A Silent Crisis:
Cancer Treatment in Developing Countries

IAEA
International Atomic Energy Agency

"A silent crisis in cancer treatment persists in developing countries and is intensifying every year. At least 50 to 60 per cent of cancer victims can benefit from radiotherapy that destroys cancerous tumours, but most developing countries do not have enough radiotherapy machines or sufficient numbers of specialised doctors and other health professionals."

— Mohamed ElBaradei, IAEA Director General

Cover photo: A victim of brain cancer in Sri Lanka is recovering thanks to radiotherapy.

A Silent Crisis:
Cancer Treatment in Developing Countries

Cancer cases in Sri Lanka have doubled over the past 10 years. The IAEA is assisting with improved treatment facilities at Kandy General hospital. To help patients recover, the Sri Lanka Cancer Society provides patients with voluntary support services including food, housing and medicine.

Foreword: Mohamed ElBaradei, IAEA Director General

A dramatic rise in cancer across the developing world is stretching already limited resources and equipment. Shortages of qualified staff and equipment are growing constraints to treating cancer effectively. Some 5,000 radiotherapy machines are presently needed to help patients fight cancer. But the entire developing world has only about 2,200 such machines. Experts predict a long-term crisis in managing cancer, with an estimated five million new patients requiring radiation therapy every year.

Meeting the challenge is not simply a matter of providing appropriate equipment. There must be sufficient trained and knowledgeable staff with clinical and medical physics expertise to deliver a safe and effective radiation dose. Appropriate facilities and radiation protection infrastructure for monitoring and regulatory control are needed. Moreover, cancer treatment must be carried out in a comprehensive context of prevention, early diagnosis, and adequate follow-up care.

Providing essential equipment and training of staff to safely treat cancer patients in the developing world is of increasing importance to the IAEA. The Agency has assisted Ethiopia, Ghana, Mongolia, Namibia, and Uganda in establishing their first radiotherapy facilities. The IAEA also provides ongoing support to some 80 developing Member States in upgrading their radiotherapy facilities and providing staff with suitable training.

Dosimetry and medical physics are an integral part of any medical treatment that uses ionizing radiation. With computerization, improved techniques are increasingly being used in developing countries to plan and treat patients in a wide range of medical therapies including teletherapy, brachytherapy, and the use of open drinkable or injectable sources.

The IAEA works in partnership with the World Health Organisation (WHO) on most of its cancer projects. The WHO works to address the full spectrum of the health-disease continuum from prevention to end-of-life care. The role of the IAEA in cancer control programmes has grown rapidly as radiotherapy and nuclear imaging become increasingly important for the management of cancer.

The Agency is actively promoting the international exchange of information on the newest treatment technology and therapies, and has developed standards and codes of practice for safe and effective medical uses of radiation. The IAEA also works with the WHO to support a network of standard dosimetry laboratories that provide calibration services to hospitals throughout the developing world to assist their quality assurance programmes.

This publication provides a brief overview of the IAEA's experiences and achievements in the radiotherapy field. In response to growing needs and the demands of Member States, and with the generous support from donor countries and organisations, we anticipate a steady increase in the extension of these services in developing countries in the early 21st century.

Hope for Sri Lanka's Cancer Victims

Kandy, Sri Lanka. The ancient Sinhalese kings built their capital in the tropical forests high in Ceylon's central mountains, later to become renowned for their fine orange pekoe teas. Today, Kandy is Sri Lanka's second largest city with a bustling marketplace and tourist trade, and a general hospital that provides free medical services to five of the country's nine provinces, or roughly seven million people. On clinic days, when doctors see outpatients, the hallways are swamped—over 2,000 patients may line up to see the doctors on any given day.

The three basement-level wards devoted to cancer are as cramped as the rest of the hospital. "Across Sri Lanka, we are witnessing a rapid rise in adult cancers of all types," explains Dr. Sarath Wattegama, the hospital's chief radiation oncologist. "People are simply living longer, and the incidence of adult cancers and the demand for radiotherapy services is accelerating."

Pressed by growing demand, Dr. Wattegama and his assistants can afford only a few minutes with each patient for diagnosis, treatment and follow-up. The inpatient ward for cancer has just 70 beds, but at any given time the number of patients is twice as large. Some do not get a bed and must pass the time sitting on a bench, or share a bed with another patient. Child patients must share a bed with their mother.

"The pattern of childhood cancers here is similar to the rest of the world," explains Dr. Wattegama, "50 per cent are leukaemia and 50 per cent are solid tumours. Unfortunately, we still lack the state-of-the art treatment equipment of the West."

In 2002 alone, almost 25,000 new and treated cases of cancer were recorded in Sri Lanka, representing more than a 100 per cent increase over the figures for 1992. "We treat about 120 to 150 patients a day with the two cobalt therapy units in this facility," explains Mr. H.M.S. Herath, the principal medical physicist at Kandy. "That's roughly twice as many patients per machine as they would treat in Australia or Singapore."

With support from the IAEA, Mr. Herath has received specialised training in operating treatment planning software, which helps more accurately calculate the dose of gamma radiation on cancerous tumours.

Mr. "C", a 45-year-old former fish vendor, is a beneficiary of Kandy's radiation therapy. He was selling fish door-to-door until nine months ago when he was diagnosed with a brain tumour.

Mrs. "M" (opposite, left) and Mr. "C" (above) are recovering cancer patients.

In fact, when he arrived semi-conscious for an examination, it appeared that he had lung cancer and that the malignant cells had already gone into his brain. Had it not been for radiotherapy, he probably would not be alive today.

Following radiation treatments, Mr. "C" is now in stable condition, but too weak to work. Sitting on the porch of his house in a village outside Kandy, Mr. "C" knows—although belatedly—that cigarette smoking was the cause of his lung cancer. In a wooden shed next to his simple house, his wife and two children try to earn a living by selling groceries and homemade pastries to neighbours.

Mrs. "M", a slender 42-year-old woman with three children, is another beneficiary of Kandy's treatment facilities. Almost a year ago, she decided to go for a second time to Dubai to earn money as a housemaid. A medical check-up, however, revealed that she had rectal cancer. She was immediately operated on at Kandy Hospital and the tumour was removed.

Mrs. "M" has a good chance for full recovery, but her treatment is not yet finished. She must undergo extensive chemotherapy followed by a course of radiation treatment. "One third of all cancer cases are curable, another third are recurrent cases, and the rest are a case of life extension—the challenge is to catch the cancer in the early stages," explains Dr. Wattegama.

Every week she travels from her village to see Dr. Wattegama at his clinic. Her home is not too far away from the city, but the journey is an ordeal for a post-cancer surgery patient. Mrs. "M's" ongoing medical expenses surpass 1,000 rupees every week—about 10 US dollars. Her husband, a manual day labourer is lucky to earn 50 to 200 rupees a day crushing stones. Their proximity to Kandy hospital, with its free medical service for the poor, is their best hope for a return to normal life.

Overall upgrading of Kandy General's cancer treatment facilities began in 1998, with US$ 260,000 in project assistance from IAEA's Technical Co-operation (T.C.) Programme. The cancer unit received a low-dose-rate brachytherapy system to treat cervical cancers, a fully equipped radiation laboratory, and a workshop to produce immobilization devices. The hospital computerized tomography (CT) and magnetic resonance imaging (MRI) scanners were linked to the newly acquired Theraplan 1000 Treatment Planning System, operated by an IAEA-trained specialist.

"Thanks to the Agency's assistance we made a very big step ahead," says Dr. Wattegama. "We are now in a position to treat patients more effectively and to control cancer more aggressively."

Cancer: A Growing Threat in Developing Countries

More than 10 million persons are diagnosed with cancer each year (not counting skin cancer). Over half of these cases occur in the developing countries, where the cancer incidence is increasing dramatically. Nearly 15 million persons will probably be diagnosed with cancer in the year 2015, with almost all of the increase coming from developing countries.

Yet the developing world is seriously underserved with the therapies designed to save lives or at least improve their quality of life. Developing countries make up 85 per cent of the world population, yet they have only about one-third of the total radiotherapy facilities. Only about 2,200 teletherapy machines are installed in developing countries—mostly cobalt-60 units—far below the estimated need of over 5,000 units.

Some 200,000 women in developing countries die each year from cervical cancer.

The most common cancer in the world is lung cancer; the most common among women is breast cancer. There are significant differences in how cancer strikes people in various parts of the world. In Mumbai (India), lung cancer is the most common cancer among men; whereas in Khon Kaen (Thailand) it is liver cancer. Such variations may be due to smoking, dietary and other social habits, and because people inherit different kinds of genetic mutations from their parents.

The best time to diagnose a cancer is before the person feels that something is wrong. Those are the cancers that are quite small and generally treated very successfully. This is called screening. Examples of screening include Pap smears for detecting cervical cancer, and mammograms for detecting breast cancer. Unfortunately, too few people, especially in developing countries, undergo screening due to either lack of awareness or lack of resources or both. For many cancers, such as lung cancer, there are as yet no methods of screening available with proven effectiveness.

All too often cancer is suspected only when it has grown large enough to produce symptoms, such as a cough, a lump, a sore, or bleeding. To prove that cancer is present it is almost always necessary to do a biopsy—i.e. remove a small piece from the suspected area with a needle or a scalpel and have a pathologist examine it under a microscope. The pathologist also tries to determine the exact "histological" type of cancer (because several different types can occur even in the same region, e.g. in the lung, and the treatment can be very different depending upon the type).

A full physical examination and other tests are usually necessary to determine the "stage" of the cancer—i.e. how big it is—how much it has spread into the neighbouring organs or to other parts of the body. These tests may include blood tests, diagnostic x-rays and different kinds of scans.

The best treatment depends upon numerous factors: the part(s) of the body affected by cancer; the histological type of the cancer; the stage of the cancer; and the age and the general condition of the patient. The prognosis, of course, also depends upon whether adequate facilities for treatment are available, and whether there are healthcare professionals qualified and trained to use them properly.

What Causes Cancer?

The human body is made up of billions of cells. Each human being starts out as just one cell. That cell divides into two cells, then four, then eight, and so on. Eventually some of these cells become the eyes, while others become the skin, the heart, the brain, etc. After they form these organs, the cells stop dividing except to repair normal wear and tear or injuries. In other words, healthy cells know when they should divide and also when they should stop multiplying.

Cancer cells have lost the ability to interact properly with their environment and multiply in an uncontrolled way to create tumours that compete for body nutrients and oxygen. Tumours may replace healthy tissue and often start spreading to other parts of the body, a life-threatening process called metastasis. If untreated, most cancers lead to protracted suffering and eventual death.

Cancers arise through multiple genetic changes in stem cells of body organs. A part of these deleterious changes accumulates with age and is unavoidable, but genetic predisposition, environmental factors—and most of all—lifestyle are of importance.

The waiting room is overflowing in the cancer ward of Kandy General Hospital in Sri Lanka.

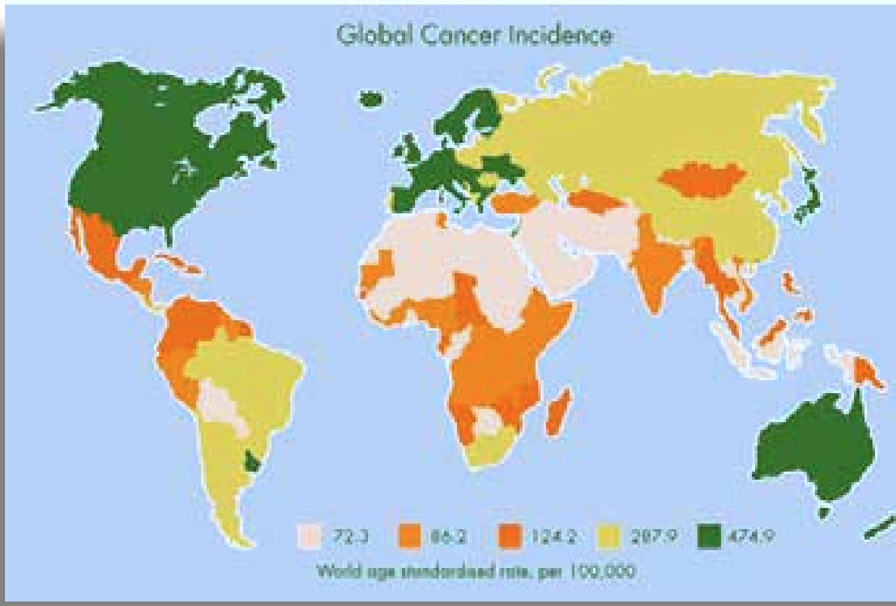
The most common preventable cause of cancers is the use of tobacco. Any part of the body that comes in contact with tobacco or tobacco smoke can turn cancerous, e.g. the mouth, the throat, the lungs and the stomach. From the lungs, toxins in the tobacco smoke enter the blood and travel to other parts of the body and can also contribute to the development of cancers in the urinary bladder, cervix, etc.

How tobacco causes cancer is not yet completely understood. Cell division is controlled by DNA. It is likely that tobacco damages the DNA and that is why control of cell division is lost by the cell. Damage to the DNA is called a mutation. Most mutations are destroyed by the body's own surveillance system, however, some DNA mutations can lead to cancer.

People who do not use tobacco can also develop cancers. In most cases, the causes are not well understood. Some people are born with certain mutations in their DNA that can lead to cancer. For instance, women born with a mutation called BRCA1 develop cancers of the breasts or ovaries much more commonly than women who do not have such a mutation.

Social habits can play a role in cancer development. Sunlight can produce mutations in the cells of the skin. Fair-skinned people from Europe who have moved to sunny areas such as Australia are particularly susceptible to developing skin cancers due to excessive sun exposure.

Some viruses also play a role. For instance, the hepatitis-B virus contibutes to the development of liver cancer, while persons infected with HIV develop certain kinds of cancer that are exceedingly rare among people who are not so infected. Dietary habits also play a role, but more research is needed to better understand how.



Worldwide Distribution of Cancer

Over half of the 10 million people diagnosed with cancer worldwide each year live in developing countries. This rapid rise of cancer is attributed mainly to the population's increasing life expectancy, as aging men and women become more likely to develop the disease. The World Health Organisation foresees a doubling of cancer cases in the developing world over the next 10 years, from just over five million today to 10 million in 2015.

"The growing cancer crisis in the developing world can be traced to people living longer, changing lifestyles, un-hygienic living conditions and other important factors. This crisis is predictable and, to some degree preventable, depending on how well we start to manage it now."

Bhadrasain Vikram, MD,
IAEA Radiation Oncologist

Accuracy of radiation dose measurements is vital in radiotherapy: a physicist at the IAEA laboratories in Seibersdorf, Austria calibrates a dosimeter to be used in a Member State

Treating Cancer with Radiotherapy

Radiotherapy, or radiation therapy, is the treatment of cancer and other diseases with ionising radiation. Ionising radiation deposits energy that injures or destroys cells in the area being treated (the "target tissue") by damaging their genetic material, making it impossible for these cells to reproduce. Although radiation damages both cancer cells and normal cells, the latter are able to repair themselves and function properly, if the radiation was delivered in the proper dosage and aimed accurately.

Radiotherapy may be used to treat localised solid tumours, such as cancers of the skin, tongue, larynx, brain, breast, or uterine cervix. It can also be used to treat cancers of the blood-forming cells and lymphatic system, for instance lymphoma.

One type of radiation therapy commonly used involves the use of machines—usually cobalt machines or linear accelerators (linacs)—to shoot photons or electrons from outside the body into a cancer site. This is called external beam radiotherapy. Photons are "packets" of energy such as gamma rays or x-rays. X-rays, gamma rays and electrons have the same effect on cancer cells. Gamma rays are produced spontaneously when certain radioisotopes (such as cobalt-60) release photons as they decay. Linacs are machines that can produce photons and electrons of various energies. Depending on the amount of energy, the photon or electron beams can be used to destroy cancer cells near the surface of or deeper in the body.

Another technique for attacking cancer cells is to place radioactive implants directly into a tumour or body cavity. This is called internal radiotherapy or brachytherapy. Interstitial and intracavitary irradiation are both types of brachytherapy. In this treatment, the radiation dose is concentrated in a small area and the patient stays in the hospital for a few hours or days. Internal radiotherapy is frequently used for cancers of the tongue, prostate and cervix.

Several new approaches to radiation therapy are being evaluated to determine their effectiveness. One technique is intra-operative irradiation, in which a large dose of external radiation is directed at the tumour and surrounding tissue during surgery.

Because of the prevalent cancer types and because of later diagnosis, the vast majority of cancers in the developing world should be treated by radiation.

Another investigational approach is particle beam radiation therapy, which differs from photon radiotherapy in that it involves the use of fast-moving subatomic particles to treat localised cancers. A very sophisticated machine is needed to produce and accelerate the particles required for this procedure. Some particles (pions, neutrons and heavy ions) deposit more energy along the path they take through tissue than do x-rays or gamma rays, thus causing more damage to the cells they hit. This type of radiation is often referred to as high linear energy transfer (high LET) radiation.

Scientists also are looking for ways to increase the effectiveness of radiation therapy. Two types of investigational drugs are being studied for their effect on cells undergoing radiation. Radiosensitisers make the tumour cells more likely to be damaged, and radioprotectors protect normal tissues from the effects of radiation. Hyperthermia, the use of heat, is also being studied for its effectiveness in sensitising tissue to radiation.

Other recent radiotherapy research has focused on the use of radiolabeled antibodies to deliver doses of radiation directly to the cancer site (radioimmunotherapy). The success of this technique will depend upon the specificity of the antibody for the targeted tumour, the identification of appropriate radioactive substances, and determination of the safe and effective dose of radiation that can be delivered in this way.

Radiation therapy may be used alone or in combination with chemotherapy drugs or surgery. Like all forms of cancer treatment, radiation therapy can have side effects. Possible side effects include temporary or permanent loss of hair in the area being treated, skin irritation, temporary change in skin colour in the treated area, and fatigue. Other side effects are largely dependent on the area of the body that is treated.

Medical imaging is an increasingly important component of clinical quality assurance for radiotherapy. With better knowledge about the size, shape and location of the cancer, it is possible to more accurately deliver radiotherapy to the tumour volume. Moreover, the ability to fuse images from different imaging modalities has provided new benefits to patients receiving radiotherapy because the various tools provide complementary information. The IAEA supports activities in diagnostic radiology within both its regular budget and in response to Member States requests for support through the TC fund.

Dr. Sarath Wattegama (centre), chief radiation oncologist, visits patients in the Women's Cancer Ward of Kandy General Hospital.

Upgrading Radiotherapy Facilities

The IAEA is stepping up efforts to help more patients survive cancer through earlier diagnosis and better treatment. At least 5,000 machines are presently needed. By 2015, at least 10,000 machines may be needed to meet growing treatment demand.

Through IAEA-supported projects, some national medical authorities are becoming better equipped to help patients beat cancer. The IAEA is currently helping to upgrade radiotherapy facilities in some 80 countries through national and regional projects. It is also establishing or improving quality assurance programmes through another 20 national projects and five regional projects.

Regional projects in east and southeastern Europe are assisting numerous countries emerging from years of conflict and economic hardships. In most cases, these countries retained medical expertise but need to re-build or upgrade radiotherapy facilities. In Bosnia and Herzegovina, for example, the radiotherapy department at the Institute of Oncology in Sarajevo was revived and modernised with IAEA support. The only radiotherapy center in the country, the Sarajevo Institute, currently treats 1,100 cancer patients per year, about a fifth of the estimated 5,000 cancer victims in the country.

An overriding aim is to help set up comprehensive national cancer management programmes that include integrated prevention and treatment approaches. Studies show that in advanced countries with such programmes, the investment yields human dividends—about 45 per cent of all cancers are cured.

New Treatment Facilities in Developing Countries

Modern radiotherapy facilities have been set up for the first time in several countries, including Ethiopia, Ghana, Mongolia, Namibia, and Uganda, while second centres have been added in Nigeria and Sudan. Currently new countries receiving support to initiate radiotherapy include Angola, Haiti, Yemen and Zambia.

"There are insufficient facilities and qualified staff to adequately treat the victims of cancer in the developing world today. The IAEA supports the provision of radiotherapy equipment, training, quality assurance and maintenance in developing countries."

Ana María Cetto, Head of the IAEA Department of Technical Co-operation

In addition, under an agreement called AFRA (African Regional Co-operative Agreement for Research, Development and Training related to Nuclear Science and Technology), 18 countries are working together to improve clinical radiotherapy and upgrade their medical physics capabilities through training workshops, seminars and other support designed to build up treatment capabilities. A similar initiative in Latin America involving the ARCAL (Regional Co-operative Arrangements for the Promotion of Nuclear Science and Technology in Latin America) Member States is fostering co-operation between radiation oncologists and medical physicists to enhance the cure rates of cancer.

Some 15 African nations and several countries in Asia lack even one radiation therapy machine. Ethiopia, which has 60 million people, possesses just one such machine, provided by the IAEA. Other developing countries have very low ratios of machines per population, often one machine for several million people, versus a ratio of one machine per 250,000 inhabitants, which is typical of most developed countries.

Establishing new treatment facilities is a long process and requires strong governmental support. It involves staff training (up to four years for a radiation oncologist and two years for a medical physicist), programme and equipment specification, facility planning and construction, equipment procurement, installation, acceptance testing and commissioning, registration and licensing, designing protocol and procedure manuals, and developing quality control programmes before initiating the treatments. Typically, about five years are needed to complete all phases.

While upgrading radiotherapy lacks the glamour of initiating radiotherapy, the Agency has addressed the enormous task of upgrading antiquated services that were present in former Soviet Union and former Yugoslavian countries with the objective of providing safe, effective therapy. Albania, Armenia, and Azerbaijan are just the beginning of the beneficiary countries. IAEA support activities have ranged from simple interventions such as providing a treatment planning unit, to completely revamping a department with strong governmental support (in Sarajevo, Bosnia and Herzegovina).

Fighting Cancer in Zambia

Building a National Cancer Treatment Centre

The oncology ward in Zambia's main hospital in Lusaka is an untold story. Within its bare halls, people in pain stream in daily, seeking cancer treatment that is out of reach.

"It is a very sad situation. People wait for treatment that may never come, says Mr. Nicholas Chikwenya from the Zambian Health Department. "You see women suffering—rates of cervical cancer are high. There is not a lot health workers can do. We do not have the diagnostic and treatment facilities."

But that will change. Zambia is about to start building its first national cancer treatment centre, capable of delivering megavoltage radiation therapy. Once this new facility is fully operational, about 1,200 new patients per year will receive treatment. Potentially, this might result in saving one life every working day. Even incurable patients would receive substantial pain relief.

At least US$ 2.5 billion is needed over the next decade to provide adequate treatment facilities in the developing world, half of it to train the physicians and physicists required for safe and effective treatment.

The centre will be constructed at the University of Zambia Teaching Hospital in Lusaka. It is being made possible by a US$ 5.6 million loan from the OPEC Fund for International Development, with technical support from the IAEA.

At present, access to good cancer treatment in Zambia is a privilege of just a few. Patients needing vital radiotherapy treatment have to travel to South Africa and Zimbabwe. The Zambian Government covers most of the cost but a financial contribution is still needed from the patient—which few can afford. Even for those that can, the waiting period can last from six months to one year. All the while, the cancer spreads.

The new facility—with its purpose built laboratories, treatment and waiting rooms—will greatly improve people's access to quality cancer diagnosis and treatment. The centre's radiotherapy capabilities will give cancer patients undergoing this treatment a 45 per cent chance of being cured. It is a project that everyone is waiting for.

None more so than Dr. Mushikita Nkandu. He is the only radiotherapy oncologist working at the Lusaka hospital. He has been lobbying for such a facility for over 10 years.

"The most common cancer we see is cervical cancer, in around 32 per cent of patients. These patients should be treated with radiotherapy. It is frustrating when the best we can offer them is palliative and supportive care," he said.

In a year's time the new centre will house two cobalt-60 radiotherapy units, a linear accelerator machine, two brachytherapy suites, and other diagnostic and therapy equipment. The hope is to start treating the first patients in 2004. But fighting cancer in Zambia requires more than just supplying buildings and equipment. Most of Zambia's oncologists and radiotherapists have left the country seeking employment elsewhere. New staff must be trained in medical dosimetry needed for safe and effective treatment. The IAEA is helping to train medical physicists and radiographers for the new facility and providing expert advice on the safe and secure use of the equipment.

Zambia is not unique in its battle against cancer. For most of the developing world, the reality is overstretched health systems, where few cancer patients get screened, diagnosis comes too late or treatment is just not available. Meanwhile, Zambia's cancer patients continue to wait. For them and their families, the national cancer centre cannot come soon enough.

Childhood cancers are the greatest tragedy: roughly half are leukaemia and the other half solid tumours.

Training Radiotherapy Professionals

Radiotherapy treatment requires highly-trained personnel in a variety of interrelated disciplines. Indeed, the most important component of any radiotherapy programme is qualified personnel. Investment in equipment without concomitant investment in training is dangerous. It is important that training not only include practical details of individual procedures, but also how to design treatment approaches that are comprehensive, replicable, of high quality and safe. Successful treatment design and implementation requires that the hospital administration, physicians, physicists and other support staff work together with common standards and goals.

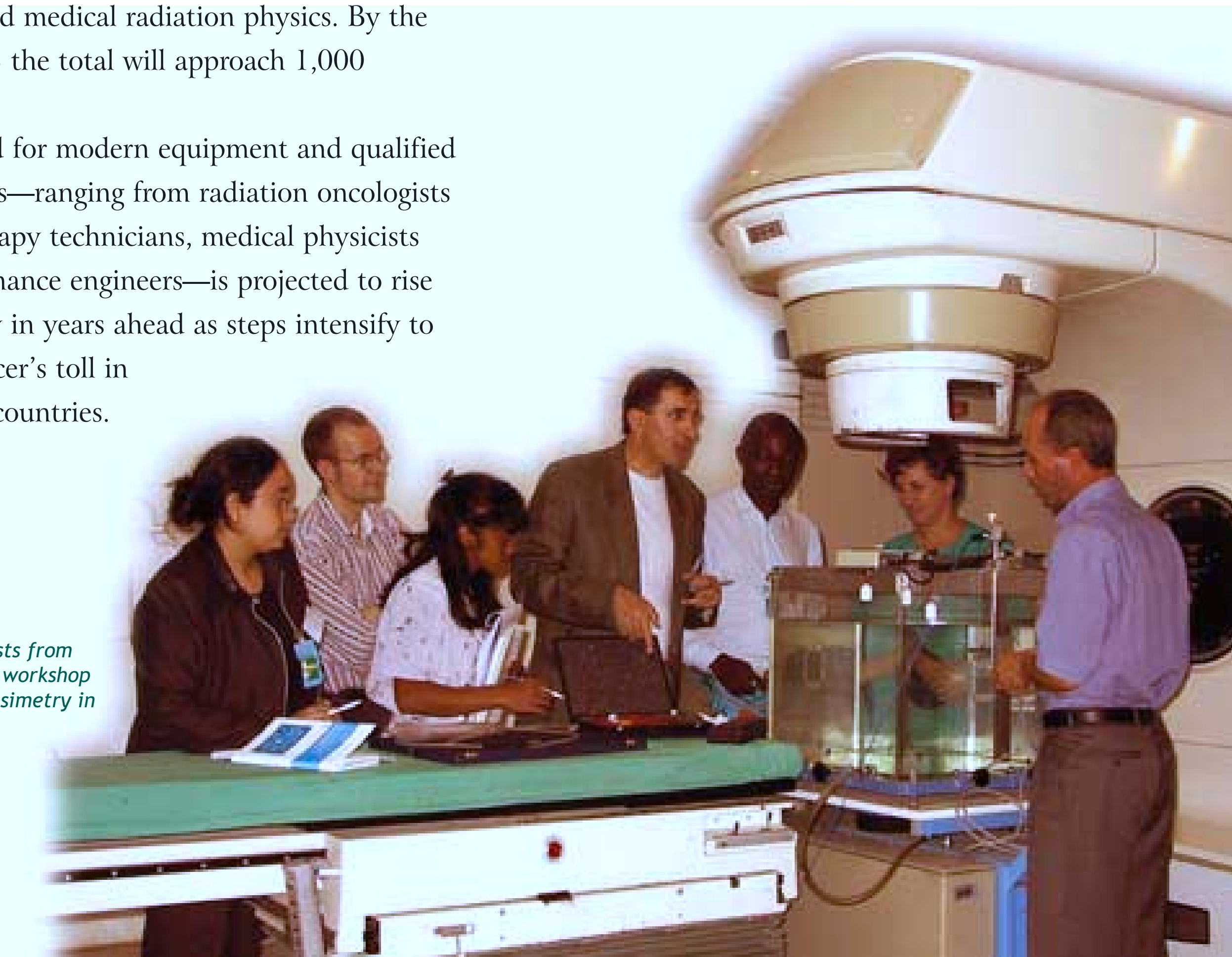
IAEA efforts focus on specialised training and continuous education of health care professionals involved in radiotherapy. Through an agreement with the European Society for Therapeutic Radiology and Oncology (ESTRO), professionals involved in IAEA projects in Europe have taken specialised courses in the fields of radiation oncology and medical radiation physics. By the end of 2003 the total will approach 1,000 trainees.

The need for modern equipment and qualified professionals—ranging from radiation oncologists to radiotherapy technicians, medical physicists and maintenance engineers—is projected to rise dramatically in years ahead as steps intensify to combat cancer's toll in developing countries.

Quality Assurance in Radiotherapy Treatment

Modern radiotherapy involves complex technology that requires precise application. Radiotherapy may harm a patient if applied without proper quality assurance (QA). The prescribed dose of radiation given to the tumour must be delivered accurately, and the dose to the surrounding normal tissue must be minimised. Imaging the cancer and immobilising the patient are very important for ensuring that the beam of radiation hits the cancer accurately, and a good treatment planning computer system is necessary for ensuring that the correct amount of radiation is delivered to the patient.

Comprehensive QA programmes should be in place at a radiotherapy department from the moment a patient enters until the treatment ends, and also continue through the follow-up period. The clinical aspects of radiotherapy (e.g. diagnosis, indications for treatment and monitoring the outcome) as well as the physical/technical aspects must be subjected to careful QA.



Medical physicists from Africa attend a workshop in Tunisia on dosimetry in radiotherapy.

The IAEA provides recommendations and guidelines for clinical, physical and technical aspects of QA, prepares training programmes and delivers courses for medical radiation physicists working in radiotherapy and fields experts for on-site assistance.

The physical and technical aspects of a QA programme include the regular control of equipment, dosimetry of radiotherapy beams, treatment planning procedures and treatment delivery. Internal quality control (QC) of equipment must be performed by the radiotherapy department; but external audits in dosimetry should be made by independent external bodies.

Ensuring Accuracy of Radiation Doses

The success of radiotherapy depends greatly upon the accuracy of the radiation dose delivered to the patient. Just as a kilogram should mean the same thing in different countries, the need for international traceability for radiation doses has been understood for decades. To help the Member States ensure accuracy of radiation doses delivered to patients, the IAEA and the WHO concluded a formal agreement in 1976 and established a network of Secondary Standards Dosimetry Laboratories (SSDLs).

A Secondary Standards Dosimetry Laboratory (SSDL) is a national laboratory that is linked to the international measurement system and which provides calibration services to end-users in the country. Through the central laboratory of the SSDL network located in Seibersdorf, Austria, the IAEA provides calibration services to its network members to ensure standardisation and harmonisation of radiation dosimetry.

Dosimeters ensure the accuracy of radiation treatment equipment.

Auditing Radiation Doses Worldwide

The IAEA, in collaboration with the WHO, was the first organisation to initiate dosimetry audits on an international scale in 1969, using mailed thermoluminescence dosimeters (TLD). WHO (or PAHO in Latin America and the Caribbean) takes care of mailing dosimeters to radiotherapy hospitals in different countries. These are irradiated by the hospital staff and sent to the IAEA. The dose received by the TLD is determined at IAEA's Dosimetry Laboratory and compared with the dose stated by the hospital staff. The IAEA is thus responsible for the technical aspects of this well-established programme for providing dose verification of radiotherapy beams. For hospitals with poor results, the IAEA establishes a follow-up programme for quality improvement, including on-site visits by local or international scientists, and provides support and training in medical physics to the hospital staff.

In 32 years, this IAEA/WHO TLD audit service has checked the calibration of more than 4,300 radiotherapy beams in about 1,200 hospitals worldwide.

Written by the IAEA Division of Public Information

Design: Iseman Creative, Inc. and Raymond Geary & Associates
(Alexandria and Richmond, Virginia, USA)

Photo credits. Petr Pavlicek/IAEA, Cover, pages 3, 5, 7, 10;
David Kinley/IAEA, pages 4, 11, 14; Peter Rickwood/IAEA, page 6;
Dean Calma/IAEA, back cover; all others are IAEA.

FOR FURTHER INFORMATION:
International Atomic Energy Agency
Division of Public Information
P.O. Box. 100, Wagramerstrasse 5,
A-1400, Vienna, Austria
Internet: http://www.iaea.org
Email: Official.Mail@iaea.org
Tel: +43-1-2600-0

IAEA
International Atomic Energy Agency

Printed by the IAEA in Austria, September 2003
IAEA/PI/A74 E/03-01531