Update to Australian National Diagnostic Reference Levels for Adult and Paediatric CT

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The Australian National Diagnostic Reference Levels (DRLs) for Computed Tomography (CT) were updated and published in July 2025. The updated DRLs reflect modern medical imaging techniques and technology, and include more representative DRLs for paediatric CT. This article discusses the revised adult and paediatric CT DRLs calculated using data submitted from over 600 facilities to ARPANSA's National Diagnostic Reference Level Service (NDRLS) and international publications. The new paediatric DRLs include age- and weight-based bands, offering clearer benchmarks for imaging practices nationwide.

What are DRLs?

DRLs act as benchmarks for medical imaging practices, indicating typical radiation doses for standard procedures. They are not dose limits but rather reference points to alert facilities that may be exposing their patients to a higher dose than necessary. The DRLs are established as the rounded 75th percentile of the distribution of median radiation doses (known as facility reference levels or FRLs) delivered by each scanner for each scan type. This means that if a facility regularly delivers a dose above the DRL, they are delivering a dose higher than three quarters of their Australian imaging provider colleagues. Radiation dose metrics used as DRLs for CT are Volume Computed Tomography Dose Index ($CTDI_{vol}$) and Dose Length Product (DLP).

It's crucial for facilities to maintain diagnostic image quality whilst considering and comparing radiation doses to the national DRLs, balancing the need for diagnostic information and patient safety.

The ARPANSA NDRLS: How It Works

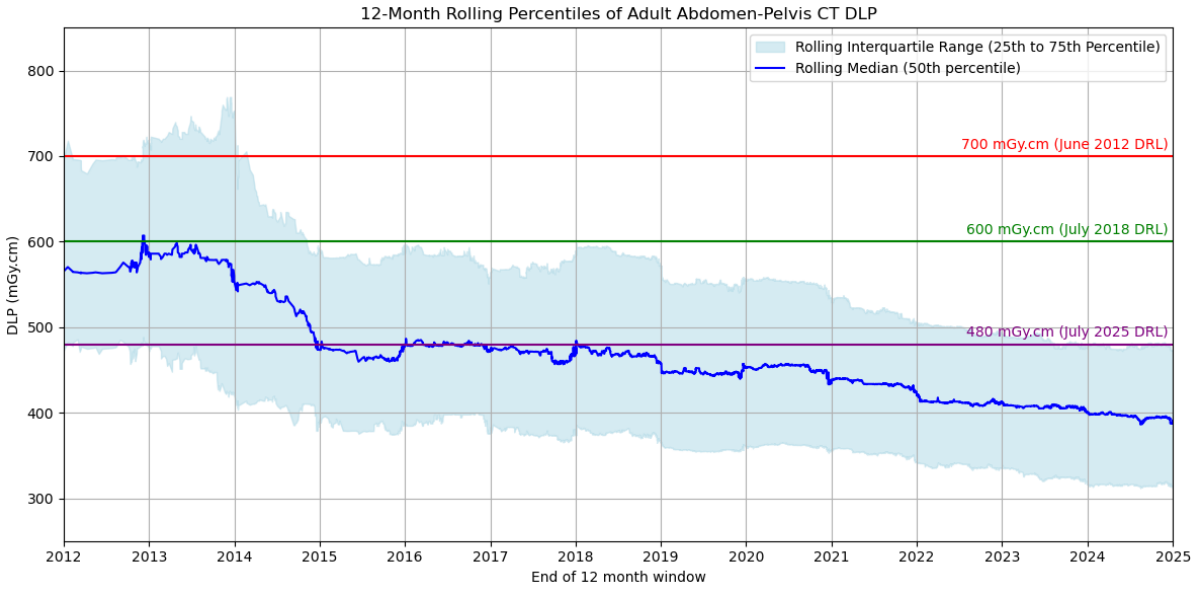
ARPANSA's NDRLS collects data from facilities nationwide to establish and maintain national DRLs. In return for submitting data to the NDRLS, participating facilities receive reports comparing their radiation doses with the current national DRLs, which in turn provides proof of the facility's compliance with Section 3.2.15 of RPS C-5, the Code for Radiation Protection in Medical Exposure (2019), and Standard 3.2 of the Diagnostic Imaging Accreditation Scheme (DIAS). Facilities submit surveys for various widely used CT scan protocols, providing data on technique parameters, patient demographics (age,

sex, and weight), and radiation dose metrics (CTDIvol and DLP). The NDRLS supports ongoing monitoring and updates of reference levels to reflect contemporary practice and technologies.

Why Update the DRLs?

The International Commission on Radiological Protection (ICRP) recommends reviewing and updating DRLs periodically as techniques and technology evolve and diagnostic radiation doses change[1]. Data collected through the NDRLS have shown a reduction in radiation dose required for a variety of scan types (see Figure 1 for example), demonstrating the effect of improved reconstruction techniques and detector technology of modern CT equipment[2,3]. The update to the DRLs ensures that they remain relevant and effective in promoting patient safety and optimal imaging standards.

Figure 1: Twelve-month rolling percentiles of DLP values for adult abdomen-pelvis CT scans (2012–2025). The shaded band shows the interquartile range. Historical and current DRLs are shown as coloured horizontal lines.



2025 Updated Australian DRLs

Updated CT DRLs for Adults (15+)

The updated adult DRLs, shown in Table 1, are based on the data submitted to the NDRLS in 2023. Additional scan categories for paranasal sinuses and low-dose CT (LDCT) chest for lung cancer screening have been added to the previous 8 scan regions. These were added due to their current or anticipated prevalence and contribution to the collective dose to the Australian population.

Table 1: Updated Australian National DRLs for Adult CT

Scan Region	$CTDI_{vol}$ (mGy)	DLP (mGy.cm)
Head^	45	820
Paranasal Sinuses^*	12	160
Cervical Spine	18	390
Soft-Tissue Neck	13	380
Chest	8	310
Low-dose CT (LDCT) Chest*	3	90
Abdomen-Pelvis	10	480
Kidney-Ureter-bladder	8	380
Chest-Abdomen-Pelvis	9	760
Lumbar Spine	20	570

^ Dose metrics are based on the 16 cm PMMA reference phantom, all other cases are based on the 32 cm PMMA reference phantom

* New scan categories will be reviewed once sufficient Australian data is collected

Updated Paediatric CT DRLs

The updated paediatric CT DRLs are shown in Tables 2-4. Aligning with ICRP recommendations[1], the new Australian paediatric DRLs for head CT scans are established for several age bands whilst those for body CT scans, including chest CT and abdomen-pelvis CT, are established for several weight bands. This approach more closely reflects the variation in dose delivered to patients of different sizes, where protocol adjustments are crucial for dose optimisation. Utilising age- or weight-appropriate scan parameters ensures that children receive the minimum radiation dose necessary for an accurate diagnosis.

The updated Australian paediatric DRLs are based on data submitted to the NDRLS from 2018-2023 and published international DRLs[4,5].

Table 2: Updated Australian National DRLs for Paediatric Head CT Scans

Scan Region	Age Bands	CTDIvol (mGy)*	DLP (mGy.cm)*
Head	0 - < 3 months	15	220
	3 months - < 1 year	19	320
	1 year – < 5 years	22	400
	5 years – < 10 years	29	510
	10 years – < 15 years	39	700

*Dose metrics are based on the 16 cm PMMA reference phantom

Table 3: Updated Australian National DRLs for Paediatric Chest CT Scans

Scan Region	Weight Bands	CTDIvol (mGy)*	DLP (mGy.cm)*
Chest	0 kg - < 5 kg	1.0	20
	5 kg – < 15 kg	1.4	40
	15 kg – < 30 kg	2.4	70
	30 kg – < 50 kg	3.2	110
	50 kg - < 80 kg	4.6	180

*Dose metrics are based on the 32 cm PMMA reference phantom

Table 4: Updated Australian National DRLs for Paediatric Abdomen-Pelvis CT Scans

Scan Region	Weight Bands	CTDIvol (mGy)*	DLP (mGy.cm)*
Abdomen-Pelvis	0 kg - < 5 kg	1.4	40
	5 kg – < 15 kg	2.1	70
	15 kg – < 30 kg	3.3	150
	30 kg – < 50 kg	4.4	210
	50 kg - < 80 kg	7.8	410

*Dose metrics are based on the 32 cm PMMA reference phantom

What's Next?

Since the national DRLs have been reduced for adults (by around 10-20%) and modified for children, it is acknowledged that there will be an increase in the number of facilities exceeding these levels. It is essential to emphasise that the DRLs serve as reference benchmarks, not dose limits. Being above the DRL is not necessarily bad practice; instead, it is a prompt to check whether improvements can be made, i.e. initiate an optimisation process. The image quality required for the diagnostic task must be maintained and not sacrificed to remain below the relevant DRL. Facilities exceeding the DRL should seek assistance on possible optimisation by liaising with their medical physicist, CT applications specialist, and radiologist, and should document their investigation.

A new Excel workbook has been developed for paediatric surveys to help facilities easily compare radiation doses used in paediatric examinations against the new age- and weight-based DRLs. This will replace the use of the NDRLS for paediatric surveys. The workbook covers all age or weight categories within a single sample, thereby simplifying the data collection and DRL comparison process. It also provides greater flexibility concerning the associated technique information. The new paediatric Excel workbook template is available on the ARPANSA website (https://www.arpansa.gov.au/research-and-expertise/surveys/national-diagnostic-reference-level-service/mdct/survey). Participating facilities are requested to email their completed spreadsheets to ndrld@arpansa.gov.au by 31 December each year, so that the data can contribute to monitoring and future updates of the Australian paediatric DRLs.

The DRLs for the newly defined adult scan categories will be subject to review once adequate data has been collected via the NDRLS to enable a formal evaluation. Similarly, the paediatric DRLs will undergo review upon the accumulation of sufficient data from a range of facilities and scanner types. ARPANSA thanks all imaging practices that have supplied data to the NDRLS and seeks your ongoing support of the DRL program.

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