National Diagnostic Reference Levels in Japan (2025)
- Japan DRLs 2025-

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Japan Network for Research and Information on Medical Exposure (J-RIME)
Japanese Association for Cancer Detection and Diagnosis
Japan Association on Radiological Protection in Medicine
Japan Gastroenterological Endoscopy Society
Japan Health Physics Society
Japan Pediatric Cardiac CT Alliance
Japan Radiological Society
Japan Society of Medical Physics
Japanese Society for Neuroendovascular Therapy
Japanese Society for Oral and Maxillofacial Radiology
Japanese Society for Radiation Oncology
Japanese Society of Interventional Radiology
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The Japan Association of Radiological Technologists
The Japan Central Organization on Quality Assurance of Breast Cancer Screening
The Japanese College of Medical Physics
The Japanese Orthopaedic Association
The Japanese Radiation Research Society
The Japanese Society for Neuroendovascular Therapy
The Japanese Society of Gastrointestinal Cancer Screening
The Japanese Society of Nuclear Medicine Technology

In cooperation with the
Japan Medical Imaging and Radiological Systems Industries Association
National Institutes for Quantum and Radiological Science and Technology

Preface

The Japan Network for Research and Information on Medical Exposure (J-RIME) has now published the *Diagnostic Reference Levels (2025 Edition)* (Japan DRLs 2025) through the collaborative efforts of its member academic societies. This achievement is entirely thanks to the generous contributions of many individuals and organizations.

Looking back, the first set of Diagnostic Reference Levels (DRLs) in Japan, titled *Establishment of Diagnostic Reference Levels Based on the Latest Domestic Survey Results: Diagnostic Reference Levels (DRLs 2015)*, was published in June 2015 under J-RIME's coordination. Five years later, in July 2020, the *Diagnostic Reference Levels (2020 Edition)* (Japan DRLs 2020) were released, and now, another five years on, we present the *Diagnostic Reference Levels (2025 Edition)*. In this latest edition, not only have the DRL values been revised, but the underlying concepts have also been clarified and systematically organized.

Over the past decade, both domestic and international efforts have continued to optimize medical exposure (i.e., patient exposure). Guidelines have been established, systems put in place, and education and training delivered, all contributing to improved radiological practices. Domestically, a landmark event was the revision of the Enforcement Regulations of the Medical Act related to radiological practices, which came into effect on April 1, 2020. This revision introduced explicit safety management measures for radiological practices. Previously, radiation protection in medical settings had focused more on structural facilities, with limited reference to medical (patient) exposure. However, the amendment explicitly mandated that medical exposure be managed and the dose management be based on DRLs.

In other words, in Japan, DRLs were first established by academic societies prior to the enactment of corresponding legal regulations. In contrast, in Europe, for example, the European Union (EU) implemented regulations on the safety of medical radiation through Council Directive 97/43/Euratom in June 1997. This directive required the establishment of DRLs for diagnostic applications, which member states subsequently introduced—thereby it can be said that the establishment of DRLs came after the introduction of laws and regulations. Although Japan was slower than Europe in implementing DRLs, its approach was unique: DRLs were developed through the voluntary efforts of researchers and academic societies, which eventually led to the formation of relevant laws and regulations.

In recent years, opportunities have also emerged for discussions about national DRLs with radiological professionals in Asia and Africa. The universal significance of DRLs in radiological practices is thus becoming increasingly evident.

For the dose survey that informed the *Diagnostic Reference Levels (2025 Edition)*, a joint questionnaire was conducted across all modalities. This allowed for standardization and resulted in improved accuracy and efficiency. We express our sincere appreciation to all those involved for their cooperation in adopting this effective approach, built on the experience gained from the two previous surveys.

Some data from the recent survey indicate a reduction in radiation doses compared to previous results. This likely reflects the spread of improved safety management practices and advancements in dose-reducing technologies. While safety management remains essential, the ideal scenario is one where technological innovation enables excellent image quality at lower doses. We will continue to closely monitor such innovations and anticipate the benefits they will bring to radiological practices.

The development of the *Diagnostic Reference Levels (2025 Edition)* required tremendous effort and time. We take this opportunity to express our heartfelt gratitude to all individuals, medical institutions, academic societies, organizations, government agencies, and the J-RIME Secretariat who contributed to this achievement. We sincerely hope that the *Diagnostic Reference Levels (2025 Edition)* will be widely utilized as a key resource for enhancing the quality of radiological practices.

July 7, 2025

Japan Network for Research and Information on Medical Exposure (J-RIME)
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I. Background of Establishment of Diagnostic Reference Levels (DRLs 2025)

International guidelines—such as the recommendations of the International Commission on Radiological Protection (ICRP) and the International Basic Safety Standards of the International Atomic Energy Agency (IAEA)—identify Diagnostic Reference Levels (DRLs) as an essential tool for optimizing radiation protection in diagnostic imaging. This is because DRLs not only specify dose values, but also define various elements, including how the quantity is defined, measured, aggregated, and implemented. They are also closely linked to quality assurance in both equipment and procedures, thereby playing a critical role in the overall optimization process.

Regarding the international status of DRLs, Europe has established a comprehensive framework for medical radiation protection through the EU Council Directive 97/43/Euratom (June 1997), which mandates the adoption of DRLs by member states in the diagnostic field. As a result, DRLs have been implemented across EU countries. In the United States, DRLs published by organizations such as the American College of Radiology (ACR), the American Association of Physicists in Medicine (AAPM), and the National Council on Radiation Protection and Measurements (NCRP) have become de facto national standards.

In Japan, various organizations, academic societies, institutions, and researchers initially conducted independent surveys on diagnostic radiation doses and proposed what they considered standard values. However, these efforts often lacked sufficient coordination, and no widely accepted DRLs were established. To address this, the Japan Network for Research and Information on Medical Exposure (J-RIME)—an organization founded to share medical exposure research and promote collaboration—established a DRL Working Group in August 2014, with representatives from its member organizations. Working under a unified platform, the group conducted a comprehensive review of dose definitions and survey methodologies, carried out a large-scale nationwide survey, and compiled and analyzed the data. The findings were then reviewed and discussed by the committee, incorporating feedback from domestic and international experts. Throughout the process, transparency and objectivity were prioritized. The resulting *Diagnostic Reference Levels (2015 Edition)* (DRLs 2015) became Japan's first nationally recognized DRLs and have since served as a foundational tool for promoting radiation protection and optimization across the country.

ICRP Publication 135, which outlines guidelines for the application of DRLs in diagnostic radiology, recommends that DRLs be reviewed and revised every three to five years. This ensures continued promotion of optimization and responsiveness to technological advances and evolving clinical needs. In line with this recommendation, J-RIME published the *Diagnostic Reference Levels (2020 Edition)* (DRLs 2020) five years after the initial edition. Around the same time, amendments to the Enforcement

Regulations of the Medical Care Act were enacted, incorporating safety management measures for diagnostic radiation—leading to significant improvements in optimization efforts at individual facilities.

This second revision, *Diagnostic Reference Levels (2025 Edition)* (DRLs 2025), aims to further enhance participation rates by integrating dose surveys across multiple modalities to reduce the reporting burden on facilities. Additionally, increased outreach and promotional efforts by J-RIME's participating academic societies are expected to raise awareness. These efforts are anticipated to result in DRL values that more accurately reflect current clinical practices and conditions.

2. Objective of Establishing new Diagnostic Reference Levels

2.1 Features of diagnostic reference levels (DRLs)

DRLs are tools designed to help facilities recognize when their radiation doses are higher than those used at comparable institutions, thereby encouraging optimization efforts. The ICRP defines a DRL as "a type of level for investigation, used as a tool to assist in optimizing protection in patients' medical exposure for diagnosis and interventional radiology (IVR)." [1] A DRL value is determined for each modality using a general, easily measurable indicator of ionizing radiation dose, typically based on dose survey data (e.g., the 75th percentile of the dose distribution).

It should be emphasized that a DRL is not a dose limit and should not be interpreted as a threshold for determining the appropriateness of a medical procedure. Dose limits are maximum permissible values that must not be exceeded under any circumstances. In contrast, a DRL may be exceeded if clinically justified. Furthermore, DRLs are intended for use with groups of patients or examinations—not to assess whether the dose for a single patient or exam is too high. This is because higher doses may be necessary depending on factors such as a patient's weight or body habitus.

DRLs may be established at the national, regional, or even local level, as equipment and procedural protocols can vary between institutions. The DRLs presented in this report represent national DRLs.

DRL values, often set at the 75th percentile of dose survey results, serve as benchmarks for identifying examinations, devices, or facilities that use comparatively high doses. In this report, each modality section includes not only the DRL value, but also the 75th percentile and median values of the corresponding dose distribution. If a facility's median dose exceeds the national median, this benchmark can serve as a useful reference point for further optimization. Conversely, if a facility's median is lower than the national median, optimization efforts can focus more on evaluating whether image quality and diagnostic performance remain clinically adequate, rather than prioritizing further dose reduction[1].

2.2 Utilization of diagnostic reference levels in clinical settings

Facilities should monitor the typical radiation doses used in their examinations. If the median dose exceeds the Diagnostic Reference Level (DRL) value, a review must be conducted to assess whether dose optimization is needed—unless there is a clinically justified reason not to do so. This review generally involves evaluating

equipment performance and imaging protocols, identifying the causes of high doses, and implementing corrective measures to achieve optimized radiation doses. When implementing such measures, priority should be given to those that do not compromise image quality.

After changes have been made, the typical doses at the facility should be reassessed and compared again with the DRL values. According to *ICRP Publication 135*[1], dose surveys should be conducted annually for CT and interventional radiology (IVR), and every three years for other modalities—unless there are changes in equipment or other relevant factors. Additionally, imaging protocols for new equipment should be evaluated before clinical use, then re-evaluated within one year of implementation, once the new examination methods have stabilized.

Throughout this process, the fundamental goal is not to achieve the highest possible image quality, but rather the level of image quality necessary for accurate diagnosis. It must also be recognized that even a small reduction in diagnostic performance due to lower image quality can significantly undermine the risk-benefit balance of the examination.

The primary purpose of DRLs is optimization, not dose reduction for its own sake. If a clinically justified examination fails to provide the required diagnostic information, the exposure may ultimately be wasted. Therefore, when adjusting imaging conditions, it is essential to ensure that diagnostic image quality is maintained, not just that radiation doses are reduced.

To promote optimization, facilities must begin by comparing their own typical dose levels against the DRLs. The most effective method for this is to utilize dose display values provided by the imaging equipment. Ideally, the adoption of devices capable of displaying DRL-relevant dose metrics should become more widespread. For examinations where device display values are unavailable or difficult to use, or at facilities that lack dosimeters, comparison with DRLs can be more challenging. As an interim solution, methods such as the Normalized Dose Data (NDD) method[2] or the use of existing dose calculation software can be considered. Additionally, establishing systems for the shared use of dosimeters or phantoms among affiliated organizations or neighboring institutions may also facilitate optimization efforts.

J-RIME Diagnostic Reference Level Working Group Chair: Masaaki Akahane

References:

1) International Commission on Radiological Protection, 2017. Diagnostic Reference Levels in Medical Imaging. ICRP Publication 135. Ann. ICRP 46 (1)

2) Mori T, Suzuki M, Sato H, et al. 1997 A Study of Creating Guidance Level in Medical Exposure [in Japanese]. Research reports of Suzuka University of Medical Science and Technology 4, 109-129.

3. National Diagnostic Reference Levels Established in 2025 (Japan DRLs 2025)

The following are recommended as national DRLs in Japan.

3.1 Japan DRLs 2025 for Computed Tomography

3.1.1 Adult CT

Protocol	$CTDI_{vol}$ [mGy]	DLP [mGy·cm]
Routine brain	67	1260
Routine chest	11	430
Chest to pelvis	13	940
Abdomen and pelvis	14	720
Liver, multi-phase	13	1630
Coronary CTA	57	940
Prospective CTA	49	770
Coronary CT calcium scan	8	160
Acute pulmonary thromboembolism and deep vein thrombosis	12	2300
Whole body CT for trauma	n/a	5290

Note 1) Standard body weight is 50-70 kg

Note 2) Liver, multiphase does not include the chest or pelvis. CTDI and DLP are based on the average of all phases and the whole examinations, respectively.

Note 3) For coronary CTA, CTDI and DLP of the CTA main scan

Note 4) The CTDI and DLP for acute pulmonary thromboembolism and deep vein thrombosis are based on the first phase and whole examinations, respectively.

Note 5) The DLP of whole-body CT for trauma includes the entire examination.

3.1.2 Pediatric CT

Age grouping

Head		$CTDI_{vol}$ [mGy]	DLP [mGy·cm]
	0-<1y	27	460
	1-<5y	34	610
	5-<10y	44	810
	10-<15y	55	1000
Chest		$CTDI_{vol}$ [mGy]	DLP [mGy·cm]
	0-<1y	2.0	50
	1-<5y	3.0	80
	5-<10y	4.0	120
	10-<15y	6.0	230
Abdomen		$CTDI_{vol}$ [mGy]	DLP [mGy·cm]
	0-<1y	2.5	70
	1-<5y	3.4	120
	5-<10y	4.5	180
	10-<15y	7.0	340
Neck to pelvis		$CTDI_{vol}$ [mGy]	DLP [mGy·cm]
	0-<1y	2.0	80
	1-<5y	2.8	145
	5-<10y	4.0	220
	10-<15y	7.0	510

Note 1) The head doses are based on a 16 cm diameter standard CT dosimetry phantom and the body doses are based on a 32 cm diameter standard CT dosimetry phantom.

Note 2) The scan range for the abdomen is from the upper abdomen to the pelvis.

Weight grouping

		$CTDI_{vol}$ [mGy]	DLP [mGy·cm]
Chest	< 5 kg	2.0	35
	5-<15 kg	3.0	60
	15-<30 kg	4.0	120
	30-<50 kg	6.0	225
		$CTDI_{vol}$ [mGy]	DLP [mGy·cm]
Abdomen	< 5 kg	2.5	65
	5-<15 kg	4.0	140
	15-<30 kg	4.0	180
	30-<50 kg	7.0	310
		$CTDI_{vol}$ [mGy]	DLP [mGy·cm]
Neck to pelvis	< 5 kg	2.0	66
	5-<15 kg	3.0	130
	15-<30 kg	4.0	230
	30-<50 kg	7.0	520

Note 1) The head doses are based on a 16 cm diameter standard CT dosimetry phantom and the body doses are based on a 32 cm diameter standard CT dosimetry phantom.

Note 2) The scan range for the abdomen is from the upper abdomen to the pelvis.

3.1.3 Pediatric cardiac CT

Age grouping

		$CTDI_{vol}$ [mGy]	DLP [mGy·cm]
Cardiac	0-<1y	1.5	26
	1-<5y	1.9	47
	5-<10y	2.1	64
	10-<15y	7.9	280

Note 1) Doses refer to the 32 cm standard CT dosimetry phantom.

Weight grouping

		$CTDI_{vol}$ [mGy]	DLP [mGy·cm]
Cardiac	< 3 kg	1.1	18
	3-<5 kg	1.2	20
	5-<10 kg	2.6	49
	10-<20 kg	3.2	54
	20-<40 kg	4.1	120
	40-<60 kg	9.6	200

Note 1) Doses refer to the 32 cm standard CT dosimetry phantom.

3.1.4 Treatment planning CT

Irradiation technique	$CTDI_{vol}$ [mGy]	DLP [mGy·cm]
Brain STI	92	2810
Head & Neck IMRT	33	1300
Lung SBRT	86	2420
Breast RT	23	930
Prostate IMRT	32	1160

STI : Stereotactic Irradiation, IMRT : Intensity Modulated Radiotherapy

SBRT : Stereotactic Body Radiotherapy

Note 1) Standard body weight was 40-80 kg.

Note 2) $CTDI_{vol}$ and DLP are the sum of the whole examination

Note 3) Dose for Brain STI refer to the 16 cm standard CT dosimetry phantom, others refer to the 32 cm.

3.2 Japan DRLs 2025 for General Radiography

Examination	Entrance-surface air kerma $K_{a,e}$ [mGy]
Chest PA (<100 kV)	0.3
Chest PA (≥ 100 kV)	0.2
Chest PA (medical checkup) (≥ 100 kV)	0.2
Abdomen (AP supine)	1.4
Infant hip joint (0-1y)	0.1
Infant chest (0-1 y)	0.1
Child chest (5 y)	0.1
Child hip joint (5y)	0.2
Child whole spine (5y)	0.2
Child whole spine (10y)	0.3
Skull	1.3
Cervical spine	0.5
Thoracic spine	1.8
Thoracic spine LAT	3.4
Lumbar spine	2.5
Lumbar spine LAT	5.5
Pelvis	1.7

3.3 Japan DRLs 2025 for Mammography

	Mean glandular dose D_G [mGy]
2D mammography based on clinical data	1.4
Digital breast tomosynthesis (DBT) based on clinical data	1.6
PMMA 40 mm	2.2

3.4 Japan DRLs 2025 for Dental X-ray Imaging

3.4.1 Intraoral Radiography

Examination site		Incident air kerma $K_{a,i}$ [mGy] Note 1)	
		Adult Note 2)	Child Note 3)
Maxilla	Incisor	1.1	0.8
	Canine	1.2	0.8
	Premolar	1.3	1.0
	Molar	1.9	1.2
Mandible	Incisor	0.9	0.6
	Canine	1.0	0.7
	Premolar	1.1	0.8
	Molar	1.3	1.0

Note 1) Air kerma at the cone-tip without patient backscatter

Note 2) Adult patients with standard body size

Note 3) Ten-year-old pediatric patients

3.4.2 Panoramic Radiography

Air kerma-area product P_{KA} [mGy·cm^2]	Dose-width product DWP Note 1) [mGy·mm]
130	91

Note 1) Value on the surface of image receptor

3.4.3 Dental Cone Beam CT

FOV area Note 1)	Air kerma-area product P_{KA} [mGy·cm^2]	Air kerma at the isocenter K_{iso} [mGy]
＜40 cm^2	720	17
40～100 cm^2	1500	17
＞100 cm^2	2200	17

Note 1) FOV area ＝FOV diameter x height

3.5 Japan DRLs 2025 for IVR

3.5.1 Head/Neck

Diagnostic Angiography (pre-op)	$K_{a,r}$ [mGy]	P_{KA} [Gy·cm^2]
Saccular aneurysm	470	82
Cerebral arteriovenous malformation	680	120
Cerebral dural arteriovenous fistula	840	170
Cervical carotid artery stenosis/occlusion	390	81
Acute cerebral artery stenosis/occlusion	490	96
Intracranial tumor	530	110
Diagnostic Angiography (post-op)	**$K_{a,r}$ [mGy]**	**P_{KA} [Gy·cm^2]**
Saccular aneurysm	410	56
Cerebral arteriovenous malformation	450	82
Cerebral dural arteriovenous fistula	610	120
Cervical carotid artery stenosis/occlusion	330	64
Acute cerebral artery stenosis/occlusion	450	73
Intracranial tumor	560	100
Endovascular treatment (IVR)	**$K_{a,r}$ [mGy]**	**P_{KA} [Gy·cm^2]**
Saccular aneurysm	2400	190
Cerebral arteriovenous malformation	3700	330
Cerebral dural arteriovenous fistula	4300	450
Cervical carotid artery stenosis/occlusion	700	130
Acute cerebral artery stenosis/occlusion	1000	160
Intracranial tumor	1900	230

3.5.2 Cardiac Regions (Adult)

	$K_{a,r}$ [mGy]	P_{KA} [Gy·cm^2]
Diagnostic catheterization	520	47
Non-CTO PCI	1300	100
CTO PCI	2500	200
Non-PVI RFCA	200	27
PVI RFCA	260	38
TAVI (transfemoral approach)	530	78

PCI：Percutaneous Coronary Intervention
CTO：Chronic Total Occlusion
RFCA：Radiofrequency Catheter Ablation
PVI：Pulmonary Vein Isolation
TAVI：Transcatheter Aortic Valve Implantation

3.5.3 Cardiac Regions (Pediatric, age grouping)

Diagnostic catheterization	$K_{a,r}$ [mGy]	P_{KA} [Gy·cm^2]
<1 year	64	4
1 ～<5 years	83	6
5 ～<10 years	93	11
10 ～<15 years	220	29
Interventional radiography	**$K_{a,r}$ [mGy]**	**P_{KA} [Gy·cm^2]**
<1 year	100	7
1 ～<5 years	130	11
5 ～<10 years	160	16
10 ～<15 years	190	24

3.5.4 Cardiac Regions (Pediatric, weight grouping)

Diagnostic catheterization	$K_{a,r}$ [mGy]	P_{KA} [Gy·cm^2]
＜5 kg	47	3
5 ～< 15 kg	69	6
15 ～< 30 kg	100	12
> 30 kg	230	33
Interventional radiography	**$K_{a,r}$ [mGy]**	**P_{KA} [Gy·cm^2]**
＜5 kg	67	4
5 ～< 15 kg	120	9
15 ～< 30 kg	140	16
> 30 kg	190	27

3.5.5 Interventional radiography for chest and abdomen

	$K_{a,r}$ [mGy]	P_{KA} [Gy·cm^2]
TACE	1200	220
TEVAR	630	170
EVAR	910	200
UAE uterine fibroids	710	150
PAVM simple type	870	150
BRTO via the left renal vein	1100	230

TACE：Transcatheter Arterial Chemoembolization
TEVAR：Thoracic Endovascular Aortic Repair
EVAR：Endovascular Aortic Repair
UAE：Uterine Artery Embolization
PAVM：Pulmonary Arteriovenous Malformations
BRTO：Balloon occluded Retrograde Transvenous Obliteration

3.5.6 EVT in the lower extremity

	$K_{a,r}$ [mGy]	P_{KA} [Gy·cm^2]
Non-CTO iliac artery	360	69
CTO iliac artery	740	120
Non-CTA femoral artery	160	36
CTA femoral artery	310	54

EVT：Endovascular Therapy

CTO：Chronic Total Occlusion

3.6 Japan DRLs 2025 for Diagnostic Fluoroscopy

3.6.1 Examination using a stationary X-ray fluoroscopy device

	$K_{a,r}$ [mGy]	P_{KA} [Gy·cm^2]	Fluoroscopic time [min]	No. of images per exam
Barium swallow	16	6.5	5.0	4.0
Upper gastrointestinal fluoroscopy with contrast	77	21	6.5	23
Ileus tube insertion	80	47	20	6.0
Barium enema	93	41	12	26
ERCP	110	28	15	13
Bronchoscopy	27	7.4	8.7	2.0
Total parenteral nutrition catheterization (CV catheter-port insertion)	7.6	3.2	2.7	2.0
Lumbar nerve root block	22	5.5	3.0	2.0
Lumbar myelography	47	18	3.9	10

ERCP: Endoscopic retrograde cholangiopancreatography

CV: Central venous

Note 1) Only over-table X-ray tubes are applicable.

Note 2) $K_{a,r}$：Incident air kerma at the patient entrance reference point

Note 3) P_{KA}：KAP：Air kerma area product

Note 4)

3.6.2 Examination using a mobile X-ray fluoroscopy device

	$K_{a,r}$ [mGy]	P_{KA} [Gy·cm^2]	Fluoroscopic time [min]	No. of images per exam
Spinal fusion (cervical)	10	3.7	4.6	2.0
Spinal fusion (cervical-thoracic junction and below)	110	23	10	2.0
Scoliosis correction	(100)	(11)	10	1.0
Open fracture surgery (thigh)	57	9.6	10	2.0

Note 1) In Scoliosis correction, ($K_{a,r}$) and (P_{KA}) are reference values due to limited data.

3.6.3 Gastric X-ray screening

	$K_{a,r}$ [mGy]	P_{KA} [Gy·cm^2]	Fluoroscopic time [min]	No. of images per exam
Population-based radiographic technique (standard inspection)	39	—	2.5	9.0
Opportunistic radiographic technique (standard inspection)	55	—	4.2	17

Reference values for fluoroscopy dose rate and radiographic dose of stationary and mobile X-ray fluoroscopy devices

	Fluoroscopy dose rate [mGy/min]	Radiographic dose [mGy / exposure]
Stationary X-ray fluoroscopy device	10	1.6
Mobile X-ray fluoroscopy device	13	1.3

Note 1) The entrance surface air kerma including backscatter was measured at the patient entrance reference point or an equivalent position, with a 20 cm acrylic phantom placed on the patient table.

3.7 Japan DRLs 2025 for Nuclear Medicine

3.7.1 SPECT radiopharmaceuticals

Radiopharmaceutical	Dose [MBq]
Bone: ^{99m}Tc-MDP	930
Bone: ^{99m}Tc-HMDP	930
Bone marrow: ^{111}In-chloride	80
Cerebral blood flow: ^{99m}Tc-HMPAO (rest or stress)	800
Cerebral blood flow: ^{99m}Tc-HMPAO (rest and stress)	1200
Cerebral blood flow: ^{99m}Tc-ECD (rest or stress)	800
Cerebral blood flow: ^{99m}Tc-ECD (rest and stress)	1100
Cerebral blood flow: ^{123}I-IMP (rest or stress)	200
Cerebral blood flow: ^{123}I-IMP (rest and stress)	270
Brain receptors: ^{123}I-iomazenil	200
Striatum: ^{123}I-ioflupane	190
Cisternography: ^{111}In-DTPA	40
Thyroid uptake: Na^{123}I	10
Thyroid: $^{99m}TcO_4^-$	240
Parathyroid: ^{201}Tl-chloride	120
Parathyroid: $^{99m}TcO_4^-$	300
Parathyroid: ^{99m}Tc-MIBI	800
Lung ventilation: ^{81m}Kr-gas	190
Lung ventilation：^{99m}Tc-gas	750
Pulmonary blood flow: ^{99m}Tc-MAA	260
Radionuclide venography: ^{99m}Tc-MAA	500
Liver/spleen: ^{99m}Tc-phytate	190
Hepatic function: ^{99m}Tc-GSA	260
Hepatobiliary: ^{99m}Tc-PMT	260
Liver and spleen: ^{99m}Tc-Sn colloid	180
Myocardial perfusion：^{201}Tl-chloride (rest)	120
Myocardial perfusion：^{201}Tl-chloride (stress)	120

Radiopharmaceutical	Dose [MBq]
Myocardial perfusion : ^{201}Tl-chloride (rest and stress)	120
Myocardial perfusion : ^{99m}Tc-tetrofosmin (rest or stress)	840
Myocardial perfusion : ^{99m}Tc-tetrofosmin (rest and stress)	1200
Myocardial perfusion : ^{99m}Tc-MIBI (rest or stress)	840
Myocardial perfusion : ^{99m}Tc-MIBI (rest and stress)	1200
Myocardial fatty acid metabolism: ^{123}I-BMIPP	130
Cardiac sympathetic function: ^{123}I-MIBG	130
Cardiac blood pool: ^{99m}Tc-HSA-D	970
Myocardial infarction: ^{99m}Tc-PYP	840
Cardiac amyloidosis : ^{99m}Tc-PYP	840
Cardiac amyloidosis : ^{99m}Tc-HMDP	870
Salivary gland : $^{99m}TcO_4^-$	370
Meckel's diverticulum: $^{99m}TcO_4^-$	440
Gastrointestinal bleeding: ^{99m}Tc-HSA-D	1000
Protein leakage: ^{99m}Tc-HSA-D	1000
Static renal imaging: ^{99m}Tc-DMSA	210
Dynamic renal imaging: ^{99m}Tc-MAG 3	380
Dynamic renal imaging: ^{99m}Tc-DTPA	380
Adrenal cortex: ^{131}I-adosterol	40
Adrenal medulla: ^{123}I-MIBG	130
Testis : ^{99m}Tc-HSA-D	850
Tumor: ^{201}Tl-chloride	120
Tumor and inflammation: ^{67}Ga-citrate	120
Somatostatin receptor: ^{111}In-pentetreotide	220
Lymphatic vessels: ^{99m}Tc-HSA-D	830
Sentinel lymph node (breast cancer): ^{99m}Tc-Sn colloid	120
Sentinel lymph node (breast cancer): ^{99m}Tc-phytate	120
Sentinel lymph node (melanoma): ^{99m}Tc-Sn colloid	120
Sentinel lymph node (melanoma): ^{99m}Tc-phytate	120

Radiopharmaceutical	Dose [MBq]
Sentinel lymph node (endometrial cancer) : ^{99m}Tc-phytate	120
Sentinel lymph node (cervical cancer) : ^{99m}Tc-phytate	120
Sentinel lymph node (vulvar cancer) : ^{99m}Tc-phytate	120
Sentinel lymph node (head and neck cancer) : ^{99m}Tc-phytate	120
RI angiography : ^{99m}Tc-HSA-D	1000

3.7.2 PET Radiopharmaceuticals

Radiopharmaceutical	Dose [MBq]
Brain function: $C^{15}O_2$-gas (2D acquisition)	8000
Brain function: $^{15}O_2$-gas (2D acquisition)	6000
Brain function: $C^{15}O$ -gas (2D acquisition)	3000
Brain function: $C^{15}O_2$-gas (3D acquisition)	1800
Brain function: $^{15}O_2$-gas (3D acquisition)	4500
Brain function: $C^{15}O$-gas (3D acquisition)	3600
Amyloid: ^{18}F-flutemetamol (in-house preparation)	260
Amyloid: ^{18}F-flutemetamol (delivery)	260
Amyloid: ^{18}F-florbetapir (in-house preparation)	370
Amyloid: ^{18}F-florbetapir (delivery)	370
Amyloid: ^{18}F-florbetaben (in-house preparation)	300
Cerebral glucose metabolism: ^{18}F-FDG (in-house preparation)	230
Cerebral glucose metabolism: ^{18}F-FDG (delivery)	230
Cerebral glucose metabolism: ^{18}F-FDG (dose per body weight)	4
Malignant glioma：^{18}F-Fluciclovine (delivery)	270
Malignant glioma：^{18}F-Fluciclovine (dose per body weight)	5
Myocardial glucose metabolism: ^{18}F-FDG (in-house preparation)	240
Myocardial glucose metabolism: ^{18}F-FDG (delivery)	240
Myocardial glucose metabolism: ^{18}F-FDG (dose per body weight)	4
Myocardial blood flow: $^{13}NH_3$ (in-house preparation)	520
Tumor glucose metabolism: ^{18}F-FDG (in-house preparation)	240
Tumor glucose metabolism: ^{18}F-FDG (delivery)	240
Tumor glucose metabolism: ^{18}F-FDG (dose per body weight)	4
Inflammation: ^{18}F-FDG (in-house preparation)	240
Inflammation: ^{18}F-FDG (delivery)	240
Inflammation: ^{18}F-FDG (dose per body weight)	4

Note 1) This criterion was set for amyloid (18F-flutemetamol, 18F-florbetapir, 18F-florbetaben) by referring to the package insert.

3.7.3 SPECT/CT Hybrid CT

Body region	$CTDI_{vol}$ [mGy]	DLP [mGy·cm]
Whole body	4.0	310
Head and neck	5.4	170
Chest	4.2	130
Upper abdomen	4.8	130
Pelvis	3.1	110
Abdomen, pelvis (upper abdomen - pelvis)	3.9	140
Head and neck - pelvis	4.1	260
Extremities	3.1	160
Brain (Attenuation correction only)	12	210
Brain (Attenuation correction and image fusion)	25	370
Heart (Attenuation correction only)	2.9	70
Heart (Attenuation correction and image fusion)	4.1	90

3.7.4 PET/CT Hybrid CT (medical examination)

Body region	$CTDI_{vol}$ [mGy]	DLP [mGy·cm]
Whole body：head - proximal thighs	5.4	540
Whole body：head - lower extremities	5.3	720
Head and neck	4.2	130
Chest	4.5	150
Upper abdomen	4.4	140
Pelvis	3.2	120
Upper abdomen - pelvis	5.0	220
Chest - pelvis	4.4	300
Extremities	2.7	130
Brain (Attenuation correction only)	10	270
Brain (Attenuation correction and image fusion)	26	570
Heart (Attenuation correction only)	2.5	50
Heart (Attenuation correction and image fusion)	4.7	140

3.7.5 PET/CT Hybrid CT (medical checkup)

Body region	$CTDI_{vol}$ [mGy]	DLP [mGy·cm]
Whole body：head - proximal thighs	5.4	540
Brain (Attenuation correction only)	10	270
Brain (Attenuation correction and image fusion)	27	570
Heart (Attenuation correction only)	2.5	50
Heart (Attenuation correction and image fusion)	4.7	140

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