Human Health

Objective

To support Member States in enhancing their capability to address needs relating to nutrition and the prevention, diagnosis and treatment of health problems through the development and application of nuclear and related techniques within a quality assurance framework.

New Agency Medical Imaging and Nuclear Medicine Global Resources Database (IMAGINE)

The Agency's new IMAGINE database is the first comprehensive global database on medical imaging and nuclear medicine. Developed in 2020, it contains detailed information from over 170 countries and territories on the availability of medical imaging and nuclear medicine equipment, and of human resources for both modalities (Fig. 1).

Using maps and graphs to display its findings, IMAGINE provides valuable information to support strategic planning in Member States and to better plan the Agency's assistance for and advice on addressing health needs through the appropriate use of radiology and nuclear medicine.

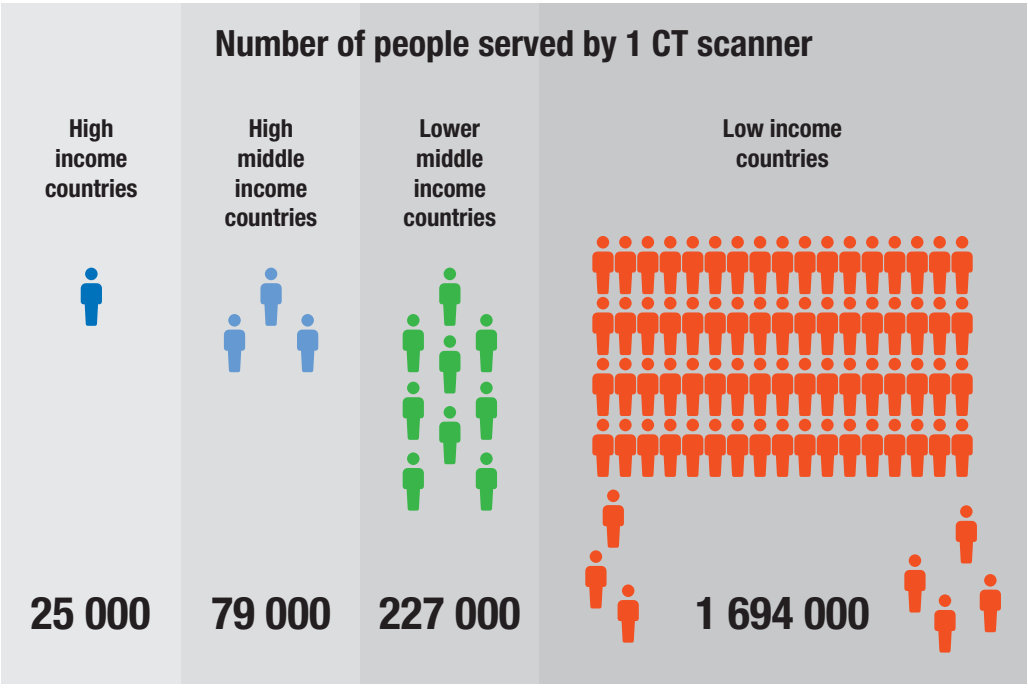


FIG. 1. The IMAGINE database contains detailed information on the availability of medical imaging equipment from over 170 countries and territories.

New Research Agenda on Diet Quality in the Context of Climate Change

In 2020, the Agency developed a framework to enable the adoption of a 'seed to fork to human health' food system value chain to better understand the links between climate change, food systems, diet quality and human health outcomes. Critical entry points for nuclear techniques are plant breeding; soil and water management; crop nutrient composition; and nutrient absorption and related nutritional and health outcomes such as body composition, breast milk output and individual nutrient status. Moreover, by taking advantage of an ongoing Agency coordinated research project, nuclear techniques may also help generate data on true protein digestion and improve understanding of the impact of climate change on gut function. A breath test under validation will enable the diagnosis of environmental enteric dysfunction, a disorder linked to growth failure in low and middle income countries.

United Nations Joint Global Programme on Cervical Cancer Prevention and Control

In addition to the work done in partnership with the World Health Organization, in 2020 the Agency continued to develop evidence to help Member States fight cervical cancer. An ongoing coordinated research project on the implementation of image guided brachytherapy gathered additional data on the global availability of brachytherapy. The data will be used to calculate the differences between the optimal and actual brachytherapy utilization rates to guide investment efforts in Member States. Qualitative methods to identify barriers to and facilitators of brachytherapy implementation in Member States are also being used. A planned costing exercise will analyse the budget impact of implementation and identify financing gaps. The results of this project will assist policy making in Member States.

Assistance to professionals in Member States included a virtual workshop on the use of brachytherapy in the treatment of cervical cancer, and work began on a comprehensive e-learning module on the topic. Guidelines for best practices were disseminated and access to e-contouring licenses was provided to participating professionals.

New High Dose Rate Brachytherapy Facility at the Dosimetry Laboratory

Following calibration of the Agency dosimetry standards and the development of appropriate safety and quality management system procedures, the first calibration certificates were issued to secondary standards dosimetry laboratories in Member States. This will enable the laboratories to calibrate the dosimeters used by hospitals to calibrate their own high dose rate brachytherapy units, thus ensuring optimized and safer treatments for patients. A new coordinated research project to develop an audit methodology for high dose rate gynaecological brachytherapy was initiated. This research, which seeks to advance the quality of care for cervical cancer patients who undergo brachytherapy treatment, is facilitated by the recently installed treatment planning system for the high dose rate brachytherapy unit at the Agency's Dosimetry Laboratory in Seibersdorf.

SPECT/CT Atlas of Quality Control and Image Artefacts

SPECT–CT (single proton emission computed tomography–computed tomography) technologies provide a wealth of diagnostic information; however, it is important that practitioners understand the principles of image formation and be fully aware of the

potential pitfalls and image artefacts that can be encountered in clinical practice. A new Agency publication entitled *SPECT/CT Atlas of Quality Control and Image Artefacts* presents an overview of these potential pitfalls as well as the quality control procedures and standards required in SPECT–CT. Figure 2 provides an example of the 39 well illustrated case studies demonstrating image artefacts from different sources, ranging from hardware malfunctions to user- and patient-induced artefacts. In addition, descriptions are given of their causes and the techniques used to identify them and avoid their recurrence. The Atlas will support the continuous improvement in the quality of SPECT–CT imaging scans that is sought by professionals in the field and improve the likelihood of reaching the correct clinical diagnosis.

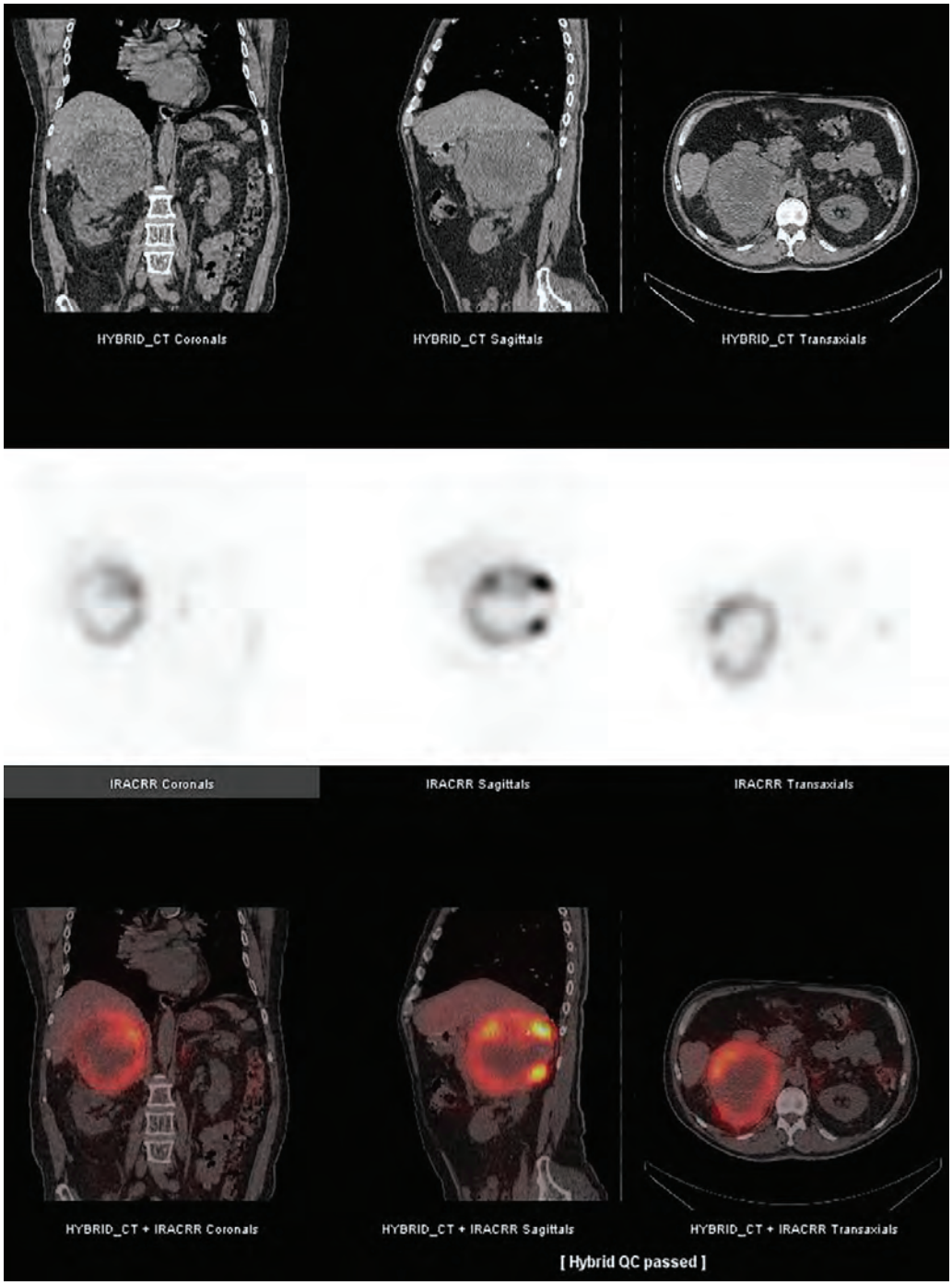


FIG. 2. CT images of a patient (top), SPECT images of the same patient (middle) and SPECT–CT images fused with each other (bottom), showing how the hybrid technologies complement each other to provide more information for a nuclear medicine physician to arrive at a diagnosis. (Photograph courtesy of J. Dickson, University College London, United Kingdom.)

CASE STUDY

Accurate Dosimetry for Quality Cancer Care

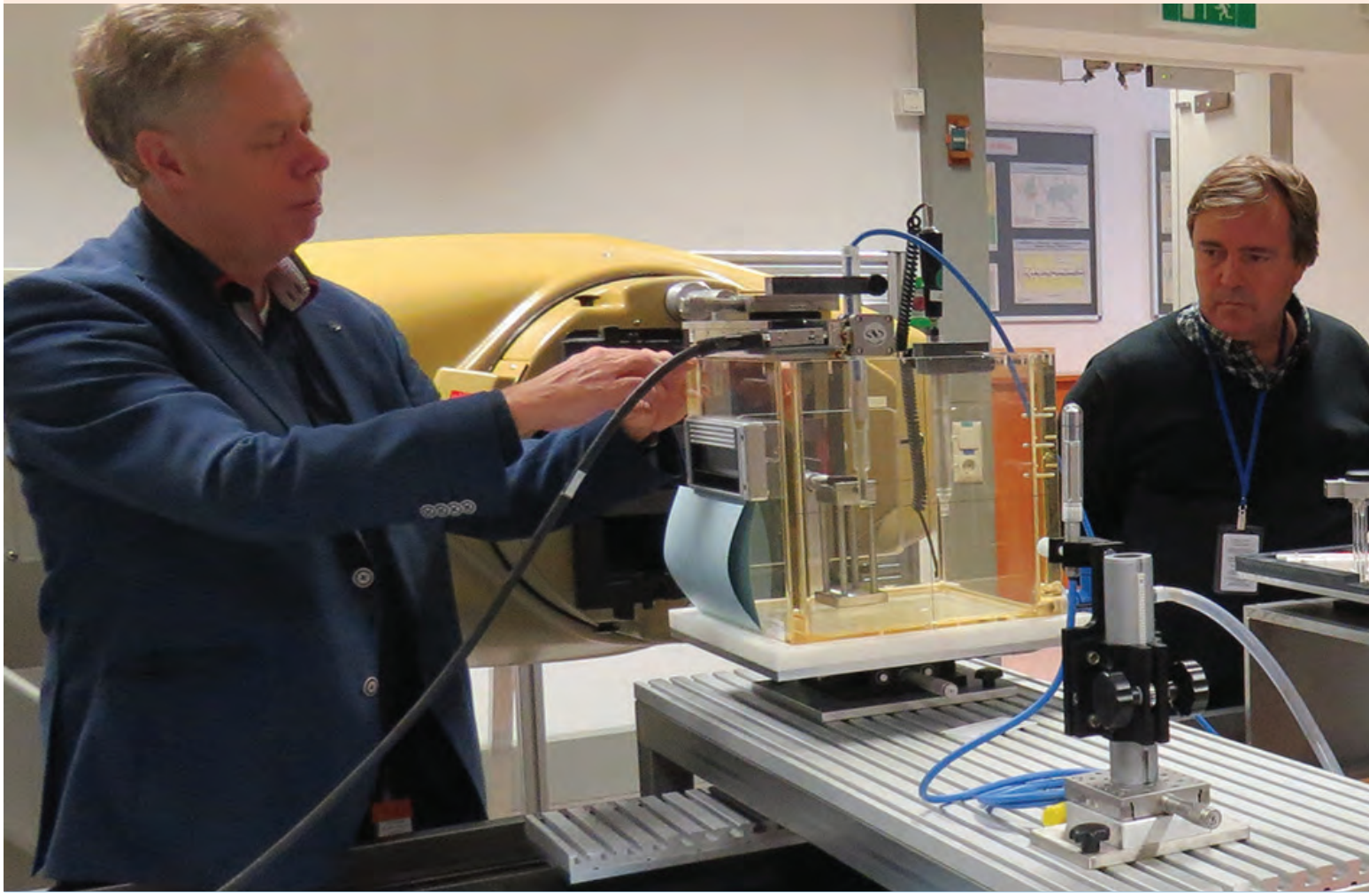
More than half of cancer patients require radiotherapy at some point during their treatment. The outcome of treatment can change significantly if the amount of radiation differs by even as little as 5% from the intended radiation dose. To provide patients with highly accurate doses of radiation, it is essential that measurement equipment be set up and operated properly — a task the Agency has been coordinating for decades.

"Accurate dosimetry is a crucial part of radiation therapy," said Sibusiso Jozela, Section Head of Dosimetry Standards at the National Metrology Institute of South Africa. "If the radiation dose is too low, the cancer might not be cured, and, on the other hand, if it is too high, it can have harmful side effects."

Radiation doses are measured using specific equipment called dosimeters. To ensure accurate dosimetry, and ultimately accurate dosage, measuring equipment needs to be calibrated regularly. This is done by cross-checking the devices' performance against national reference standards maintained by national calibration laboratories, such as secondary standards dosimetry laboratories (SSDLs).

A network of SSDLs was set up by the Agency and the World Health Organization (WHO) in 1976 to help countries improve accuracy in dosimetry. Currently this network comprises 87 SSDLs, located in 74 countries, that provide calibrations for dosimeters. The objective of the IAEA/WHO SSDL Network is to improve accuracy and consistency in radiation dosimetry and to promote cooperation among countries.

"Training and sharing skills are vital for this field, as technology is developing very quickly," Jozela said, adding that "some developing countries are only now establishing



The Agency's Dosimetry Laboratory, in Seibersdorf, Austria, provides practical training in how to perform accurate calibrations for dosimetry.

their own national calibration laboratories, and the SSDL Network provides the precise support required."

The Agency's Dosimetry Laboratory in Seibersdorf, Austria, acts as the central laboratory of the SSDL Network. The measurement standards of countries are calibrated, free of charge, at the laboratory, particularly for countries that do not have direct access to primary standards dosimetry laboratories, which are laboratories that establish quantities used for radiation dose measurements.

The Dosimetry Laboratory also provides postal dosimetry audit services to calibration laboratories and for more than 3400 medical linear accelerators (linacs) in hospitals in low and middle income countries. Linacs — machines that use electricity to create beams of high energy X rays or electrons — are most commonly used for treating cancer with radiotherapy. In 2020, 620 hospitals and 89 dosimetry laboratories participated in the postal dosimetry audit. The Agency is also helping to ensure that quality diagnostic imaging and radiation treatment are available to promote the health of women and girls. It supports an initiative to reduce deaths from cervical cancer by 30% by 2030 in participating countries. The Agency is working within the United Nations Joint Global Programme on Cervical Cancer Prevention and Control as one of seven United Nations agencies conducting joint inception missions, resulting in joint workplans that stretch all the way from prevention to diagnosis, treatment and palliative care. As a continuation of this collaboration, the Agency is cooperating with WHO within the framework of the recently launched WHO global strategy to accelerate the elimination of cervical cancer as a public health problem; one of the targets aims at ensuring that, by 2030, 90% of women identified with cervical disease receive treatment.