identify and document areas for improvement and provide advice for further development of the audited centres. The Agency works with Member States and partners such as ESTRO, to promote the safe and effective use of nuclear technologies. Representatives of the Division of Human Health are regularly present at meetings of the ESTRO Board and of the Education and Training Committee. Conversely, ESTRO delegates are regularly part of the IAEA process of establishing guidelines and codes-of-practice in radiotherapy.

The Agency has long recognized the consistent high quality of ESTRO teaching courses and more than 1582 participants have been sponsored by the Agency to attend ESTRO courses since 1997, mainly from Central and Eastern Europe and the Commonwealth of Independent States. Starting in 2008, ESTRO and the IAEA are conducting the “Best Practice in Radiation oncology”, a process to train-the-trainers for radiotherapy technologists.

Challenges of the introduction of new technologies

The actual or potential use of the new advanced radiotherapy technologies raises many questions about their cost, efficacy and even ethics. The increased capital and operating costs and the burden of the increased QA are a challenge. Some of the new technologies have the advantages of improved dose-distributions and time saving, but require well-qualified personnel and demanding QA/QC programmes.

Advanced technology options in radiation oncology must be considered in the context of the needs and priorities of countries in terms of their essential infrastructure, in order to allow for a smooth, incremental and safe progression.

An important theme echoed by experts is the shortage of skilled radiotherapy professionals in low and middle-income countries. It is noted that while in the short-term, local solutions have been devised, there is still a need in many countries for long-term workforce planning. Training must be adapted to both the working environment and the available technology; little benefit is derived by a country or institution, when their trainees are exposed to a technology not available in his/her own country. On the other hand, low and middle-income countries follow the path of developing radiotherapy technology. The IAEA accompanies them in this path and provides guidance for a sound and effective transition.

The IAEA’s “Europe region” consists of a group of 32 countries that receive assistance from the Organization in the framework of technical cooperation for development. This group includes countries in Central, Eastern Europe and the former Soviet Republics. Our experience reveals heterogeneous levels of radiotherapy development in these countries, having different needs and priorities. We have initiated a process of assessment of the current radiotherapy landscape and bridging the gap with the
Commonwealth of Independent States. The results of this process will be of value to the IAEA and to ESTRO at the time of developing a framework for collaboration.

These are exciting times when ESTRO is developing a new strategy that includes European as well as non-European activities. The ties of collaboration between ESTRO and the IAEA are being strengthened.

References