

# No Time to Lose

by Massoud Samiei,  
Michael D. Rosenthal &  
David Kinley III



Petr Pavlicek/IAEA

## ***The IAEA Seeks Greater Resources to Fight Cancer in the World's Poorest Regions***

### **Kandy, Sri Lanka**

One hour inside the bustling hospital waiting room in Sri Lanka's second largest city is enough to explain the emerging cancer crisis in the developing world. 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 morning.

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 Wategama, 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. Wategama 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. Wategama, "50% are leukemia and 50% are solid tumours. Unfortunately, we still lack the state-of-the-art treatment equipment of the West."

Last year, over 25,000 new and treated cases of cancer were recorded in Sri Lanka, representing more than a 100% increase over the figures for a decade earlier. "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." Mr. Herath has received IAEA-funded training in operating treatment planning software, which helps accurately calculate the dose of gamma radiation on cancerous tumours.

The scarcity of facilities and trained personnel that causes Sri Lankans to suffer can likewise be found in Albania, Bolivia, El Salvador, Guatemala, Mali, Moldova, Nicaragua, Nigeria, Tanzania and most other developing countries. The acute shortage of cancer treatment capacity can also be witnessed in many of the former Eastern Bloc

nations. As IAEA Director General, Mohamed ElBaradei recently described the situation: “The IAEA has an important contribution to make to combating cancer in developing countries. Given the current lack of access to radiotherapy — as well as to nuclear medicine for diagnosis and treatment — we have no time to lose...only the lives that will be lost if we fail to act.”

Upgrading of Kandy General’s cancer treatment facilities began in 1998, with \$260,000 in project assistance from IAEA’s technical co-operation programme. This assistance helped the cancer unit to set-up a low-dose-rate brachytherapy system for treating cervical cancers, a fully equipped dosimetry laboratory and a facility to produce immobilization devices. The hospital’s computerized tomography (CT) and magnetic resonance imaging (MRI) scanners were linked to the newly acquired treatment planning system operated by an IAEA-trained specialist.

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

## A Silent Crisis

More than 10 million persons are diagnosed with cancer each year (not counting skin cancer). Over half of these cases occur in developing countries, where the cancer incidence is increasing dramatically. Nearly 16 million persons will probably be diagnosed with cancer in the year 2020, with almost all of the increase coming from developing countries. Globally, cancer kills more people than AIDS, tuberculosis and malaria put together.

Most poor countries remain seriously underserved with the therapies designed to save lives or at least improve their quality of life. Developing countries make up 85% of the world population, yet they have only about one-third of the total radiotherapy facilities — a small fraction of the estimated need.

The most common cancer in the world is lung cancer; the most common among women is breast cancer. Some 200,000 women in developing countries die each year from cervical 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. In Malaysia, breast cancer is the most common cancer to cause death in women. 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. In some cases, by way of screen-

ing patients, it is possible to diagnose cancers that are very small and have a high probability of successful treatment. 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 and 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

*The incidence of adult cancers and the demand for radiotherapy services is accelerating in the developing world.*



are available, and whether there are healthcare professionals qualified and trained to use them properly.

## 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 high energy 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 decay. Linacs are machines that can produce photons and electrons of various energies. Depending on their energy, the photon or electron beams can be used to destroy cancer cells near the surface 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.

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 including temporary or permanent loss of hair in the area being treated, skin irritation, temporary change in skin color in the treated area and fatigue.

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 combine 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 medical imaging with the aim of enhancing treatment accuracy while responding to Member States requests for support.

## Improving Cancer Management in Developing Countries

The IAEA is stepping up efforts to help more patients survive cancer through earlier diagnosis and better treatment. As the cancer burden mounts in developing countries, many more doctors, nurses, and skilled personnel will be needed, as well as necessary equipment. Through IAEA supported projects, some institutes in developing Member States are better prepared to help patients beat cancer.

But equipment alone will not solve the problem, and establishing new treatment facilities is a long process that requires strong governmental support. It involves staff training (up to four years for a radiation oncologist and two years for a medical physicist), facility planning and construction, equipment specification and procurement, installation, acceptance testing and commissioning, registration and licensing, designing protocol and procedure manuals, and development of quality control programmes prior to initiating treatment. Typically, up to five years may be needed to complete all phases. However, in many cases improvements in existing facilities can lead to significant increases in patient treatment in much less time.

The IAEA continues to address this enormous task and is currently involved in helping to upgrade radiotherapy facilities, train staff and establish quality assurance programmes in approximately 100 countries worldwide through national and regional projects.

Some 15 African nations and several in Asia lack even one radiotherapy machine. Ethiopia, with a population of over 70 million, has just one such machine. Many other developing countries have far less treatment capacity than needed. With Agency support, modern radiotherapy facilities, the first of their kind, have been set up in several countries including Ethiopia, Ghana, Namibia, Tanzania, Uganda, and Mongolia, while Nigeria has established its fourth center. Currently other countries receiving support to initiate radiotherapy include Angola, Haiti, Yemen and Zambia.

In Tanzania, Agency assistance has recently led to improvement of radiotherapy through provision to the Ocean Road Cancer Institute (ORCI) in Dar Es Salaam of a therapy simulator and dosimetry equipment, including a complete quality control kit for evaluation of imaging parameters of a simulator. Recognizing the crucial role of ORCI in the fight

# IAEA's Life Saving PACT

Radiation therapy has a fundamental role to play in cancer treatment – it saves lives and relieves pain. It is a mature technology, and evidence shows that it is appropriate for at least 50% of cancer patients.

However, radiation therapy is not available for most cancer patients in developing countries. Because treatment capacity is lacking, each day thousands of cancer patients go without the radiotherapy necessary to save their lives or relieve their pain.

In recent years the international community has focused on the need to take concerted action to address the health needs of developing countries. At the World Summit on Sustainable Development, health was identified as one of the five core areas in which progress is sought. The Millennium Declaration emphasized the importance of reducing the burden of disease, recognizing that this goal fits squarely in the framework of achieving sustainable development and eliminating poverty.

In this context and against the background of large and rapidly increasing rates of cancer in the developing world, in June 2003 the World Health Organization (WHO) and the International Union Against Cancer (UICC) issued a call for action “through concerted efforts by all sectors to prevent and treat cancer throughout the world.”

They challenged “international organizations, governments, institutions and individuals from all sectors, public and private, to work together to reverse the trends by addressing common risk factors, providing recommended

against cancer in the country, the Government has made one million dollars available for the further development of the facility and for ORCI to double its capacity for treating patients.

IAEA assistance is also provided for strengthening teaching in radiotherapy at both the undergraduate and graduate levels. This entails establishing a national educational and training programme for radiotherapy technicians and registers, and therapy radiographers.

Projects in southeastern Europe and the former Soviet Union are assisting countries emerging from years of conflict and economic hardship. In most cases, these countries retained medical expertise but needed to rebuild or upgrade their facilities. IAEA activities have ranged from simple interventions such as providing a treatment planning system to completely revamping a department with strong governmental support.

treatment, and planning effectively at national and regional levels.”

Can this call for action be answered? Yes, but only through concerted efforts. Among international organizations, the IAEA has a unique mandate — to “accelerate and enlarge the contribution of atomic energy to peace, health, and prosperity throughout the world.”

The IAEA has strong technical expertise and unrivalled experience in responding to the need for safe, effective and sustained implementation of radiotherapy services around the world. Its experience demonstrates that radiotherapy technology can be transferred successfully to less developed countries.

*Each day thousands of cancer patients go without the radiotherapy necessary to save their lives or relieve their pain.*



In Bosnia and Herzegovina, for example, the Nuclear Medicine and Oncology Institutes of the Clinical Centre of Sarajevo University Hospital were revived and modernized with IAEA support. At the Oncology Institute, a cobalt-60 unit was procured increasing the possibility of treatment via external beam therapy, and the sources for the brachytherapy unit were provided.

Through provision of dosimetry and quality control equipment, in addition to organizing staff training, a quality assurance programme was established that allows treatment of radiotherapy patients according to internationally accepted standards. Being the only radiotherapy centre in the country, the Institute treats 1,600 cancer patients per year, about one third of the estimated 5,000 cancer patients in the country.

In the FYR of Macedonia, the government recently launched a programme of upgrading radiotherapy services

However, IAEA resources are inadequate to respond effectively to the looming crisis posed by the increase in cancer in developing countries. Meeting needs at present levels would cost hundreds of millions of additional dollars, far more resources than the IAEA can provide. These needs are projected to increase by more than 50% over the next 15-20 years.

To respond effectively to this challenge and to the call for action by WHO and UICC, the IAEA has developed a Programme of Action for Cancer Therapy (PACT). PACT responds to the needs of developing countries by addressing the legal, regulatory, technical and human resources needed to establish, improve or expand radiotherapy treatment programs in the context of national cancer control strategies and according to the priorities and needs of the countries and regions concerned.

PACT seeks to (1) build a coalition of interested parties who are committed to addressing the challenge of cancer in developing countries in all aspects, with a particular emphasis on cancer therapy; and (2) mobilize resources from charitable trusts, foundations and others in the public and private sectors for the benefit of cancer patients.

In addition to raising resources for radiotherapy treatment centres, PACT will respond to the most frequent problems encountered by developing countries. In particular, in order to assist Member States to analyse options and put in place cancer diagnosis and therapy programmes appropriate to their needs in the context of national cancer control strategies, PACT will seek to:

- ◆ Raise public awareness;
- ◆ Strengthen national programmes for cancer control;
- ◆ Enable Member States to design and support sound policies and projects for applying radiotherapy appropriate for their needs;
- ◆ Establish radiotherapy centers with adequate radiation safety and protection programmes;
- ◆ Establish centres of excellence in developing countries for training and research in radiotherapy; and
- ◆ Build strategic partnerships promoting cancer therapy.

Over the past 25 years, the IAEA has contributed some \$150 million to cancer diagnosis and therapy facilities and training in the developing world. These donations have been more than matched by contributions from the recipient Member States enabling many of them to establish for the first time safe and effective radiotherapy treatment capabilities.

Over the next decade, the IAEA estimates that several billion dollars will be needed to provide adequate treatment facilities in the developing world — half to purchase machines, and half to train the physicians and physicists required to ensure safe and effective treatment. PACT's ultimate goal is to fill this tremendous resource gap and bring relief to millions of cancer sufferers throughout the developing world.

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For more information on PACT, please contact Mr. Massoud Samiei, Programme Manager (PACT@iaea.org) or visit the IAEA website: [www.iaea.org](http://www.iaea.org).

in the country by providing the only institute of oncology with two accelerators, a computer tomography simulator, a treatment planning system, equipment for dosimetry and a network system linking these components used in conjunction for radiotherapy. As a complementary activity to support Macedonia's national development priority in the field of health, the IAEA provided a high dose rate brachytherapy unit as well as training for doctors, physicists and technicians. As a result, the institute now has the capacity to provide comprehensive treatment, including for gynecologic malignancies, lung tumors and prostate.

In Asia, the increasing demand for cancer diagnosis and treatment led the Banjarmasin Provincial Authority to establish the first radiotherapy centre on Borneo Island, Indonesia. With IAEA support, the centre was established at the Ulin General Hospital. Civil work is in the final stage, with a contribution of more than \$250,000 by the local authorities to support the facility. The IAEA will provide

the centre with a new cobalt-60 radiotherapy machine to start treatment. To ensure safe and effective operation of the facility, training of personnel is continuing. The local government has demonstrated strong commitment and cooperation, which is the key factor for success and sustainability of the efforts.

The Agency also supports regional initiatives for cooperation among developing countries. Under the AFRA (African Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology) agreement, eighteen 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. Similar initiatives are underway in Latin America involving ARCAL countries (IAEA's Regional Cooperative Arrangements for the Promotion of Nuclear Science and Technology in Latin America) and fostering cooperation

# Guatemala

**Guatemala City:** Among the wan faces in the crowded cancer ward at Guatemala City's Liga Nacional Contra el Cancer Hospital, Lydia Xon and her husband Rogelion stand out as vividly as polychromatic figures against a black and white background. Four months ago the 38-year-old mother of four came to the charitable institution with a malignant tumour of the cervix.

She has been treated with teletherapy and brachytherapy, the first technique directing radiation at the tumor from outside her body, the second inserting tiny radioactive sources directly into the tumour. Today she's back for a routine check up. Her physician Dr. Miguel Ortega, a radiation oncologist, has given her a clean bill of health with which to return to her village of Coban in Alta Vera Paz in the country's Mayan hinterland.

"This is wonderful news for me and my family," Lydia Xon, a housewife says. "I'm very happy," says her beaming husband, a book salesman.

But many women from Guatemala's rural population with cervical cancer will not share Lydia Xon's outcome. Dr. Ortega says, in part, that's because there's a reluctance to come to the capital city, the only location where radiotherapy treatment is available. Delayed diagnosis and treatment—particularly of cervical cancer, of which there is a very high incidence in Guatemala, where little screening for early detection is practiced—reduces a patient's chances for survival.

In most northern countries, Pap smears and prompt treatment have seriously reduced the odds that cervical cancer will cause a woman's death.

In a wheelchair beside Dr. Ortega, a 59-year-old woman, palsied and confused, awaits treatment. "Hers is a very advanced case of cervical cancer. We are doing palliative treatment but her chances of survival are not very good," Dr. Ortega says.

"People from small villages don't like coming here (to Guatemala City) — they are fearful. As a result they delay seeking diagnosis and treatment," the physician says.

Guatemala's mostly Mayan rural population, whose culture and language separate them from the ways of the capital, also bring an entourage of relatives with them when they come to Guatemala City for medical treatment.

"They don't understand," says Oscar Tobar, manager of the cancer institute. "Frequently we make collections to help them, because based on their ability they have to pay a token fee. But in 2003 our funding from government was cut and we had to tighten our belts. The final result is that some people say I can't come back because I don't have money, and they go home to die."

Through its technical cooperation and research programmes, the IAEA is supporting Guatemala in its efforts to help more cancer patients and improve health care.

— Peter Rickwood, IAEA staff report.

between radiation oncologists and medical physicists to enhance the cure rates of cancer.

In response to the rapidly rising rates of cancer in developing countries, and based on its solid technical and managerial experience in working in developing countries over the past 30 years to develop and deploy essential elements of a sound cancer management programme, the IAEA has established the Programme of Action for Cancer Therapy (PACT). PACT will improve cancer treatment in developing nations where the unmet demand for radiotherapy and other cancer treatments is significant (*See box, page 30*). The vision of PACT is to ensure that the essential facilities and skilled personnel for cancer therapy are in place to care for all patients for whom radiation therapy is part of their recommended treatment. PACT's mission is to help developing countries in accordance with their priorities

and needs to establish, improve, or expand radiotherapy treatment programs in the context of sound national cancer control strategies, including integrated prevention and treatment approaches. IAEA support for nuclear medicine complements and enhances the value of radiotherapy services. The IAEA is uniquely placed to take the lead to seek and direct funds from a wide range of traditional and non-traditional donors to further enhance its delivery of cancer treatment technologies and related diagnostic techniques to developing countries within the scope of their national programmes.

*Massoud Samiei is the Programme Manager of the IAEA-PACT initiative; Michael D. Rosenthal works in the IAEA Department of Nuclear Sciences and Applications; and David Kinley III works in the IAEA Division of Public Information.*