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# Establishment of Local Dose Reference Levels for Radiotherapy Planning CT Scans

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## **1. Background-Aim**

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A fundamental principle of radiation protection is to maintain the doses As Low As Reasonably Achievable. Diagnostic Reference Levels (DRLs) and **Size Specific Dose Estimate (SSDE)** are both important tools in Computed Tomography (CT) optimization procedures. Although CT is typically used for simulation (CT-SIM) **in radiotherapy** (RT), DRLs are not widely established for these scans.

***The primary objective of this study was to establish local DRLs (LDRLs) and SSDE values for various adult RT/CT-SIM protocols.*** The ultimate goal was to identify potential improvements of the clinically used CT protocols in radiotherapy.

## **2. Materials & Methods**

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- ❖ **The LDRLs were established** for Thorax, Brain, Abdomen, Pelvis and Head & Neck RT protocols using the 75th percentile approach.
- ❖ **The indices** included in the analysis were: **CTDI, DLPscan, DLPexam and SSDE.**
- ❖ The Effective diameter and SSDE were calculated using the **AAPM TG 204 methodology.**
- ❖ A total of **150 scans** (30 scans per protocol) of standard-size patients were included in the analysis.
- ❖ Since National DRLs have not been established, **a comparison was performed with the respective British DRLs.**

### 3. Results

**CTDI, DLPscan, DLPexam and SSDE values are shown in the table.**

RT_Thorax		
	Metaxa Hospital	UK DRLs
CTDI (mGy)	9	Breast: 10 Lung 3D: 14
DLP (mGy*cm)	354	-
DLP <sub>TOTAL</sub> (mGy*cm)	360	Breast: 390 Lung 3D: 550
Effective Diameter (cm)	29	-
SSDE (mGy)	12	-

- ❖ The RT/CT-SIM scans concerning breast and lung are performed with the RT\_Thorax protocol.

### 3. Results

**CTDI, DLPscan, DLPexam and SSDE values are shown in the table.**

RT_Abdomen			RT_Pelvis		
	Metaxa Hospital	UK DRLs		Metaxa Hospital	UK DRLs
CTDI (mGy)	14	Gynecological: 16 Prostate: 16	CTDI (mGy)	14	Gynecological: 16 Prostate: 16
DLP (mGy*cm)	617	-	DLP (mGy*cm)	597	-
DLP <sub>TOTAL</sub> (mGy*cm)	623	Gynecological: 610 Prostate: 1750	DLP <sub>TOTAL</sub> (mGy*cm)	604	Gynecological: 610 Prostate: 1750
Effective Diameter (cm)	29	-	Effective Diameter (cm)	29	-
SSDE (mGy)	18	-	SSDE (mGy)	18	-

- ❖ The RT/CT-SIMs concerning gynecological and prostate cases are performed with the RT\_Pelvis and RT\_Abdomen protocols depending on the scan length.

### 3. Results

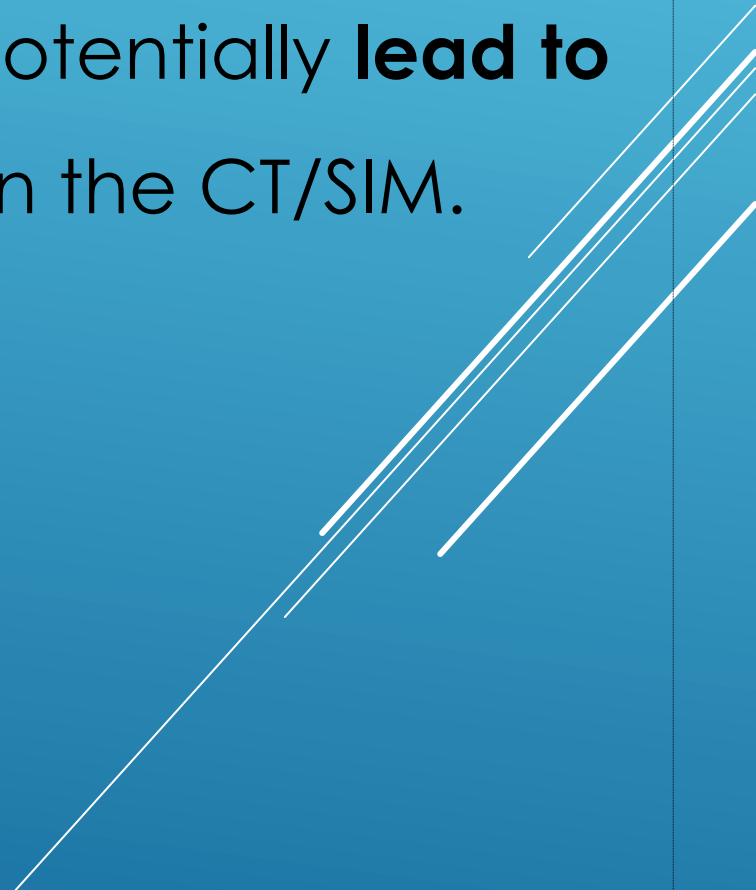
**CTDI, DLPscan, DLPexam and SSDE values are shown in the table.**

RT_Head			RT_Head^Neck		
	Metaxa Hospital	UK DRLs		Metaxa Hospital	UK DRLs
CTDI (mGy)	55	50	CTDI (mGy)	5	49
DLP (mGy*cm)	1407	-	DLP (mGy*cm)	205	-
DLP <sub>TOTAL</sub> (mGy*cm)	1416	1500	DLP <sub>TOTAL</sub> (mGy*cm)	208	2150
EFFECTIVE DIAMETER	17	-	EFFECTIVE DIAMETER	24	-
SSDE (mGy)	54	-	SSDE (mGy)	8	-

- ❖ Our results were comparable with the British DRLs for all protocols except for the Head & Neck for which ours were significantly lower. This is because the UK doses for Head & Neck examinations refer to measurements in the 16cm standard CT dosimetry phantom, while our values refer to measurements in the 32cm standard CT dosimetry phantom.

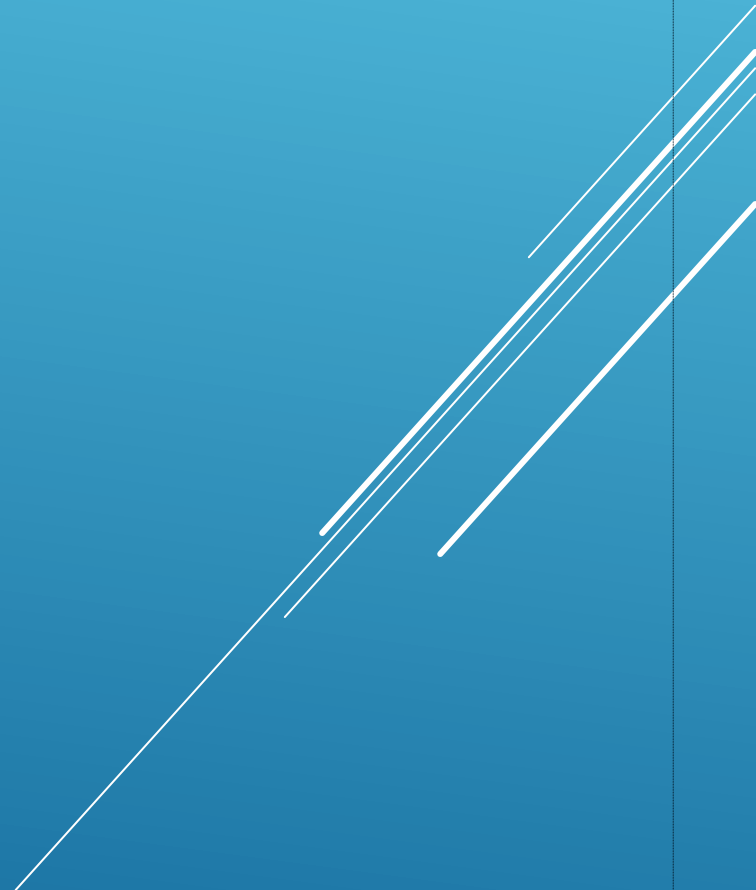
## 4. Conclusions

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- ❖ The LDRL values indicated that **acceptable radiation protection practices are followed.**
  - ❖ Continuing monitoring and analysis of the LDRLs could potentially **lead to further dose reduction**, while maintaining image quality in the CT/SIM.
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## 5. References

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1. AAPM Report No. 204 “Size-Specific Dose Estimates (SSDE) in Pediatric and Adult Body CT Examinations” (2011).
  2. Guidance “National Diagnostic Reference Levels (NDRLs) from 13 October 2022”
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