

3.3 Promote the effective use of ionising radiation in medicine

The exposure of patients to ionising radiation for effective diagnosis and treatment continues to grow in Australia. It is important that, when medical equipment that involves ionising radiation is used, the benefits are balanced against the risk (justified), and the lowest dose necessary is given to provide the diagnostic information (optimised). Likewise, in therapy it is necessary that the right radiation exposure is delivered in the right place, since even small deviations may be detrimental to health.

Justification and optimisation are the core principles for radiation protection. The objective of ARPANSA is to ensure these principles are taken into consideration by medical professionals to minimise the risk to patients.

In 2014-15, ARPANSA continued to promote the safe and effective use of ionising radiation in diagnostic imaging. We conducted dose surveys to monitor radiation doses from computed tomography and established establishment of diagnostic reference levels (DRLs) for interventional cardiology and radiology and nuclear medicine.

ARPANSA also participated in a project under a Memorandum of Understanding (MoU) with the Department of Health to improve the safety and quality of diagnostic imaging in Australia. Through this MoU ARPANSA provided direct technical specialist support to the Australian Commission for Safety and Quality in Healthcare regarding the paediatric doses from CT. Additionally ARPANSA developed an online training module to assist in the education of the referrers reading the risk associated with ionising radiation exposure incurred through diagnostic imaging.

Medical imaging

Of more than 15 million medical procedures involving ionising radiation that Australians undergo each year, most are diagnostic imaging procedures. The radiation exposure from diagnostic imaging is the largest source of exposure from ionising radiation to the Australian population and it is dominated by exposures from computed tomography (CT). The medical exposure of the population is increasing despite improvements in technology allowing procedures to be done with lower doses because of the increasing number

of procedures and the increasing complexity and capacity afforded by modern technology. ARPANSA has a responsibility to estimate the radiation doses to the Australian population from radiological procedures and use this information to inform practitioners concerning their responsibility for the appropriate justification of referrals.

The Diagnostic Reference Level Survey is an ongoing program which determines the distribution of doses delivered from common diagnostic imaging procedures. Diagnostic imaging procedures should provide images of adequate diagnostic quality obtained with equipment and protocols which have been optimised for the radiation protection of the patient. Evaluation of the dose distributions provides the baseline which is used for optimisation of dose management. The data allows Australian doses to be compared with those of other countries and for the setting of national DRLs. The latter are used as indicative benchmarks for comparative radiological practices. Comparison of DRL data for CT collected in 2011 against 2014 data shows a reduced patient dose for CT with the introduction of iterative reconstruction technology; while for CT systems that do not utilise this technology, doses remain constant or slightly increased. The National DRL Database is gradually being populated with a larger practice dataset. There are approximately 270 (30%) of national computed tomography practices registered with over 2500 surveys completed since August 2011. The National DRL project has successfully implemented new surveys for nuclear medicine and image guided interventional procedures. National DRLs for these new modalities are expected to be published by the end of 2015. Presentations and publications have been delivered to distribute DRL information to the relevant stakeholder and professional groups.

Radiotherapy calibrations

ARPANSA provides calibration services for instruments used to measure radiation in various commercial, medical and public sector applications. The service is used where accurate knowledge of the radiation dose is important. This is especially so in radiotherapy, where even small discrepancies in dose prescriptions can have an effect on patient outcome. This year, 18 therapy



Attendees at the inaugural Practical Reference Dosimetry Course for medical physicists

dosimeters, 40 radiation survey meters, and two neutron monitors were calibrated. Air kerma rate measurements were made on site for three clients. A new calibration service using linear accelerator beams was implemented for seven clients.

Practical reference dosimetry course

The first ARPANSA course in reference dosimetry for medical physicists was conducted 21-24 April 2015. Fourteen trainees and a few senior physicists attended ARPANSA for a mix of lectures, dosimetry measurements and example calculations. The feedback was positive, particularly for the ionisation chamber calibration and small field dosimetry practicals. This was the first time ARPANSA has organised such an event.

Ensuring dose measurement capability for Australia

ARPANSA is authorised by the National Measurement Institute (Australia) to maintain primary standards for the measurement of radiation dose. As a condition of this authorisation, ARPANSA must maintain quality assurance programs, regularly participate in international comparisons of radiation

dose, and liaise with the users of the ARPANSA dose standards. This year ARPANSA published the results of one comparison with Japan, and published three articles detailing the methods used to provide absorbed dose to water values, quality control programs and the implications of small changes to absorbed dose in Australian radiotherapy.

Synchrotron dosimetry

ARPANSA has an ongoing collaboration with the Imaging and Medical Beamline (IMBL) at the Australian Synchrotron to determine the radiation dose rate in their beams. This collaboration will provide the beamline with dosimetry traceability, a prerequisite if the beam is to be used on patients. The collaboration has recently made possible novel research on the way detectors of radiation work. The synchrotron is capable of producing very small, high intensity beams. Using these beams, ARPANSA and IMBL staff were able to map the response of the chamber as function of the position of the beam. Measurements such as these help understand how the detectors work, and will eventually lead to more accurate radiation measurements thereby increasing patient safety and treatment quality.

The Australian Clinical Dosimetry Service

In late 2014, the Australian Government approved two years funding for the Australian Clinical Dosimetry Service (ACDS) to transition from a federally funded program to explore funding options for an ongoing service post calendar year (CY) 2016. Subsequently a Memorandum of Understanding (MoU) was signed between the Department of Health and ARPANSA which formalised the auditing and stakeholder requirements to the end of CY 2016. Meeting the Minister's directive, the ACDS has increased its stakeholder engagement and initiated a hiring and training program to meet the requirement of the MoU.

Radiation Protection of the Patient Referrer Training Module

In 2013-14, ARPANSA committed to develop a multi-platform referrer education module to meet an identified shortfall in knowledge regarding radiation risk to a patient undergoing a diagnostic imaging procedure. The 2014-15 financial year saw the full development of the Radiation Protection of the Patient module with the penultimate draft being successfully presented to the Australian Commission on Safety and Quality in Health Care Project Reference Group. A number of key professional organisations have agreed to host the finalised module and negotiations are ongoing to include the module in tertiary institutions' undergraduate and postgraduate training programs.

Performance against deliverables

Key Performance Indicator

Key Performance Indicator	Introduce and establish DRLs as tools for quality improvement in diagnostic radiology for interventional cardiology and radiology, and Nuclear Medicine
2014-15 Reference Point	Evidence of increased awareness of the need to optimise radiation dose (i.e. quality improvement) by use of the Diagnostic Reference Level Service
RESULT	The Multi Detector Computed Tomography DRL survey has shown that the introduction of iterative reconstruction technology has significantly decreased patient doses. Facility registrations have reached 30% and the number of compliant surveys is more than 2500. The requirement for facilities to undertake DRL evaluation has been introduced into the Diagnostic Imaging Accreditation Scheme.