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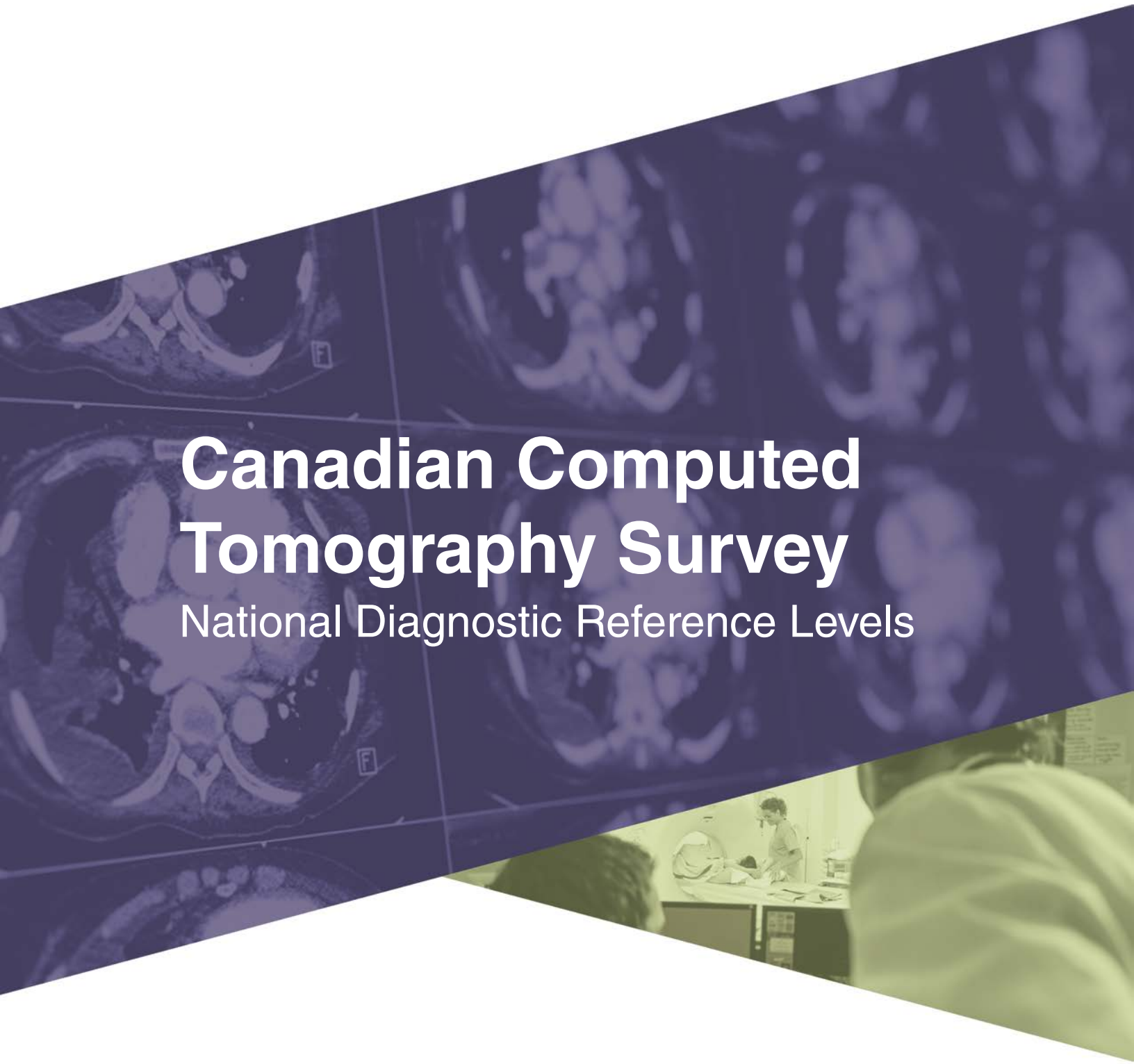

Canadian Computed Tomography Survey

National Diagnostic Reference Levels

Canada

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EXECUTIVE SUMMARY

This report summarizes the results of the first Canadian Computed Tomography (CT) Survey and provides national Diagnostic Reference Levels (DRLs) for CT imaging in Canada.

CT is a valuable x-ray imaging tool in medicine, providing information that supports the diagnosis, treatment, and monitoring of patients. In Canada, the number of CT scanners and the number of CT examinations performed has increased by approximately 41% and 57% respectively from 2004/2005 to 2011/2012. Over the same period, the rate of CT examinations per 1000 population increased steadily from 87.3 to 125.5, an increase of nearly 44%. While the clinical applications of CT equipment and their benefits to patients are significant, there is increased global focus on the need to carefully manage radiation exposures from CT imaging, as radiation doses from CT examinations are in general, higher than those from most other medical x-ray imaging examinations.

An internationally recognized approach to radiation protection of patients, recommended by the International Commission on Radiological Protection (ICRP), is the establishment and use of DRLs. DRLs are dosimetric indicators, established from surveys of imaging practice and provide guidance to help manage dose and promote optimization, so that the applied dose is appropriate for a given clinical need.

The primary goal of the Canadian CT Survey was to collect CT dose index data in order to establish national DRLs for commonly performed CT examinations of adults and pediatric patients. The survey was conducted using a highly collaborative approach between Health Canada, provincial and territorial governments as well as medical associations and other healthcare professionals who helped shape the survey, and promoted survey participation.

Overall participation was high and resulted in data collection from approximately 75% of all CT scanners in Canada from every province and territory having CT equipment. This provided data from 18 985 individual patient CT examinations and 24 280 CT imaging sequences. National DRLs were determined for seven commonly performed CT imaging examinations: Adult Head, Chest, Abdomen/Pelvis, and Chest/Abdomen/Pelvis, and Pediatric Head, Chest, and Abdomen. In addition, the survey data provides insights into the heterogeneity of CT imaging practice as well as some of the factors affecting radiation output from CT equipment.

The National CT Survey provides a current snap-shot of CT equipment technology and CT imaging practices in Canada. The national DRLs will help promote optimization of CT clinical protocols in Canada and ultimately contribute to national and international efforts to minimize medical exposures to ionizing radiation from CT.

1.0 INTRODUCTION

Computed Tomography (CT) is a medical imaging modality using specialized x-ray equipment to produce cross sectional and three-dimensional images of internal structures of the human body. It is a valuable tool in medicine, providing information that supports the diagnosis, treatment and management of patients. As CT technology has advanced, the number of medical applications of CT imaging has increased, along with increased availability and use of CT equipment [1,2]. This has led to increased global attention to patient radiation exposures from CT imaging.

In Canada, there has been a continuous increase in the number of CT scanners and CT examinations performed over the past 25 years. The Canadian Institute for Health Information (CIHI) has reported that in 2011/2012, there were 510 CT scanners in Canada and approximately 4.4 million examinations performed. This represents an approximate 41% increase in the number of CT scanners and 57% increase in the number of CT examinations since 2004/2005. Over the same period, the rate of CT examinations per 1000 population increased steadily from 87.3 to 125.5, an increase of nearly 44% [3,4].

While the benefits of CT imaging in the delivery of healthcare are significant, there is increased international attention on the need to appropriately manage ionizing radiation exposures in CT. CT technology has advanced very quickly from first generation machines, to modern CT units which are capable of very rapidly scanning large volumes of the body resulting in relatively large exposures per exam when compared to planar radiography. In fact, a recent report of the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) indicated that, in many countries, radiation doses from CT examinations will make the largest contribution to population dose from man-made exposures [5]. This is likely in large part due to the increased availability and use of CT equipment, and relatively larger exposures per exam [1,2,6].

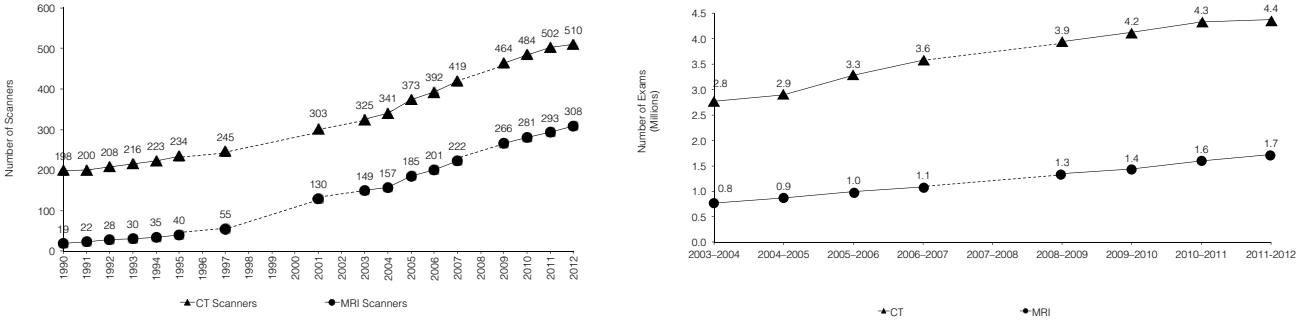

Figure 1: CIHI data shows trend of increasing number of CT scanners and exam frequency.In 2012 there were 510 CT units and 4.4 million exams performed. Figures taken from CIHI data release [3].

Mitigating patient exposure risk in CT imaging focuses on two general principles: justification and optimization. Justification of imaging examinations ensures that only medically necessary examinations are carried out. Optimization involves the management of CT examinations such that the lowest possible dose of radiation is applied for a given clinical need. Application of these principles is especially important in pediatric CT examinations given the increased sensitivity of children's tissues to ionizing radiation. Recommendations from initiatives such as Image Gently [7] have been particularly successful in bringing attention to pediatric CT dose optimization. Other initiatives such as Image Wisely [8] have focused attention on optimization of adult x-ray imaging examinations.

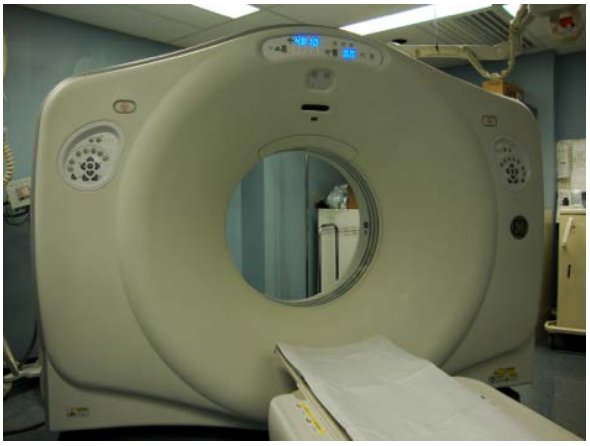

Figure 2: Typical Computed Tomography (CT) scanner in use at diagnostic facilities. Image courtesy of The Ottawa Hospital, Ontario.

In both pediatric and adult scanning, previous surveys of CT practice have shown that for given CT imaging procedures, wide variations in exposure can exist [9]– thus, there is significant potential for optimization and reduction in exposure-risk for CT patients. A widely accepted approach to optimization of medical radiation exposures, recommended by the International Commission on Radiological Protection (ICRP) [10,11] and the International Atomic Energy Agency (IAEA) [12], is the establishment and use of national, regional and local DRLs.

1.1 DIAGNOSTIC REFERENCE LEVELS (DRLS) AND CT DOSE INDICES

DRLs are used to address potential patient exposure-risk by focusing CT practice. DRLs are dosimetric indicators, established from surveys [13] of imaging practice and provide guidance to help manage dose, so that the dose is commensurate with the clinical purpose. They attempt to summarize what would be considered reasonable and good application of the quantity or measure of ionizing radiation and have shown to be an effective measure in reducing patient exposure for frequently used protocols, while allowing clinical staff sufficient latitude to manage clinical needs and maintain diagnostic image quality for the purpose intended [14,15]. DRLs are not regulatory or punitive limits, and can be exceeded where there is clinical need, but provide thresholds at which reasons for exceeding should be investigated. While DRLs provide an initial target for optimization, it may be possible to acquire images of sufficient clinical quality at doses below DRLs.

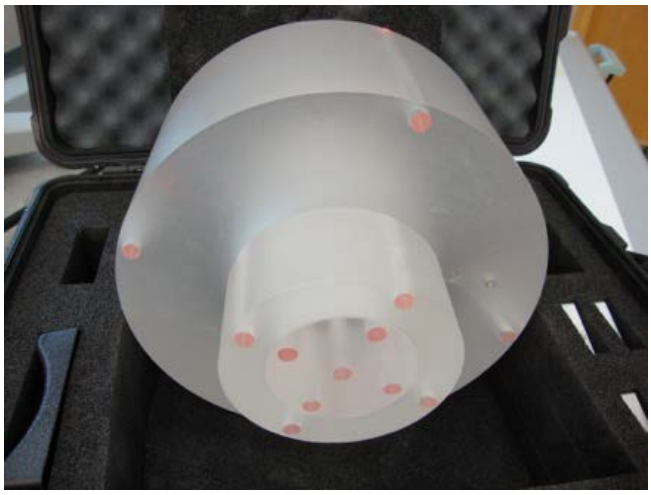

Figure 3: CTDI plastic PMMA phantom used as reference for CT scans–16 cm diameter (middle portion) cylinder shown protruding from larger, 32 cm diameter cylinder. Type shown here is a "nested" model that also contains a 10 cm (inner) smallest cylinder. (Image taken by HC).

DRLs for specific CT examinations and specific patient groups (e.g. adults and children of different sizes) are established based on surveys of dose indices displayed on CT equipment during clinical examinations and are usually taken as the 75th percentile of the dose index distributions. The two most common dose indices for CT are the volume Computed Tomography Dose Index (CTDIvol, units of mGy) and Dose-Length Product (DLP, units of

mGy·cm). The displayed CTDIvol and DLP values are both calculated in a standard way across all CT models using plastic polymethylmethacrylate (PMMA) cylindrical phantoms (Figure 3). A 16 cm diameter phantom is used to report adult and pediatric head examinations. A 32 cm diameter phantom is used to report adult body examinations; however, when reporting pediatric body examinations, vendors may vary the standard phantom size—some use the 16 cm and some use the 32 cm phantom. Therefore, when reviewing CTDIvol and DLP values in pediatric body scanning the phantom size must be considered.

CTDIvol is a standard indicator of the dose delivered by a given CT scanner corresponding to the selected acquisition settings. This standardized "dose" or output is a weighted measure over the circular area of the central scan plane of the standard PMMA phantoms, and is adjusted for speed of table movement relative to x-ray beam collimation (variable pitch)—it does **not** represent patient dose. The DLP is calculated by multiplying the CTDIvol by the length of the region scanned, providing a standard indicator of dose to the scan volume—it also does not represent actual individual patient dose. Given that these dose indices represent the radiation output measured directly at the time of the CT examination, they provide a direct means to compare examination protocols and therefore offer the potential for patient dose reduction.

2.0 SURVEY DESIGN AND IMPLEMENTATION

The primary goal of the CT survey was to collect equipment and dose index data from across Canadian hospitals and clinics which could then be compiled and used to recommend current national DRLs supporting optimization of CT doses. Previous regional or provincial DRL surveys [16–19] have been performed in Canada; however, for this first national level survey it was important that a standard survey design be used to ensure consistency in data collection. The survey itself was adapted from the 2003 CT survey performed in the United Kingdom by the National Radiological Protection Board, now Public Health England [20], which was kindly shared with Health Canada (HC).

From the early planning stages of the survey, HC identified and contacted key groups within provincial and territorial governments in order to establish a formal collaborative approach to the national survey. Working collaboratively with the provinces and territories offered important benefits to the survey. First, individual CT facilities would be able to collect their own data for establishing local DRLs. Second, provincial and territorial governments would also be able to collect their own data. Finally, HC would receive national data. Participation in the survey was voluntary, an invitation letter along with a survey participation form was sent to all CT facilities in the country via provincial/territorial collaborators. The provincial/territorial collaborators then informed HC of the number of CT scanners participating in the survey from their region and survey booklets were distributed accordingly.

Efforts were made to promote the survey in order to maximize the participation rate. Promotional information on the survey was prepared by HC and shared with our provincial/territorial collaborators as well as with the Canadian Association of Radiologists (CAR), the Canadian Association of Medical Radiation Technologists (CAMRT) and the Canadian Organization of Medical Physicists (COMP), who then in turn distributed the information to their members.

Survey booklets, one per CT scanner, were distributed across the country to participating facilities. Each survey booklet was uniquely numbered (on all pages to ensure no data loss if booklet pages were removed); however, facility-booklet pair information was blinded during the mass mailing. Only a record of booklet numeric identifiers and quantity mailed out was maintained, leaving no means to link survey data (in booklets) with specific facilities at the national level. In one province, the survey data collection was carried out using electronic data collection format (MS Excel templates), given their previous experience in CT imaging data collection.

The collection period began in late 2012/early 2013 and extended into summer of 2013. Facilities were given approximately 16 weeks to collect data. Some extensions were given where circumstances warranted, but limited as much as reasonably possible. In some cases, regions also started data collection at different times due to availability of local resources and receipt of survey booklets, but were still encouraged to limit data collection to 16 weeks. At all times during the collection period, HC and provincial/territorial collaborators were available to answer questions and support local data collection. Completed survey booklets from each province and territory were returned to the respective provincial/territorial government collaborators, who in turn removed any facility identifying information and submitted the survey booklets to HC.

2.1 SURVEY BOOKLETS, STANDARD CT EXAMINATIONS AND PATIENT GROUPS

The survey data collection booklets consisted of four (4) sections:

- Section I: Facility and Scanner Information
- Section II: Routine CT protocols (as set on CT equipment)
- Section III: Individual patient examination data
- Section IV: Routine CTDI measurements (optional)

Section I of the survey captured general information on the CT scanner such as the manufacturer, model, maximum detector configuration and availability of dose reduction technology. This section also collected information on the healthcare facility in which the CT scanner is installed; however this information was retained only by provincial/territorial collaborators. No facility identifying information was collected by HC.

Section II of the survey collected information on the routine protocols programmed on CT scanners for defined adult and pediatric patient populations. These protocols were collected for seven standard examination types (anatomical regions), as shown below in Table 1. It was requested that data be collected according to specified clinical indications for each examination type in order to help focus data collection. This is important since, even when the same area of the body is being imaged, different protocols may be required for different clinical indications. During the collection period, some facilities also contacted HC in order to confirm if other indications could be collected for given anatomical regions being surveyed—this was allowed if the additional indications were deemed to have similar technical settings as those given in Table 1.

Table 1: *Standard CT examinations (anatomical region) surveyed and corresponding clinical indications that are most likely used (not a completely exhaustive list).*

Anatomical Region	Clinical Indication
Routine Head [Adult]	Headache, Cerebrovascular Accident (CVA), or Transient Ischemic Attack (TIA)
Chest [Adult]	Primary cancer, known/suspected metastasis or lung nodule follow-up
Abdomen, Pelvis [Adult]	Primary/metastatic work-up or abscess
Chest, Abdomen, Pelvis [Adult]	Lymphoma staging, follow-up or Trauma
Pediatric Head	Trauma, including non-accidental injury
Pediatric Chest	Detection of malignancy, Trauma
Pediatric Abdomen	Detection of malignancy, Trauma

A single CT protocol may consist of one or more scan sequence or phase. Therefore, for each protocol, data was requested describing at least the first two sequences. Information captured for each sequence included a description of the anatomical range scanned and the equipment settings used (e.g. detector configuration, loading factors, scanning mode and console dose indices). For 3rd sequences or higher, only dose index (CTDI and DLP) information was requested.

CT protocols can vary depending on the size of the patient. Again in an effort to focus data collection, the survey collected data only for patients that were considered of “standard” size. Adults were considered to be greater than or equal to 19 years of age and between 50 and 90 kg (average ~70kg). Pediatric patients were considered to be less than or equal to 13 years and typically sized for their age–the aim being to keep pediatric data as unrestricted as possible in order to maximize the sample size.

For the purpose of assessing DRLs, 3 age group bins for pediatric data were chosen to closely resemble the ages of commonly reported pediatric DRL ages and commercially available tissue equivalent or anthropomorphic pediatric dosimetry phantoms (0–1, 5, 10 yrs. and older). As shown in Table 2, during analysis pediatric age bins were selected as 0–3, 3–7, and 7–13 years or target median ages of ~1.5, 5 and 10 years. Of course, children develop rapidly at a young age and it would be advantageous to have a much finer sampling of pediatric age bins for the examination types given; however, this would likely require a larger sample of pediatric patient examination data. Table 3 provides an overall summary of age and mass restrictions of the adult and pediatric survey data.

Table 2: *Typical pediatric patient age bins (and phantom sizes) along with age groups chosen during analysis of Canadian CT Survey data to best correspond to those ages. With sufficient sample sizes, the median age in the survey pediatric age bin should be very close to the typical age given.*

Typical Pediatric Reference Ages (yrs.)	Survey Pediatric Age Range (yrs.)
0–1	0–3
5	3–7
10	7–13

Table 3: *Age and mass criteria used in analysis of adult and pediatric patient data–pediatric mass restrictions were left open to encourage larger sample sizes.*

Anatomical Region	Age (yrs.)	Mass (kg)
Routine Head [Adult]	≥ 19	50 ≤ X ≤ 90
Chest [Adult]	≥ 19	50 ≤ X ≤ 90
Abdomen, Pelvis [Adult]	≥ 19	50 ≤ X ≤ 90
Chest, Abdomen, Pelvis [Adult]	≥ 19	50 ≤ X ≤ 90
Pediatric Head	0 < X ≤ 3	< 50
	3 < X ≤ 7	< 50
	7 < X ≤ 13	< 50
Pediatric Chest	0 < X ≤ 3	< 50
	3 < X ≤ 7	< 50
	7 < X ≤ 13	< 50
Pediatric Abdomen	0 < X ≤ 3	< 50
	3 < X ≤ 7	< 50
	7 < X ≤ 13	< 50

Section III of the survey gathered information on actual CT examinations performed on clinical patients, since patient scanning may differ from the standard protocols collected in Section II. For each of the standard examinations shown in Table 1, data was requested for at least 15 unique patients. For each sequence of a patient examination, data was collected on the scanned range, equipment settings and the displayed CT dose indices (CTDI and DLP for each sequence and the examination DLP). In addition, generic patient characteristics such as age, mass and body habitus (axial anterior-posterior (AP) and lateral (LAT)) measurements were collected on the patient scanned. The survey did not collect any patient identifiable/re-identifiable information.

Section IV of the survey requested data on actual CTDI measurements performed on the CT equipment using the standard 16 cm and 32 cm standard PMMA phantoms in order to investigate the relationship between the measured and displayed values of CTDI for each phantom. This section of the survey was made optional to complete as it required time on the CT equipment (when not scanning patients), the availability of the phantoms, dosimetry instrumentation and also the availability of a qualified individual during the timeframe of the survey to perform the measurements.

Page samples of data collection templates for Sections I-IV are shown in Appendix A.

2.2 SURVEY DATABASE, DATA QUALITY AND PRE-PROCESSING

A Statistical Package for the Social Sciences (SPSS) (Chicago, SPSS Inc.) database was developed by HC in order to compile the national survey data. A data entry team was responsible for transcription of the survey booklet data into the database. As with any survey of this scale, efforts must be made to optimize data quality. Prior to survey data entry, data entry staff received introductory sessions on CT imaging principles and practical training. The practical component consisted of entering a common training dataset, constructed with purposeful mistakes and omissions. The objective was to familiarize data entry staff with common content and data entry errors that may arise during transcription from booklet to database. Entries from each team member were evaluated on a "cell by cell" basis against the training dataset and were used to identify common mistakes, standardize the data entry process and thereby minimize individual variation/errors. The same feedback mechanism was repeated shortly after entry of actual survey data began and at subsequent periodic intervals (~3–4 months). A vetting regime was also established where data entry staff were required to review each booklet or page (if booklet is extensive) as completed. At all times, a close relationship between data entry staff, database administrator and analyst was maintained to provide additional support for interpretation of complex data or questions of inclusion. Reference tables for data entry staff were also constructed to help summarize common questions/issues as they arose and exclude unnecessary free comments/extraneous information which may have been included in survey booklets. Any instances where specific data fields were not completed in the survey booklets (e.g. missing patient mass) a "not-specified" (NS) or "not-applicable" (NA) marker was entered into the database accordingly.

2.3 DATA REVIEW FOR CONSISTENCY AND COMPLETENESS

Upon completion of data entry, a review was conducted of the large data set to identify and address any data quality issues.

2.3.1 CT Scanner Naming Convention

Among the sample of CT equipment in the database, a verification process was undertaken to ensure that the specific CT scanner models were consistently named. For a given CT scanner model, various modified versions of the model name may be provided by those completing the survey booklets. A standard naming convention was established for vendors and models and applied to the data in order to facilitate filtering during the analysis processes.

2.3.2 Sample Size Optimization and Patient Characteristics

Before data could be analyzed for the determination of the national DRLs, a verification process was undertaken to ensure that all adult and pediatric data was obtained only from patients meeting the pre-defined age and mass restrictions shown in Table 3. For any instance where the patient's age was not provided, the corresponding data was excluded from the analysis; however, in any instance where the age was provided without the patient's mass, efforts were made to use the AP and LAT measures, when provided, to establish criteria for inclusion. Specifically, for a given sequence if the patient AP and LAT measures were within three standard deviations of the group sample mean they were considered similar to others and therefore appropriate to include. The purpose for applying this logical pre-processing of the data was to extend the sample sizes as much as possible in order to maximize the amount of useable data. Consequently, this ensured that all reported individual dose indices (CTDI, DLP) would be originating from data that had at least correlated patient age and mass, or age and AP and LAT measures—many sequences gave more than this minimal information. Individual patient sequence data that gave no age or significantly different body habitus (outside $\pm 3\sigma$) information from the group mean and where mass was not given were eliminated. The following examples illustrate this pre-processing logic:

Example 1: *Adult Chest sequence Age = 28 yrs., Mass = 72 kg, AP = n/s, LAT = n/s. This sequence data can be included in Adult Chest group as it meets criteria.*

Example 2: *Adult Chest sequence Age = 39 yrs., Mass = n/s, AP = 25.1, LAT = 34.8. If only using age and mass as criteria this would be excluded; however, if AP* ***and*** *LAT are within ±3σ of Adult Chest group then it's reasonable to conclude it's "similar" to group and therefore can be included.*

2.3.3 CT Practice Heterogeneity: Scan Mode, Contrast and Dose Reduction

The large volume of data collected during the survey presented a significant opportunity to delve into more than simply grouping dose indices (CTDI and DLP) per exam type. For example an important aspect to address was the overall heterogeneity of how given examinations are performed. Are most pediatric head scans performed using axial scanning without contrast? How frequent is dose reduction technology used? In order to filter data at that level, all data that was not specifically labelled as using; (i) axial or helical scanning, (ii) contrast or none (C+ or C-), and (iii) fixed tube current (Fix) or dose reduction (DR) technology had to be confirmed. Thus, custom code VBA (Visual Basic for Applications, MS Excel) templates were developed to score and verify whether an unlabeled sequence was actually axial or helical, C+ or C-, and Fix or DR. The templates searched associated data and comment fields of each individual CT sequence for the presence (or absence) of data that could help confirm the scan mode, contrast use and application of DR technology. While this was primarily targeted at those cases where data was transposed from booklet to database as either NA or NS, algorithms developed also helped uncover a small number of mistakes in previously (and assumed correctly) processed data. Ultimately, the process of verifying the mode of acquisition, the use of contrast and the use of dose reduction techniques permitted the separation of the data, for each standard examination, into 8 subgroups.

2.3.4 Pediatric Reference Phantoms

As outlined in section 1.1, the standard phantom sizes used in reporting pediatric body CTDI vary by vendor. Thus, efforts were made prior to analysis of DRLs to ensure that all pediatric body sequences were consistently reported relative to the standard 32 cm body phantom. The survey data collection forms requested that the corresponding reference phantom size (16 cm or 32 cm) be provided along with pediatric body scanning dose indices. Where the reference phantom size was not provided in the survey booklets, further analysis was performed in order to confirm that the values of the dose indices (CTDI and DLP) provided were reported relative to the 16 cm or 32 cm standard phantom and to make corrections so that all pediatric body dose indices were reported relative to the 32 cm phantom.

The correction approach involved dividing reported pediatric body CTDI values into two distributions (low and high range). The lower range of CTDI values corresponds approximately to the 32 cm phantom whereas the higher range of CTDI values roughly correspond to the 16 cm phantom—a larger diameter implies a larger volume, therefore less energy deposited per unit volume. Relatively high values could then be flagged and investigated further. With some prior knowledge of vendor preferences, along with data provided per sequence, most high pediatric CTDI body values could be corrected relative to the 32 cm phantom. The correction used a simple factor of two since the diameter of the standard 32 versus 16 cm phantom differs by a factor of two; however, this is approximate given that beam filtration, shaping filters and other machine settings could make this slightly higher, or lower than two. In the absence of confirmed reference phantoms it was felt this represented an appropriate correction for the purposes of DRLs.

3.0 RESULTS

3.1 CT EQUIPMENT SAMPLE

By working closely with provincial and territorial governments and through efforts to promote the survey, a large sample of Canadian facilities was polled. This ensured that the survey provided a representative sample of Canadian adult and pediatric CT examinations, spanning as many equipment vendors, models and provinces/territories as possible. Overall, there was a high level of participation from facilities across Canada. As shown in Table 4, 409 survey booklets were returned to HC and of those, 381 were transposed into a database. This implies that approximately 75% of the 510 CT units reported in Canada were surveyed, providing a large cross-section of vendors and models (Table 5). The 381 booklets (one per CT scanner) ultimately provided 18 985 individual patient samples, corresponding to 24 280 individual scan phases or sequences–28 booklets were deemed incomplete, or contained insufficient machine and dose index information.

A significant amount of data was also obtained for routine CT protocols as set up on equipment (Section II of the survey); however, this report will focus on patient examination data only in the interest of providing representative CT DRLs. Routine protocol data may be used in future work.

Survey data on actual CTDI measurements using standard PMMA phantoms (Section IV of the survey) was limited. Hence this report does not include results from this section of the survey. Considering the limited data collected, future work will evaluate its potential use.

Table 4: *Summary of survey booklets returned, transposed into database and response rate (%).*

Returned Booklets	Booklets Entered into Database	Number of CT scanners in Canada*	Returned* (%)	Database* (%)
409	381	510	80.2	74.7

**Returned and entered into database percentages are based upon CIHI 2012 [3] report of 510 total CT units in Canada compared to returned (409) and booklets entered into database (381). HC sent one booklet per CT scanner surveyed. Survey also included PET/CT or SPECT/CT units if they were used for CT diagnostic purpose–these were very few in number relative to CT only units.*

Table 5: *All Vendors/Models captured in Canada CT Survey organized by vendor, model, maximum number detector rows, and totals.*

VENDOR	MODEL	NUMBER OF ROWS	COUNT	TOTAL (%)
GENERAL ELECTRIC	HISPEED QX/i	4	3	
	LIGHTSPEED QX/i	4	3	
	LIGHTSPEED PLUS	4	2	
	LIGHTSPEED ULTRA	8	7	
	LIGHTSPEED PRO 16	16	5	
	LIGHTSPEED 16	16	22	
	BRIGHTSPEED ELITE	16	7	
	LIGHTSPEED RT	16	4	
	DISCOVERY STE	16	1	
	LIGHTSPEED PRO 32	32	1	
	LIGHTSPEED VCT	64	73	
	DISCOVERY CT 750HD	64	31	
	OPTIMA CT 660	64	5	
	DISCOVERY CT 670NM	64	1	
			165	**0.43**
SIEMENS	EMOTION DUO	2	1	
	SENSATION 4	4	1	
	EMOTION 6	6	3	
	EMOTION 16	16	1	
	SENSATION 16	16	14	
	BIOGRAPH 16	16	1	
	SENSATION 40	20	2	
	DEFINITION AS 40	20	1	
	SENSATION 64	32	23	
	DEFINITION AS	32	10	
	DEFINITION AS+	64	14	
	DEFINITION FLASH	64	10	
			81	**0.21**
TOSHIBA	ASTEION	4	3	
	AQUILION 16	16	12	
	AQUILION 32	32	1	
	AQUILION 64	64	54	
	AQUILION PRIME	80	1	
	AQUILION ONE	320	14	
			85	**0.22**

VENDOR	MODEL	NUMBER OF ROWS	COUNT	TOTAL (%)
PHILIPS	BRILLIANCE CT 10	10	4	
	MX 8000 IDT 10	10	1	
	MX 8000 IDT 16	16	4	
	BRILLIANCE CT 16	16	9	
	BRILLIANCE CT BIG BORE 16	16	3	
	GEMINI GXL 16	16	1	
	BRILLIANCE CT 40	40	2	
	BRILLIANCE CT 64	64	16	
	GEMINI TF 64	64	2	
	BRILLIANCE iCT	128	7	
			49	**0.13**
NEUROLOGICA	CERETOM NL 3000	8	**1**	**<0.01**
			381	**1.00**

Note: *No patient data was included for the Discovery CT 670NM. One Philips scanner was only identified by detector row maximum = 40, therefore assumed to be a Brilliance CT 40 for purposes of report.*

The manufactured and installation years of the surveyed CT equipment is shown in Figure 4. Installation year of Canadian CT equipment shows a mix of older and newer units. Most scanners seem to have been installed in facilities from approximately 2003 through 2012 with a median installation year of 2007. Figure 5 shows the distribution of maximum detector-row and slice capability of surveyed equipment. The predominant CT units in the survey had 16 or 64 detector rows representing 76% of the participating CT equipment (using table 5 data); however, there are a number of CT units that have ≤ 8 detector rows, representing 6.3%, and >128 detector rows, representing 3.7%. Thus a broad range of available collimation widths are represented.

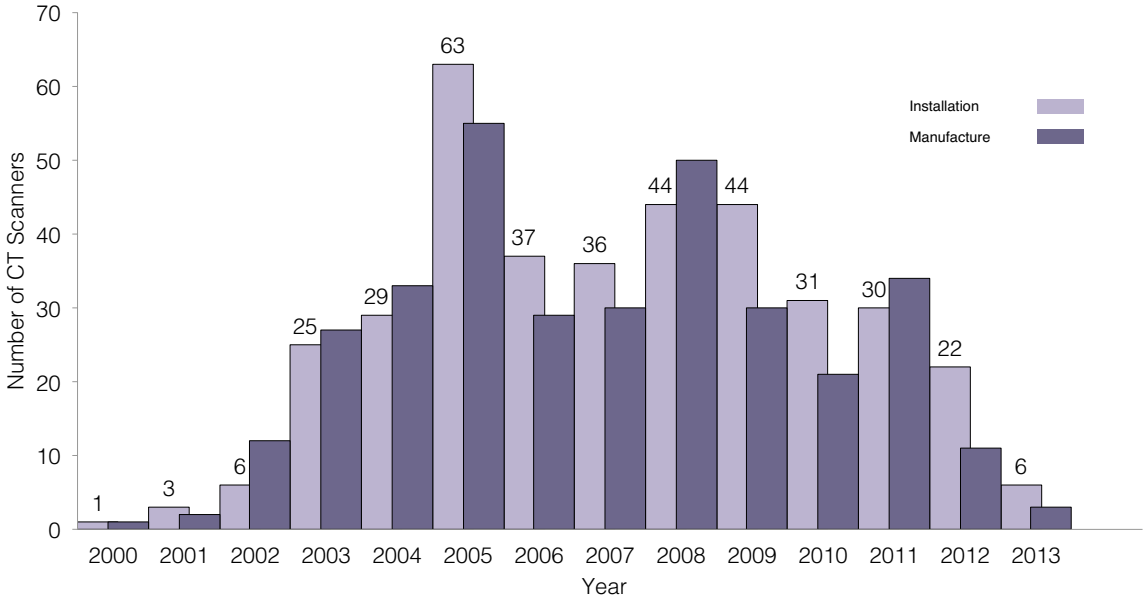

Figure 4: Year of installation, and manufacture of CT scanners surveyed across Canada. The year of installation and the year of manufacture may not be the same for a given scanner. Of 381 scanners surveyed 377 reported an install year, but only 338 reported a manufactured year.

Almost all of the scanners surveyed are capable of helical (continuous) scanning and a large portion have some form of dose reduction technology available, including iterative reconstruction, as shown in Table 6. By far, most of the surveyed CT scanners are single x-ray tube (source), although clearly some specialized (dual source or energy, CT simulator) and combination CT units (PET/CT, SPECT/CT) are used for clinical purposes, as indicated in Figure 6.

Additional information was requested regarding other applications of CT scanners polled, namely whether given CT units were also used in virtual colonoscopy, interventional and angiographic procedures (Table 7). Clearly, the CT units surveyed also play significant roles in other diagnostic and interventional capacities.

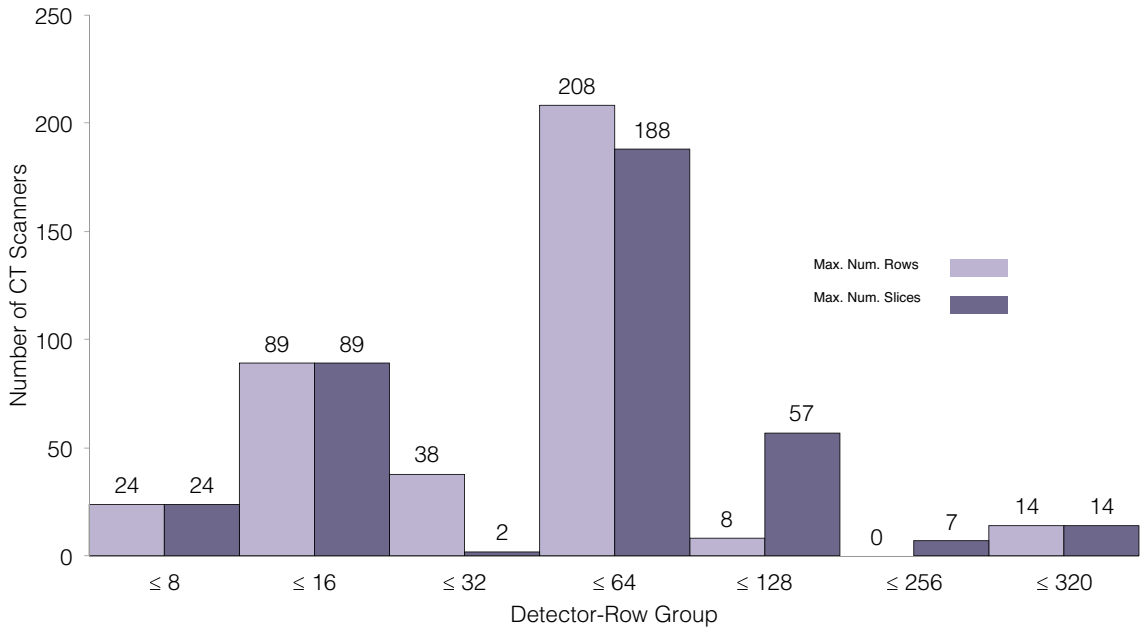

Figure 5: Detector row group (class) for scanners surveyed. Group is defined as maximum number of detector rows used for largest collimation setting (at minimal slice width)–does not always correspond to maximum number of slices for all scanner technologies.

***Table 6:** Availability of helical scanning and "dose reduction" technologies on scanners surveyed.*

Helical Scanning	Dose Reduction Technologies
Yes–372	Yes–298
No–0	No–56
Not specified–9	Not specified–27

***Note:** Original design of survey intended only to survey availability of tube current modulation dose reduction schemes; however, iterative reconstruction is promoted as a dose reduction technology, therefore these are included here alongside commonly used tube current modulation techniques.*

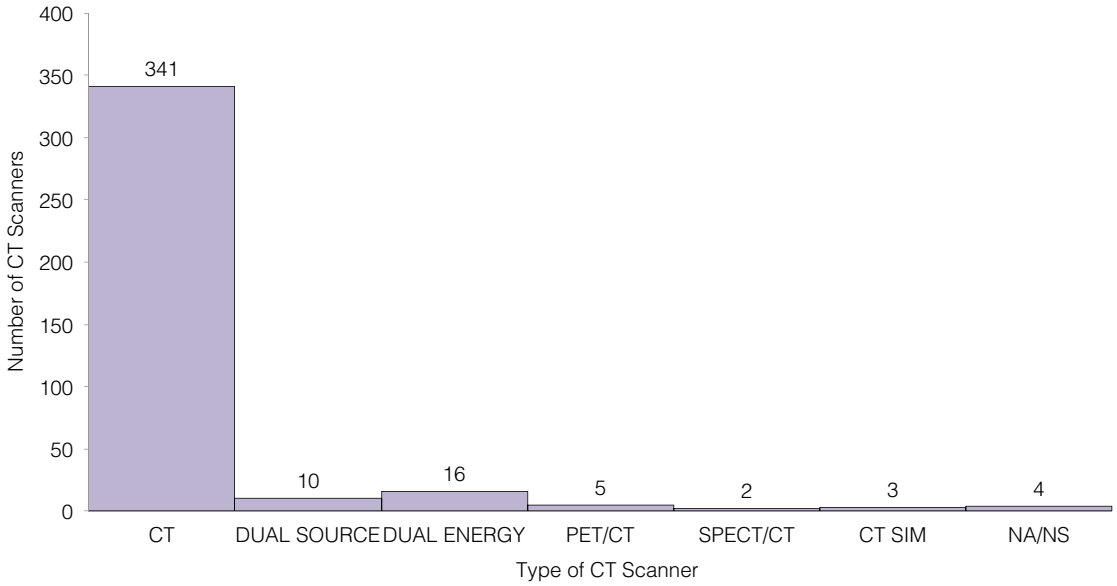

Figure 6: Types of scanners included in CT survey–instructions only allowed for those scanners that were used for diagnostic, monitoring, and follow-up purposes (exam types and indications outlined above in Table 1).

Table 7: *Polling results of CT units for other clinical purposes–showing expanding role of CT unit usage.*

	YES	NO	NS/NA
VIRTUAL COLONOSCOPY	173	177	31
INTERVENTIONAL PROCEDURES	237	123	21
ANGIOGRAPHY	324	50	7

The overwhelming majority of CT units surveyed are located in diagnostic imaging departments, with few located in nuclear medicine, emergency and “other” departments (Figure 7).

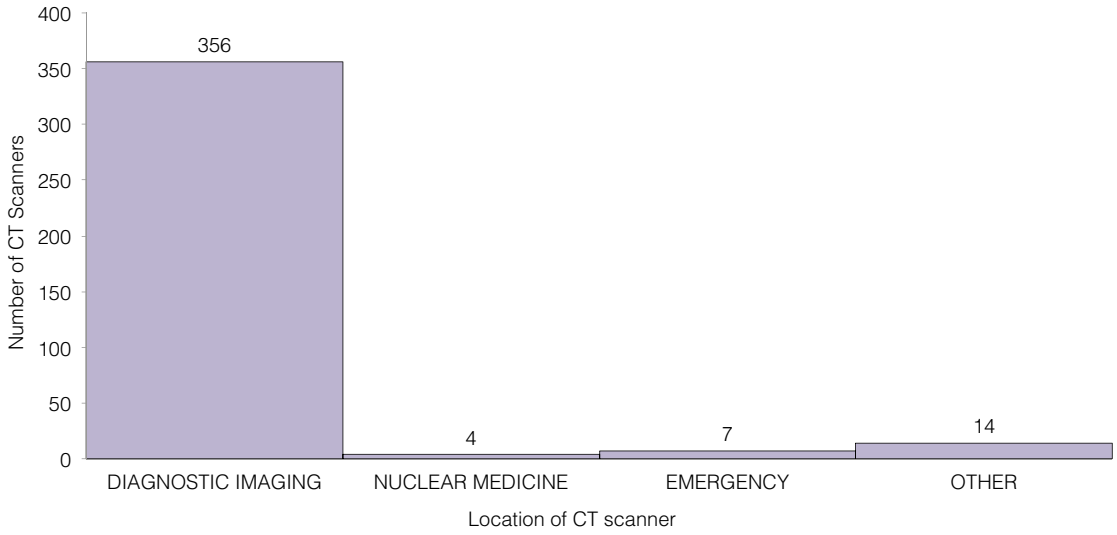

Figure 7: Location of CT units surveyed (departments)–as presented, most are located in diagnostic imaging departments. "Other" locations were reported as; private clinic, cancer treatment centre, radiation oncology, radiotherapy and heart services.

3.2 PATIENT EXAMINATION DATA AND DOSE INDICES

As outlined in section 2.3.2, processing logic that incorporated patient body habitus characteristics to expand the total number of samples per examination type was incorporated when the patient mass was not provided. By using this approach all sample pools for individual patient data were extended beyond using reported mass alone. This was welcomed in pediatric cases where any option to extend sample size would be beneficial. Considering Adult Head examination samples as an example, this approach allowed the group sample to be increased from n = 4834 available sequences to n = 5495 sequences. Appendix B shows similar increases for other exam types over using only reported age and body mass. Although pediatric sample sizes are reasonable, unfortunately, they still represent a small portion of the adult sample sizes.

Further processing algorithms also allowed available patient sequences to be further segmented by scan mode (axial or helical), use of contrast (C- or C+) and application of dose reduction technologies (fixed tube current (Fix) or dose reduction (DR)), as outlined in section 2.3.3. Ultimately, this resulted in a large, well defined patient sample of CT scanning practice. The sample sizes, in terms of number of sequences, of all individual patient exam groups and sub-groups are summarized in Table 8. Note that sequence counts per exam category in Table 8 are from the total number of sequences available and may differ from the actual number used for the assessment of DRLs, if for some sequences a given variable such as CTDIvol or DLP was not provided.

Table 8: *Number (n) of individual patient sequences/scan phases for each exam (group) type used in this report. Data is further divided into sub-groups dictated by scanning mode, use of contrast and application of dose reduction technologies.*

	AXIAL				HELICAL				n
	C-		C+		C-		C+		
	FIX	DR	FIX	DR	FIX	DR	FIX	DR	
ADULT EXAMINATIONS									
HEAD	2288	1071	198	65	1223	469	131	50	**5495**
CHEST	7	5	3	0	165	1539	143	2046	**3908**
ABD+PELVIS	0	0	33	5	67	429	217	3494	**4245**
CHEST+ABD+PELVIS	0	0	24	3	80	310	318	5143	**5878**
PEDIATRIC EXAMINATIONS									
HEAD (0–3 yrs.)	74	11	8	1	47	32	1	0	**174**
HEAD (3–7 yrs.)	58	10	4	0	27	23	5	1	**128**
HEAD (7–13 yrs.)	82	18	3	0	29	32	2	2	**168**
CHEST (0–3 yrs.)	1	0	0	0	2	15	6	27	**51**
CHEST (3–7 yrs.)	0	0	0	0	3	12	4	19	**38**
CHEST (7–13 yrs.)	0	0	0	0	0	13	4	17	**34**
ABDOMEN (0–3 yrs.)	0	0	0	0	0	2	1	32	**35**
ABDOMEN (3–7 yrs.)	0	0	0	0	0	5	2	38	**45**
ABDOMEN (7–13 yrs.)	0	0	0	0	0	3	1	44	**48**

Note that actual number of CTDI and DLP samples per group and sub-group will also vary according to heterogeneity of reporting–further details are given in Appendix C. Exam group totals and restrictions based upon age and body mass are presented in Appendix B.

Generally, in referring to Table 8, we can see that adult and pediatric head scanning spans a broad range of techniques for the clinical indications surveyed, including a mix of axial versus helical scanning and application of dose reduction. Contrast is used in a relatively small proportion of cases. Whereas adult and pediatric body scanning is dominated by helical type scanning and seems to show a higher proportion of contrast use and application of dose reduction relative to head scanning.

For each examination type (group) and its sub-groups, Figures 8–33 show dose index histograms for CTDIvol and DLP. In each case the CTDIvol DRL (75th percentile for whole group) is shown by a solid and dashed vertical line for axial and helical scanning respectively. Similarly in the DLP case, the DRL or 75th percentile line is shown for both DLP per sequence and for the entire exam (whole exams may be made up by multiple sequences) as a solid and dashed line respectively. The lower portions of Figures 8–33 show the corresponding 75th and 95th percentile values of dose indices for labelled sub-groups, providing valuable, additional context to help identify dose reduction opportunities. Sample size (frequency), patient characteristic and dose index summary tables for all exam groups and sub-groups are provided in Appendix C.

In a number of sub-group plots (lower, horizontal bars), the DRL of the DLP for the whole exam (DLPexam) is equal to or less than the DRL for the DLP per sequence (DLPseq). In those cases where they are equivalent, this is simply because many exams are made up of single sequences; therefore DLPseq and DLPexam are the same. In some cases, sparse reporting of DLPseq and the corresponding DLPexam affected the dose index distribution shape of the subgroups; therefore the DRL of DLPseq may be greater depending on how

DLPseq is reported relative to DLPexam. In all of these cases, the plots may seem to be missing the DRL of DLPexam values, but they are simply the same (so cannot be displayed) or are "over-lapped" by the DRL value of DLPseq and therefore not shown on horizontal bar plots.

In Figures 8–33, data was pre-processed to remove obvious outliers and inconsistent data. A fairly conservative approach was taken in removing extreme CTDIvol values. Specifically, twice the 99th percentile of the original raw data was taken as a limiting threshold. This removed those values of CTDIvol which were extremely high or very likely interchanged with DLP values, but even after applying this conservative threshold some relatively higher dose index values remained. Some additional investigation showed that a number of the higher CTDIvol (and associated DLP) values appeared valid and consistent, as clinical practice could warrant; however, it's possible that some may be other types of mistakes. For example, during data transposition from booklet to database, a small number of cases were discovered where it was suspected that CTDIvol values had been added over multiple sequences (first CTDIvol + second CTDIvol etc.) and then reported as single value. In some other cases, certain vendors provide options to report CTDIvol maximum, rather than typical average CTDIvol. In both of these cases, the reported value of CTDIvol would be higher than expected relative to other sequences in the same group; however, the small number of relatively high values and the elimination of extreme values should have a limited overall effect on the distribution. Using the Adult Head data as an example, if the outlier threshold is lowered to the 99th percentile from twice the 99th percentile then the calculated CTDIvol DRL changes from 83.4 to 81.9 mGy for axial scanning and showed no change in 79.1 mGy for helical scanning–a difference of approximately 1.8% in axial case. Thus, rather than eliminate potentially valid data with more stringent outlier thresholds, the above conservative approach was applied uniformly across all exam types. Following elimination of outlying CTDIvol values, DLP values were checked for consistency with the corresponding scan lengths.

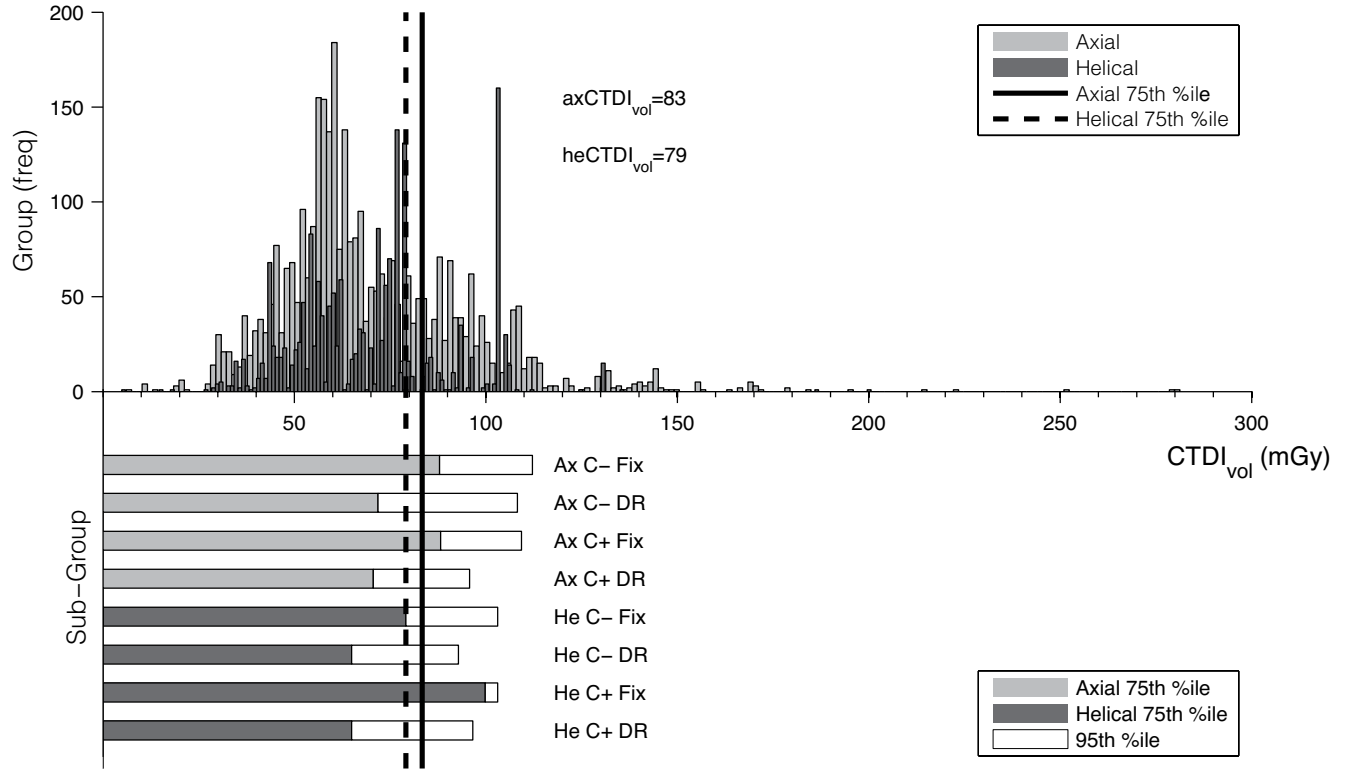

Figure 8: ***Adult Head CTDI (mGy)*** *values for whole group (Upper) and for select sub-groups (Lower).*

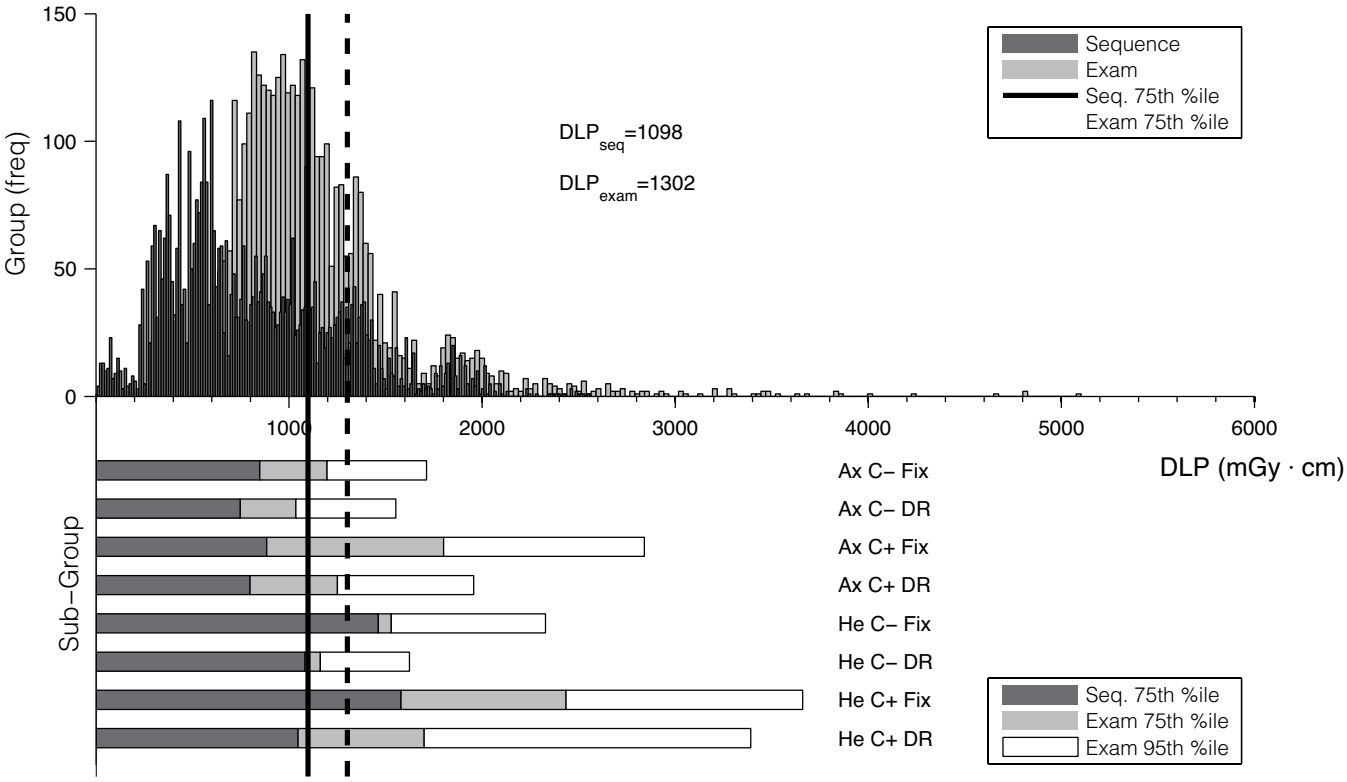

Figure 9: ***Adult Head DLP (mGy·cm)*** *values for whole group (Upper) and for select sub-groups (Lower).*

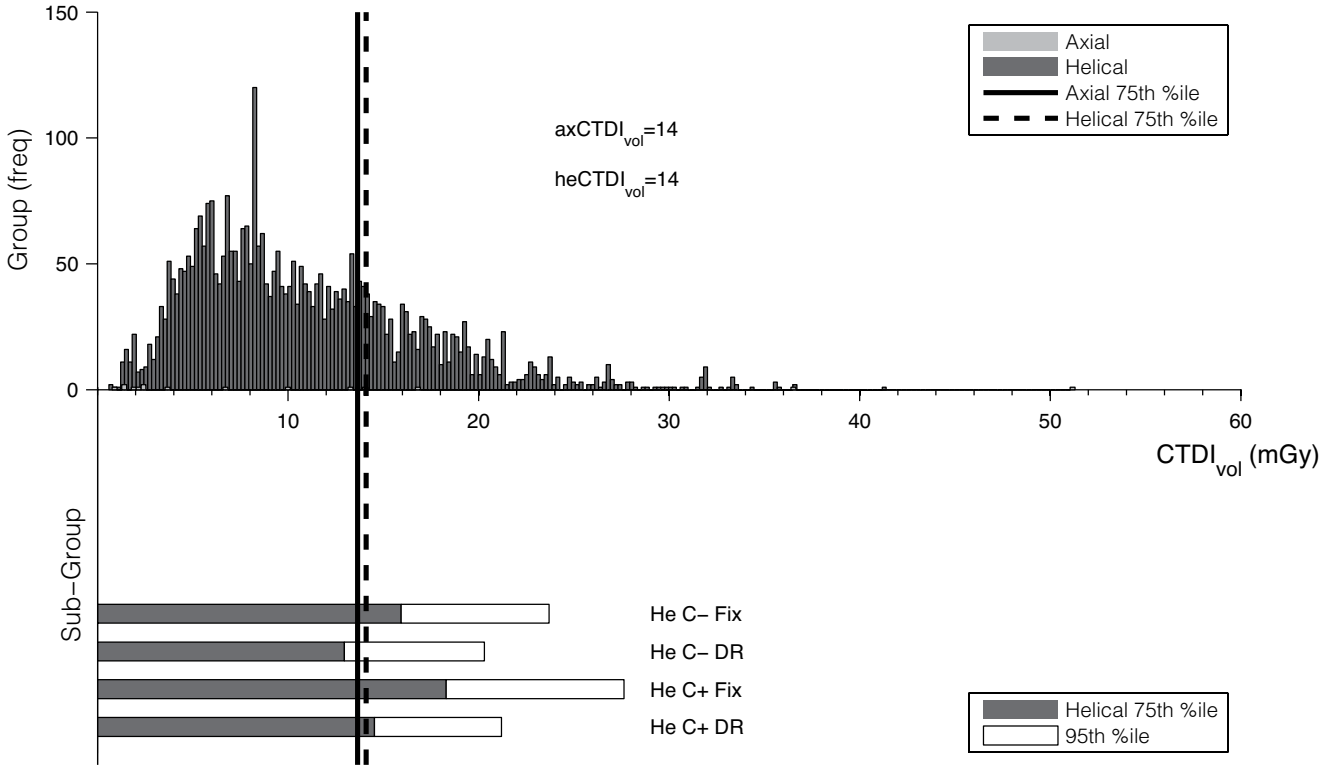

Figure 10: ***Adult Chest CTDI (mGy)*** *values for whole group (Upper) and for select sub-groups (Lower).*

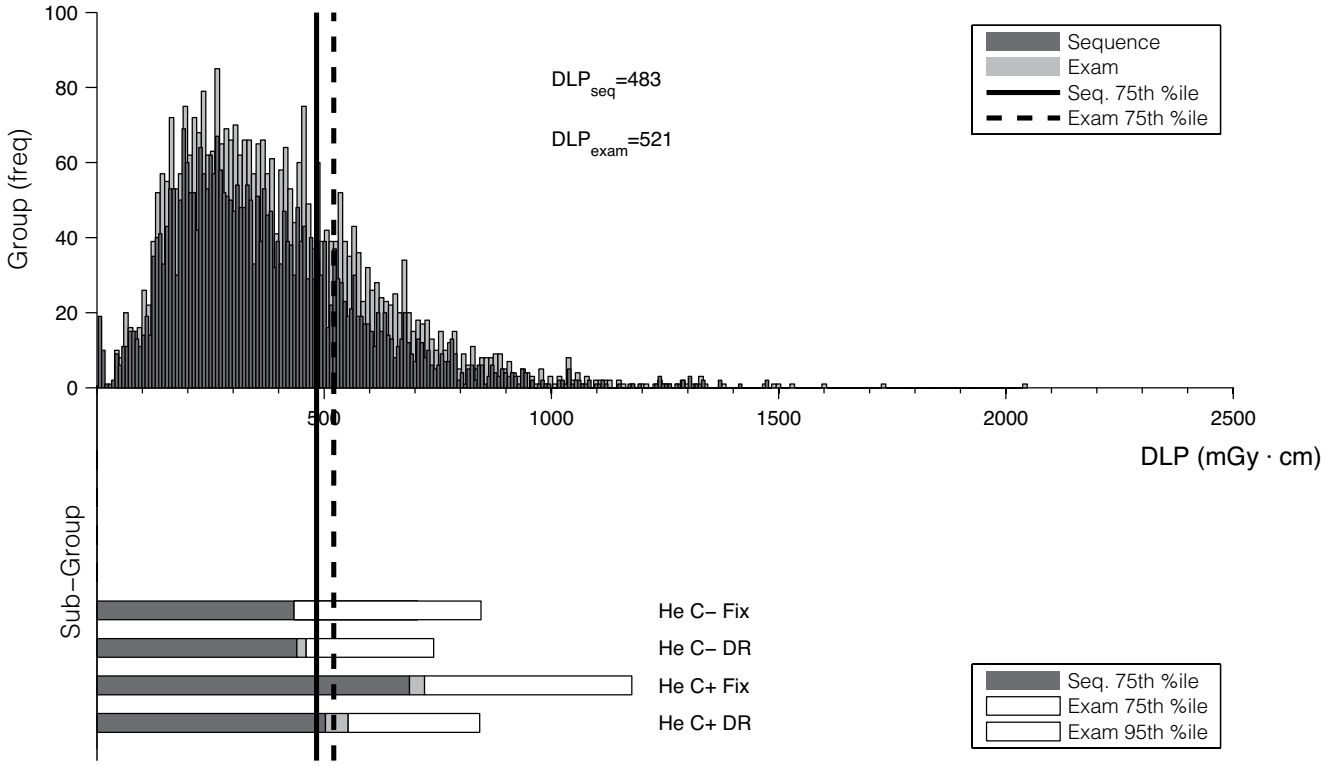

Figure 11: ***Adult Chest DLP (mGy·cm)*** *values for whole group (Upper) and for select sub-groups (Lower).*

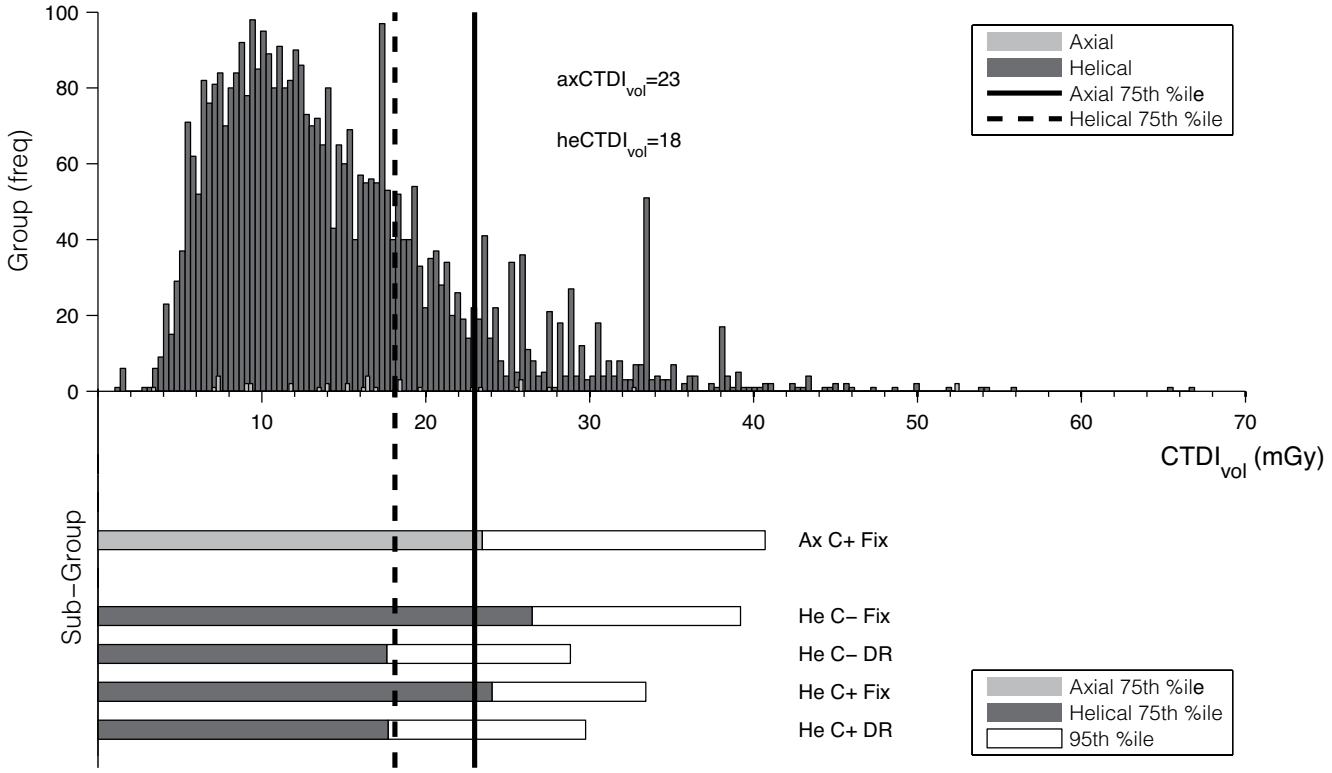

Figure 12: ***Adult Abdomen + Pelvis CTDI (mGy)*** *values for whole group (Upper) and for select sub-groups (Lower).*

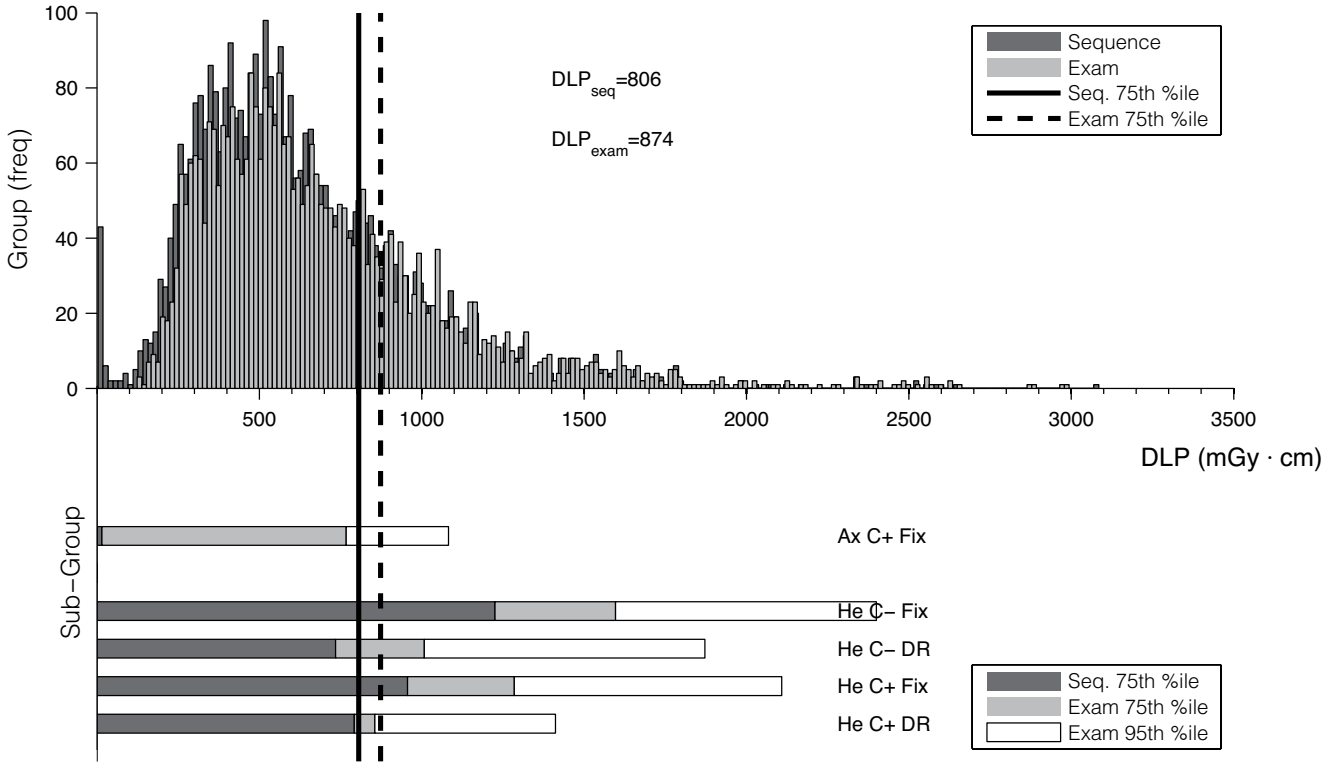

*Figure 13: A****dult Abdomen + Pelvis DLP (mGy·cm)*** *values for whole group (Upper) and for select sub-groups (Lower).*

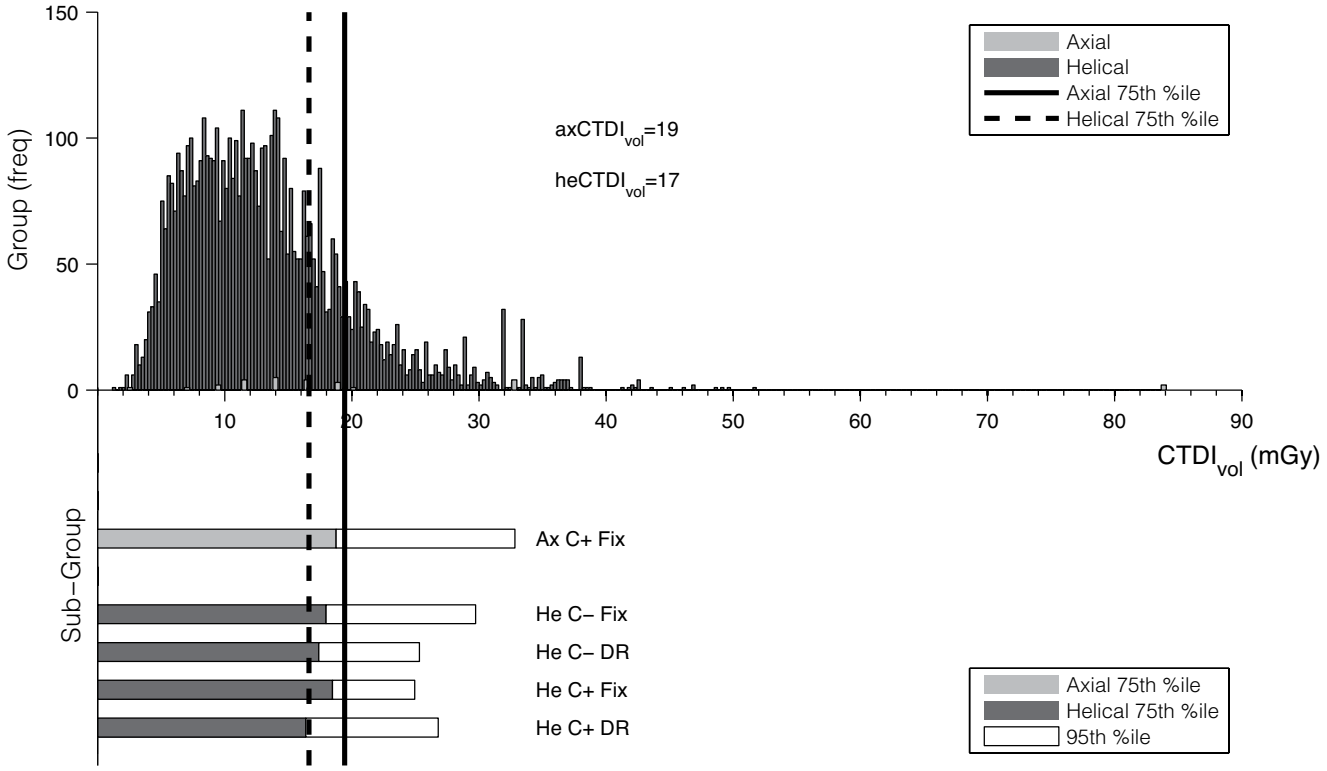

Figure 14: ***Adult Chest + Abdomen + Pelvis CTDI (mGy)*** *values for whole group (Upper) and for select sub-groups (Lower).*

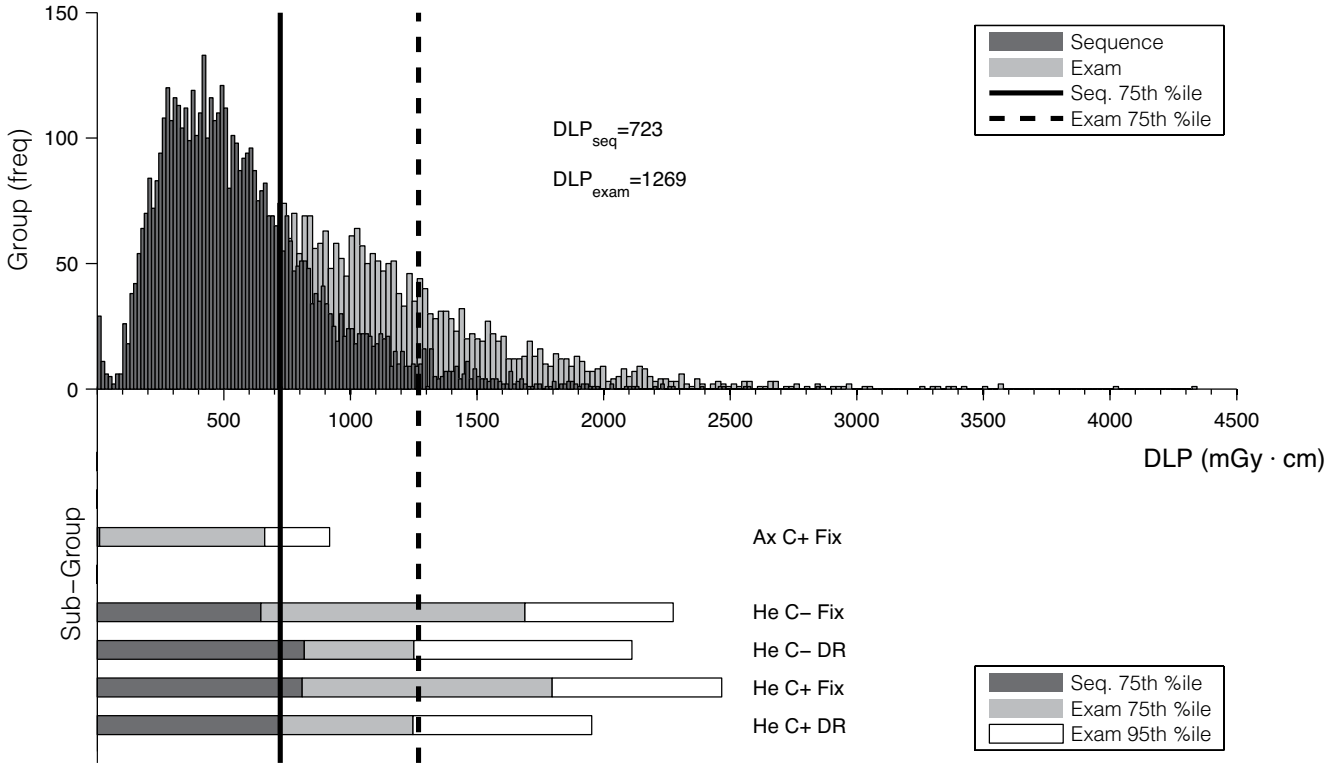

Figure 15: ***Adult Chest + Abdomen + Pelvis DLP (mGy·cm)*** *values for whole group (Upper) and for select sub-groups (Lower).*

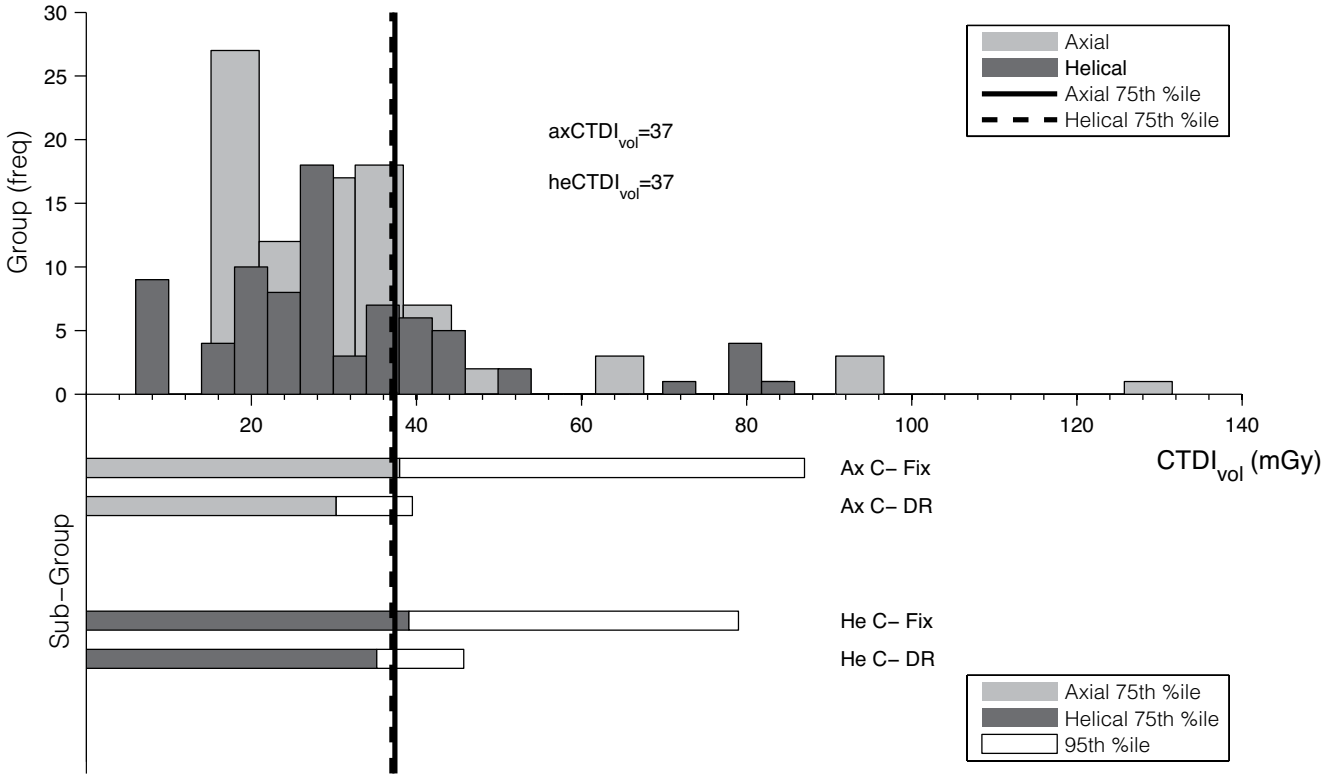

Figure 16: ***Pediatric Head (0–3 yrs.) CTDI (mGy)*** *values for whole group (Upper) and for select sub-groups (Lower).*

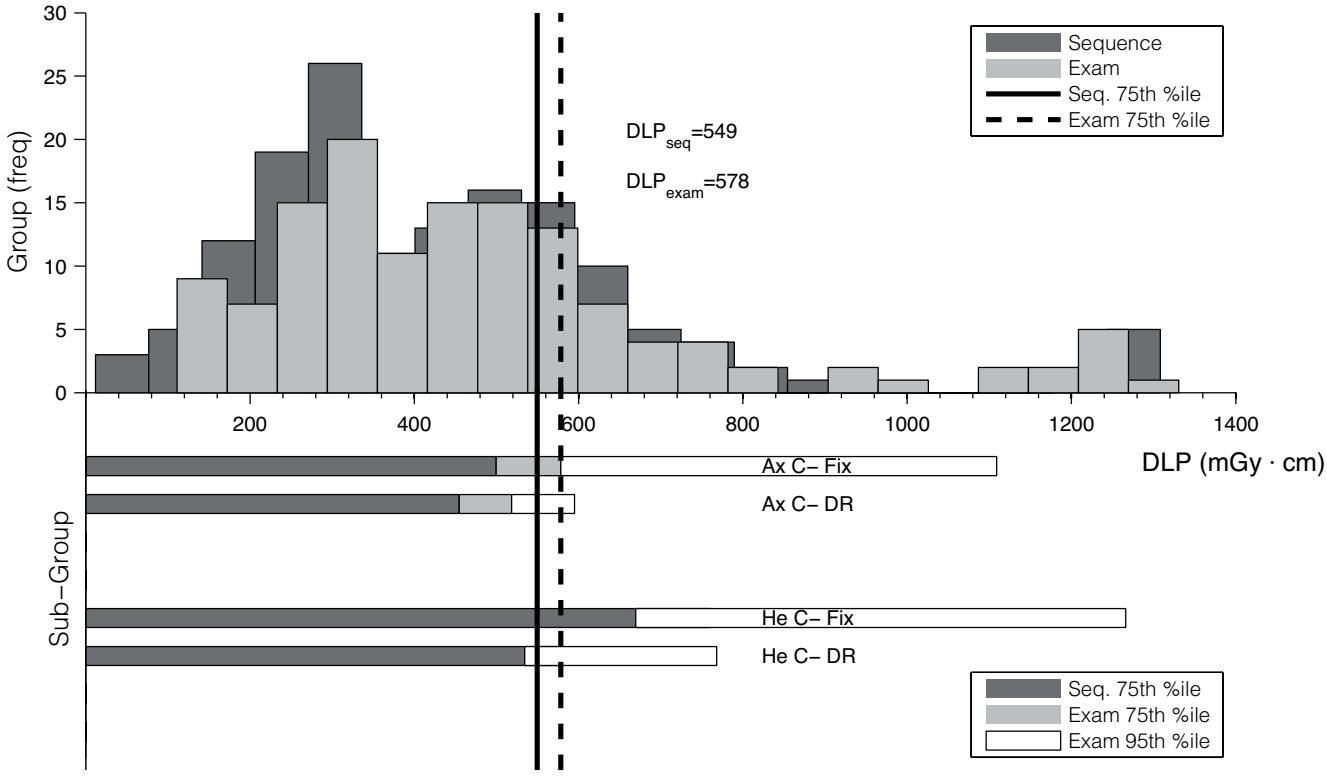

Figure 17: ***Pediatric Head (0–3 yrs.) DLP (mGy·cm)*** *values for whole group (Upper) and for select sub-groups (Lower).*

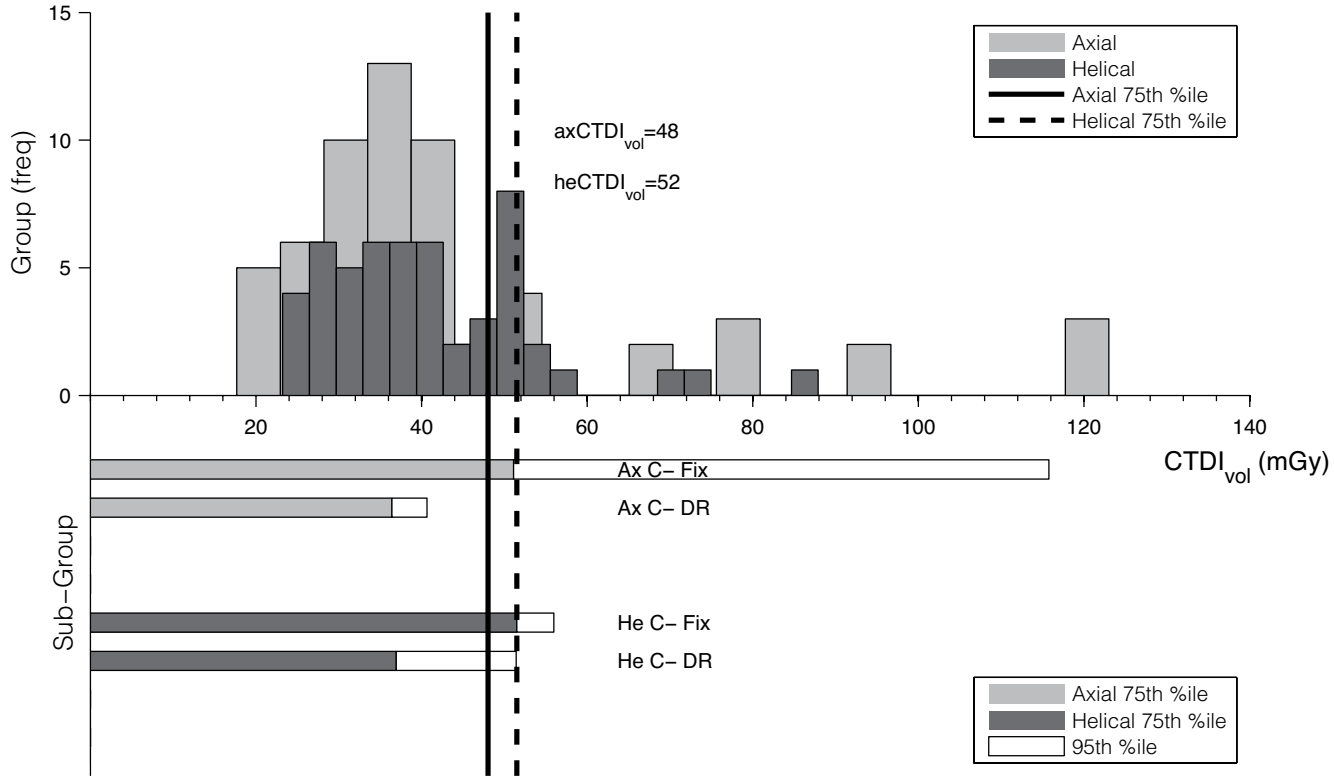

Figure 18: ***Pediatric Head (3–7 yrs.) CTDI (mGy)*** *values for whole group (Upper) and for select sub-groups (Lower).*

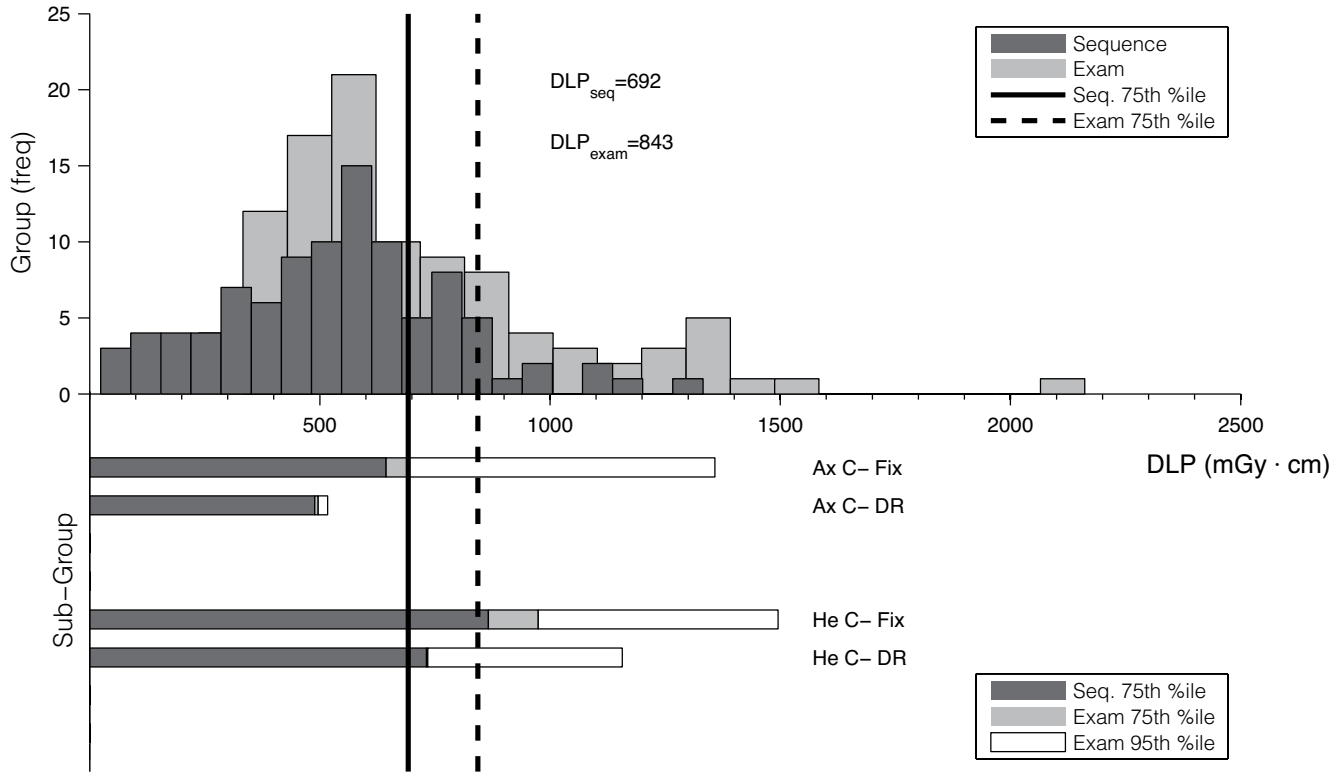

Figure 19: ***Pediatric Head (3–7 yrs.) DLP (mGy·cm)*** *values for whole group (Upper) and for select sub-groups (Lower).*

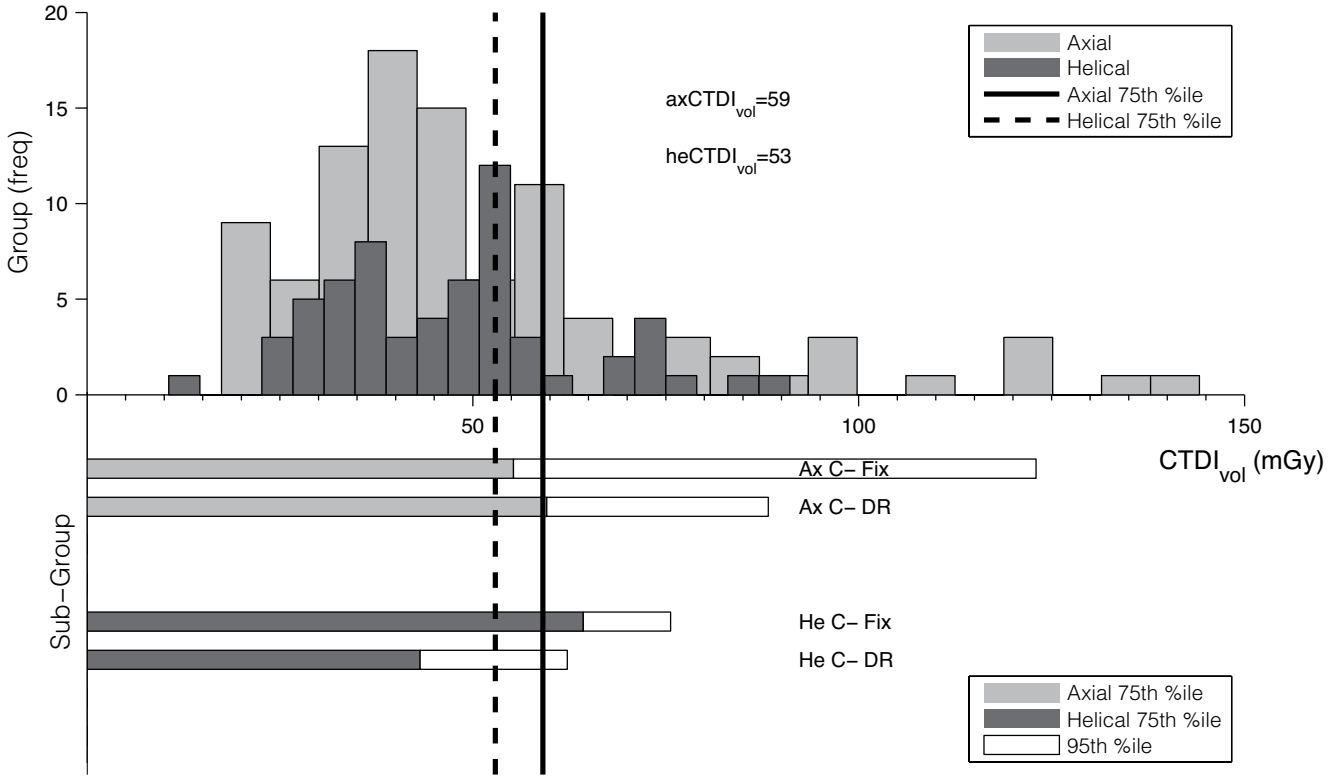

Figure 20: ***Pediatric Head (7–13 yrs.) CTDI (mGy)*** *values for whole group (Upper) and for select sub-groups (Lower).*

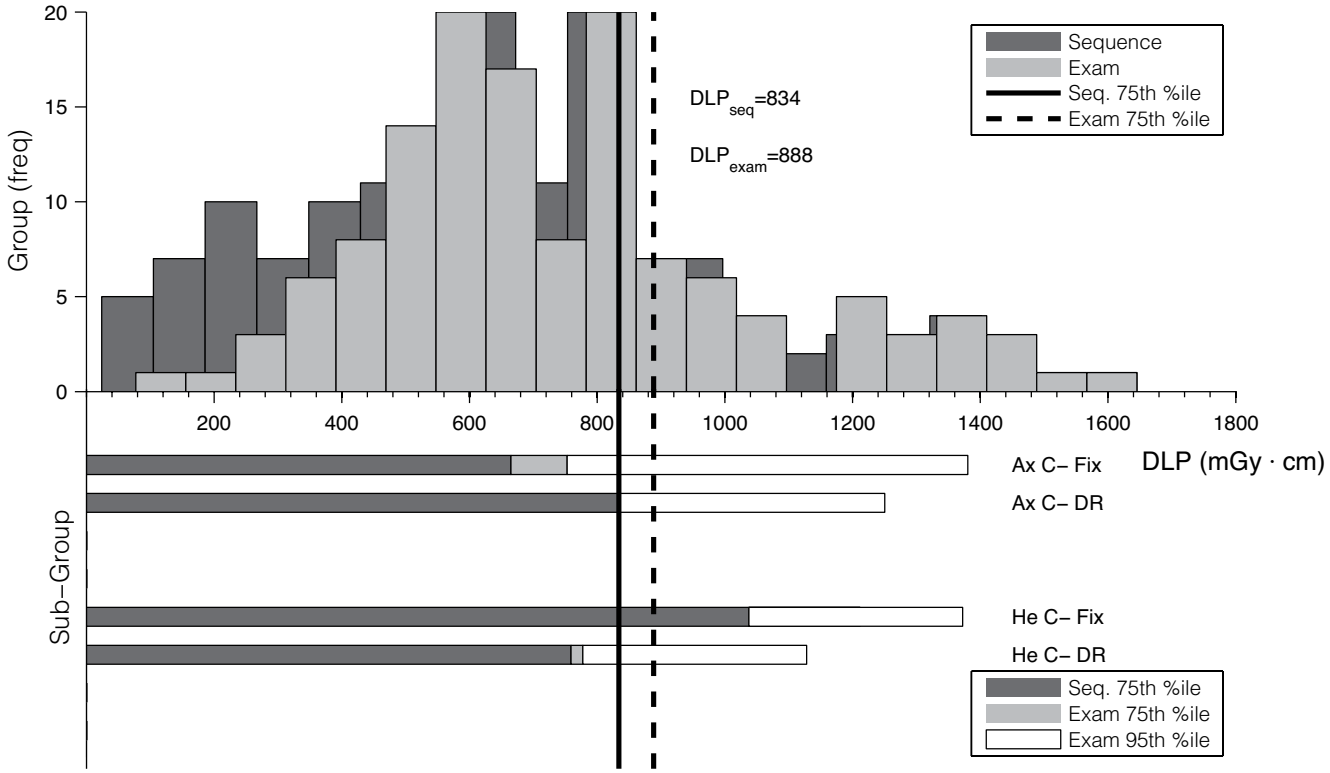

Figure 21: ***Pediatric Head (7–13 yrs.) DLP (mGy·cm)*** *values for whole group (Upper) and for select sub-groups (Lower).*

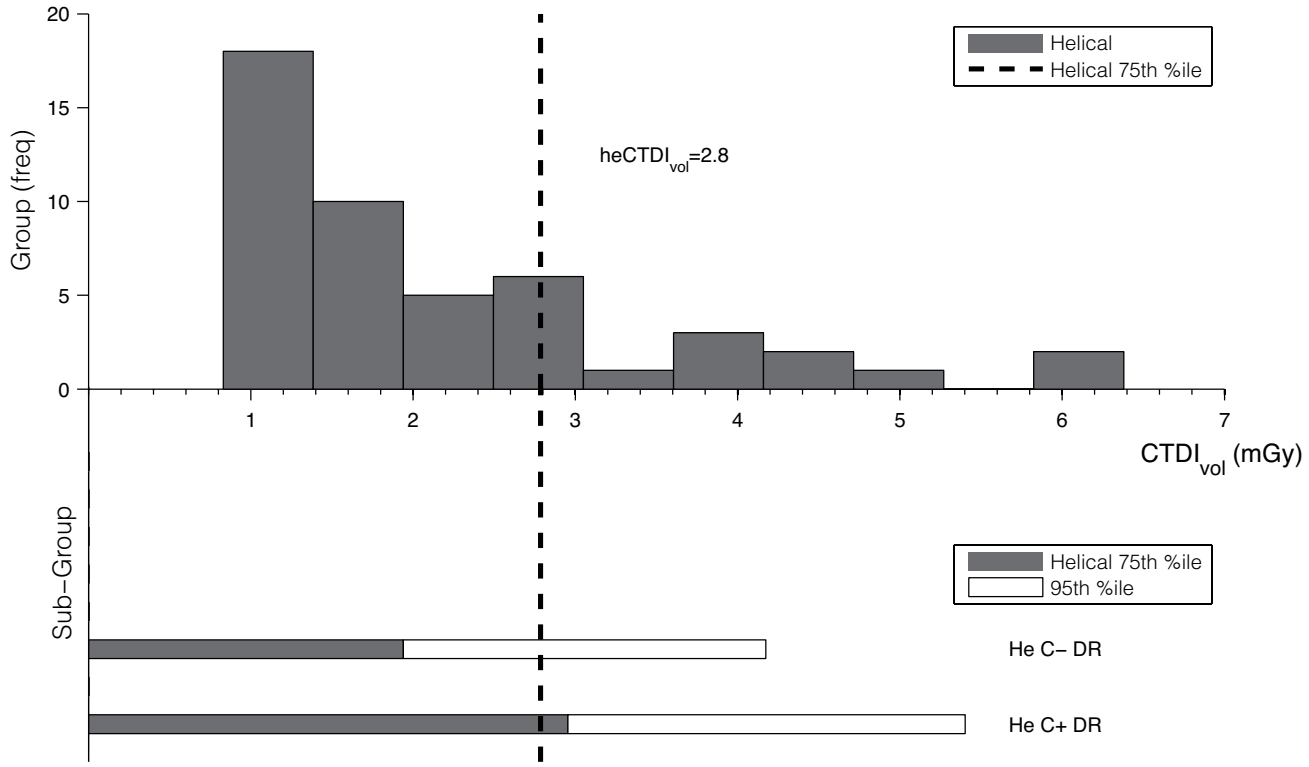

Figure 22: ***Pediatric Chest (0–3 yrs.) CTDI (mGy)*** *values for whole group (Upper) and for select sub-groups (Lower)–relative to the 32 cm reference phantom (see section 2.3.4).*

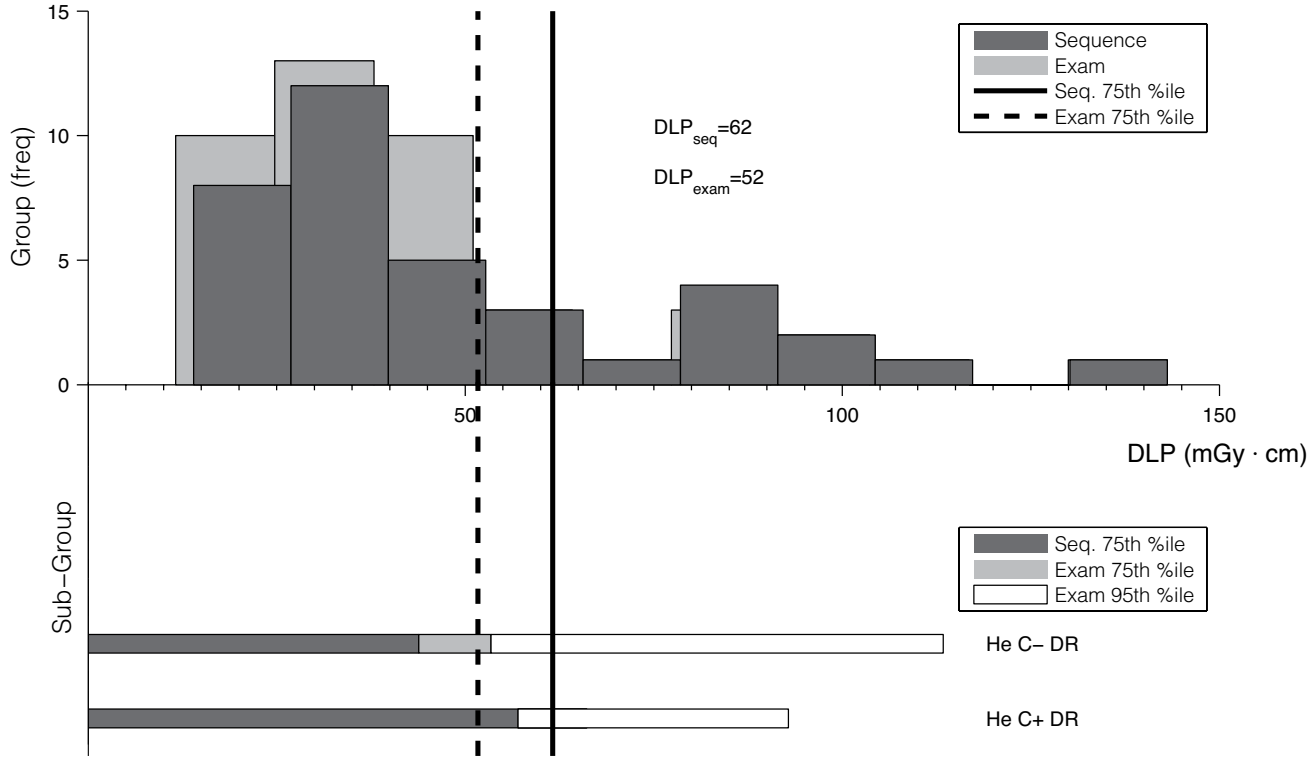

Figure 23: ***Pediatric Chest (0–3 yrs.) DLP (mGy·cm)*** *values for whole group (Upper) and for select sub-groups (Lower)–relative to the 32 cm reference phantom (see section 2.3.4).*

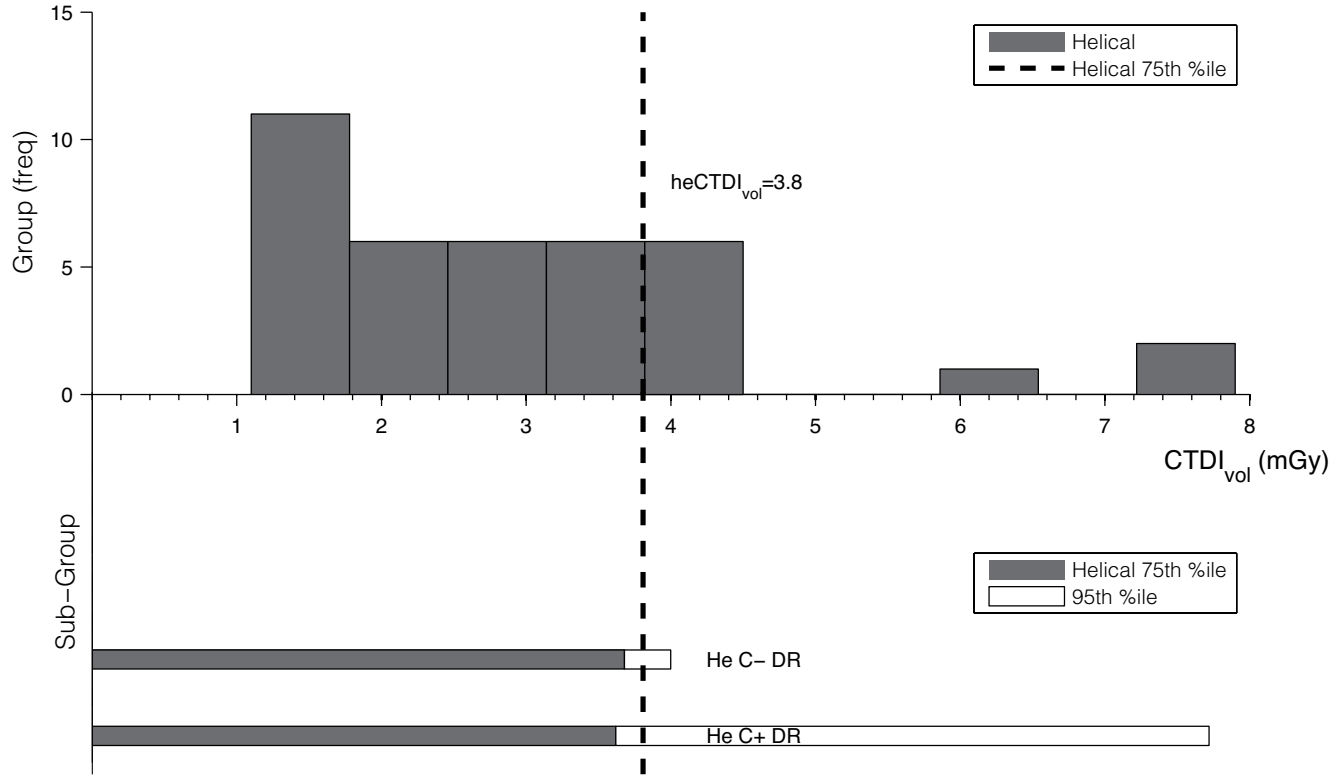

Figure 24: ***Pediatric Chest (3–7 yrs.) CTDI (mGy)*** *values for whole group (Upper) and for select sub-groups (Lower)–relative to the 32 cm reference phantom (see section 2.3.4).*

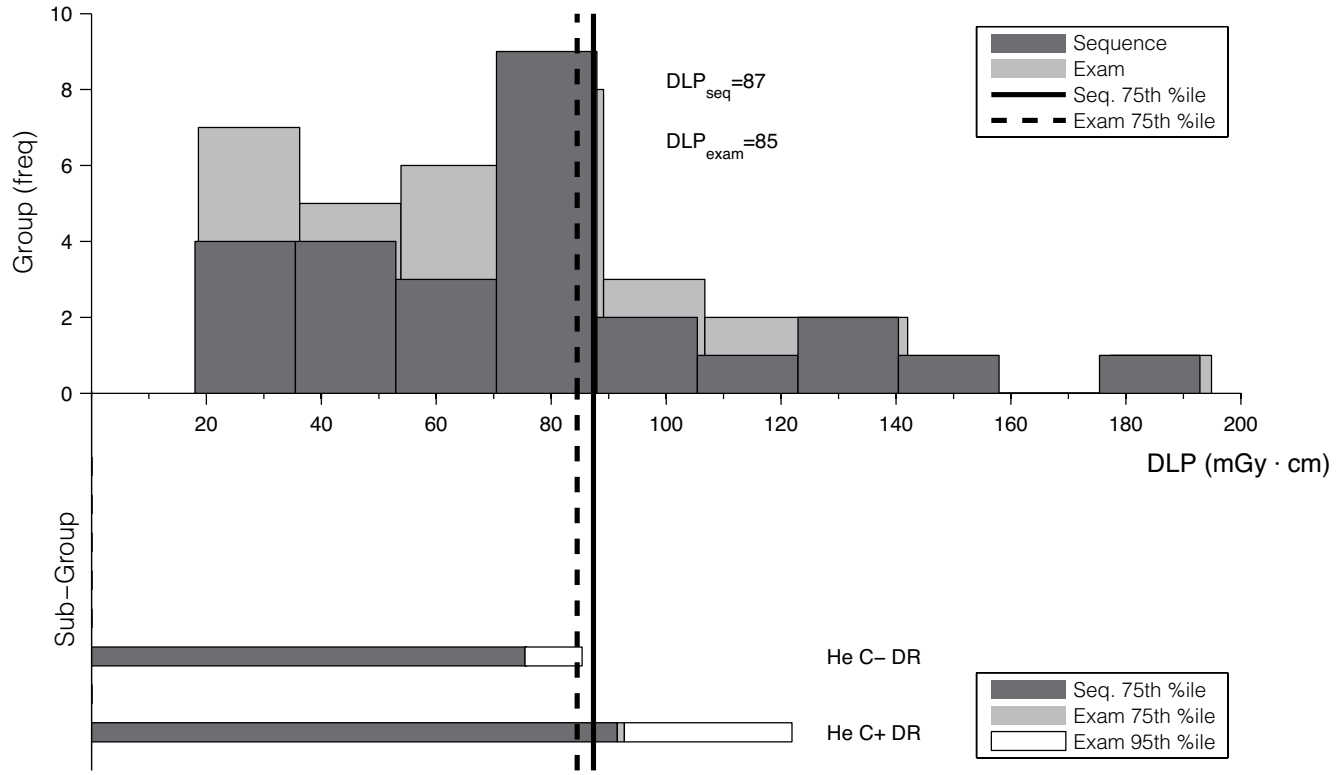

Figure 25: ***Pediatric Chest (3–7 yrs.) DLP (mGy·cm)*** *values for whole group (Upper) and for select sub-groups (Lower)–relative to the 32 cm reference phantom (see section 2.3.4).*

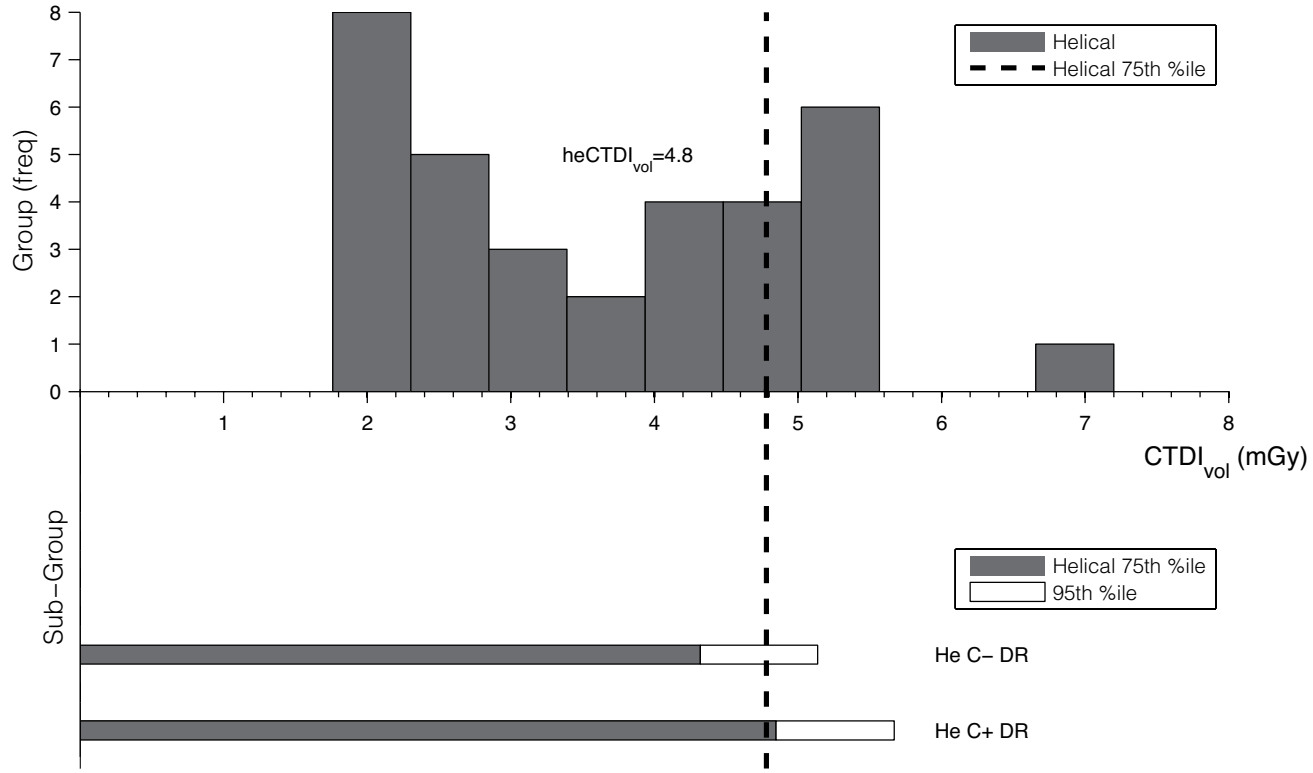

Figure 26: ***Pediatric Chest (7–13 yrs.) CTDI (mGy)*** *values for whole group (Upper) and for select sub-groups (Lower)–relative to the 32 cm reference phantom (see section 2.3.4).*

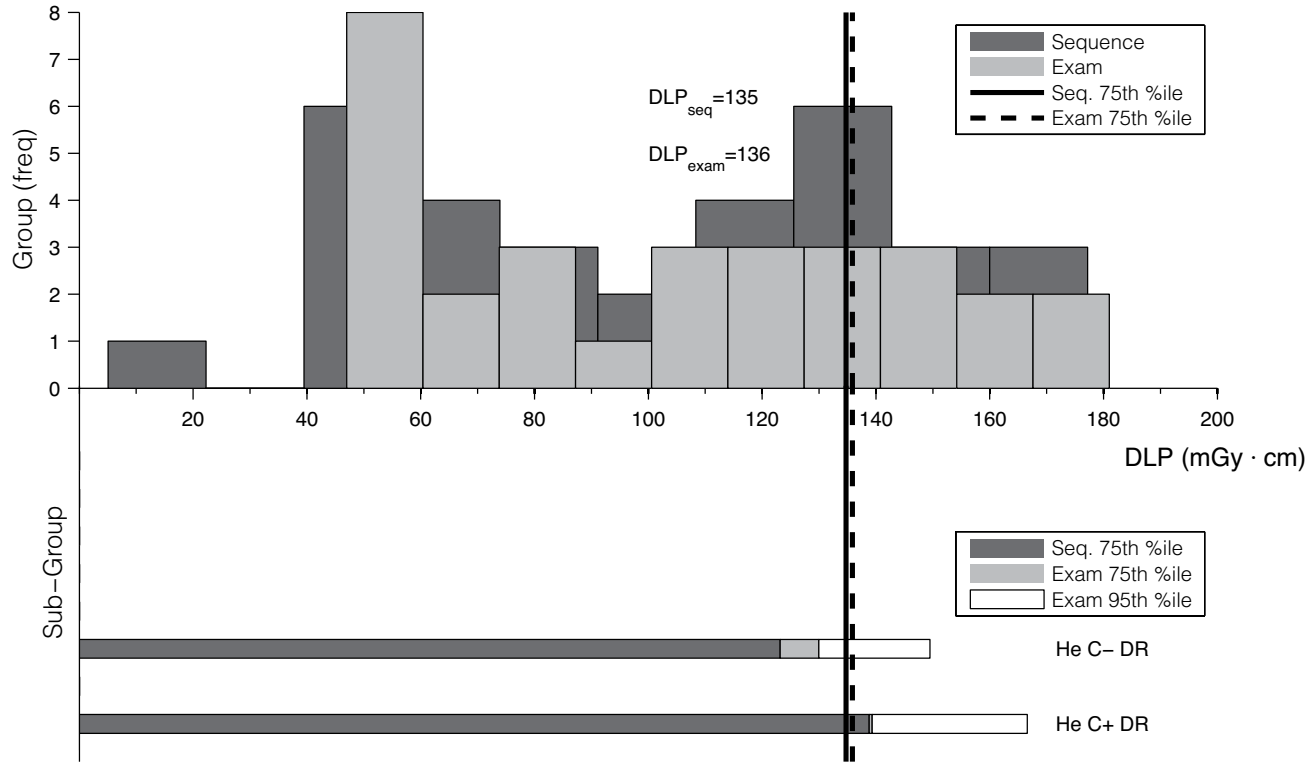

Figure 27: ***Pediatric Chest (7–13 yrs.) DLP (mGy·cm)*** *values for whole group (Upper) and for select sub-groups (Lower)–relative to the 32 cm reference phantom (see section 2.3.4).*

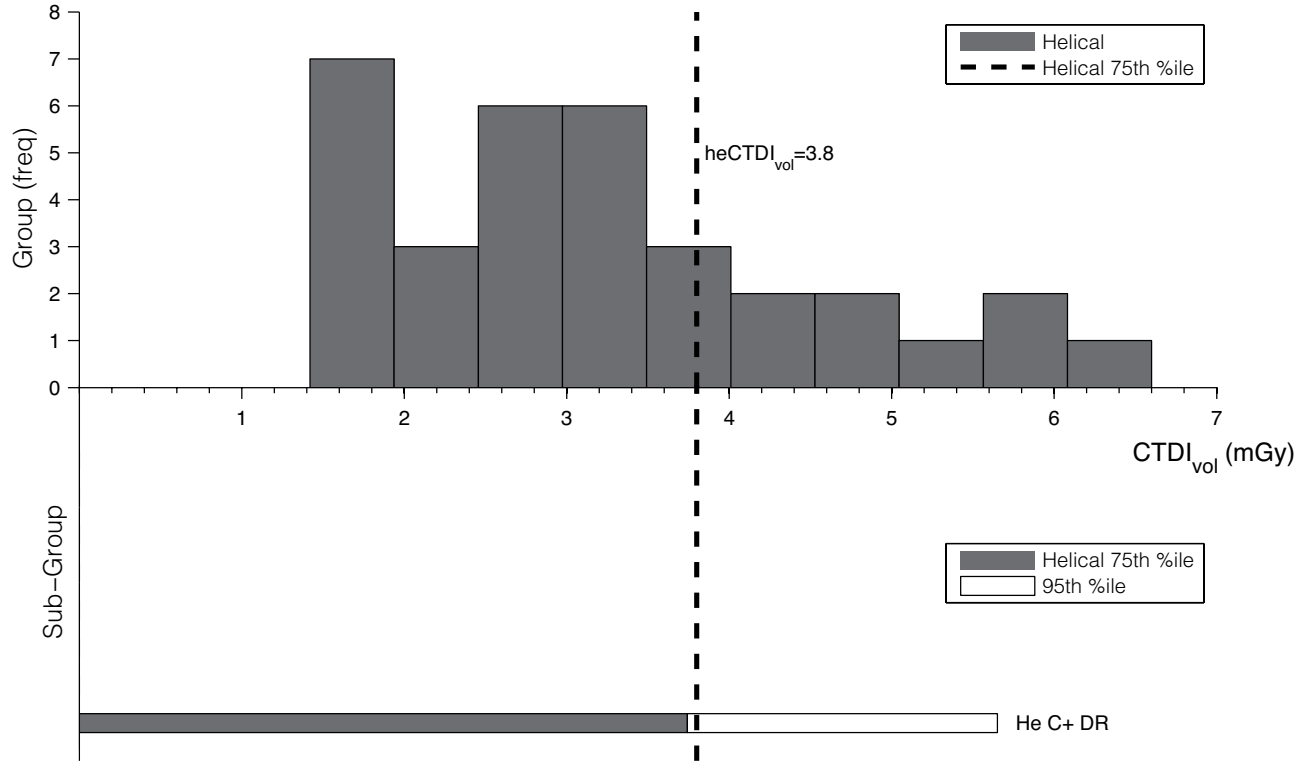

Figure 28: ***Pediatric Abdomen (0–3 yrs.) CTDI (mGy)*** *values for whole group (Upper) and for select sub-groups (Lower)–relative to the 32 cm reference phantom (see section 2.3.4).*

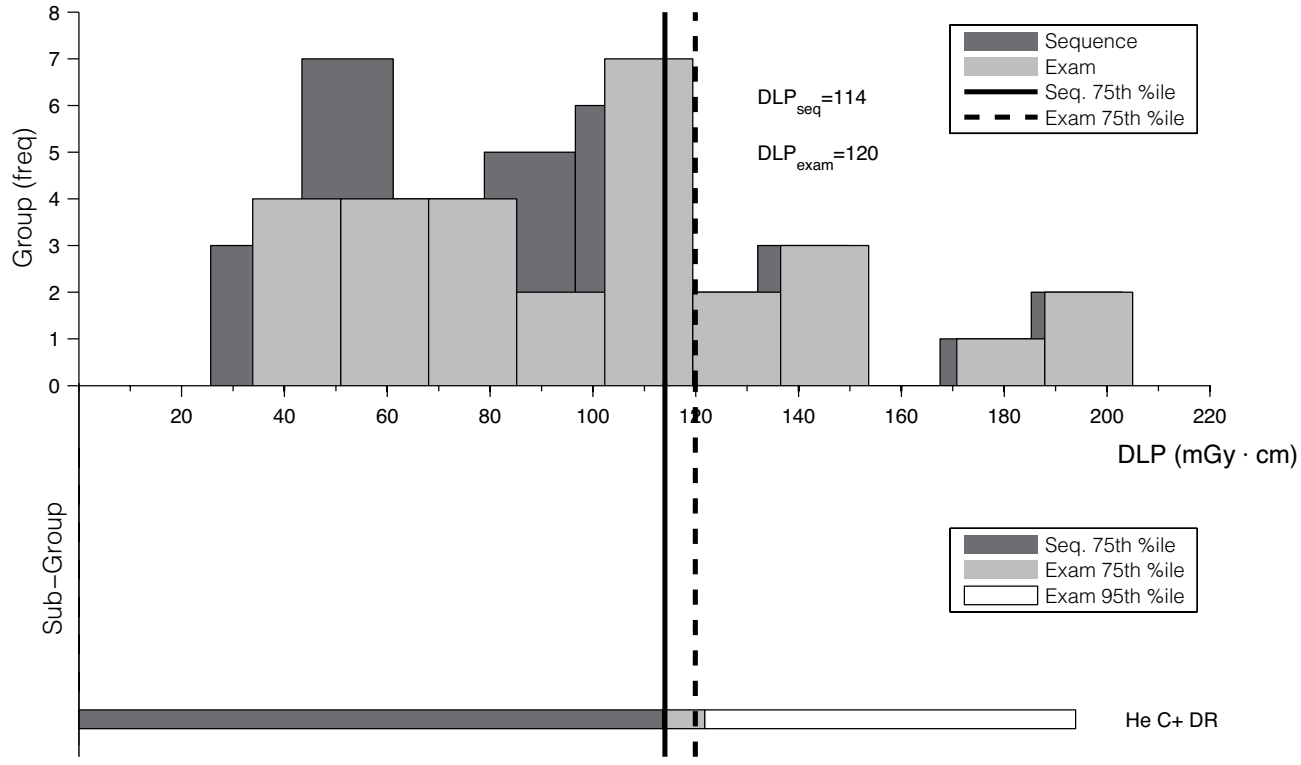

Figure 29: ***Pediatric Abdomen (0–3 yrs.) DLP (mGy·cm)*** *values for whole group (Upper) and for select sub-groups (Lower)–relative to the 32 cm reference phantom (see section 2.3.4).*

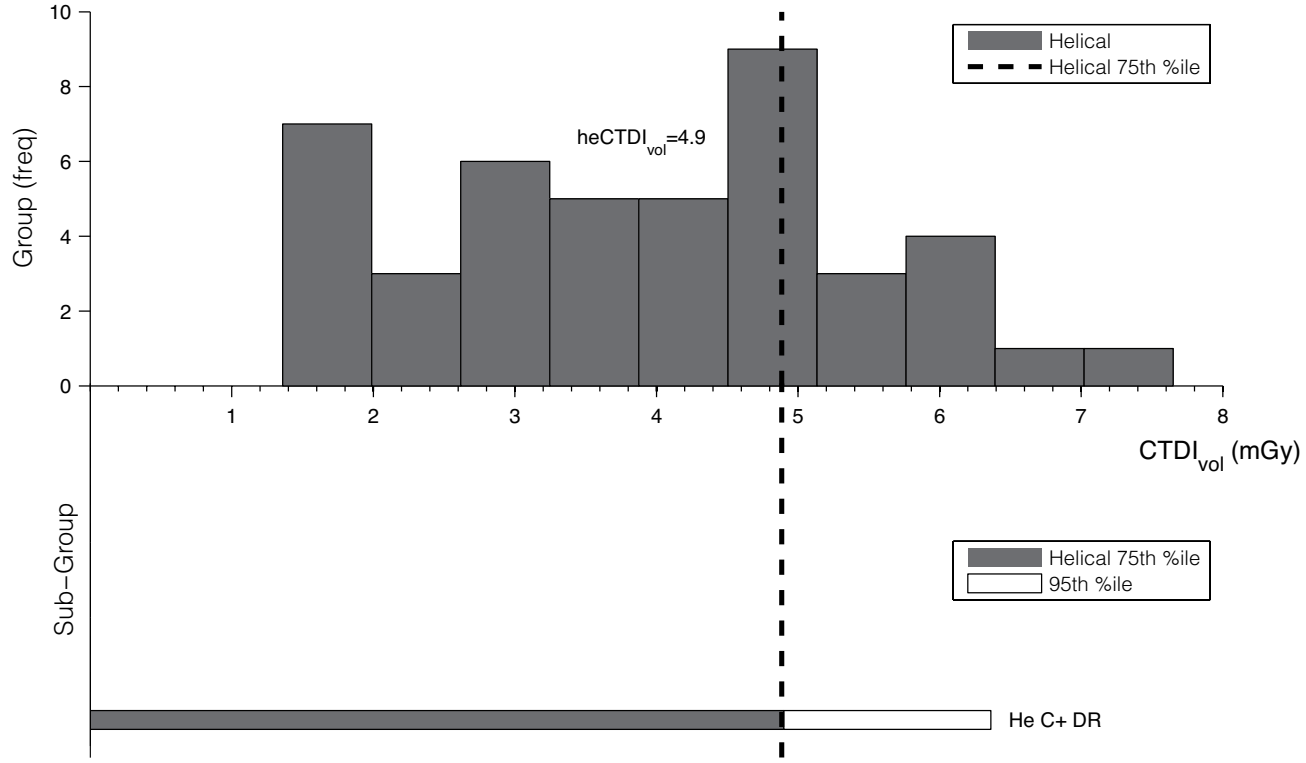

Figure 30: ***Pediatric Abdomen (3–7 yrs.) CTDI (mGy)*** *values for whole group (Upper) and for select sub-groups (Lower)–relative to the 32 cm reference phantom (see section 2.3.4).*

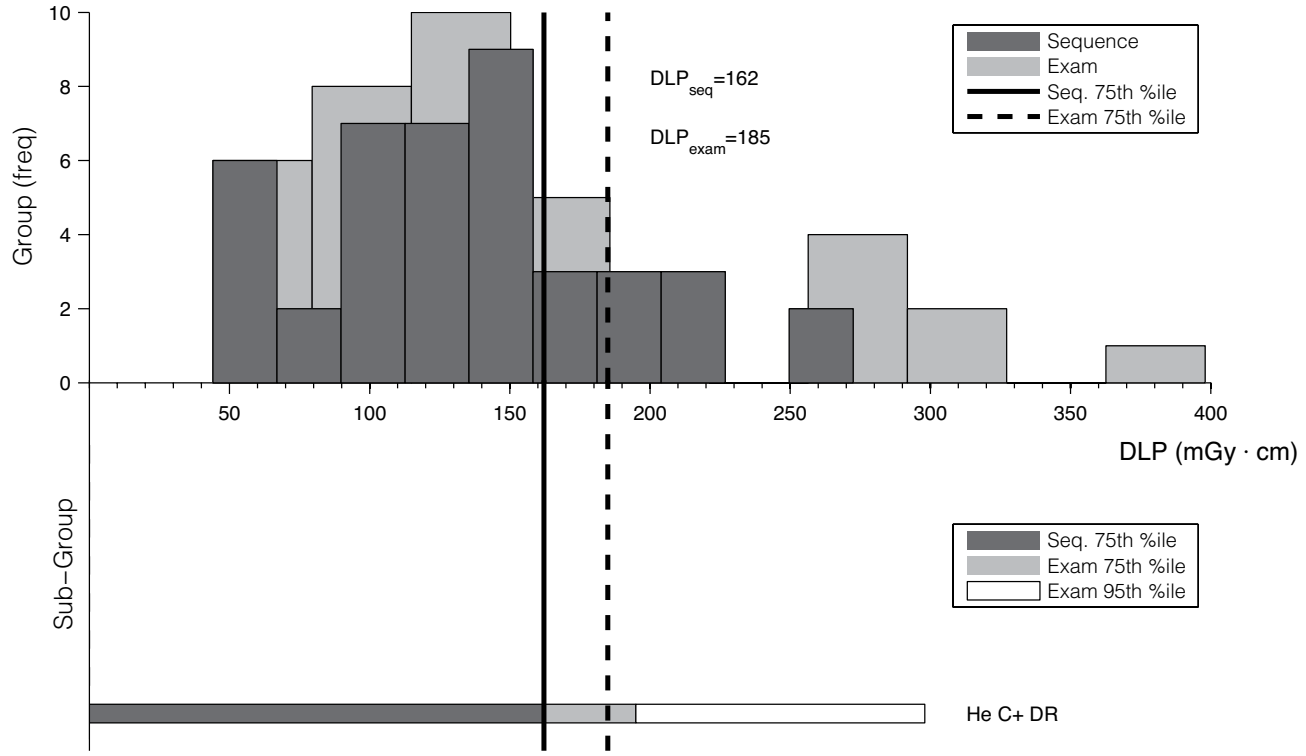

Figure 31: ***Pediatric Abdomen (3–7 yrs.) DLP (mGy·cm)*** *values for whole group (Upper) and for select sub-groups (Lower)–relative to the 32 cm reference phantom (see section 2.3.4).*

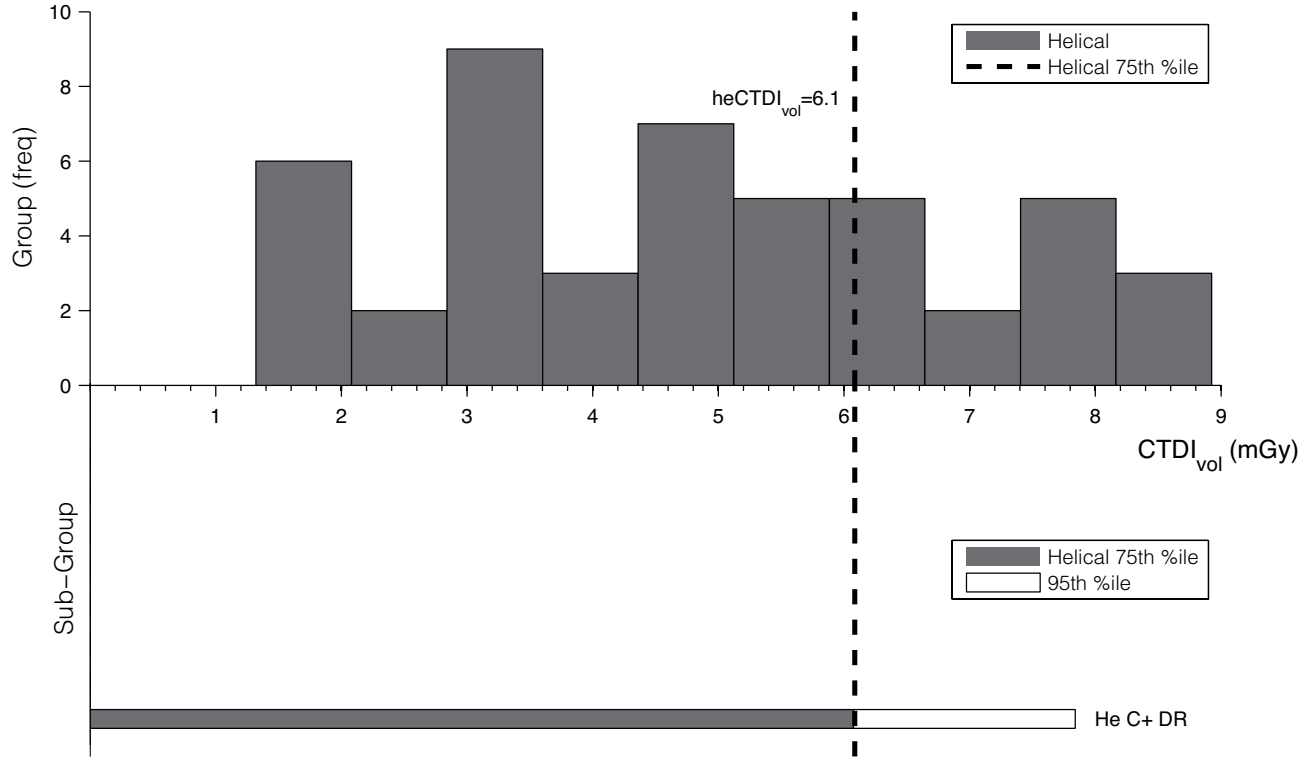

Figure 32: ***Pediatric Abdomen (7–13 yrs.) CTDI (mGy)*** *values for whole group (Upper) and for select sub-groups (Lower)–relative to the 32 cm reference phantom (see section 2.3.4).*

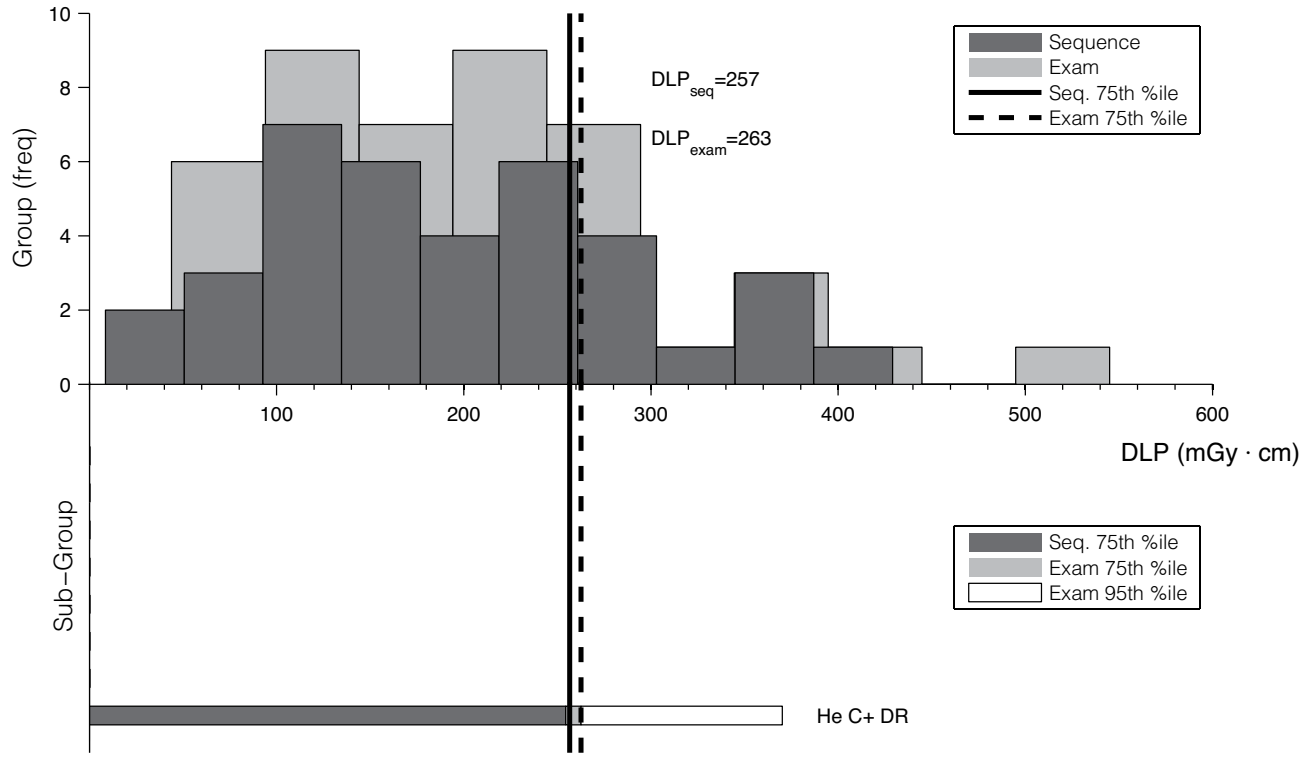

Figure 33: ***Pediatric Abdomen (7–13 yrs.) DLP (mGy·cm)*** *values for whole group (Upper) and for select sub-groups (Lower)–relative to the 32 cm reference phantom (see section 2.3.4).*

Table 9: *Summary of the 75th percentile and median values of CTDIvol (mGy), DLPseq (mGy·cm) and DLPexam (mGy·cm) for each exam type, as outlined in Tables 3 and 8. Median dose index values or "achievable doses" are shown in brackets [21]. The 75th percentiles and median values of CTDIvol, for axial (ax) and helical (he) scanning, are per sequence. Similarly, the 75th percentiles and median values of DLP are given per sequence (DLPseq) and for entire exam (DLPexam). CTDI and DLP values for pediatric body examinations are reported relative to the 32 cm reference phantom.*

	75th Percentile [Median] of Dose Index Distributions			
	axCTDIvol (mGy)	heCTDIvol (mGy)	DLPseq (mGy·cm)	DLPexam (mGy·cm)
ADULT EXAMINATIONS				
HEAD	83.4 [63.4]	79.1 [71.7]	1098 [709]	1302 [1044]
CHEST	13.7 [3.6]*	14.1 [9.5]	483 [334]	521 [362]
ABDO+PELVIS	23.0 [16.4]	18.1 [12.8]	806 [562]	874 [609]
CHEST+ABD+PELVIS	19.4 [16.4]	16.6 [12.2]	723 [502]	1269 [931]
PEDIATRIC EXAMINATIONS				
HEAD (0–3 yrs.)	37.4 [29.9]	37.0 [27.3]	549 [397]	578 [446]
HEAD (3–7 yrs.)	48.0 [38.1]	51.5 [39.2]	692 [552]	843 [601]
HEAD (7–13 yrs.)	59.1 [42.9]	52.9 [47.0]	834 [610]	888 [665]
CHEST (0–3 yrs.)	-	2.8 [1.5]	62 [40]*	52 [36]*
CHEST (3–7 yrs.)	-	3.8 [2.8]	87 [72]*	85 [68]*
CHEST (7–13 yrs.)	-	4,8 [3.4]	135 [105]	136 [105]
ABDOMEN (0–3 yrs.)	-	3.8 [3.0]	114 [85]	120 [103]
ABDOMEN (3–7 yrs.)	-	4.9 [4.0]	162 [128]	185 [139]
ABDOMEN (7–13 yrs.)	-	6.1 [4.9]	257 [200]	263 [194]

**Adult Chest median axCTDIvol (=3.6) is much lower due to low sample number and distribution shape. In both Pediatric Chest 0–3 years and 3–7 years, low sample number, coupled with sparse reporting affected distribution, showing DLPseq > DLPexam. Further details given in Appendix C.*

Figures 8–33 show that a large variation in dose indices is possible for a given exam type. This is representative of the wide variation in application of technical settings and options that are available on todays' CT models. The 75th percentile values of dose indices (CTDI and DLP) from all dose index histograms are summarized in Table 9 along with median (50th percentile) values which are often reported in parallel and sometimes termed "achievable doses" [21]–providing future dose optimization targets.

Combining data from Tables 8 and 9, allows a practice weighted 75th percentile of CTDIvol to be calculated using the frequency in which sequences, of a given examination type, were identified as being performed using axial or helical scanning. The resulting DRL values are summarized in Table 10 along with median age, mass, AP and LAT measures—providing essential patient context. Note that for any given sequence,

the scanning mode could be indicated but the corresponding value of CTDIvol may or may not be given. This leads to a difference in the number of axial or helical sequences versus the number of corresponding CTDIvol values. Therefore, a similar calculation was undertaken using the frequency of axial and helical CTDI values actually reported (see Appendix C). Almost exactly the same results were obtained using this approach. In all but one case (Pediatric Head 3–7 years), practice weighted CTDI DRLs were identical when reported to one decimal place (Pediatric Head 3–7 CTDI differed by 0.1).

Table 10: *Summary of DRLs–CTDI (frequency weighted using Tables 8 and 9) and DLP. CTDIvol values are per sequence and DLP values are for entire exam (multiple sequences). Similar to Table 9, median dose index values or "achievable doses" are also shown in brackets. All DRLs for head examinations (adult and pediatric) are reported relative to 16 cm reference phantom whereas all DRLs for body examinations are reported relative to the 32 cm reference phantom. Median age, mass, anterior-posterior (AP), and lateral (LAT) measurements of exam groups are also shown for appropriate comparison. Further details on dose indices and patient characteristics are given in Appendix C for all groups and sub-groups.*

	DRL [Median] and Patient Characteristic Summary					
	CTDIvol per sequence (mGy)	DLP per exam (mGy·cm)	Age (yrs.) [median]	Mass (kg) [median]	AP (cm) [median]	LAT (cm) [median]
ADULT EXAMINATIONS						
HEAD	82 [66]	1302 [1044]	63.0	70.3	18.6	15.2
CHEST	14 [9.5]	521 [362]	66.0	70.3	25.9	34.0
ABDO+PELVIS	18 [13]	874 [609]	61.0	71.0	25.9	33.6
CHEST+ABD+PELVIS	17 [12]	1269 [931]	65.0	72.0	25.7	33.9
PEDIATRIC EXAMINATIONS						
HEAD (0–3 yrs.)	37 [29]	578 [446]	1.5	10.0	15.6	13.2
HEAD (3–7 yrs.)	49 [39]	843 [601]	6.0	20.0	17.1	14.0
HEAD (7–13 yrs.)	57 [44]	888 [665]	10.0	32.0	17.6	14.5
CHEST (0–3 yrs.)	2.8 [1.5]	62 [40]	1.7	11.1	12.8	17.0
CHEST (3–7 yrs.)	3.8 [2.8]	87 [72]	5.0	18.0	14.9	21.3
CHEST (7–13 yrs.)	4.8 [3.4]	136 [105]	9.5	31.0	17.7	26.0
ABDOMEN (0–3 yrs.)	3.8 [3.0]	120 [103]	2.0	13.0	13.7	17.9
ABDOMEN (3–7 yrs.)	4.9 [4.0]	185 [139]	6.0	22.0	15.0	20.7
ABDOMEN (7–13 yrs.)	6.1 [4.9]	263 [194]	10.0	34.0	17.8	24.6

4.0 DISCUSSION

In Canada, radiation protection of patients is a shared responsibility between the federal government, the provincial/territorial governments and the various groups of medical professionals involved in the delivery of health care to patients. HC administers legislation governing the safety and effectiveness of CT equipment imported and sold in Canada, while provincial/territorial governments and medical professionals are responsible for the safe installation and use of equipment. Recognizing this shared responsibility for radiation protection, the collaborative approach in which this survey was conducted contributed to the high level of survey participation. With a large dataset, collected from approximately 75% of CT equipment from across the country and covering many equipment models, the national DRLs (shown in Table 10) are derived from a sufficiently broad sample of CT imaging in Canada.

The primary goal of the survey was to collect CT dose index data to establish national DRLs for commonly performed CT examinations; however the survey templates were designed intentionally to also gather quantitative information on the patient population (age, mass, AP and LAT body habitus measurements) as well as information on the CT equipment technology and scanning modes applied to examinations. This additional information allows the national DRLs presented here to be associated with a well characterized patient population and actual scanning practice. This will facilitate comparison with any future evaluations of national DRLs given that the patient population, CT equipment technology and scanning modes directly impact the CT dose indices.

It is important to note that the DRLs presented here are for overall examinations or protocols (e.g. head, chest, etc.) and do not provide explicit reference levels for sub-protocols (e.g. lower head) even if the exam is performed in multiple scan phases or sequences. Further analysis is required to obtain this level of reporting. DRLs here may average over multiple sequences of different anatomical regions–optimized DRLs would compare exactly similar regions—thus, are approximate over a given anatomical region. This is especially important for cases of chest/abdomen/pelvis exams performed in distinct chest and abdomen/pelvis multiple sequence exams; however, DRLs obtained through averaging over multiple sequences of different anatomical regions may still provide valuable targets to help optimize patient scanning.

In addition to the national DRL values for the standard CT examinations, this report also provides insight into subgroups of data, representing different modes of scanning (sub-group plots in Figures 8–33), to help identify potential points of guidance towards optimization of imaging. Specifically, for a given type of examination, it's clear from the perspective of the 75th percentiles of sub-groups that dose reduction technologies reduce standardized dose from machines. In almost all cases, when comparing the 75th percentile of sub-group CTDIvol values for a given examination type, with the only difference being application of dose reduction, the 75th percentile values of CTDIvol of the dose reduction subgroups are lower. This is also seen when comparing the 75th percentile of DLP values of sub-groups, but it's not as apparent since DLP is modulated by the varying scan lengths employed. While this data adds additional insights into factors affecting CT dose indices, it must be noted that the overall intent of the survey was not to test statistical significance between groups or prove any relationships; rather, it was simply to present evidence based DRLs for the purpose of reducing exposures to patients and helping identify optimization opportunities.

As this is the first national level survey of CT practice in Canada, this report cannot make comparisons with any previous national DRL values. To assist in interpreting the Canadian national DRLs and assessing the potential for further optimization of CT imaging in Canada, Tables 11 and Table 12 provide a summary of published Canadian regional and international CT DRLs for adult and pediatric imaging respectively.

It is difficult to make exact comparisons of the Canadian national DRLs and values in the literature given the numerous factors that affect the dose indices used to establish DRLs for specific examinations. This includes the clinical indications for a given examination type, the patient's size, and specifically for pediatric DRLs, the patient's age and the reference phantom against which the dose indices are reported. Within this report, pediatric body dose indices are corrected (as best as possible) relative to a 32 cm standard phantom. Care should be exercised when reporting and adopting pediatric CTDI values—the corresponding reference

phantom must be noted. Failure to verify this information could result in CTDI (and DLP) being reported incorrectly by a factor of ~2 (depending on scanner beam and shaping filtration etc.).

In general, the overall results are consistent with international DRLs. Key points to notice are that Canadian DRLs, although they fall in the upper range of literature values in some cases, are not outside the overall minimum and maximum of similar data reported elsewhere. The DRLs for pediatric body examinations seem well below international levels. These results may be attributable, in large part, to dose reduction initiatives of specialized pediatric centres and can serve as guidance to other imaging centres to help reduce doses to children.[1]

Local regions or individual facilities are encouraged to use the data provided, or adopt a similar approach, to establish DRLs that are representative of local practice and further commit to regular assessment of these levels with changes in CT technology and radiological practice. This process will allow facilities to identify imaging practices where unnecessarily high doses are being used for a given clinical purpose, as well as doses which may be too low. Where local DRLs for a given examination type are lower than the national DRLs and where the examination protocol is deemed to provide acceptable diagnostic image quality, this report does not encourage increasing dose indices. In these cases, the existing DRL values should be maintained and even further reduced where possible, exercising the ALARA (As Low As Reasonably Achievable) principle; however, optimization is always a balance between sufficient diagnostic image quality and reduced dose. Radiation output, via CTDIvol, that is reduced too far could result in significantly increased image noise and a diagnostically sub-standard image, therefore any reductions in CTDIvol values or particularly low local DRLs should always be carefully evaluated.

Given the significant volume of information obtained in this survey, further analysis into size specific optimization for adult and pediatric DRLs is also possible. Future work could focus upon incorporation of Size Specific Dose Estimates (SSDE) or the use of water equivalent diameter concepts as recently presented [22,23]. Linking DRLs to general or standardized noise/image quality measures would also be a beneficial aid to help further optimize patient exposures.

1

5.0 CONCLUSION

The response to Canada's first survey of CT imaging was very positive and the success of the survey can be attributed to the high level of co-operation between HC, provincial/territorial governments and medical professionals who promoted the survey and participated in the data collection. The collaborative approach resulted in the collection of a large sample of imaging data, spanning a wide array of CT equipment technologies, for seven common CT examinations: Adult Head, Chest, Abdomen/Pelvis, and Chest/Abdomen/Pelvis and Pediatric Head, Chest, and Abdomen.

DRLs are an effective starting point for evaluating imaging protocols and identifying situations where doses may be unusually high. The availability of national DRLs in Canada will allow CT imaging facilities to review, compare, and evaluate their local practice with the national survey results. The level of detailed information in this report will also support identification of potential opportunities for further optimization of imaging and promote the use of a narrower range of doses. This process will ultimately reduce unnecessary tissue radiation doses and therefore lead to reduced potential health risks from radiation.

The publication of this report is an important step forward in providing guidance for the purpose of reducing patient exposure in CT imaging. It is hoped that the analysis and summaries presented in this report will be used to optimize CT scanning within Canada and also contribute further to international efforts in radiation protection of patients.

Table 11: *Sample of Adult DRL values from literature–CTDI, and DLP exam values.*

REGION [Ref]	AGE (yrs.)	MASS (kg)	HEAD		CHEST		ABDO/PELV		CHEST/ABDO/PELV	
			CTDIvol (mGy)	DLPexam (mGy·cm)	CTDIvol (mGy)	DLPexam (mGy·cm)	CTDIvol (mGy)	DLPexam (mGy·cm)	CTDIvol (mGy)	DLPexam (mGy·cm)
AUS [2]	>14	-	60	1000	15	450	15	700	30	1200
BC [10]	13–98, Av: 59.4	27.3–175, Av: 74.6	-	1300	-	600	-	1100	-	-
CHE [21]	-	60–85	65	1000	10	400	15	650	15	1000
DEU [3]	-	-	65	950	12	400	-	-	-	-
EC [6,20]	-	-	72	945	12	421	15	724	-	-
FIN [15]	-	60–90, Av: 74.8	55	800	9[a]	290[a]	-	-	-	-
FRA [17]	-	-	65	1050	15	475	17	800	20	1000
GBR [19]	-	-	60 60[b] 80[c]	970	12 4[d] 12[e]	610 140[d] 350[e]	15	745	-	1000
GRC [20]	-	-	67	1055	14	480	16	760	17	1020
IRL [11]	-	60–80	58[b] 66[c]	940	9[a] 11[f]	390	12	600	12[a] 10[g]	850
JPN [1]	-	50–60	85	1350	15	550	20	1000	18	1300
KOR [14]	Av: 48	50–80, Av: 66.4	53	900	13	710	-	-	-	-
MB [9]	Av: 56.8	Av: 78.3	-	1305	-	823	-	1325	-	2185
NLD [22]	-	65.0–89.0	-	935.6	-	346.5 276.1[h]	-	-	-	-
NOR [12]	-	55–90	75	1000	15 35[h]	400 280[h]	-	-	-	-
PRT [18]	>17	-	75	1010	14	470	-	-	-	-
QC [5]	-	-	-	1352	-	496	-	850	-	1200
SAU [16]	-	60–80	-	-	18 20[h]	630 600[h]	15	800	16	1040
SWE [7]	-	60–80, Av: 70	75	1200	20	600	-	-	-	-
USA [4]	-	-	75	-	-	-	-	-	-	-

Notes: *[a]lung sequence, [b]upper head, [c]lowerhead, [d]highresolution chest, axial [e]high resolution chest, helical [f]liver sequence, [g]abdomen sequence, [h]high resolution chest.*

Table 12: *Sample of Pediatric DRL values from literature.*

REGION [Ref]	AGE (yrs.)	MASS (kg)	HEAD		CHEST		ABDOMEN (PELVIS)	
			CTDIvol (mGy)	DLPexam (mGy·cm)	CTDIvol (mGy)	DLPexam (mGy·cm)	CTDIvol (mGy)	DLPexam (mGy·cm)
AUS [2]	0–4	-	30	470	2	60	7	170
	5–14	-	35	600	5	110	10	390
CHE [24]	<1	-	20	270	5	110	7	130
	1–5	0–20	30	420	8	200	9	300
	5–10	20–35	40	560	10	220	13	380
	10–15	>35	60	1000	12	460	16	500
DEU [3]	Newborn	≤5	27[a]	300[a]	3[a] 1.5[b]	40[a] 20[b]	5[a] 2.5[b]	90[a] 45[b]
	≤1	6–10	33[a]	400[a]	4[a] 2[b]	60[a] 30[b]	7[a] 3.5[b]	170[a] 85[b]
	2–5	11–20	40[a]	500[a]	7[a] 3.5[b]	130[a] 65[b]	12[a] 6[b]	330[a] 165[b]
	6–10	21–30	50[a]	650[a]	10[a] 5[b]	230[a] 115[b]	16[a] 8[b]	500[a] 250[b]
	11–15	31–50	60[a]	850[a]	8[b]	230[b]	13[b]	500[b]
	>15	51–80	65[a]	950[a]	12[b]	400[b]	20[b]	900[b]
FIN [13]	<1	-	23[a]	330[a]	-	-	-	-
	1–5	-	25[a]	370[a]	-	-	-	-
	5–10	-	29[a]	460[a]	-	-	-	-
	10–15	-	35[a]	560[a]	-	-	-	-
FRA [17]	1	10	30[a]	420[a]	3[b]	30[b]	4[b]	80[b]
	5	20	40[a]	600[a]	4[b]	65[b]	5[b]	120[b]
	10	30	50[a]	900[a]	5[b]	140[b]	7[b]	245[b]
GBR [19]	0–1	-	25[a]	350[a]	-	-	-	-
	1–5	-	40[a]	650[a]	-	-	-	-
	>5	-	60[a]	860[a]	-	-	-	-
INTL [23]	<1	-	26[a]	440[a]	5.2[b]	130[b]	5.2[b]	130[b]
	>1–5	-	36[a]	540[a]	6[b]	140[b]	7[b]	250[b]
	>5–10	-	43[a]	690[a]	6.8[b]	170[b]	7.8[b]	310[b]
	>10–15	-	53[a]	840[a]	7.3[b]	300[b]	9.8[b]	460[b]
IRL [8,18]	<1	-	-	300	-	200	-	-
	5	-	-	600	-	400	-	-
	10	-	-	750	-	600	-	-

JPN [1]	<1	-	38[a]	500[a]	11[a] 5.5[b]	210[a] 105[b]	11[a] 5.5[b]	220[a] 110[b]
	1–5	-	47[a]	660[a]	14[a] 7[b]	300[a] 150[b]	16[a] 8[b]	400[a] 200[b]
	6–10	-	60[a]	850[a]	15[a] 7.5[b]	410[a] 205[b]	17[a] 8.5[b]	530[a] 265[b]
PRT [20]	<1	-	48	630	2.4	45	-	-
	5	-	50	770	5.6	140	-	-
	10	-	70	1100	5.7	185	-	-
	15	-	72	1120	7.1	195	-	-

Notes: *[a]relative to 16cm diameter CTDI dosimetry phantom, [b]relative to 32cm diameter CTDI dosimetry phantom.*

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APPENDIX A–SAMPLES OF CT SURVEY BOOKLET TEMPLATES

Section I–General CT Scanner information.

SCANNER INFORMATION

CT Manufacturer:		**Model:**	
Installation Date: YY/MM		**Manufactured Date:** YY/MM	

		(CIRCLE APPLICABLE)
Unit Features Available:	**Helical Scanning**	**Y / N**
	Max. Detector Config. (e.g. 24 x 1.2mm OR 16 x 0.625mm)	
	Dose Reduction Technology	**Y / N**

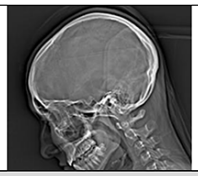
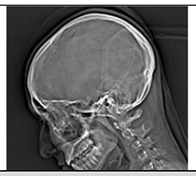
		(CIRCLE APPLICABLE)
Unit Type:	**CT**	**Y / N**
	Dual source CT (DSCT)	**Y / N**
	Dual energy CT (DECT)	**Y / N**
	PET – CT	**Y / N**
	SPECT – CT	**Y / N**
	CT Simulator	**Y / N**

		(CIRCLE APPLICABLE)
Other Usage:	**Virtual Colonoscopy (VC)**	**Y / N**
	Interventional Procedures	**Y / N**
	CT Angiography	**Y / N**

		(CHECK ONE)
Location of CT unit:	**Diagnostic Imaging Dept.**	
	Nuclear Medicine	
	Emergency Dept.	
	Other (specify)	

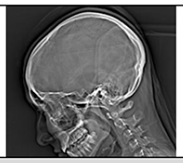
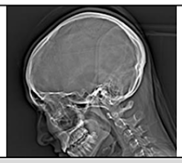
Section II–Routine Protocols (Adult Head Example Shown).

Examination: **Routine head [Adult]**
Indication: **Headache, Cerebrovascular Acc. (CVA), Transient Ischemic Attack (TIA)**

Routine Protocol Survey		Provide data for each axial or helical scan sequence in exam		
		Sequence 1	**Sequence 2**	**COMMENTS**
Indicate the usual start and end positions with lines on each image.				Shielding Type (if any) ❑ Bismuth ❑ Lead
Describe anatomical range scanned				
IV contrast? Indicate phase name		❑ Y ❑ N	❑ Y ❑ N	
Detector Configuration (e.g. 24x1.2mm)				
SFOV (mm) / pre-set name (e.g. Head, S)		/	/	
Tube voltage (kV)				
Tube rotation time (s)				
Tube current (mA)				
Displayed mA·s (mAs ❑ mAs/slice ❑ effective mAs ❑)				
Auto-dose reduction typically used? Name / mA		❑ Y ❑ N /	❑ Y ❑ N /	
Axial Scanning	**Helical Scanning**	❑ Axial ❑ Helical	❑ Axial ❑ Helical	
Table incr. (mm)	Pitch			
Over scan or partial scan angle (+° or -°)	Table speed/travel (mm per rotation)			
Console $CTDI_w$	Console $CTDI_{vol}$			
Rx / Reconstructed slice thickness (mm)				

Section III–Individual Patient Examinations (Adult Head Example Shown).

Examination: **Routine head [Adult]**
Indication: (circle) **Headache, Cerebrovascular Acc. (CVA), Transient Ischemic Attack (TIA)**

Individual Patient Survey		**Provide data for each axial or helical scan sequence in exam**		
		Sequence 1	**Sequence 2**	**COMMENTS**
Indicate actual start and end positions with lines on each image.				Shielding Type (if any) ❑ Bismuth ❑ Lead
Describe anatomical range scanned Scanned range (cm)				Mark with lightly shaded bar
Age (yrs.) / Weight (kg, lbs) / Sex (M, F)		/ /	/ /	
Axial Dimensions (cm) AP. / LAT.		/	/	
IV contrast? Indicate phase name		❑ Y ❑ N	❑ Y ❑ N	
Detector Configuration (e.g. 24x1.2mm)				
SFOV (mm) / pre-set name (e.g. Head, S)		/	/	
Tube voltage (kV)				
Tube rotation time (s)				
Tube current (mA)				
Displayed mA·s (mAs ❑ mAs/slice ❑ effective mAs ❑)				
Auto-dose reduction used? Name / mA		❑ Y ❑ N /	❑ Y ❑ N /	
Axial Scanning	**Helical Scanning**	❑ Axial ❑ Helical	❑ Axial ❑ Helical	
No. Axial Slices	Scan Length (cm)			
Table incr. (mm)	Pitch			
Over scan or partial scan angle (+° or -°)	Table speed/travel (mm per rotation)			
Console $CTDI_w$	Console $CTDI_{vol}$			
Rx / Reconstructed slice thk / Spacing (mm)		/ /	/ /	
Console DLP – SEQUENCE (mGy · cm)				
Console DLP – EXAM (mGy · cm)				

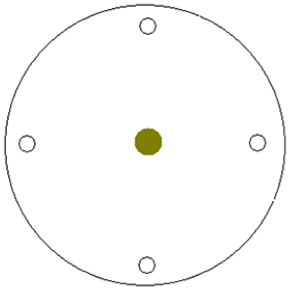
Section IV–Routine CTDI Measurements.

STANDARD HEAD (16cm) PMMA PHANTOM

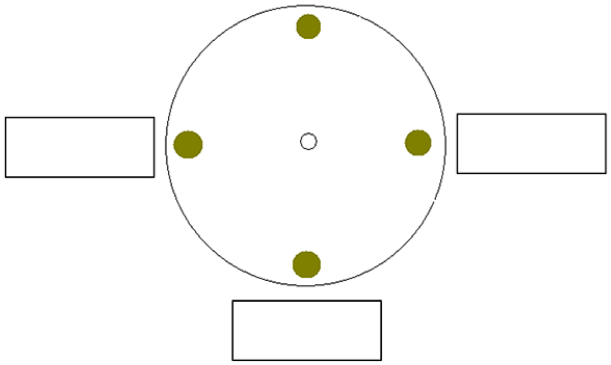
SFOV pre-set name (head, SS etc.):

SFOV for this setting (cm):

mGy



mGy



On Screen $CTDI_{vol}$

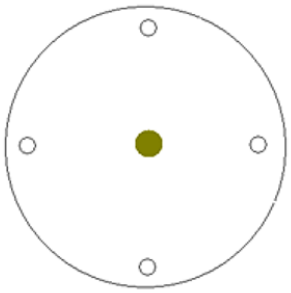
Approx. error on chamber: ± _____ %

STANDARD BODY (32cm) PMMA PHANTOM

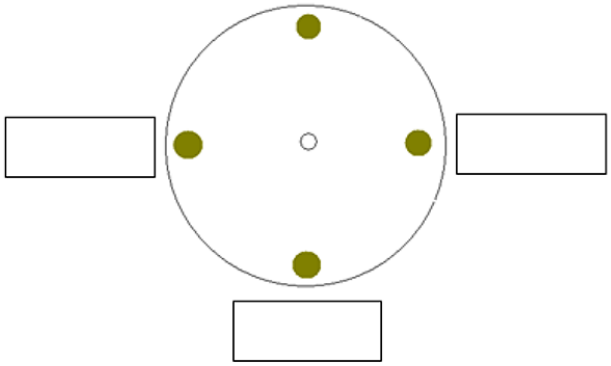
SFOV pre-set name (body, small body, L etc.):

SFOV for typical setting (cm):

mGy



mGy



On Screen $CTDI_{vol}$

Approx. error on chamber: ± _____ %

APPENDIX B–GENERAL SUMMARY OF DATA POOLS USED IN ANALYSIS (INDIVIDUAL PATIENT SEQUENCES)

Tables below provide a summary of the total number of individual patient sequences or scan phases for examination types surveyed. Text in key cells is highlighted (**bold**) in order to draw attention to those sequences which met age and body mass criteria. Specifically, greater than or equal to 19 years of age and between 50 and 90 kg (inclusive) for adults, compared to less than or equal to 13 years of age and less than 50 kg for pediatric patients. Those sequences where mass was reported as not stated (NS) or not applicable (NA) shows the potential for increasing compliant sample size as discussed in section 2.3.2 above. Further explanatory notes are provided below each table.

Age is provided in ~99% of adult cases and greater than 99% of pediatric cases. Any future secondary analysis will most likely rely on age to provide context information on population sampled–age, mass, cross-sectional area etc. as function of dose indices, thus is important to include.

The seven (7) Tables below account for 24 279 of 24 280 individual patient data sequences in the survey database—one sequence was eliminated during analysis as it provided no patient characteristic or dose information.

Table B1: *ADULT–HEAD*

RESTRICTION		NUM. SAMPLES (phases/seqs)	% TOTAL
AGE (yrs.)*	MASS (kg–lbs also incl.)		
≥19	<50	131	1.97
≥19	>90	298	4.48
≥19	50 ≤ x ≤ 90	**4834**	**72.6**
≥19	NS/NA	1262	20.0
≥19	------	6525	98.1
<19	------	64	1.0
AGE PROVIDED	------	**6589**	**99.0**
AGE OMITTED	------	65	0.98
		6654	~100

In the tables for the adult examinations, (*) indicates that only cases where a valid age was provided are included. "AGE PROVIDED" summarizes the number of sequences for which age is given, "AGE OMITTED" where age is not given.

Table B2: *ADULT–CHEST*

RESTRICTION		NUM. SAMPLES (phases/seqs)	% TOTAL
AGE (yrs.)*	MASS (kg–lbs also incl.)		
≥19	<50	95	2.02
≥19	>90	277	5.89
≥19	50 ≤ x ≤ 90	**3489**	**74.2**
≥19	NS/NA	774	16.5
≥19	------	4635	98.6
<19	------	10	0.21
AGE PROVIDED	------	**4645**	**98.9**
AGE OMITTED	------	54	1.15
		4699	~100

Table B3: *ADULT–ABDOMEN/PELVIS*

RESTRICTION		NUM. SAMPLES (phases/seqs)	% TOTAL
AGE (yrs.)*	MASS (kg–lbs also incl.)		
≥19	<50	97	1.92
≥19	>90	324	6.43
≥19	50 ≤ x ≤ 90	**3925**	**77.9**
≥19	NS/NA	621	12.3
≥19	------	4967	98.6
<19	------	20	0.40
AGE PROVIDED	------	**4987**	**99.0**
AGE OMITTED	------	51	1.01
		5038	~100

Table B4: *ADULT–CHEST/ABDOMEN/PELVIS*

RESTRICTION		NUM. SAMPLES (phases/seqs)	% TOTAL
AGE (yrs.)*	MASS (kg–lbs also incl.)		
≥19	<50	142	2.03
≥19	>90	395	5.65
≥19	50 ≤ x ≤ 90	**5428**	**77.6**
≥19	NS/NA	943	13.5
≥19	------	6908	98.8
<19	------	9	0.13
AGE PROVIDED	------	**6917**	**98.9**
AGE OMITTED	------	78	1.12
		6995	~100

Table B5: *PEDIATRIC–HEAD*

RESTRICTION		NUM. SAMPLES (phases/seqs)	% TOTAL
AGE (yrs.)	MASS (kg–lbs also incl.)		
0 < x ≤ 3	≥50	0	0.00
0 < x ≤ 3	<50	**139**	**22.8**
0 < x ≤ 3	NS/NA	65	10.7
0 < x ≤ 3	------	204	33.5
3 < x ≤ 7	≥50	0	0.00
3 < x ≤ 7	<50	**104**	**17.1**
3 < x ≤ 7	NS/NA	55	9.03
3 < x ≤ 7	------	159	26.1
7 < x ≤ 13	≥50	9	1.48
7 < x ≤ 13	<50	**122**	**20.0**
7 < x ≤ 13	NS/NA	95	15.6
7 < x ≤ 13	------	226	37.1
≤13**	------	**591**	**97.0**
>13*	------	16	2.63
AGE PROVIDED	------	607	99.6
AGE OMITTED	------	2	0.33
		609	~100

Similar to tables for adult examinations, in all tables for pediatric examinations (*) indicates that only cases where a valid age was provided are included. (**) includes cases where age = 0. In table above, two sequences indicated age = 0 yrs.

Table B6: *PEDIATRIC–CHEST*

RESTRICTION		NUM. SAMPLES (phases/seqs)	% TOTAL
AGE (yrs.)	MASS (kg–lbs also incl.)		
0 < x ≤ 3	≥50	0	0.00
0 < x ≤ 3	<50	**49**	**36.8**
0 < x ≤ 3	NS/NA	5	3.76
0 < x ≤ 3	------	54	40.6
3 < x ≤ 7	≥50	0	0.00
3 < x ≤ 7	<50	**36**	**27.1**
3 < x ≤ 7	NS/NA	3	2.26
3 < x ≤ 7	------	39	29.3
7 < x ≤ 13	≥50	2	1.50
7 < x ≤ 13	<50	**33**	**24.8**
7 < x ≤ 13	NS/NA	3	2.26
7 < x ≤ 13	------	38	28.6
≤13**	------	**131**	**98.5**
>13*	------	2	1.50
AGE PROVIDED	------	133	~100
AGE OMITTED	------	0	0.00
		133	~100

**See explanation below table B5. **No cases where age = 0.*

Table B7: *PEDIATRIC–ABDOMEN*

RESTRICTION		NUM. SAMPLES (phases/seqs)	% TOTAL
AGE (yrs.)	MASS (kg–lbs also incl.)		
0 < x ≤ 3	≥50	0	0.00
0 < x ≤ 3	<50	**35**	**23.2**
0 < x ≤ 3	NS/NA	0	0.00
0 < x ≤ 3	------	35	23.2
3 < x ≤ 7	≥50	0	0.00
3 < x ≤ 7	<50	**45**	**29.8**
3 < x ≤ 7	NS/NA	1	0.7
3 < x ≤ 7	------	46	30.5
7 < x ≤ 13	≥50	8	5.30
7 < x ≤ 13	<50	**45**	**29.8**
7 < x ≤ 13	NS/NA	12	7.95
7 < x ≤ 13	------	65	43.0
≤13**	------	**146**	**96.7**
>13*	------	4	2.65
AGE PROVIDED	------	150	99.3
AGE OMITTED	------	1	0.66
		151	~100

**See explanation below table B5. **No cases where age = 0.*

APPENDIX C–GROUP/SUB-GROUP INDIVIDUAL PATIENT DATA SUMMARY TABLES: PATIENT CHARACTERISTICS AND DOSE INDICES

Tables (in sets of three) are given below containing summaries of sample size, patient characteristics, and dose indices for all 13 examinations (groups) surveyed, as listed in Table 3 (four adult, and three pediatric x three age groups).

Each set of tables provides key descriptive values for the exam type as a whole or for the eight individual sub-groups of the given exam. The first table provides a summary of booklet, patient and sequence/scan phase counts, along with the average sequence to patient ratio and patient male/female count. The second table provides a select statistical summary of the corresponding patient characteristics: age (years); mass (kg); anterior–posterior (AP) and lateral (LAT) measures. Similarly, the third table provides a select statistical summary of key and related dose indices: CTDIvol (mGy, axial and helical separately); scan range (cm); scan length (cm); and DLP (mGy·cm, per sequence and whole exam).

Both scan range and length provide a quantitative link between CTDIvol and DLP, but differ in how they were originally designed to be collected and reported. Scan range was intended to capture the overall measure of the planned distance to scan from the scan start to the scan stop position (see example of Section III survey template provided in Appendix A). This was to be correlated with secondary measures of actual scan distance: slice thickness and number of slices in axial scanning (their product giving scan length) and reported scan length in helical scanning—providing some redundancy of measure for scan distance. In either case, secondary measures were expected to be similar in value to scan range, but any differences would help reveal the extent of under or over-scanning along the z-axis. Unfortunately; the number of axial slices was often only reported for single rotations, not the entire scan region (i.e. product of the number of slices and slice thickness was only representative of total collimation for one rotation, not entire region). So ultimately, *scan range* gave best option for correlation with axial scanning dose indices, being representative of entire scan distance, but both *scan range* and *scan length* were well suited for correlation with helical scanning dose indices. Hence, why sub-group tables below summarizing axial scanning show scan range data and tables summarizing helical scanning show both scan range and scan length. In either case, their inclusion helps provide additional insight.

Ultimately, for each exam type surveyed there are potentially nine sets of summary tables. Using the Adult Head exam type as an example, these would be listed as follows:

1. Group (Exam type)–Adult Head–*considering all patient sequences/scan phases reported for that exam type and providing summary of group key descriptors and dose indices*.
2. Sub-group–Adult Head–Axial Mode Scan/No IV Contrast/Fixed Tube Current–*considering contribution of only these segmented sequences via same key descriptors and dose indices*)
3. Sub-group–Adult Head–Axial/No Contrast/Dose Reduction technology employed
4. Sub-group–Adult Head–Axial/With Contrast/Fixed Current
5. Sub-group–Adult Head–Axial/With Contrast/Dose Reduction
6. Sub-group–Adult Head–Helical/No Contrast/Fixed Current
7. Sub-group–Adult Head–Helical/No Contrast/Dose Reduction
8. Sub-group–Adult Head–Helical/With Contrast/Fixed Current
9. Sub-group–Adult Head–Helical/No Contrast/Dose Reduction

For the purposes of the survey, the term dose reduction (DR) technologies was used throughout to collectively summarize available options on CT units which may ultimately result in potential dose savings–aware that the reduction in dose specifically arises from the devices' ability to produce images of similar quality at a lower dose for a given clinical purpose. Originally, the DR flag was intended to focus information capture on tube-current modulation schemes; however, many CT units now also apply iterative reconstruction techniques which aim to provide less noisy images at lower doses than non-iterative techniques and are marketed as dose reduction options, therefore these were also included under the DR term.

Ultimately, this means that "Fixed" versus "DR" in the report equates to comparison of fixed (constant) tube current versus any option (or combination of) that is designed to reduce dose:

(i) typical reconstruction technique and modulated tube current,

(i) iterative reconstruction and fixed tube current, and

(i) iterative reconstruction and modulated tube current.

In some sub-groups, there were an insufficient number of sequences (n < 10) reported, thus no summary tables are given. There were also five "border-line" cases where the number of sub-group sequences reported was ≥ 10, but the actual number of dose index or other key descriptor values reported were less than 10–these cases were limited to pediatric sub-groups where overall numbers were relatively low. Table cells are highlighted below for those cases. Tables 8–10 (Section 3.2 above) use sequence numbers as a frequency weighted calculation, no sub-group patient characteristics or dose indices are used. Thus, the "border-line" sub-group cases have no direct impact on DRL recommendations here, but their summary data is used in Figures 7–32 (lower plots) to provide additional context for each exam. In two cases, Pediatric Head (3–7) and Pediatric Chest (3–7) the number of DLPseq values is less than 10 (n = 9), thus is technically below the threshold of minimum sample size imposed (n = 10), but close enough that it was thought appropriate to include in plots for completeness. Note that no sub-group DLPexam values are included in tables below, given that segmentation of data was performed and compiled on a per sequence basis; however, for consistency and appropriate relative comparison, DLPexam percentiles of sub-groups are included graphically in Figures 8–33.

There are two group (exam) cases (Pediatric Chest 0–3 and 3–7 years) where the 75th percentile of DLPseq is greater than that of DLPexam which seems counter-intuitive (DLPexam ≥ DLPseq); however, it occurs in those cases where the sample size (n) is low and reported DLPseq values were not inserted in both DLPseq and DLPexam boxes for single sequence examinations. It's clear in these small sample, single sequence cases, if a number of lower values are reported as DLPexam only, but no similar values are also reported as DLPseq then it affects the DLP distributions–the net result being, a slightly lower DLPexam. Data could have been "copied" in place, but a "report as-is" approach was taken. The greater of DLPseq and DLPexam has been taken as a conservative approach in such cases. For all pediatric body dose indices, values are reported relative to 32 cm reference phantom, as outlined in section 2.3.4.

ADULT HEAD–ENTIRE GROUP

Table C1.0.1

SAMPLE SIZE	
CT UNITS	339
PATIENTS	4071
SEQUENCES	5495
SEQ/PAT RATIO	1.35
MALE	2264
FEMALE	3200

Table C1.0.2

GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	N	SD	IQR*
AGE (yrs.)	19.0	47.5	61.0	63.0	77.0	100.0	5495	19.1	29.5
MASS (kg)	49.9	62.1	70.6	70.3	79.4	90.0	4832	10.6	17.2
AP (cm)	13.8	17.8	18.4	18.6	19.4	23.1	4344	1.5	1.6
LAT (cm)	11.4	14.5	15.4	15.2	16.0	19.6	4243	1.4	1.5

**IQR = "interquartile range"*

Table C1.0.3

GROUP	DOSE INDICES and SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	N	SD	IQR
axCTDIvol (mGy)	6.1	55.0	69.7	63.4	83.4	281.3	3333	24.5	28.3
SCAN RANGE (cm)	0.3	9.2	12.8	14.0	15.5	30.0	3482	5.2	6.3
heCTDIvol (mGy)	4.9	54.9	70.1	71.7	79.1	200.6	1796	20.0	24.2
SCAN LEN. (cm)	3.9	14.4	15.4	15.1	16.0	31.2	1453	1.7	1.6
DLPseq (mGy·cm)	6	479	808	709	1098	2558	4582	443	619
DLPexam (mGy·cm)	78	853	1137	1044	1302	5102	3735	449	449

ADULT HEAD–SUB-GROUPS (8)

ADULT HEAD–AXIAL / NO CONTRAST / FIXED CURRENT

Table C1.1.1

SAMPLE SIZE	
CT UNITS	143
PATIENTS	1519
SEQUENCES	2288
SEQ/PAT RATIO	1.51
MALE	960
FEMALE	1315

Table C1.1.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	19.0	48.0	61.4	64.0	78.0	100.0	2288	19.4	30.0
MASS (kg)	49.9	62.1	70.6	71.0	79.4	90.0	2036	10.6	17.2
AP (cm)	13.8	17.6	18.3	18.5	19.3	23.0	1714	1.6	1.7
LAT (cm)	11.4	14.5	15.5	15.2	16.0	19.6	1713	1.5	1.5

Table C1.1.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	11.48	57.1	72.9	65.7	87.9	281.3	2039	24.3	30.8
SCAN RANGE (cm)	0.2	7.5	11.9	13.1	15.0	30.0	1323	5.8	7.5
heCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN LEN. (cm)	-	-	-	-	-	-	0	-	-
DLPseq (mGy·cm)	6	455	681	599	848	2518	1940	354	393

ADULT HEAD–AXIAL / NO CONTRAST / DOSE REDUCTION

Table C1.2.1

SAMPLE SIZE	
CT UNITS	74
PATIENTS	701
SEQUENCES	1071
SEQ/PAT RATIO	1.53
MALE	407
FEMALE	652

Table C1.2.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	N	SD	IQR
AGE (yrs.)	19.0	49.0	61.5	65.0	77.0	97.0	1071	18.7	28.0
MASS (kg)	49.9	63.0	70.2	68.9	79.4	90.0	986	10.4	16.4
AP (cm)	13.8	17.6	18.3	18.5	19.3	22.9	741	1.6	1.7
LAT (cm)	11.8	14.6	15.5	15.3	16.1	19.0	705	1.4	1.5

Table C1.2.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	N	SD	IQR
axCTDIvol (mGy)	6.1	50.0	63.1	60.2	71.8	144.3	1052	21.9	21.9
SCAN RANGE (cm)	0.4	6.1	10.2	9.5	14.0	20.0	772	4.4	7.9
heCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN LEN. (cm)	-	-	-	-	-	-	0	-	-
DLPseq (mGy·cm)	27	338	567	472	748	1915	1032	340	410

ADULT HEAD–AXIAL / CONTRAST / FIXED CURRENT

Table C1.3.1

SAMPLE SIZE	
CT UNITS	53
PATIENTS	145
SEQUENCES	198
SEQ/PAT RATIO	1.37
MALE	82
FEMALE	116

Table C1.3.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	19.0	44.3	56.5	57.0	69.0	91.0	198	17.5	24.8
MASS (kg)	49.9	64.4	71.8	72.6	80.0	89.8	190	9.9	15.6
AP (cm)	14.0	17.9	18.5	18.7	19.4	21.7	151	1.3	1.5
LAT (cm)	12.9	14.6	15.3	15.3	15.8	19.3	152	1.2	1.2

Table C1.3.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	35.4	55.7	73.2	64.3	88.2	178.7	192	25.4	32.5
SCAN RANGE (cm)	0.2	9.5	12.4	14.1	15.0	30.0	112	5.5	5.5
heCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN LEN. (cm)	-	-	-	-	-	-	0	-	-
DLPseq (mGy·cm)	38	485	704	643	884	1643	184	340	399

ADULT HEAD–AXIAL / CONTRAST / DOSE REDUCTION

Table C1.4.1

SAMPLE SIZE	
CT UNITS	22
PATIENTS	55
SEQUENCES	65
SEQ/PAT RATIO	1.18
MALE	16
FEMALE	49

Table C1.4.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	20.0	43.0	58.8	57.0	75.0	92.0	65	20.0	32.0
MASS (kg)	49.9	59.5	67.4	68.0	73.7	86.2	59	9.7	14.2
AP (cm)	14.0	17.5	17.9	18.0	19.0	20.2	52	1.5	1.5
LAT (cm)	12.7	14.1	15.3	14.8	16.0	19.0	50	1.8	1.9

Table C1.4.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	39.1	52.7	62.6	57.1	70.6	147.7	61	18.4	17.9
SCAN RANGE (cm)	3.8	6.8	10.9	10.2	14.3	20.0	39	4.6	7.5
heCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN LEN. (cm)	-	-	-	-	-	-	0	-	-
DLPseq (mGy·cm)	243	432	633	601	798	1344	58	242	365

ADULT HEAD–HELICAL / NO CONTRAST / FIXED CURRENT

Table C1.5.1

SAMPLE SIZE	
CT UNITS	109
PATIENTS	1215
SEQUENCES	1223
SEQ/PAT RATIO	1.01
MALE	521
FEMALE	699

Table C1.5.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	19.0	47.0	61.0	63.0	77.0	99.0	1223	19.2	30.0
MASS (kg)	49.9	62.2	70.8	71.7	79.4	90.0	1042	10.9	17.2
AP (cm)	13.8	18.0	18.6	18.8	19.5	23.1	1146	1.4	1.5
LAT (cm)	11.8	14.5	15.3	15.1	15.9	19.6	1095	1.2	1.4

Table C1.5.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	7.2	14.5	16.2	15.4	16.8	25.6	785	2.9	2.3
heCTDIvol (mGy)	26.9	60.1	74.2	74.4	79.1	186.6	1170	19.2	19.0
SCAN LEN. (cm)	9.8	14.4	15.4	15.2	16.0	31.2	1099	1.6	1.6
DLPseq (mGy·cm)	185	1084	1317	1276	1463	2558	851	369	379

ADULT HEAD–HELICAL / NO CONTRAST / DOSE REDUCTION

Table C1.6.1

SAMPLE SIZE	
CT UNITS	46
PATIENTS	444
SEQUENCES	469
SEQ/PAT RATIO	1.06
MALE	207
FEMALE	260

Table C1.6.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	19.0	47.0	61.2	63.0	78.0	97.0	469	19.9	31.0
MASS (kg)	49.9	60.2	69.8	70.3	79.4	90.0	351	11.6	19.2
AP (cm)	14.0	18.0	18.7	18.8	19.7	22.9	397	1.5	1.7
LAT (cm)	12.5	14.5	15.5	15.3	16.2	19.6	392	1.5	1.7

Table C1.6.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	4.4	14.0	14.4	15.0	16.0	24.8	341	3.3	2.0
heCTDIvol (mGy)	4.9	45.2	57.4	55.1	64.9	105.4	448	15.6	19.7
SCAN LEN. (cm)	4.3	14.1	15.2	15.0	16.0	24.0	220	1.7	1.9
DLPseq (mGy·cm)	290	721	892	878	1082	1797	392	287	361

ADULT HEAD–HELICAL / CONTRAST / FIXED CURRENT

Table C1.7.1

SAMPLE SIZE	
CT UNITS	49
PATIENTS	127
SEQUENCES	131
SEQ/PAT RATIO	1.03
MALE	54
FEMALE	76

Table C1.7.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	19.0	48.5	57.8	60.0	68.5	91.0	131	16.2	20.0
MASS (kg)	49.9	65.2	72.1	72.6	79.4	90.0	127	10.2	14.2
AP (cm)	14.2	18.5	19.1	19.2	19.8	23.1	107	1.3	1.3
LAT (cm)	12.5	14.7	15.4	15.3	16.1	19.1	101	1.2	1.4

Table C1.7.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	13.0	14.5	16.0	15.5	17.0	25.5	63	2.2	2.6
heCTDIvol (mGy)	18.0	72.2	79.8	77.3	99.9	107.8	119	17.3	27.7
SCAN LEN. (cm)	6.4	14.6	15.6	15.5	16.3	20.9	116	1.7	1.7
DLPseq (mGy·cm)	521	1184	1389	1342	1580	2130	97	343	396

ADULT HEAD–HELICAL / CONTRAST / DOSE REDUCTION

Table C1.8.1

SAMPLE SIZE	
CT UNITS	23
PATIENTS	44
SEQUENCES	50
SEQ/PAT RATIO	1.14
MALE	17
FEMALE	33

Table C1.8.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	21.0	42.5	55.8	60.5	66.8	84.0	50	16.0	24.3
MASS (kg)	51.0	65.0	71.2	68.9	76.2	89.0	41	9.0	11.2
AP (cm)	16.0	18.1	18.8	18.8	19.8	20.6	36	1.2	1.7
LAT (cm)	13.5	14.8	15.2	15.1	15.5	18.5	35	1.0	0.6

Table C1.8.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	3.9	9.3	13.2	14.8	15.6	20.0	39	4.4	6.4
heCTDIvol (mGy)	29.4	46.8	60.4	56.0	64.9	200.6	42	27.5	18.1
SCAN LEN. (cm)	3.9	14.0	15.2	14.6	16.7	24.0	16	4.1	2.7
DLPseq (mGy·cm)	280	556	838	963	1047	1602	40	333	491

ADULT CHEST–ENTIRE GROUP

Table C2.0.1

SAMPLE SIZE	
CT UNITS	332
PATIENTS	3770
SEQUENCES	3908
SEQ/PAT RATIO	1.04
MALE	1865
FEMALE	2020

Table C2.0.2

GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	19.0	56.0	65.0	66.0	75.0	100.0	3908	13.9	19.0
MASS (kg)	49.9	61.7	70.3	70.3	79.4	90.0	3487	10.9	17.7
AP (cm)	14.0	23.4	26.3	25.9	28.5	38.6	3654	4.1	5.1
LAT (cm)	20.0	30.9	33.6	34.0	36.5	47.5	3595	4.7	5.6

Table C2.0.3

GROUP	DOSE METRIC SUMMARY STATS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	0.8	1.9	11.0	3.6	13.7	51.3	15	14.6	11.7
SCAN RANGE (cm)	1.0	29.3	32.2	31.9	35.0	67.5	2649	5.5	5.8
heCTDIvol (mGy)	0.6	6.3	10.8	9.5	14.1	41.4	3638	5.9	7.8
SCAN LEN. (cm)	9.0	29.1	31.9	31.5	34.3	62.0	3151	4.9	5.2
DLPseq (mGy·cm)	3	224	375	334	483	1478	3279	212	260
DLPexam (mGy·cm)	39	236	401	362	521	2047	3357	222	285

ADULT CHEST–SUB-GROUPS (8)

ADULT CHEST–AXIAL / NO CONTRAST / FIXED CURRENT

Insufficient data, n = 7 (≥10 sequences set as threshold)

ADULT CHEST–AXIAL / NO CONTRAST / DOSE REDUCTION

Insufficient data, n = 5

ADULT CHEST–AXIAL / CONTRAST / FIXED CURRENT

Insufficient data, n = 3

ADULT CHEST–AXIAL / CONTRAST / DOSE REDUCTION

No data, n = 0

ADULT CHEST–HELICAL / NO CONTRAST / FIXED CURRENT

Table C2.5.1

SAMPLE SIZE	
CT UNITS	50
PATIENTS	165
SEQUENCES	165
SEQ/PAT RATIO	1.00
MALE	70
FEMALE	90

Table C2.5.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	19.0	56.0	64.1	65.0	73.0	90.0	165	13.0	17.0
MASS (kg)	49.9	59.9	69.9	70.3	79.4	89.8	137	11.6	19.5
AP (cm)	17.8	22.8	25.7	25.5	27.6	37.0	133	4.0	4.8
LAT (cm)	20.0	30.4	33.2	33.6	36.0	46.8	127	5.2	5.6

Table C2.5.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	3.9	29.1	31.1	32.0	34.6	50.0	93	8.1	5.5
heCTDIvol (mGy)	1.1	3.2	9.4	5.7	15.9	35.5	145	8.2	12.7
SCAN LEN. (cm)	17.4	29.8	33.5	32.5	35.6	51.6	132	6.4	5.9
DLPseq (mGy·cm)	3	116	424	235	706	1478	107	401	590

ADULT CHEST–HELICAL / NO CONTRAST / DOSE REDUCTION

Table C2.6.1

SAMPLE SIZE	
CT UNITS	272
PATIENTS	1528
SEQUENCES	1539
SEQ/PAT RATIO	1.01
MALE	718
FEMALE	810

Table C2.6.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	19.0	56.0	65.1	66.0	75.0	97.0	1539	13.5	19.0
MASS (kg)	49.9	62.2	70.5	70.3	79.4	90.0	1318	10.8	17.2
AP (cm)	15.8	23.6	26.5	26.0	28.9	38.6	1456	4.1	5.3
LAT (cm)	20.1	31.0	33.6	33.9	36.5	47.0	1438	4.6	5.5

Table C2.6.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	1.0	29.3	32.2	31.7	34.8	62.0	1098	4.9	5.5
heCTDIvol (mGy)	0.6	5.7	9.8	8.5	13.0	36.6	1475	5.5	7.3
SCAN LEN. (cm)	9.0	29.0	31.4	31.2	33.8	62.0	1184	4.1	4.8
DLPseq (mGy·cm)	5	197	334	302	440	1323	1316	188	243

ADULT CHEST–HELICAL / CONTRAST / FIXED CURRENT

Table C2.7.1

SAMPLE SIZE	
CT UNITS	34
PATIENTS	142
SEQUENCES	143
SEQ/PAT RATIO	1.01
MALE	63
FEMALE	80

Table C2.7.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	23.0	57.5	65.3	67.0	75.0	91.0	143	13.4	17.5
MASS (kg)	49.9	60.3	70.1	70.3	79.4	90.0	137	10.8	19.1
AP (cm)	18.2	24.0	26.4	26.0	28.5	36.1	110	3.6	4.5
LAT (cm)	20.7	30.9	34.6	35.6	38.8	44.7	110	5.5	8.0

Table C2.7.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	18.3	29.5	32.5	32.0	34.1	50.0	67	5.7	4.6
heCTDIvol (mGy)	3.1	12.4	16.1	14.1	18.3	35.8	117	6.3	5.9
SCAN LEN. (cm)	18.3	28.6	31.1	31.4	33.5	40.5	127	3.5	4.9
DLPseq (mGy·cm)	108	443	561	496	688	1374	101	242	245

ADULT CHEST–HELICAL / CONTRAST / DOSE REDUCTION

Table C2.8.1

SAMPLE SIZE	
CT UNITS	282
PATIENTS	1960
SEQUENCES	2046
SEQ/PAT RATIO	1.04
MALE	1004
FEMALE	1035

Table C2.8.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	19.0	56.0	64.9	66.0	75.0	100.0	2046	14.3	19.0
MASS (kg)	49.9	61.5	70.2	70.3	79.3	90.0	1881	10.8	17.8
AP (cm)	14.0	23.3	26.2	25.8	28.4	38.4	1940	4.2	5.1
LAT (cm)	20.0	30.8	33.6	33.8	36.3	47.5	1905	4.6	5.5

Table C2.8.3

SUB-GROUP	DOSE METRIC SUMMARY STATS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	1.0	29.0	32.4	32.0	35.4	67.5	1382	5.7	6.4
heCTDIvol (mGy)	1.3	6.9	11.3	10.0	14.5	41.4	1905	5.7	7.6
SCAN LEN. (cm)	9.1	29.1	32.1	31.8	34.8	60.2	1706	5.3	5.7
DLPseq (mGy·cm)	6	248	394	356	503	1370	1740	200	255

ADULT ABDO/PELVIS–ENTIRE GROUP

Table C3.0.1

SAMPLE SIZE	
CT UNITS	333
PATIENTS	3908
SEQUENCES	4245
SEQ/PAT RATIO	1.09
MALE	1909
FEMALE	2317

Table C3.0.2

GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	19.0	50.0	60.2	61.0	73.0	100.0	4245	16.3	23.0
MASS (kg)	49.9	62.7	70.7	71.0	79.4	90.0	3925	10.7	16.7
AP (cm)	13.0	23.0	26.4	25.9	29.4	40.8	3864	4.8	6.4
LAT (cm)	19.2	30.7	33.5	33.6	36.3	47.8	3804	4.8	5.6

Table C3.0.3

GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	3.3	9.4	17.9	16.4	23.0	52.5	37	10.9	13.6
SCAN RANGE (cm)	0.5	41.0	43.6	44.1	47.5	88.5	2860	8.5	6.5
heCTDIvol (mGy)	1.0	9.1	14.6	12.8	18.1	66.9	3953	7.7	9.1
SCAN LEN. (cm)	5.4	40.8	42.7	43.8	46.7	89.9	3411	7.9	5.9
DLPseq (mGy·cm)	3.5	389	630	562	806	3085	3591	348	417
DLPexam (mGy·cm)	124	427	700	609	874	2993	3483	385	446

ADULT ABDO/PELVIS–SUB-GROUPS (8)

ADULT ABDO/PELVIS–AXIAL / NO CONTRAST / FIXED CURRENT

No data, n = 0

ADULT ABDO/PELVIS–AXIAL / NO CONTRAST / DOSE REDUCTION

No data, n = 0

ADULT ABDO/PELVIS–AXIAL / CONTRAST / FIXED CURRENT

Table C3.3.1

SAMPLE SIZE	
CT UNITS	4
PATIENTS	33
SEQUENCES	33
SEQ/PAT RATIO	1.00
MALE	19
FEMALE	14

Table C3.3.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	34.0	51.0	62.5	65.0	73.0	83.0	33	13.8	22.0
MASS (kg)	49.9	65.8	72.2	72.6	80.3	89.8	33	10.1	14.5
AP (cm)	16.9	20.7	22.8	22.6	25.8	28.6	13	3.6	5.1
LAT (cm)	25.6	30.5	32.0	32.1	33.3	39.5	13	3.5	2.8

Table C3.3.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	3.3	9.4	18.1	16.4	23.5	52.5	33	11.5	14.1
SCAN RANGE (cm)	-	-	-	-	-	-	0	-	-
heCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN LEN. (cm)	-	-	-	-	-	-	0	-	-
DLPseq (mGy·cm)	4	7	11	9	15	27	33	7	8

ADULT ABDO/PELVIS–AXIAL / CONTRAST / DOSE REDUCTION

Insufficient data, n = 5.

ADULT ABDO/PELVIS–HELICAL / NO CONTRAST / FIXED CURRENT

Table C3.5.1

SAMPLE SIZE	
CT UNITS	22
PATIENTS	66
SEQUENCES	67
SEQ/PAT RATIO	1.02
MALE	40
FEMALE	27

Table C3.5.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	24.0	57.5	63.9	65.0	72.5	90.0	67	14.5	15.0
MASS (kg)	49.9	65.8	72.5	72.0	79.8	90.0	53	10.3	14.1
AP (cm)	14.0	21.7	24.5	23.9	26.4	38.1	48	4.8	4.7
LAT (cm)	23.0	31.6	34.6	35.4	37.0	45.4	46	4.8	5.4

Table C3.5.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	1.1	20.5	31.3	28.3	43.5	80.0	29	18.1	23.0
heCTDIvol (mGy)	9.8	17.5	22.4	23.7	26.5	43.3	60	7.8	9.0
SCAN LEN. (cm)	19.0	35.4	41.6	43.0	48.5	84.6	53	12.4	12.6
DLPseq (mGy·cm)	62	491	952	1013	1226	3085	58	617	734

ADULT ABDO/PELVIS–HELICAL / NO CONTRAST / DOSE REDUCTION

Table C3.6.1

SAMPLE SIZE	
CT UNITS	163
PATIENTS	415
SEQUENCES	429
SEQ/PAT RATIO	1.03
MALE	196
FEMALE	231

Table C3.6.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	19.0	52.0	63.3	65.0	75.0	97.0	429	16.0	23.0
MASS (kg)	49.9	63.1	71.0	72.0	79.4	90.0	376	10.6	16.2
AP (cm)	14.0	23.2	26.4	26.0	29.0	40.1	385	4.3	5.8
LAT (cm)	20.0	31.3	33.9	34.0	36.4	47.0	381	4.5	5.1

Table C3.6.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	1.0	39.0	41.0	43.8	48.0	88.5	295	11.1	9.0
heCTDIvol (mGy)	3.5	8.6	14.2	12.9	17.6	45.6	416	7.3	9.0
SCAN LEN. (cm)	8.9	37.8	39.7	43.0	46.5	54.1	305	10.3	8.7
DLPseq (mGy·cm)	9	349	590	516	735	2333	359	352	386

ADULT ABDO/PELVIS–HELICAL / CONTRAST / FIXED CURRENT

Table C3.7.1

SAMPLE SIZE	
CT UNITS	36
PATIENTS	200
SEQUENCES	217
SEQ/PAT RATIO	1.09
MALE	100
FEMALE	117

Table C3.7.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	20.0	53.0	62.2	64.0	75.0	94.0	217	16.2	22.0
MASS (kg)	49.9	63.5	70.9	70.3	78.0	90.0	216	9.8	14.5
AP (cm)	14.2	24.4	28.5	28.0	32.4	39.7	162	5.2	8.1
LAT (cm)	19.5	27.9	32.7	32.5	37.0	47.8	157	6.3	9.1

Table C3.7.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	8.5	40.9	47.0	45.5	50.0	85.0	110	16.4	9.1
heCTDIvol (mGy)	5.3	13.7	18.9	17.5	24.1	44.2	180	7.4	10.3
SCAN LEN. (cm)	5.0	40.0	41.4	43.8	46.5	73.5	197	9.4	6.5
DLPseq (mGy·cm)	138	595	825	843	956	1990	162	344	362

ADULT ABDO/PELVIS–HELICAL / CONTRAST / DOSE REDUCTION

Table C3.8.1

SAMPLE SIZE	
CT UNITS	316
PATIENTS	3358
SEQUENCES	3494
SEQ/PAT RATIO	1.04
MALE	1552
FEMALE	1925

Table C3.8.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	19.0	49.0	59.6	61.0	72.0	100.0	3494	16.3	23.0
MASS (kg)	49.9	62.6	70.6	70.8	79.4	90.0	3242	10.8	16.8
AP (cm)	13.0	23.0	26.4	25.8	29.2	40.8	3251	4.8	6.2
LAT (cm)	19.2	30.7	33.5	33.5	36.3	47.8	3202	4.7	5.6

Table C3.8.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	3.8	41.3	43.9	44.1	47.5	81.1	2422	6.9	6.2
heCTDIvol (mGy)	1.0	8.9	14.3	12.4	17.7	66.9	3295	7.6	8.8
SCAN LEN. (cm)	5.4	41.0	43.1	43.8	46.8	89.9	2859	7.4	5.8
DLPseq (mGy·cm)	5	394	626	557	792	2645	2972	329	399

ADULT CHE/ABD/PEL–ENTIRE GROUP

Table C4.0.1

SAMPLE SIZE	
CT UNITS	316
PATIENTS	3444
SEQUENCES	5878
SEQ/PAT RATIO	1.71
MALE	2860
FEMALE	3009

Table C4.0.2

GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	19.0	56.0	64.2	65.0	74.0	97.0	5878	13.7	18.0
MASS (kg)	49.9	63.5	71.2	72.0	79.4	90.0	5427	10.5	15.9
AP (cm)	13.0	23.2	26.3	25.7	29.0	39.7	5320	4.4	5.8
LAT (cm)	20.0	31.0	33.8	33.9	36.7	47.7	5224	4.6	5.7

Table C4.0.3

GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	2.3	11.7	21.7	16.4	19.4	84.1	27	19.6	7.7
SCAN RANGE (cm)	0.5	31.1	42.9	41.8	50.5	100.0	3882	14.7	19.4
heCTDIvol (mGy)	1.2	8.4	13.3	12.2	16.6	51.8	5474	6.7	8.2
SCAN LEN. (cm)	1.5	31.2	42.9	41.8	50.5	97.4	4593	13.6	19.3
DLPseq (mGy·cm)	1	335	570	502	723	2853	5256	332	389
DLPexam (mGy·cm)	210	662	1021	931	1269	4344	3213	494	608

ADULT CHE/ABD/PEL–SUB-GROUPS (8)

ADULT CHE/ABD/PEL–AXIAL / NO CONTRAST / FIXED CURRENT

No data, n = 0.

ADULT CHE/ABD/PEL–AXIAL / NO CONTRAST / DOSE REDUCTION

No data, n = 0

ADULT CHE/ABD/PEL–AXIAL / CONTRAST / FIXED CURRENT

Table C4.3.1

SAMPLE SIZE	
CT UNITS	2
PATIENTS	24
SEQUENCES	24
SEQ/PAT RATIO	1.00
MALE	14
FEMALE	10

Table C4.3.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	32.0	56.8	62.6	64.0	71.0	78.0	24	11.5	14.3
MASS (kg)	54.4	64.5	71.7	71.3	79.9	90.0	24	11.4	15.4
AP (cm)	25.1	25.3	25.4	25.4	25.6	25.7	2	0.4	0.3
LAT (cm)	32.3	32.9	33.4	33.4	34.0	34.5	2	1.6	1.1

Table C4.3.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	2.3	11.7	16.6	14.1	18.8	32.8	24	8.3	7.0
SCAN RANGE (cm)	-	-	-	-	-	-	0	-	-
heCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN LEN. (cm)	-	-	-	-	-	-	0	-	-
DLPseq (mGy·cm)	1	6	9	8	10	16	24	4	4

ADULT CHE/ABD/PEL–AXIAL / CONTRAST / DOSE REDUCTION

Insufficient data, n = 3.

ADULT CHE/ABD/PEL–HELICAL / NO CONTRAST / FIXED CURRENT

Table C4.5.1

SAMPLE SIZE	
CT UNITS	23
PATIENTS	71
SEQUENCES	80
SEQ/PAT RATIO	1.13
MALE	39
FEMALE	41

Table C4.5.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	21.0	57.8	66.5	69.0	76.0	88.0	80	13.5	18.3
MASS (kg)	49.9	63.0	70.8	71.7	79.5	89.8	80	11.6	16.4
AP (cm)	20.9	24.1	26.5	25.9	29.0	37.0	34	3.5	4.9
LAT (cm)	27.9	31.3	34.2	33.4	35.9	47.1	33	4.7	4.6

Table C4.5.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	2.4	20.7	31.0	25.8	36.6	69.9	36	17.5	15.9
heCTDIvol (mGy)	4.9	9.7	15.5	14.4	18.0	38.0	75	7.6	8.3
SCAN LEN. (cm)	10.0	24.0	35.4	28.5	44.5	69.9	35	15.4	20.5
DLPseq (mGy·cm)	52	316	528	463	647	2027	71	351	331

ADULT CHE/ABD/PEL–HELICAL / NO CONTRAST / DOSE REDUCTION

Table C4.6.1

SAMPLE SIZE	
CT UNITS	118
PATIENTS	243
SEQUENCES	310
SEQ/PAT RATIO	1.28
MALE	162
FEMALE	147

Table C4.6.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	21.0	59.0	68.1	71.0	79.0	92.0	310	13.9	20.0
MASS (kg)	49.9	61.4	71.0	72.6	79.4	90.0	277	11.5	18.0
AP (cm)	17.9	23.6	26.3	25.6	28.2	38.0	258	4.1	4.6
LAT (cm)	23.0	31.1	34.1	34.0	37.0	47.5	251	4.1	5.9

Table C4.6.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	1.5	33.8	44.6	43.0	59.6	97.4	227	16.4	25.8
heCTDIvol (mGy)	1.9	7.9	13.4	12.6	17.4	35.4	294	6.5	9.5
SCAN LEN. (cm)	16.4	35.2	48.6	47.1	62.5	97.4	225	15.4	27.3
DLPseq (mGy·cm)	15	357	604	564	818	1693	282	334	461

ADULT CHE/ABD/PEL–HELICAL / CONTRAST / FIXED CURRENT

Table C4.7.1

SAMPLE SIZE	
CT UNITS	43
PATIENTS	205
SEQUENCES	318
SEQ/PAT RATIO	1.55
MALE	154
FEMALE	164

Table C4.7.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	22.0	57.3	64.7	66.0	73.0	93.0	318	13.7	15.8
MASS (kg)	49.9	61.2	70.4	71.7	78.0	90.0	317	10.6	16.8
AP (cm)	18.0	23.8	27.5	27.0	30.8	39.5	234	4.8	6.9
LAT (cm)	20.0	30.0	33.8	33.9	38.0	47.5	234	5.9	8.0

Table C4.7.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	18.0	31.9	49.7	42.5	61.3	120.0	152	24.9	29.4
heCTDIvol (mGy)	3.1	13.2	15.6	14.1	18.5	41.9	269	5.5	5.3
SCAN LEN. (cm)	1.5	30.6	40.7	40.5	46.4	74.0	261	12.8	15.8
DLPseq (mGy·cm)	103	485	683	663	809	1656	236	287	324

ADULT CHE/ABD/PEL–HELICAL / CONTRAST / DOSE REDUCTION

Table C4.8.1

SAMPLE SIZE	
CT UNITS	298
PATIENTS	3109
SEQUENCES	5143
SEQ/PAT RATIO	1.65
MALE	2489
FEMALE	2646

Table C4.8.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	19.0	56.0	63.9	65.0	74.0	97.0	5143	13.7	18.0
MASS (kg)	49.9	63.5	71.2	72.0	79.4	90.0	4726	10.5	15.9
AP (cm)	13.0	23.1	26.3	25.7	29.0	39.7	4789	4.4	5.9
LAT (cm)	20.0	31.0	33.7	33.9	36.6	47.7	4701	4.6	5.6

Table C4.8.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	6.4	31.2	43.0	41.8	50.1	99.5	3464	14.3	19.0
heCTDIvol (mGy)	1.2	8.3	13.2	11.8	16.4	51.8	4839	6.8	8.1
SCAN LEN. (cm)	10.0	31.1	42.8	41.7	50.0	87.8	4072	13.5	18.9
DLPseq (mGy·cm)	6	331	567	497	717	2853	4636	331	385

PEDIATRIC HEAD (0<X≤3)–ENTIRE GROUP

Table C5.0.1

SAMPLE SIZE	
CT UNITS	53
PATIENTS	151
SEQUENCES	174
SEQ/PAT RATIO	1.15
MALE	118
FEMALE	56

Table C5.0.2

GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	0.0	0.7	1.5	1.5	2.0	3.0	174	1.0	1.3
MASS (kg)	2.5	8.0	10.4	10.0	13.6	19.0	139	3.7	5.6
AP (cm)	10.0	14.0	15.3	15.6	16.6	18.8	136	1.8	2.7
LAT (cm)	9.0	12.1	13.0	13.2	14.0	17.4	134	1.6	1.9

Table C5.0.3

GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	15.1	19.9	33.1	29.9	37.4	131.6	91	19.6	17.5
SCAN RANGE (cm)	3.0	12.1	13.1	13.7	14.2	20.0	132	2.7	2.1
heCTDIvol (mGy)	6.0	21.0	31.1	27.3	37.0	85.8	78	17.4	16.0
SCAN LEN. (cm)	9.9	12.8	13.7	14.0	14.7	16.7	47	1.5	1.9
DLPseq (mGy·cm)	12	266	430	397	549	1308	148	251	284
DLPexam (mGy·cm)	111	302	490	446	578	1331	135	274	277

PEDIATRIC HEAD (0<X≤3)–SUB-GROUPS (8)

PEDIATRIC HEAD (0<X≤3)–AXIAL / NO CONTRAST / FIXED CURRENT

Table C5.1.1

SAMPLE SIZE	
CT UNITS	21
PATIENTS	61
SEQUENCES	74
SEQ/PAT RATIO	1.21
MALE	54
FEMALE	20

Table C5.1.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	0.0	0.8	1.6	1.6	3.0	3.0	74	1.0	2.3
MASS (kg)	3.0	8.2	11.2	11.1	14.5	19.0	60	3.7	6.3
AP (cm)	11.0	14.7	15.6	16.0	16.8	18.8	52	1.6	2.1
LAT (cm)	9.7	12.7	13.5	13.6	14.3	17.4	51	1.5	1.6

Table C5.1.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	16.0	20.9	35.0	30.3	38.0	131.6	72	21.2	17.0
SCAN RANGE (cm)	3.5	11.7	12.3	13.3	14.0	17.3	59	3.1	2.3
heCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN LEN. (cm)	-	-	-	-	-	-	0	-	-
DLPseq (mGy·cm)	12	247	368	346	500	828	72	173	253

PEDIATRIC HEAD (0<X≤3)–AXIAL / NO CONTRAST / DOSE REDUCTION

Table C5.2.1

SAMPLE SIZE	
CT UNITS	6
PATIENTS	11
SEQUENCES	11
SEQ/PAT RATIO	1.00
MALE	6
FEMALE	5

Table C5.2.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	0.0	0.3	1.2	1.2	2.0	3.0	11	1.0	1.7
MASS (kg)	2.5	4.8	8.7	8.3	12.2	15.0	11	4.5	7.4
AP (cm)	11.0	13.9	15.1	16.6	16.8	17.0	7	2.3	2.9
LAT (cm)	10.0	11.5	13.0	13.5	14.3	15.2	8	1.9	2.9

Table C5.2.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	15.1	18.1	24.1	19.1	30.3	40.0	11	9.1	12.2
SCAN RANGE (cm)	12.0	14.0	14.8	14.0	15.2	20.0	9	2.2	1.2
heCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN LEN. (cm)	-	-	-	-	-	-	0	-	-
DLPseq (mGy·cm)	15	216	322	268	455	628	11	182	238

PEDIATRIC HEAD (0<X≤3)–AXIAL / CONTRAST / FIXED CURRENT

Insufficient data, n = 8.

PEDIATRIC HEAD (0<X≤3)–AXIAL / CONTRAST / DOSE REDUCTION

Insufficient data, n = 1.

PEDIATRIC HEAD (0<X≤3)–HELICAL / NO CONTRAST / FIXED CURRENT

Table C5.5.1

SAMPLE SIZE	
CT UNITS	19
PATIENTS	46
SEQUENCES	47
SEQ/PAT RATIO	1.02
MALE	31
FEMALE	16

Table C5.5.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	0.1	0.7	1.5	1.6	2.0	3.0	47	0.9	1.3
MASS (kg)	3.2	7.4	9.9	10.0	12.5	18.3	39	3.6	5.1
AP (cm)	10.5	13.6	14.9	15.0	16.3	18.3	41	1.9	2.7
LAT (cm)	9.0	11.9	12.9	13.0	14.0	16.3	39	1.7	2.1

Table C5.5.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	10.0	12.8	14.3	13.8	15.0	29.6	36	3.3	2.2
heCTDIvol (mGy)	6.0	20.9	32.9	27.6	39.1	85.8	45	21.1	18.2
SCAN LEN. (cm)	9.9	13.3	13.8	14.1	15.0	15.7	21	1.5	1.7
DLPseq (mGy·cm)	84	324	637	565	760	1308	29	368	436

PEDIATRIC HEAD (0<X≤3)–HELICAL / NO CONTRAST / DOSE REDUCTION

Table C5.6.1

SAMPLE SIZE	
CT UNITS	13
PATIENTS	32
SEQUENCES	32
SEQ/PAT RATIO	1.00
MALE	19
FEMALE	13

Table C5.6.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	0.0	0.3	1.3	1.0	2.0	3.0	32	1.0	1.8
MASS (kg)	4.4	6.1	9.0	9.1	10.7	15.0	19	3.3	4.5
AP (cm)	10.0	13.9	14.8	15.0	16.1	17.7	30	1.9	2.2
LAT (cm)	9.0	11.8	12.3	12.5	13.4	14.3	30	1.4	1.5

Table C5.6.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	9.9	12.2	13.3	13.6	14.1	15.6	22	1.4	2.0
heCTDIvol (mGy)	8.3	23.4	28.4	26.4	35.2	53.7	32	10.1	11.8
SCAN LEN. (cm)	9.9	12.5	13.4	13.5	14.4	16.0	25	1.4	1.9
DLPseq (mGy·cm)	140	350	454	404	576	915	28	188	226

PEDIATRIC HEAD (0<X≤3)–HELICAL / CONTRAST / FIXED

Insufficient data, n = 1.

PEDIATRIC HEAD (0<X≤3)–HELICAL / CONTRAST / DOSE REDUCTION

No data, n = 0

PEDIATRIC HEAD (3<X≤7)–ENTIRE GROUP

Table C6.0.1

SAMPLE SIZE	
CT UNITS	56
PATIENTS	105
SEQUENCES	128
SEQ/PAT RATIO	1.22
MALE	72
FEMALE	56

Table C6.0.2

GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	3.5	5.0	5.7	6.0	7.0	7.0	128	1.1	2.0
MASS (kg)	7.0	16.8	19.6	20.0	22.0	32.0	100	4.7	5.3
AP (cm)	14.0	16.6	17.1	17.1	17.8	19.3	92	1.1	1.2
LAT (cm)	12.0	13.4	14.0	14.0	14.5	15.8	88	0.7	1.1

Table C6.0.3

GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	17.7	30.6	44.7	38.1	48.0	123.0	60	24.8	17.4
SCAN RANGE (cm)	3.8	12.0	12.8	13.8	14.9	19.8	81	3.7	2.9
heCTDIvol (mGy)	23.2	30.7	41.2	39.2	51.5	87.9	52	12.8	20.8
SCAN LEN. (cm)	4.7	14.0	14.9	14.9	15.8	19.2	40	2.5	1.8
DLPseq (mGy·cm)	24.0	370	544	552	692	1332	97	253	322
DLPexam (mGy·cm)	237	494	706	601	843	2161	101	329	349

PEDIATRIC HEAD (3<X≤7)–SUB-GROUPS (8)

PEDIATRIC HEAD (3<X≤7)–AXIAL / NO CONTRAST / FIXED CURRENT

Table C6.1.1

SAMPLE SIZE	
CT UNITS	25
PATIENTS	42
SEQUENCES	58
SEQ/PAT RATIO	1.38
MALE	34
FEMALE	24

Table C6.1.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	3.7	5.6	5.9	6.0	7.0	7.0	58	1.1	1.4
MASS (kg)	9.1	16.5	20.1	20.0	22.4	32.0	50	4.9	5.9
AP (cm)	14.0	16.6	17.1	17.3	17.9	19.3	32	1.3	1.3
LAT (cm)	13.1	13.9	14.3	14.4	14.7	15.8	28	0.7	0.8

Table C6.1.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	17.7	32.3	48.1	39.9	51.1	123.0	46	27.2	18.9
SCAN RANGE (cm)	3.8	7.8	11.0	13.2	14.0	17.5	40	4.0	6.2
heCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN LEN. (cm)	-	-	-	-	-	-	0	-	-
DLPseq (mGy·cm)	24	290	456	496	644	773	45	203	354

PEDIATRIC HEAD (3<X≤7)–AXIAL / NO CONTRAST / DOSE REDUCTION

Table C6.2.1

SAMPLE SIZE	
CT UNITS	4
PATIENTS	7
SEQUENCES	10
SEQ/PAT RATIO	1.43
MALE	7
FEMALE	3

Table C6.2.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	4.0	5.0	5.7	6.0	6.8	7.0	10	1.2	1.8
MASS (kg)	15.0	18.1	19.0	20.4	20.4	22.7	9	2.6	2.3
AP (cm)	16.1	16.5	16.9	17.2	17.3	17.3	5	0.5	0.8
LAT (cm)	13.5	14.0	14.5	14.5	15.2	15.4	5	0.8	1.2

Table C6.2.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	26.6	30.6	33.1	31.1	36.4	42.6	10	4.9	5.8
SCAN RANGE (cm)	16.0	16.0	16.0	16.0	16.0	16.0	2	0.0	0.0
heCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN LEN. (cm)	-	-	-	-	-	-	0	-	-
DLPseq (mGy·cm)	77	256	359	429	489	490	9	154	233

PEDIATRIC HEAD (3<X≤7)–AXIAL / CONTRAST / FIXED CURRENT

Insufficient data, n = 4.

PEDIATRIC HEAD (3<X≤7)–AXIAL / CONTRAST / DOSE REDUCTION

No data, n = 0

PEDIATRIC HEAD (3<X≤7)–HELICAL / NO CONTRAST / FIXED CURRENT

Table C6.5.1

SAMPLE SIZE	
CT UNITS	15
PATIENTS	27
SEQUENCES	27
SEQ/PAT RATIO	1.00
MALE	13
FEMALE	14

Table C6.5.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	3.5	4.9	5.4	5.0	6.0	7.0	27	1.1	1.1
MASS (kg)	10.4	16.0	19.4	19.0	22.7	31.8	21	4.9	6.7
AP (cm)	15.5	16.4	17.1	17.1	17.7	19.0	26	1.0	1.3
LAT (cm)	12.0	13.4	13.9	14.0	14.4	15.3	26	0.7	0.9

Table C6.5.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	4.7	14.0	14.7	14.9	15.5	19.8	20	3.2	1.6
heCTDIvol (mGy)	29.7	39.1	45.0	43.8	51.5	87.9	25	12.0	12.4
SCAN LEN. (cm)	4.7	14.0	14.8	14.8	16.0	19.2	19	3.1	2.0
DLPseq (mGy·cm)	343	558	751	829	866	1077	17	201	308

PEDIATRIC HEAD (3<X≤7)–HELICAL / NO CONTRAST / DOSE REDUCTION

Table C6.6.1

SAMPLE SIZE	
CT UNITS	13
PATIENTS	23
SEQUENCES	23
SEQ/PAT RATIO	1.00
MALE	14
FEMALE	9

Table C6.6.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	4.0	4.0	5.3	5.0	6.0	7.0	23	1.1	2.0
MASS (kg)	7.0	16.0	18.2	19.5	22.4	27.2	11	6.1	6.4
AP (cm)	14.0	17.0	17.2	17.2	18.0	18.7	21	1.1	1.0
LAT (cm)	12.8	13.1	13.7	14.0	14.0	14.8	21	0.6	0.9

Table C6.6.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	10.5	13.1	13.8	14.0	14.6	17.2	13	1.6	1.5
heCTDIvol (mGy)	23.2	28.3	34.3	29.7	37.0	71.8	23	10.7	8.7
SCAN LEN. (cm)	10.5	14.3	15.1	15.2	15.8	18.5	14	1.9	1.6
DLPseq (mGy·cm)	360	456	612	597	732	1174	18	201	276

PEDIATRIC HEAD (3<X≤7)–HELICAL / CONTRAST / FIXED CURRENT

Insufficient data, n = 5.

PEDIATRIC HEAD (3<X≤7)–HELICAL / CONTRAST / DOSE REDUCTION

Insufficient data, n = 1.

PEDIATRIC HEAD (7<X≤13)–ENTIRE GROUP

Table C7.0.1

SAMPLE SIZE	
CT UNITS	61
PATIENTS	146
SEQUENCES	168
SEQ/PAT RATIO	1.15
MALE	91
FEMALE	77

Table C7.0.2

GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	7.5	8.4	9.9	10.0	11.0	13.0	168	1.6	2.6
MASS (kg)	21.0	27.2	32.4	32.0	36.3	48.0	121	6.8	9.1
AP (cm)	14.1	17.0	17.6	17.6	18.4	20.0	140	1.2	1.4
LAT (cm)	12.8	14.0	14.6	14.5	15.2	17.4	132	1.0	1.2

Table C7.0.3

GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	17.4	34.7	51.2	42.9	59.1	144.2	97	26.3	24.4
SCAN RANGE (cm)	3.5	12.5	13.2	14.0	15.0	28.0	121	3.9	2.5
heCTDIvol (mGy)	10.6	36.0	46.5	47.0	52.9	91.1	61	15.9	17.0
SCAN LEN. (cm)	13.0	14.3	15.2	15.0	15.9	21.6	42	1.5	1.6
DLPseq (mGy·cm)	24	420	635	610	834	1645	144	330	414
DLPexam (mGy·cm)	77	551	749	665	888	1645	132	302	337

PEDIATRIC HEAD (7<X≤13)–SUB-GROUPS (8)

PEDIATRIC HEAD (7<X≤13)–AXIAL / NO CONTRAST / FIXED CURRENT

Table C7.1.1

SAMPLE SIZE	
CT UNITS	25
PATIENTS	61
SEQUENCES	82
SEQ/PAT RATIO	1.34
MALE	45
FEMALE	37

Table C7.1.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	7.5	8.0	9.8	9.9	11.0	13.0	82	1.7	3.0
MASS (kg)	21.5	26.0	32.0	32.0	36.8	47.0	66	7.2	10.8
AP (cm)	14.1	16.3	17.5	17.6	18.5	20.0	58	1.4	2.2
LAT (cm)	12.8	14.0	14.8	14.8	15.3	17.4	54	1.1	1.3

Table C7.1.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	17.4	33.4	50.9	42.7	55.3	144.2	77	27.7	21.9
SCAN RANGE (cm)	3.5	8.3	11.4	12.8	14.0	18.1	61	4.0	5.7
heCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN LEN. (cm)	-	-	-	-	-	-	0	-	-
DLPseq (mGy·cm)	24	248	489	496	665	1343	76	292	416

PEDIATRIC HEAD (7<X≤13)–AXIAL / NO CONTRAST / DOSE REDUCTION

Table C7.2.1

SAMPLE SIZE	
CT UNITS	7
PATIENTS	18
SEQUENCES	18
SEQ/PAT RATIO	1.00
MALE	8
FEMALE	10

Table C7.2.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	8.0	9.0	10.2	10.0	11.0	12.0	18	1.4	2.0
MASS (kg)	27.2	30.1	33.1	32.7	36.3	40.8	13	4.1	6.2
AP (cm)	16.6	17.5	17.8	17.9	18.3	18.7	16	0.6	0.9
LAT (cm)	13.0	14.2	14.5	14.5	14.8	16.2	14	0.9	0.6

Table C7.2.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	20.8	42.6	53.8	58.4	59.6	110.9	18	21.5	16.9
SCAN RANGE (cm)	3.4	13.7	13.1	14.0	14.0	15.9	10	3.5	0.3
heCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN LEN. (cm)	-	-	-	-	-	-	0	-	-
DLPseq (mGy·cm)	298	533	752	834	834	1553	16	316	301

PEDIATRIC HEAD (7<X≤13)–AXIAL / CONTRAST / FIXED CURRENT

Insufficient data, n = 3.

PEDIATRIC HEAD (7<X≤13)–AXIAL / CONTRAST / DOSE REDUCTION

No data, n = 0.

PEDIATRIC HEAD (7<X≤13)–HELICAL / NO CONTRAST / FIXED CURRENT

Table C7.5.1

SAMPLE SIZE	
CT UNITS	17
PATIENTS	29
SEQUENCES	29
SEQ/PAT RATIO	1.00
MALE	14
FEMALE	15

Table C7.5.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	8.0	8.0	9.5	9.0	10.3	13.0	29	1.4	2.3
MASS (kg)	21.0	27.2	31.7	31.1	36.3	47.0	24	6.5	9.1
AP (cm)	14.8	16.8	17.3	17.5	18.3	18.9	29	1.1	1.5
LAT (cm)	13.0	14.0	14.4	14.3	15.0	16.3	28	0.8	1.1

Table C7.5.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	13.0	14.2	14.9	14.7	15.0	20.0	20	1.4	0.8
heCTDIvol (mGy)	10.6	47.0	54.4	51.5	64.3	91.1	27	16.0	17.3
SCAN LEN. (cm)	13.0	14.7	15.1	15.0	16.0	16.8	21	1.0	1.3
DLPseq (mGy·cm)	539	879	1026	966	1212	1645	20	267	332

PEDIATRIC HEAD (7<X≤13)–HELICAL / NO CONTRAST / DOSE REDUCTION

Table C7.6.1

SAMPLE SIZE	
CT UNITS	17
PATIENTS	32
SEQUENCES	32
SEQ/PAT RATIO	1.00
MALE	20
FEMALE	12

Table C7.6.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	7.5	9.0	10.2	10.0	11.3	13.0	32	1.5	2.3
MASS (kg)	21.0	29.3	33.1	31.9	38.0	46.3	14	7.0	8.6
AP (cm)	14.6	17.1	17.9	17.6	18.7	19.6	30	1.1	1.6
LAT (cm)	12.9	13.9	14.5	14.4	15.1	17.2	30	1.0	1.2

Table C7.6.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	9.2	14.3	15.5	15.0	16.0	21.6	25	2.4	1.8
heCTDIvol (mGy)	23.4	31.5	39.6	36.5	43.2	83.4	31	13.0	11.6
SCAN LEN. (cm)	13.0	14.3	15.4	15.0	15.6	21.6	19	1.9	1.3
DLPseq (mGy·cm)	415	495	672	615	759	1297	28	218	264

PEDIATRIC HEAD (7<X≤13)–HELICAL / CONTRAST / FIXED CURRENT

Insufficient data, n = 2.

PEDIATRIC HEAD (7<X≤13)–HELICAL / CONTRAST / DOSE REDUCTION

Insufficient data, n = 2.

PEDIATRIC CHEST (0<X≤3)–ENTIRE GROUP

Table C8.0.1

SAMPLE SIZE	
CT UNITS	15
PATIENTS	50
SEQUENCES	51
SEQ/PAT RATIO	1.02
MALE	32
FEMALE	19

Table C8.0.2

GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	0.0	0.5	1.5	1.7	2.9	3.0	51	1.1	2.4
MASS (kg)	2.4	7.0	10.3	11.1	14.0	22.5	49	4.8	7.0
AP (cm)	8.7	10.9	12.5	12.8	13.9	17.8	47	2.1	3.0
LAT (cm)	8.8	14.1	16.6	17.0	19.7	21.7	47	3.4	5.6

Table C8.0.3

GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	3.9	12.0	15.5	16.0	18.9	24.7	45	4.6	6.9
heCTDIvol (mGy)	0.8	1.3	2.2	1.5	2.8	6.4	48	1.3	1.5
SCAN LEN. (cm)	8.3	12.4	16.0	16.9	19.1	24.7	32	4.2	6.8
DLPseq (mGy·cm)	14	30	51	40	62	143	37	30	31
DLPexam (mGy·cm)	12	26	45	36	52	143	44	29	26

PEDIATRIC CHEST (0<X≤3)–SUB-GROUPS (8)

PEDIATRIC CHEST (0<X≤3)–AXIAL / NO CONTRAST / FIXED CURRENT

Insufficient data, n = 1.

PEDIATRIC CHEST (0<X≤3)–AXIAL / NO CONTRAST DOSE REDUCTION

No data, n = 0.

PEDIATRIC CHEST (0<X≤3)–AXIAL / CONTRAST / FIXED CURRENT

No data, n = 0.

PEDIATRIC CHEST (0<X≤3)–AXIAL / CONTRAST / DOSE REDUCTION

No data, n = 0.

PEDIATRIC CHEST (0<X≤3)–HELICAL / NO CONTRAST / FIXED CURRENT

Insufficient data, n = 2.

PEDIATRIC CHEST (0<X≤3)–HELICAL / NO CONTRAST / DOSE REDUCTION

Table C8.6.1

SAMPLE SIZE	
CT UNITS	8
PATIENTS	15
SEQUENCES	15
SEQ/PAT RATIO	1.00
MALE	10
FEMALE	5

Table C8.6.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	0.1	1.5	2.1	2.0	3.0	3.0	15	1.1	1.5
MASS (kg)	4.5	12.5	13.7	14.1	15.5	22.5	15	4.2	3.0
AP (cm)	10.7	13.1	13.7	14.2	15.0	16.4	13	1.6	1.9
LAT (cm)	14.0	18.1	19.1	20.1	20.4	21.7	13	2.4	2.3

Table C8.6.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	10.8	15.3	17.1	17.1	19.3	22.5	14	2.9	4.0
heCTDIvol (mGy)	1.0	1.3	1.9	1.3	1.9	4.8	14	1.1	0.7
SCAN LEN. (cm)	16.1	17.1	18.5	18.6	19.5	22.5	10	1.9	2.4
DLPseq (mGy·cm)	25	31	50	38	44	143	13	34	13

PEDIATRIC CHEST (0<X≤3)–HELICAL / CONTRAST / FIXED CURRENT

Insufficient data, n = 6.

PEDIATRIC CHEST (0<X≤3)–HELICAL / CONTRAST / DOSE REDUCTION

Table C8.8.1

SAMPLE SIZE	
CT UNITS	9
PATIENTS	27
SEQUENCES	27
SEQ/PAT RATIO	1.00
MALE	18
FEMALE	9

Table C8.8.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	0.0	0.5	1.3	1.1	2.0	3.0	27	1.1	1.5
MASS (kg)	2.4	7.0	9.0	9.4	12.0	14.0	25	3.5	5.0
AP (cm)	9.0	10.2	11.8	11.6	13.0	15.3	26	1.6	2.8
LAT (cm)	10.7	14.2	16.6	17.2	18.9	20.5	26	2.9	4.7

Table C8.8.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	9.5	11.9	16.0	16.0	19.5	24.7	23	4.9	7.5
heCTDIvol (mGy)	0.8	1.3	2.4	1.9	3.0	6.4	27	1.4	1.6
SCAN LEN. (cm)	9.5	11.9	15.8	15.8	19.0	24.7	18	4.4	7.1
DLPseq (mGy·cm)	14	33	52	49	66	116	20	28	33

PEDIATRIC CHEST (3<X≤7)–ENTIRE GROUP

Table C9.0.1

SAMPLE SIZE	
CT UNITS	18
PATIENTS	37
SEQUENCES	38
SEQ/PAT RATIO	1.03
MALE	17
FEMALE	21

Table C9.0.2

GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	4.0	4.1	5.3	5.0	6.0	7.0	38	1.0	1.9
MASS (kg)	12.8	16.4	18.1	18.0	20.0	23.0	34	2.8	3.6
AP (cm)	12.6	13.6	14.9	14.9	16.1	18.7	35	1.7	2.6
LAT (cm)	13.3	19.8	20.8	21.3	22.1	26.0	35	2.8	2.3

Table C9.0.3

GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	8.0	17.3	19.5	20.0	22.0	24.8	34	3.4	4.6
heCTDIvol (mGy)	1.1	1.7	3.0	2.8	3.8	7.9	38	1.7	2.1
SCAN LEN. (cm)	8.0	18.2	20.0	21.0	22.1	24.5	22	3.6	3.9
DLPseq (mGy·cm)	18	45	77	72	87	193	27	40	43
DLPexam (mGy·cm)	19	43	71	68	85	195	34	37	41

PEDIATRIC CHEST (3<X≤7)–SUB-GROUPS (8)

PEDIATRIC CHEST (3<X≤7)–AXIAL / NO CONTRAST / FIXED CURRENT

No data, n = 0.

PEDIATRIC CHEST (3<X≤7)–AXIAL / NO CONTRAST / DOSE REDUCTION

No data, n = 0.

PEDIATRIC CHEST (3<X≤7)–AXIAL / CONTRAST / FIXED CURRENT

No data, n = 0.

PEDIATRIC CHEST (3<X≤7)–AXIAL / CONTRAST DOSE REDUCTION

No data, n = 0.

PEDIATRIC CHEST (3<X≤7)–HELICAL / NO CONTRAST / FIXED CURRENT

Insufficient data, n = 3.

PEDIATRIC CHEST (3<X≤7)–HELICAL / NO CONTRAST / DOSE REDUCTION

Table C9.6.1

SAMPLE SIZE	
CT UNITS	5
PATIENTS	11
SEQUENCES	12
SEQ/PAT RATIO	1.09
MALE	5
FEMALE	7

Table C9.6.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	4.0	5.0	5.3	5.0	6.0	7.0	12	0.9	1.0
MASS (kg)	13.0	16.0	18.2	18.0	20.0	22.5	11	3.0	4.0
AP (cm)	12.9	13.1	14.4	13.6	15.9	18.0	11	1.8	2.8
LAT (cm)	19.0	19.7	21.1	20.6	21.7	25.1	11	2.1	2.0

Table C9.6.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	8	17.4	18.4	19.4	20.6	22.1	12	3.8	3.1
heCTDIvol (mGy)	1.1	1.2	2.2	1.5	3.7	4.1	12	1.2	2.4
SCAN LEN. (cm)	16.3	19.3	20.0	20.5	21.7	22.1	6	2.2	2.4
DLPseq (mGy·cm)	18	34	53	42	76	90	9	27	42

PEDIATRIC CHEST (3<X≤7)–HELICAL / CONTRAST / FIXED CURRENT

Insufficient data, n = 4.

PEDIATRIC CHEST (3<X≤7)–HELICAL / CONTRAST / DOSE REDUCTION

Table C9.8.1

SAMPLE SIZE	
CT UNITS	12
PATIENTS	19
SEQUENCES	19
SEQ/PAT RATIO	1.00
MALE	7
FEMALE	12

Table C9.8.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	4.0	4.1	5.4	5.3	6.0	7.0	19	1.2	1.9
MASS (kg)	15.0	17.0	18.6	18.7	20.0	22.7	17	2.1	3.0
AP (cm)	12.6	14.0	14.8	14.9	15.5	17.7	17	1.3	1.5
LAT (cm)	19.0	20.6	21.7	21.8	22.0	26.0	17	1.7	1.4

Table C9.8.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	15.7	17.6	20.4	21.0	23.0	24.8	15	3.1	5.3
heCTDIvol (mGy)	1.4	2.3	3.3	3.1	3.6	7.9	19	1.8	1.4
SCAN LEN. (cm)	16.0	18.3	20.5	21.0	22.3	24.5	11	2.6	4.0
DLPseq (mGy·cm)	35.21	62	80	72	92	141	15	33	29

PEDIATRIC CHEST (7<X≤13)–ENTIRE GROUP

Table C10.0.1

SAMPLE SIZE	
CT UNITS	13
PATIENTS	34
SEQUENCES	34
SEQ/PAT RATIO	1.00
MALE	20
FEMALE	14

Table C10.0.2

GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	7.3	8.1	9.8	9.5	11.0	13.0	34	1.7	2.9
MASS (kg)	20.0	27.0	32.4	31.0	38.7	46.0	33	7.5	11.7
AP (cm)	13.9	17.0	18.1	17.7	19.8	22.2	33	2.0	2.8
LAT (cm)	18.7	22.8	25.6	26.0	28.9	32.6	34	3.7	6.2

Table C10.0.3

GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	18.3	21.6	23.9	23.5	24.8	39.8	29	4.0	3.2
heCTDIvol (mGy)	1.8	2.4	3.6	3.4	4.8	7.2	33	1.4	2.4
SCAN LEN. (cm)	18.9	21.0	23.0	23.5	24.5	26.5	13	2.3	3.5
DLPseq (mGy·cm)	5	60	101	105	135	177	32	44	75
DLPexam (mGy·cm)	47	61	104	105	136	181	30	42	75

PEDIATRIC CHEST (7<X≤13)–SUB-GROUPS (8)

PEDIATRIC CHEST (7<X≤13)–AXIAL / NO CONTRAST / FIXED CURRENT

No data, n = 0.

PEDIATRIC CHEST (7<X≤13)–AXIAL / NO CONTRAST / DOSE REDUCTION

No data, n = 0.

PEDIATRIC CHEST (7<X≤13)–AXIAL / CONTRAST / FIXED CURRENT

No data, n = 0.

PEDIATRIC CHEST (7<X≤13)–AXIAL / CONTRAST / DOSE REDUCTION

No data, n = 0.

PEDIATRIC CHEST (7<X≤13)–HELICAL / NO CONTRAST / FIXED CURRENT

No data, n = 0.

PEDIATRIC CHEST (7<X≤13)–HELICAL / NO CONTRAST / DOSE REDUCTION

Table C10.6.1

SAMPLE SIZE	
CT UNITS	6
PATIENTS	13
SEQUENCES	13
SEQ/PAT RATIO	1.00
MALE	5
FEMALE	8

Table C10.6.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	7.3	8.0	9.0	9.0	9.0	13.0	13	1.6	1.0
MASS (kg)	20.0	25.0	30.3	28.7	36.0	44.0	13	7.5	11.0
AP (cm)	16.0	17.0	18.5	17.7	19.8	21.2	13	1.7	2.8
LAT (cm)	21.8	22.7	25.9	25.4	29.4	30.2	13	3.4	6.7

Table C10.6.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	18.3	21.2	22.7	23.3	23.7	28.0	12	2.6	2.5
heCTDIvol (mGy)	1.8	2.0	3.5	3.4	4.3	5.3	13	1.3	2.3
SCAN LEN. (cm)	22.0	23.1	23.3	23.5	23.6	24.0	4	0.9	0.5
DLPseq (mGy·cm)	5	54	87	94	123	147	11	44	69

PEDIATRIC CHEST (7<X≤13)–HELICAL / CONTRAST / FIXED CURRENT

Insufficient data, n = 4.

PEDIATRIC CHEST (7<X≤13)–HELICAL / CONTRAST / DOSE REDUCTION

Table C10.8.1

SAMPLE SIZE	
CT UNITS	10
PATIENTS	17
SEQUENCES	17
SEQ/PAT RATIO	1.00
MALE	12
FEMALE	5

Table C10.8.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	8.0	9.0	10.5	10.5	11.0	13.0	17	1.5	2.0
MASS (kg)	22.7	30.0	34.0	32.8	40.2	45.0	16	6.6	10.2
AP (cm)	14.0	17.4	18.5	18.0	20.1	22.2	16	2.1	2.7
LAT (cm)	18.7	25.0	26.5	26.8	28.8	32.6	17	3.5	3.8

Table C10.8.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	18.9	23.2	25.5	24.7	27.3	39.8	14	4.8	4.0
heCTDIvol (mGy)	2.02	2.5	3.7	3.3	4.8	7.2	16	1.5	2.3
SCAN LEN. (cm)	18.9	20.8	23.2	23.9	25.7	26.5	6	3.2	5.0
DLPseq (mGy·cm)	53	76	110	121	139	177	17	41	63

PEDIATRIC ABDOMEN (0<X≤3)–ENTIRE GROUP

Table C11.0.1

SAMPLE SIZE	
CT UNITS	14
PATIENTS	34
SEQUENCES	35
SEQ/PAT RATIO	1.03
MALE	22
FEMALE	12

Table C11.0.2

GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	0.0	1.0	1.8	2.0	3.0	3.0	35	1.0	2.0
MASS (kg)	3.2	9.5	12.4	13.0	15.0	20.0	35	4.6	5.5
AP (cm)	8.9	12.2	13.5	13.7	14.2	18.6	34	1.8	1.9
LAT (cm)	12.0	16.6	18.0	17.9	20.1	22.0	33	2.6	3.5

Table C11.0.3

GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	6.1	24.1	27.1	27.4	30.5	41.6	32	7.1	6.4
heCTDIvol (mGy)	1.4	2.2	3.2	3.0	3.8	6.6	33	1.4	1.6
SCAN LEN. (cm)	16.0	23.8	27.7	26.7	30.6	41.6	20	6.2	6.9
DLPseq (mGy·cm)	26	58	94	85	114	203	33	45	56
DLPexam (mGy·cm)	34	67	101	103	120	205	29	45	53

PEDIATRIC ABDOMEN (0<X≤3)–SUB-GROUPS (8)

PEDIATRIC ABDOMEN (0<X≤3)–AXIAL / NO CONTRAST / FIXED CURRENT

No data, n = 0.

PEDIATRIC ABDOMEN (0<X≤3)–AXIAL / NO CONTRAST / DOSE REDUCTION

No data, n = 0.

PEDIATRIC ABDOMEN (0<X≤3)–AXIAL / CONTRAST / FIXED CURRENT

No data, n = 0.

PEDIATRIC ABDOMEN (0<X≤3)–AXIAL / CONTRAST / DOSE REDUCTION

No data, n = 0.

PEDIATRIC ABDOMEN (0<X≤3)–HELICAL / NO CONTRAST / FIXED CURRENT

No data, n = 0.

PEDIATRIC ABDOMEN (0<X≤3)–HELICAL / NO CONTRAST / DOSE REDUCTION

Insufficient data, n = 2.

PEDIATRIC ABDOMEN (0<X≤3)–HELICAL / CONTRAST / FIXED CURRENT

Insufficient data, n = 1.

PEDIATRIC ABDOMEN (0<X≤3)–HELICAL / CONTRAST / DOSE REDUCTION

Table C11.8.1

SAMPLE SIZE	
CT UNITS	12
PATIENTS	32
SEQUENCES	32
SEQ/PAT RATIO	1.00
MALE	21
FEMALE	10

Table C11.8.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	0.0	1.0	1.8	2.0	3.0	3.0	32	1.0	2.0
MASS (kg)	3.2	9.8	12.4	12.7	15.0	20.0	32	4.4	5.3
AP (cm)	8.9	12.6	13.5	13.7	14.3	18.6	32	1.9	1.7
LAT (cm)	12.0	16.7	18.2	18.5	20.1	22.0	31	2.5	3.4

Table C11.8.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	16.0	24.4	27.8	27.8	30.5	41.6	31	6.0	6.1
heCTDIvol (mGy)	1.42	2.2	3.2	3.1	3.7	6.6	30	1.3	1.5
SCAN LEN. (cm)	16.0	23.5	27.9	27.0	30.8	41.6	19	6.4	7.3
DLPseq (mGy·cm)	34	62	95	90	114	203	30	42	52

PEDIATRIC ABDOMEN (3<X≤7)–ENTIRE GROUP

Table C12.0.1

SAMPLE SIZE	
CT UNITS	17
PATIENTS	42
SEQUENCES	45
SEQ/PAT RATIO	1.07
MALE	33
FEMALE	9

Table C12.0.2

GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	3.8	5.0	6.0	6.0	7.0	7.0	45	0.9	2.0
MASS (kg)	13.7	18.0	22.8	22.0	25.0	41.0	45	6.6	7.0
AP (cm)	12.1	14.1	15.4	15.0	16.2	20.9	43	2.0	2.1
LAT (cm)	17.3	19.0	20.9	20.7	22.5	26.1	41	2.3	3.5

Table C12.0.3

GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	8.9	29.0	31.5	31.3	33.6	48.4	38	7.7	4.6
heCTDIvol (mGy)	1.4	3.1	4.0	4.0	4.9	7.7	44	1.6	1.8
SCAN LEN. (cm)	16.1	28.9	31.7	30.6	33.3	48.4	33	5.9	4.4
DLPseq (mGy·cm)	44	93	133	128	162	273	42	57	70
DLPexam (mGy·cm)	44	94	153	139	185	398	39	83	91

PEDIATRIC ABDOMEN (3<X≤7)–SUB-GROUPS (8)

PEDIATRIC ABDOMEN (3<X≤7)–AXIAL / NO CONTRAST / FIXED CURRENT

No data, n = 0.

PEDIATRIC ABDOMEN (3<X≤7)–AXIAL / NO CONTRAST / DOSE REDUCTION

No data, n = 0.

PEDIATRIC ABDOMEN (3<X≤7)–AXIAL / CONTRAST / FIXED CURRENT

No data, n = 0.

PEDIATRIC ABDOMEN (3<X≤7)–AXIAL / CONTRAST / DOSE REDUCTION

No data, n = 0.

PEDIATRIC ABDOMEN (3<X≤7)–HELICAL / NO CONTRAST / FIXED CURRENT

No data, n = 0.

PEDIATRIC ABDOMEN (3<X≤7)–HELICAL / NO CONTRAST / DOSE REDUCTION

Insufficient data, n = 5.

PEDIATRIC ABDOMEN (3<X≤7)–HELICAL / CONTRAST / FIXED CURRENT

Insufficient data, n = 2.

PEDIATRIC ABDOMEN (3<X≤7)–HELICAL / CONTRAST / DOSE REDUCTION

Table C12.8.1

SAMPLE SIZE	
CT UNITS	15
PATIENTS	37
SEQUENCES	38
SEQ/PAT RATIO	1.03
MALE	27
FEMALE	9

Table C12.8.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	3.8	5.0	6.0	6.0	7.0	7.0	38	0.9	2.0
MASS (kg)	13.7	18.0	22.2	22.0	24.4	41.0	38	6.3	6.4
AP (cm)	12.1	14.3	15.7	15.4	16.4	20.9	36	2.1	2.1
LAT (cm)	17.3	18.9	20.9	20.8	22.6	26.1	35	2.4	3.7

Table C12.8.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	14.1	29.1	32.5	31.4	33.5	48.4	32	6.7	4.4
heCTDIvol (mGy)	1.4	3.1	4.0	3.8	4.9	7.7	37	1.6	1.8
SCAN LEN. (cm)	25.5	29.0	32.3	30.8	33.4	48.4	28	5.5	4.4
DLPseq (mGy·cm)	45	96	136	128	162	273	34	55	66

PEDIATRIC ABDOMEN (7<X≤13)–ENTIRE GROUP

Table C13.0.1

SAMPLE SIZE	
CT UNITS	23
PATIENTS	47
SEQUENCES	48
SEQ/PAT RATIO	1.02
MALE	21
FEMALE	25

Table C13.0.2

GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	8.0	8.9	10.2	10.0	12.0	13.0	48	1.7	3.1
MASS (kg)	21.5	29.0	34.4	34.0	40.0	49.0	45	7.9	11.0
AP (cm)	12.3	15.4	17.9	17.8	19.7	25.8	46	3.3	4.3
LAT (cm)	16.6	22.6	24.6	24.6	26.4	32.9	46	3.4	3.8

Table C13.0.3

GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	19.2	35.3	38.0	37.6	41.9	51.9	41	7.2	6.7
heCTDIvol (mGy)	1.3	3.2	4.8	4.9	6.1	8.9	47	2.1	2.9
SCAN LEN. (cm)	26.5	33.3	37.2	36.5	39.0	57.9	31	6.4	5.8
DLPseq (mGy·cm)	9	111	197	200	257	429	37	102	146
DLPexam (mGy·cm)	44	116	204	194	263	545	44	107	147

PEDIATRIC ABDOMEN (7<X≤13)–SUB-GROUPS (8)

PEDIATRIC ABDOMEN (7<X≤13)–AXIAL / NO CONTRAST / FIXED CURRENT

No data, n = 0.

PEDIATRIC ABDOMEN (7<X≤13)–AXIAL / NO CONTRAST / DOSE REDUCTION

No data, n = 0.

PEDIATRIC ABDOMEN (7<X≤13)–AXIAL / CONTRAST / FIXED CURRENT

No data, n = 0.

PEDIATRIC ABDOMEN (7<X≤13)–AXIAL / CONTRAST / DOSE REDUCTION

No data, n = 0.

PEDIATRIC ABDOMEN (7<X≤13)–HELICAL / NO CONTRAST / FIXED CURRENT

No data, n = 0.

PEDIATRIC ABDOMEN (7<X≤13)–HELICAL / NO CONTRAST / DOSE REDUCTION

Insufficient data, n = 3.

PEDIATRIC ABDOMEN (7<X≤13)–HELICAL / CONTRAST / FIXED CURRENT

Insufficient data, n = 1.

PEDIATRIC ABDOMEN (7<X≤13)–HELICAL / CONTRAST / DOSE REDUCTION

Table C13.8.1

SAMPLE SIZE	
CT UNITS	21
PATIENTS	43
SEQUENCES	44
SEQ/PAT RATIO	1.02
MALE	18
FEMALE	24

Table C13.8.2

SUB-GROUP	PATIENT CHARACTERISTICS								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
AGE (yrs.)	8.0	9.0	10.2	10.0	12.0	13.0	44	1.7	3.0
MASS (kg)	21.5	29.3	34.8	35.2	40.0	49.0	42	7.7	10.8
AP (cm)	12.3	15.6	17.8	17.8	19.6	25.8	42	3.1	4.0
LAT (cm)	16.6	22.7	24.7	24.9	26.4	32.9	42	3.3	3.7

Table C13.8.3

SUB-GROUP	DOSE INDICES AND SCAN LENGTH								
	MIN	25th%	MEAN	MEDIAN	75th%	MAX	n	SD	IQR
axCTDIvol (mGy)	-	-	-	-	-	-	0	-	-
SCAN RANGE (cm)	19.2	33.9	38.1	38.1	42.1	51.9	38	7.5	8.2
heCTDIvol (mGy)	1.3	3.2	4.7	4.9	6.1	8.9	43	2.1	2.9
SCAN LEN. (cm)	26.5	33.3	37.6	36.5	39.6	57.9	27	6.6	6.3
DLPseq (mGy·cm)	9	108	194	200	254	429	35	100	146