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Assessment of Doses Received by Patients Who Underwent Abdominal Computed Tomography Using NCICT® Software

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Abstract: Estimating the radiation doses received from the growing demand for Computed Tomography (CT) scans helps to optimize protocols and image quality. With the aim of evaluating medical exposures in total abdomen protocols, this study extracted CT data from the Santa Catarina Telehealth and Telemedicine System (STT-SC), which was entered into the NCICT® 3.0 software to estimate the effective doses and organ doses for the examinations evaluated. The presentation of the main data obtained through statistical and descriptive analysis allows comparison with other studies. The average effective dose was 7.50 mSv for female patients (n=57) and 8.03 mSv for male patients (n=43). The spleen received the highest dose in the abdominal region, with an average of 10.99 (±4.24) mGy for men and 9.89 (±4.75) mGy for women. In conclusion, this study found variations in organ doses between male and female patients, with the lungs receiving the highest dose in women and the liver in men. These results support the need to review and adapt CT examination protocols to optimize radiation exposure, and the results presented in this study will allow for comparative evaluation with data that may be collected later as the study continues.

Keywords: Computed Tomography, Dose estimation in patients, Radiological protection, Medical exposure.

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Avaliação das doses recebidas por pacientes submetidos à Tomografia Computadorizada abdominal por meio do software NCICT®

Resumo: A estimativa das doses de radiação recebidas pela crescente demanda de exames de Tomografia Computadorizada (TC) contribui para a otimização de protocolos e da qualidade das imagens. Com o objetivo de avaliar as exposições médicas em protocolos de abdome total, este estudo extraiu dados de TC do Sistema de Telessaúde e Telemedicina de Santa Catarina (STT-SC), os quais foram inseridos no software NCICT® 3.0 para estimar as doses efetivas e as doses nos órgãos para os exames avaliados. A apresentação dos principais dados obtidos por meio de análise estatística e descritiva permite a comparação com outros estudos. A dose efetiva média foi de 7,50 mSv para pacientes do sexo feminino (n=57) e 8,03 mSv para pacientes do sexo masculino (n=43). O baço recebeu a maior dose na região abdominal, com uma média de 10,99 (±4,24) mGy para os homens e 9,89 (±4,75) mGy para as mulheres. Em conclusão, este estudo encontrou variações nas doses nos órgãos entre pacientes do sexo masculino e feminino, com os pulmões a receberem a dose mais elevada nas mulheres e o fígado nos homens. Estes resultados apoiam a necessidade de rever e adaptar os protocolos de exames de TC para otimizar a exposição à radiação, além disso os resultados apresentados neste estudo permitirão a avaliação comparativa com dados que venham a ser coletados posteriormente com a continuidade do estudo.

Palavras-chave: Tomografia computadorizada, Estimativa de dose em pacientes, Proteção radiológica, Exposição médica.

1. INTRODUCTION

Computed Tomography (CT) is a supplementary exam modality that utilizes ionizing radiation for image acquisition, facilitating the detection of various diseases. The number of CT exams has increased by 80% in recent years, making it the radiological exam that delivers the highest dose to patients. Collective effective doses from CT exams have risen from 37% to over 61% of all exposures from medical sources [1;2].

According to Alves and Caldas (2020), one of the current challenges is the development of strategies to quantify and reduce the risks associated with ionizing radiation in CT exams. This is compounded by the fact that within the majority of CT services, there is still no routine practice of monitoring the radiation doses received by patients [1; 3]. To quantify radiological risks, one available strategy is the usage of the Size-Specific Dose Estimate (SSDE), which aims to estimate the dose in CT considering the patient's size using linear dimensions measured from axial images of patients [4].

In medical physics, the dose in CT scans is quantified using dose index values such as Computed Tomography Dose Index ($CTDI_{vol}$) and Dose-Length Product (DLP). These parameters are provided by the equipment during CT image acquisitions and are essential for estimating patient doses. With all necessary parameters, the software used in this research was NCICT® 3.0 due to its accessibility, practicality, and the availability of a batch run functionality, allowing for the simultaneous processing of a large volume of exams. Therefore, the objective of this study was to estimate the dose received by patients undergoing abdominal CT examinations at a public service in southern Brazil using NCICT® software [1; 5].

1.1. Reference Levels in Diagnostic Radiological Protection

According to Souza *et al.* (2022), computed tomography has numerous advantages in medicine for diagnosis and disease monitoring. However, it is crucial to monitor patients' effective doses [6]. Radiological protection plays a vital role in this monitoring. With the development and implementation of Resolution Nº 06/1973, the creation of the "Basic Standards of Radiological Protection" by the National Commission of Nuclear Energy (CNEN) was approved, marking one of the first regulations focused on radiological protection in Brazil. Currently, several radiological protection organizations collaborate globally, such as the International Commission on Radiological Protection (ICRP) with its publications and radiological protection standards. In Brazil, the ICRP standards are translated and followed by the CNEN and the National Health Surveillance Agency (ANVISA) (SOUZA *et al.* 2022, IAEA, 2022) [6;7].

Furthermore, as stated by Souza *et al.* (2022), other organizations and commissions also play a role in developing regulations and assessing the biological effects of radiation, including the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), the United Nations Environment Programme (UNEP), the World Health Organization (WHO), and the International Nuclear Information System (IAEA). The IAEA sets radiological protection requirements that should be implemented, such as: each country must ensure the establishment of Diagnostic Reference Levels (DRLs); medical exposures must be justified considering the diagnosis and benefits; patients should be informed of the benefits and risks associated with exposure; and medical exposure optimization should be practiced (SOUZA *et al.* 2022; IAEA, 2022)[6;7].

1.2. National Cancer Institute Dosimetry System for Computed Tomography

The NCICT® software, a Dosimetry System from the National Cancer Institute for Computed Tomography in the USA, uses a voxelized phantom and operates on systems such as Windows, iOS and Linux (NIH, 2022) [8]. This software has made it possible to analyze crucial parameters such as kVp, mAs, pitch, scan length, CT dose volume, DLP, CT machine specifications, and the estimation of effective dose (TAHMASEBZADEH *et al.* 2022) [9]. The research focused on head, thorax, and abdomen-pelvis scans. A significant difference was observed between the centers in thorax and head scans, showing that younger patients received lower effective doses. In abdomen-pelvis scans, older patients received doses above the average. According to Tahmasebzadeh *et al.* (2022), this is due to the need for increased contrast administration [9].

2. MATERIALS AND METHODS

This study is characterized as a documentary, descriptive, and exploratory research of a quantitative nature, based on an undergraduate thesis approved by the ethics committee under opinion Nº 4.534.873/2021. In this study, data collection was conducted in a documentary manner at a public hospital in Santa Catarina. Data extraction was performed through the Santa Catarina Telehealth and Telemedicine System (STT-SC). The technical parameters extracted from the STT-SC examination database were: tension (kV), current-time product (mAs), pitch, scan length, $CTDI_{vol}$, and DLP. The inclusion criteria consisted of data from examinations of adult patients (18-59 years old) of both sexes, using the total abdomen CT protocol, conducted from January 2021 to December 2022. Exclusion criteria involved removing examinations with incomplete data in the STT-SC system or those with inconsistencies in the scan length values from the sample.

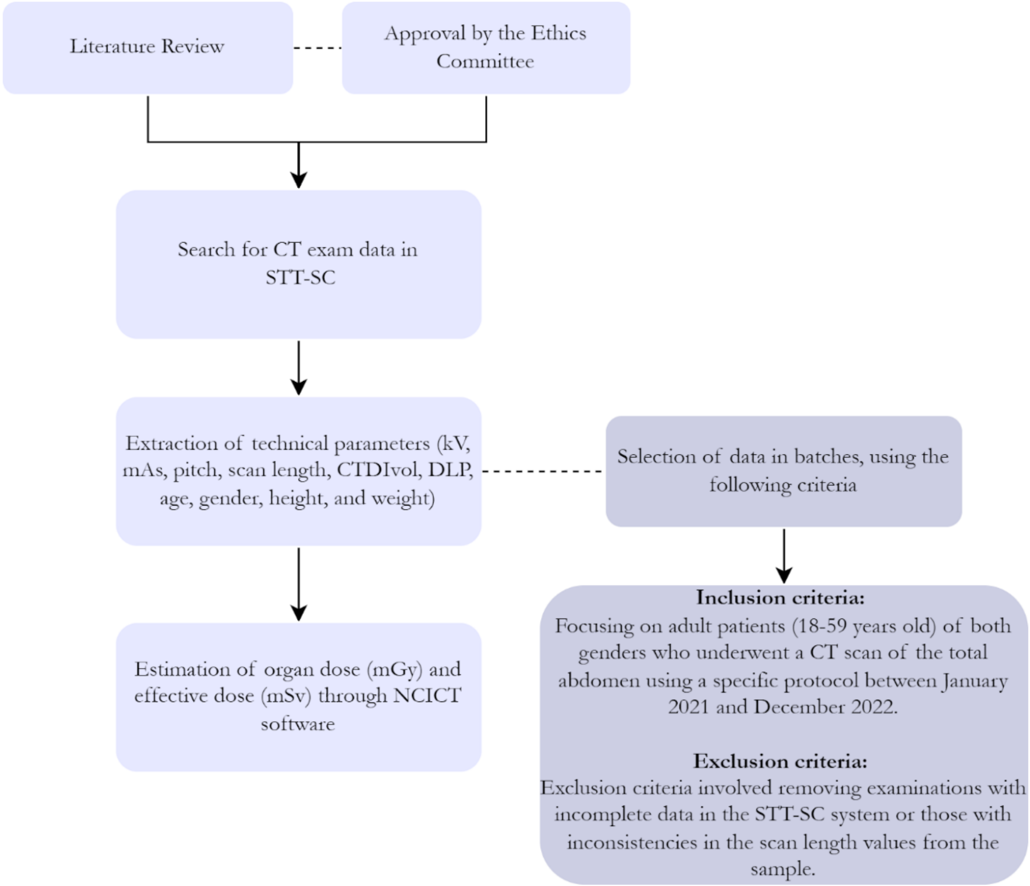
The initial phase of the research involved extracting data and technical parameters used in abdominal CT scans from the STT-SC, pertaining to a public hospital in the southern region of Brazil, through the textual headers of the images in the Digital Imaging and Communications in Medicine (DICOM) format. Data collection was facilitated by a collaboration between the researchers and the STT-SC. Currently, the STT-SC is responsible for storing information from radiological examinations originating from medical services in the state of Santa Catarina/Brazil.

Approximately 900 examinations were acquired. While the ICRP recommends a minimum of 20 to 30 examinations for research, despite having a large dataset, the examinations were selected based on anatomical region, protocol used, and adult age range. As a result, 100 examinations were selected for this research. Of these 100 examinations, 43 corresponded to male patients and 57 to female patients.

With the data saved in the appropriate format, it was possible to process the batch of 100 examinations all at once. As a result of this process, NCICT® generated a new file in ".csv" format containing information on organ dose and effective dose. This file included dose values for the following organs in the thoracic and abdominal regions: ovaries and prostate, urinary bladder, small intestine and colon, pancreas, kidney, spleen, gallbladder, adrenal glands, stomach, liver, active bone marrow, superficial bone marrow - bone surface, heart, breasts, and lungs.

All these examinations followed the total abdomen protocol, which also included the analysis of thoracic organs due to their exposure to radiation during the acquisition of the scan. A flowchart of this work's methodology can be seen in Figure 1.

Figure 1: Flowchart of the phases used in this research.



Source : The authors (2023).

The second phase involved using the NCICT® software to obtain organ dose and effective dose values. The data were extracted from the STT-SC and shared with the authors by Google Spreadsheet. After applying the inclusion and exclusion criteria, the 100 selected examinations were compiled into a spreadsheet in Microsoft Excel. To estimate the effective doses of the collected examinations, the data were inputted into the NCICT® Version 3.0 software using the batch analysis tool available in the program.

The organ dose values (mGy) per patient were normalized using the $CTDI_{vol}$ (mGy) obtained for each examination. The $CTDI_{vol}$ is a parameter provided for each examination through the Radiation Dose Structured Report (RDSR), thus enabling the estimation of organ doses (mGy). It also serves as a normalization factor to enhance the accuracy of the values. The normalization involved dividing the organ dose values by the $CTDI_{vol}$, with the purpose of following the methodology proposed by researchers in the field and allowing comparison between different studies. Following this, descriptive statistics were performed, presenting the normalized values as mean, minimum and maximum.

The final stage of this study consisted of analyzing and comparing the obtained values with those found in the literature. After acquiring the effective doses and organ doses in adult patients who underwent CT examinations, a descriptive statistical analysis was conducted. Additionally, the results for $CTDI_{vol}$ and DLP were compared with studies in the field found in both national and international literature.

2.1. Extraction of Data and Technical Parameters from the STT-SC

The data from the 100 examinations sent were organized into a table in a ".csv" file format for later use in the NCICT® software. The parameters included in the table were: tension (kV), current-time product (mAs), pitch, scan length, $CTDI_{vol}$, DLP, and secondary patient data (age, sex, weight, and height).

Regarding weight and height information, standardized values from the Brazilian Normative Instruction (IN) No. 93 of May 27, 2021, were used, which standardizes the weight and height of patients for the purpose of evaluating medical exposure in adult patients. The normative instruction considers a reference weight of 60 kg for female patients and 75 kg for male patients. For height, the IN considers 1.60 m for female patients and 1.75 m for male patients [10]. The use of these parameters in dose estimation became necessary since, routinely, such information is not obtained at the time of the scans, and the software used requires these parameters for a more reliable estimation.

3. RESULTS AND DISCUSSIONS

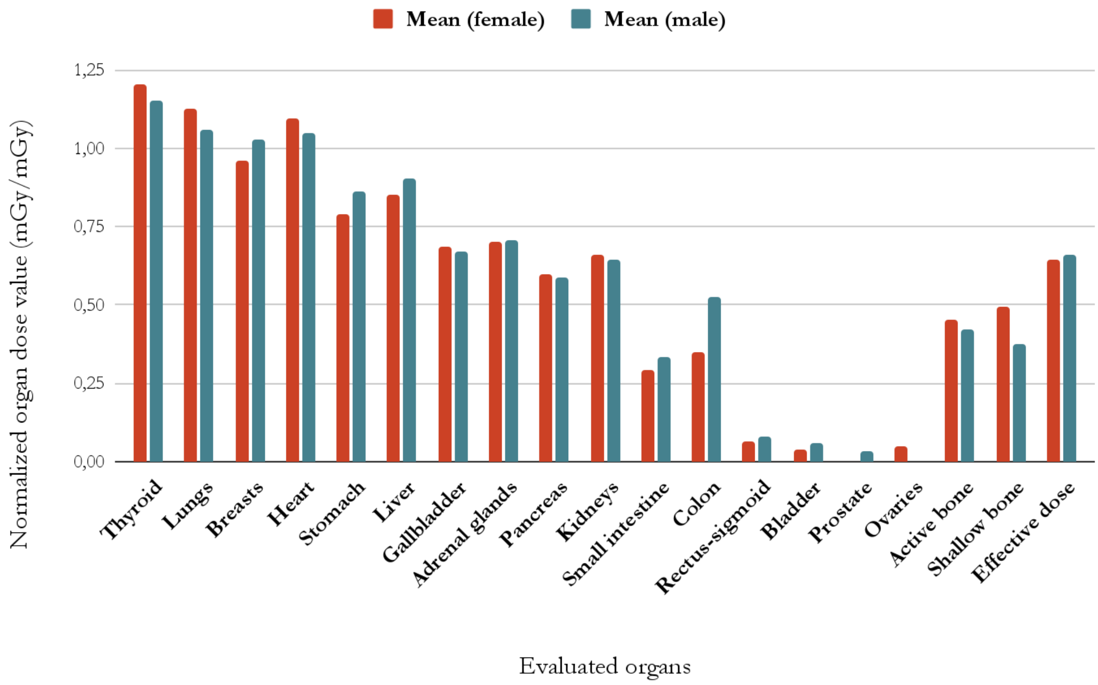
The primary outcome of this study was the estimation and quantification of the effective dose and organ dose values received during medical exposures of patients undergoing CT examinations using the total abdomen protocol at a public hospital in the southern region of Brazil. The results are presented in three stages, as described in the methodology section.

3.1. Acquisition of Organ Dose and Effective Dose Values

The organs with the highest normalized organ dose values (mGy/mGy) were the Lungs for female patients, with a mean of 1.13 mGy (Figure 2). In the abdominal region, the organ with the highest dose was the liver for male patients, with a mean value of 0.90 mGy.Bearing in mind that the scan area varied considerably between the examinations evaluated, the authors chose to also keep the dose data for other regions, thyroid and lung, since the results were significant for these regions. Although abdominal protocols were selected, the high dose results for organs in other regions may indicate that the nomenclature adopted by the participating service may not correspond exactly to what has been practiced in the service's routine. Sometimes total abdomen has been initiated in the thoracic region, which may explain the high values. In addition, inappropriate centralization in the exams may also explain the high doses in these other organs.

Table 1 presents the normalized organ dose values (mGy) separated by gender and the normalized standard deviation. The standard deviation and median values were calculated to ensure the reliability of the mean values, in addition to the organ dose (mGy).

Figure 2: Normalized Organ Dose Values (mGy) / $CTDI_{vol}$ (mGy/mGy) for both genders.



Source : The authors (2023).

Table 1 also shows that the highest dose compared to other organs was for the Lungs, with values of 1.13 mGy for females and 1.06 mGy for males. In contrast, the organs with the lowest doses were the prostate and ovaries, with doses of 0.03 mGy and 0.05 mGy, respectively.

Table 1 : Normalized organ dose values/$CTDI_{vol}$ (mGy/mGy) and effective dose/$CTDI_{vol}$ (mSv/mGy) for both genders.

Organs/tissues	MALE (N=43)			FEMALE (N=57)		
	Mean	Min.	Max.	Mean	Min.	Max.
Thyroid	1.15 (±0.23)	0.01	1.28	1.20 (±0.24)	0.06	1.28
Lungs	1.06 (±0.13)	0.31	1.11	1.13 (±0.12)	0.64	1.18
Breasts	1.03 (±0.12)	0.34	1.08	0.96 (±0.18)	0.13	1.03
Heart	1.05 (±0.12)	0.54	1.1	1.09 (±0.14)	0.5	1.16
Stomach	0.86 (±0.31)	0.06	1.09	0.79 (±0.35)	0.04	1.12
Liver	0.90 (±0.30)	0.07	1.12	0.85 (±0.32)	0.06	1.11
Gallbladder	0.67 (±0.37)	0.02	1	0.69(±0.33)	0.03	1
Adrenal glands	0.70 (±0.33)	0.04	0.97	0.70 (±0.30)	0.04	0.96

Organs/tissues	MALE (N=43)			FEMALE (N=57)		
	Mean	Min.	Max.	Mean	Min.	Max.
Pancreas	0.59 (±0.39)	0.01	0.98	0.60 (±0.38)	0.02	1.01
Kidneys	0.65 (±0.44)	0.02	1.16	0.66 (±0.45)	0.02	1.22
Small intestine	0.33 (±0.31)	0	1.06	0.29 (±0.31)	0.01	1.09
Colon	0.53 (±0.44)	0.01	1.18	0.35 (±0.38)	0	1.24
Recto-sigmoid	0.08 (±0.17)	0	0.95	0.07 (±0.15)	0	0.82
Bladder	0.06 (±0.16)	0	1.01	0.04 (±0.12)	0	0.85
Prostate	0.03 (±0.14)	0	0.95	-	-	-
Ovaries	-	-	-	0.05 (±0.14)	0	0.89
Active bone marrow	0.42 (±0.07)	0.28	0.6	0.45 (±0.08)	0.27	0.67
Shallow bone marrow	0.37 (±0.04)	0.3	0.47	0.49 (±0.05)	0.36	0.63
Effective dose	0.66 (±0.13)	0.3	0.83	0.64 (±0.14)	0.25	0.86

Source: The authors (2023).

Table 1 also shows that the highest dose, compared to other organs, was in the thyroid, with a value of 1.15 (mGy) in males and 1.20 (mGy) in females. Conversely, the prostate and ovaries received the lowest doses, 0.03 (mGy) and 0.05 (mGy), respectively.

Table 2 highlights the non-normalized organ dose values (mGy) and standard deviations for males and females, respectively, for the purpose of comparison with the study by Maxwell *et al.* (2019), which did not perform normalization. [11]

Table 2 : Non-normalized organ dose values (mGy) for males and females

Organs/tissues	Organ dose/mGy (male)			Organ dose/mGy (female)		
	Mean	Min.	Max.	Mean	Min.	Max.
Stomach	10.39(±4,05)	0.79	16.93	9.13(±4.61)	0.44	16.38
Colon	6.16(±5,32)	0.07	17.50	4.18(±4.98)	0.04	16.84
Liver	10.91(±4.01)	01.06	17.88	9.82(±4.27)	0.66	16.39
Lungs	12.90(±3.10)	4.64	20.72	13.10(±2.88)	7.35	18.75
Ovaries	-	-	-	0.68(±1.93)	0.01	11.83
Prostate	0.44(±2.10)	0.00	14.01	-	-	-
Breasts	11.20(±3.0)	1.37	16.23	11.20(±3.06)	1.37	16.23

Organs/tissues	Organ dose/mGy (male)			Organ dose/mGy (female)		
	Mean	Min.	Max.	Mean	Min.	Max.
Bladder	0.77(±2.34)	0.01	14.91	0.48(±1.62)	0.01	11.27
Thyroid	14.10(±4.34)	0.22	23.29	13.90(±3.84)	0.77	20.76
Spleen	10.99(±4.24)	0.97	18.91	9.89(±4.75)	0.47	16.84

Source: The authors (2023).

In Table 2, the unnormalized dose values, the highest dose variations and standard deviation variations were highlighted. For male patients (n=43), the organs in the abdominal region that received the highest doses were: spleen 10.99 (±4.24), liver 10.91(±4.01), and stomach 10.39(±4,05). For female patients (n=57), average dose to abdominal organs: spleen 9.89 mGy ±4.75), liver 9.82(±4.27), and stomach 9.13(±4.61).

According to Table 3, female patients had a mean effective dose of 7.50 mSv, while male patients had a mean effective dose of 8.03 mSv. Table 3 presents the average, minimum, and maximum effective dose (mSv) values, along with the unnormalized standard deviation. Overall, it can be observed that the average effective dose for female patients was lower than the average for male patients.

Table 3: Non-normalized organ dose values (mGy) for males and females

Gender	Average Effective Dose (mSv)	Minimum Effective Dose (mSv)	Maximum Effective Dose (mSv)
Female	7.5 (±2.36)	2.7	12.27
Male	8.03 (±2.08)	3.6	11.93

Source: The authors (2023).

The average effective dose for female patients was 7.50 mSv (±2.36), with a minimum value of 2.70 mSv and a maximum of 12.27 mSv. For male patients, the average was 8.03 mSv (±2.08), with a minimum value of 3.60 mSv and a maximum of 11.93 mSv.

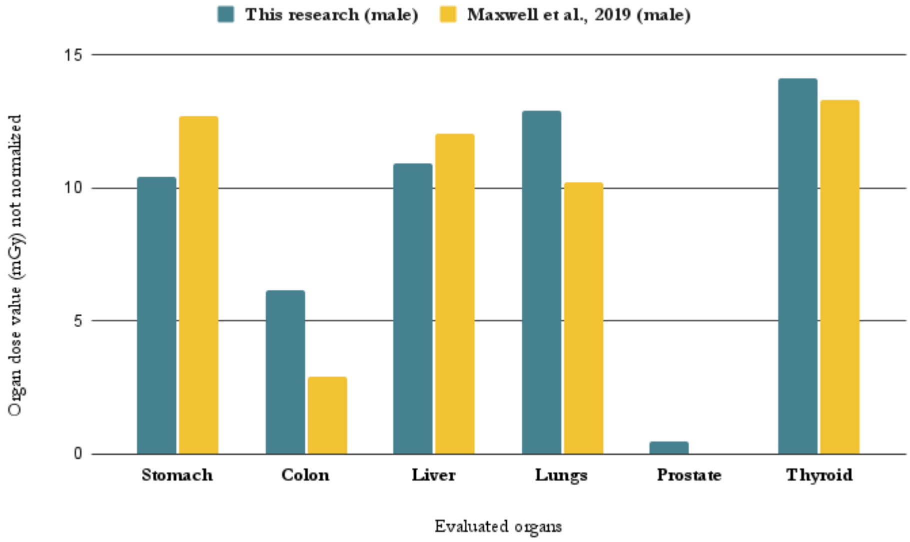
3.2. Analysis and Comparison of the Obtained Values: A Literature Perspective

In the literature on the topic proposed in this study, Lee *et al.* (2015) calculate the normalization of organ dose values, as previously explained [12]. In the study by Lee *et al.* (2015), the author performed dose normalization using the $CTDI_{vol}$ value. To compare the doses obtained in this study, normalization of organ doses (mGy) and effective doses (mSv) were carried out [12]. Another important work for this study is that of Maxwell *et al.* (2019), which utilized non-normalized values [11].

The National Cancer Institute Dosimetry System for Computed Tomography (NCICT®) is a program that estimates organ doses for pediatric and adult patients undergoing CT scans. The software utilizes reference phantoms developed by the ICRP and Monte Carlo simulations to calculate organ doses and effective doses, enabling batch calculations for a large number of patients. Moreover, Lee *et al.* (2015) compared the results generated by NCICT® with the CT-expo software. However, Lee *et al.* (2015) assert that NCICT® has good accuracy, allowing for the estimation of doses for patients of various ages. It also boasts realistic phantoms developed by the ICRP and enables the calculation of organ dose (mGy/mGy) and effective dose (mSv) for a variety of CT examinations. The study by Maxwell *et al.* (2019) used 160 cases for the total abdomen protocol and 158 cases for the thoracic protocol. The primary objective of this study was to use data provided by various software, including NCICT®, which employs voxelized phantoms to provide organ dose (mGy) and effective dose (mSv) data, to estimate cancer incidence due to CT exposure.

Figure 3 shows a comparison of the values obtained in the Maxwell *et al.* (2019) study of male patients and the data from this research, also using data from male patients [12]. In order to compare organ dose values, the same organs used in the study by Maxwell *et al.* were selected. In Maxwell *et al.* (2019) study, weight and height information were standardized following the NCICT using the voxelized ICRP reference phantoms, ICRP AM and AF that model a reference male (1.78m, 73kg) and a reference female (1.68m, 60kg) respectively.

Figure 3: Comparison of Organ Dose (mGy) in Examinations of Male Patients.



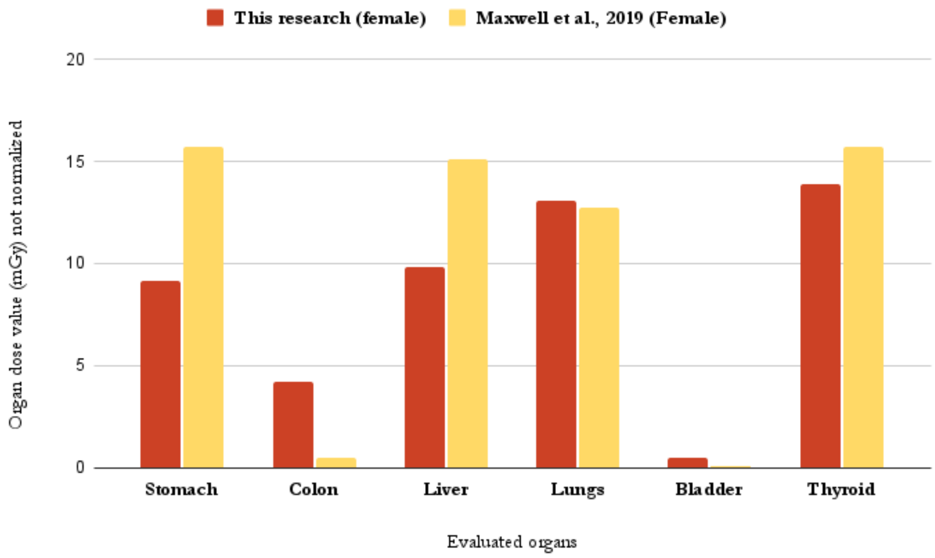
Source : The authors (2023).

Figure 3 shows that in this study, the average organ dose (mGy) for the stomach was 10.39 (mGy), while Maxwell *et al.* (2019) found an average value of 12.7 (mGy). In this work, the average organ dose for the colon was 6.16 (mGy), while in Maxwell *et al.* (2019), the average was 2.88 (mGy)[11]. In this study, the average organ dose for the liver was 10.91 (mGy), while in the author's study, the average was 12.04 (mGy). In this study, the average organ dose for the lung was 12.90 (mGy), while in the author's study for the total abdomen protocol, the average organ dose was 10.23 (mGy).

It is possible to analyze in this comparison that the organ dose values (mGy) in this research are higher than expected compared to the study by Maxwell *et al.* (2019), where the greatest differences in dose were observed in the colon, lungs, thyroid, and prostate [11].

In this study, the high dose may be attributed to the number of examinations analyzed in Maxwell *et al.* (2019), which were greater compared to this research. Additionally, Maxwell *et al.* segmented the data into groups by examination protocol, including abdomen/pelvis, thorax, and head [11]. The comparisons were made with the values for abdomen/pelvis, although some mean values are quite close to the values reported by Maxwell *et al.* (2019). It can be observed that the greatest variation in dose occurs in the colon, liver, and stomach. This variation may be due to the number of examinations collected by the author as well as the radiation dose used in each examination and region of interest. Figure 4 shows a comparison of the values obtained in the study of Maxwell *et al.* (2019) of female patients and the data from this research, also using data from female patients.

Figure 4: Normalized Organ Dose Values (mGy) / $CTDI_{vol}$ (mGy/mGy) for both genders.



Source : The authors (2023).

The greatest variation in dose occurs in the colon, liver, and stomach. This variation may be due to the number of examinations collected by the author and also to the radiation dose used in each examination and region of interest. The organs that obtained similar results were the lung examinations, where in this work, the average organ dose (mGy) in the lung was 13.10 (mGy). In the study of Maxwell *et al.* (2019), the average organ dose (mGy) in the lung was 12.7 (mGy).

During the development of this work, a comparison of normalized and unnormalized organ dose (mGy) values was conducted. In the work of Maxwell *et al.* (2019), it was necessary to use normalized values for comparison. Furthermore, in this work, the protocol used was total abdomen, as it was in the research of the author in question. This allowed for the analysis and comparison of organ dose (mGy). It is possible to observe that the dose values obtained in this study for male patients were higher than those obtained in Maxwell *et al.* (2019)[11,12]. This may have occurred due to the high dose used for CT examinations, or due to the number of examinations collected by the author.

When comparing with female patients, there were dose variations. In the study of Maxwell *et al.* (2019), the liver and thyroid regions obtained higher values, while in this study, the colon region showed the greatest deviation from the average. The organ dose (mGy) values in the author's study are close to the dose (mGy) values in this study. This is due to the fact that the author in question used the same protocol as the one used in this research [13,14]. The quality control tests of the equipment on which the tests were carried out were carried out by the hospital staff following the periodicity established in the national regulations. Normalization was performed using the average $CTDI_{vol}$ of all patients and also with the individual $CTDI_{vol}$ of each patient. It was possible to visualize that when using the individual $CTDI_{vol}$ of each patient, the obtained value was closer to reality and to the way other works in the field had been conducted. Therefore, the average used was the individual $CTDI_{vol}$ of each patient.

In conclusion, this study identified variations in the doses absorbed by organs between male and female patients, with the lungs showing the highest normalized dose among women, and the liver among men. These results can contribute to radiological protection actions such as reviewing and adapting protocols to optimize radiation exposure in CT scans. The comparison with previous studies, such as Maxwell *et al.* (2019), shows that although some dose values are consistent, there are significant differences in certain organs, possibly due to the limited number of scans analyzed and variations in the protocols adopted. Thus, the findings reinforce the need for further studies and a review of current protocols to improve patient safety in radiological practices.

The results obtained in this study also can contribute to optimizing the protocols at the participating service, allowing the technical team to know the doses delivered and to begin a process of establishing local DRLs and, based on this, refining the parameters of the protocols practiced at the site, in order to reduce unnecessary exposure and improve the overall quality of the diagnoses.

4. CONCLUSIONS

Using the collected dose data, this study aims to raise awareness about optimizing effective doses (mSv) and organ doses (mGy) while maintaining image quality. This research will contribute to the field of dose estimation for adult patients undergoing CT scans in the Brazilian state of Santa Catarina. Throughout the study, the importance of comparing organ dose (mGy) and effective dose (mSv) with values found in existing literature became evident, as this data allowed us to analyze whether the dose values were above or below the average for other regions.

Variations in organ dose (mGy) can occur due to several factors, primarily related to the number of patients included in other studies within the field. Additionally, the standard deviation might be even lower if the actual weight and height of the patients were used.

The results of this study were slightly lower than those reported in the literature. Reviewing protocols and monitoring the doses applied to patients could be actions implemented in the participating service. In Brazil, DRLs have not yet been established nationwide, and studies such as this one seek to contribute to the creation of national DRLs.

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CONFLICT OF INTEREST

All authors declare that they have no conflicts of interest.

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