The use of RadLex playbook to manage CT big data: an Italian multicenter study

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Introduction

One of the aims of PREP (a research project of Regione Lombardia) is to manage and analyse dosimetric data in order to:

- analyse and compare protocols,
- optimize radiodiagnostic activity,
- estimate the dose delivered to the patient,
- estimate the risk due to radiologic examinations.

One of its tasks is to create a central database of dosimetric data analysing exposure values of the CT scanners installed in 4 different hospitals (ASST GOM Niguarda, Fondazione IRCCS Ca' Granda Ospedale Maggiore Policlinico, Ospedale dei Bambini "Vittore Buzzi", ASST Fatebenefratelli Sacco).

In order to create a dosimetric database using the data from exams performed with different CT scanners and in different hospitals, it has been necessary to find a way for clustering these big data. We have chosen RadLex playbook(1).

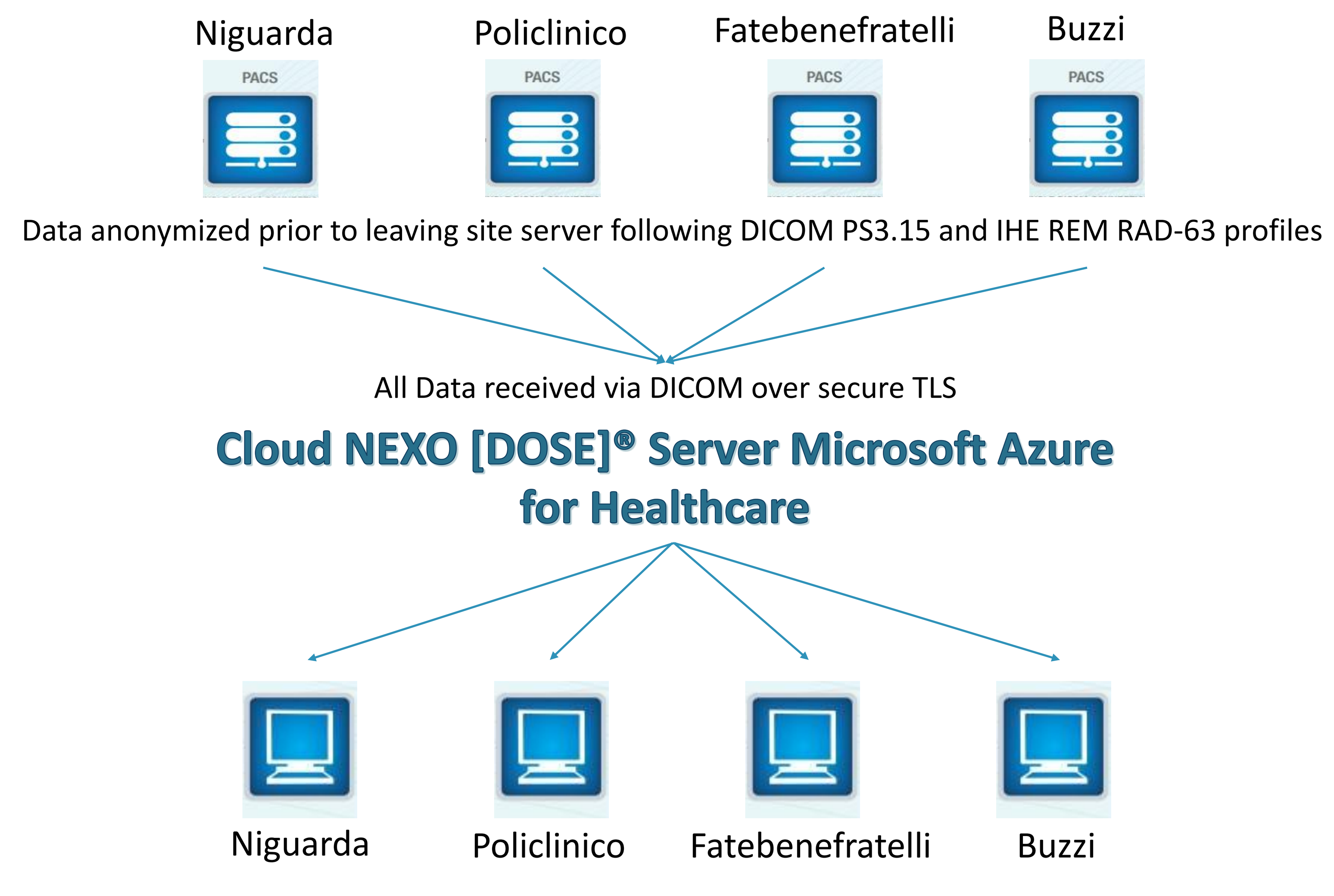

Figure 1. Cloud Server architecture.

Methods and Materials

To collect all the data, we used a cloud server provided by NEXO[DOSE]® (Bracco, Italy), a Radiation Dose Index Monitoring (RDIM) software (**Figure 1**) that reports, for each exam, patients' demographic (age, gender) and scan protocol information (CTDIvol, DLP), with all the sensitive data previously anonymized.

The arrangement of exams in homogeneous groups, by scan region and acquisition task, is complicated by the different scanners and RIS/PACS which compile DICOM tags in different ways.

A Study Common Name (SCN) has been associated to each description (DICOM tag 0008,1030) or protocol name (DICOM tag 0018,1030). The SCN is a label from RadLex Playbook able to classify exams in a consistent way (scan region and use or not of intravenous contrast, etc).

Actually more than 400 CT procedures have been clustered in just 95 SCNs, with 10 SCNs including about 80% of the exams (**Figure 2**).

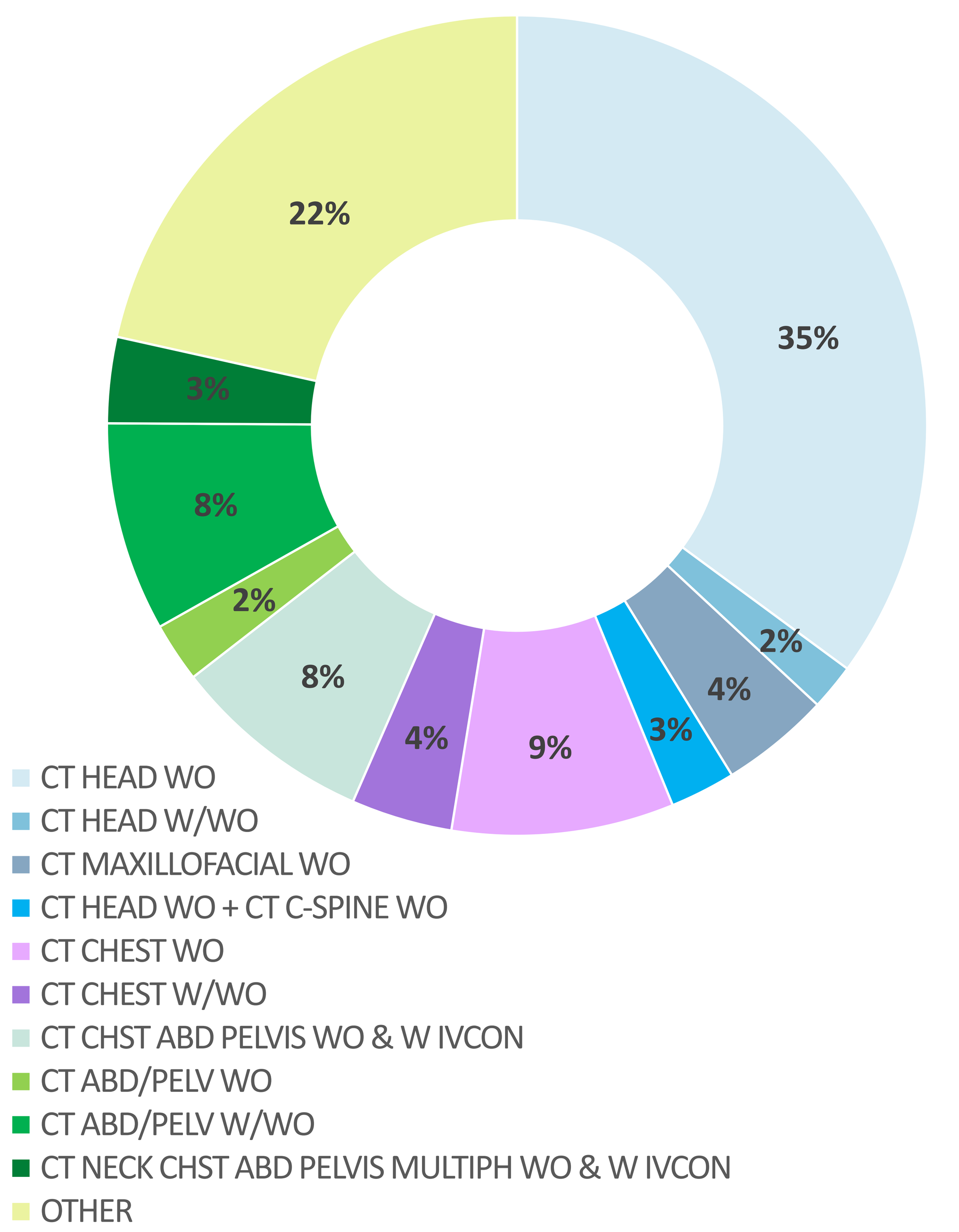

Figure 2. Procedures clustered through Study Common Names.

Results

Since the procedures within a RadLex label should have homogeneous exposure parameters, this clustering can be used to analyse population and dosimetric quantities for each SCN in a consistent way.

Data for the SCN "CT chest WO" in 2017 have been analysed as an example.

In terms of population, 54% of patients are males and the median age is 66.

The total DLP distribution has a median value of 264 mGy*cm, well below the DRL(2), and the shape of a gamma function (**Figure 3**).

The series analysis shows that the SCN includes exposures not belonging to this kind of exam, e.g. chest with intravenous contrast or chest and abdomen are not in line with "CT chest WO".

Even if the percentage of exams not in line with SCN is relevant (17%), the median values of dosimetric quantities and scan length vary for a few percent only (**Table 1**).

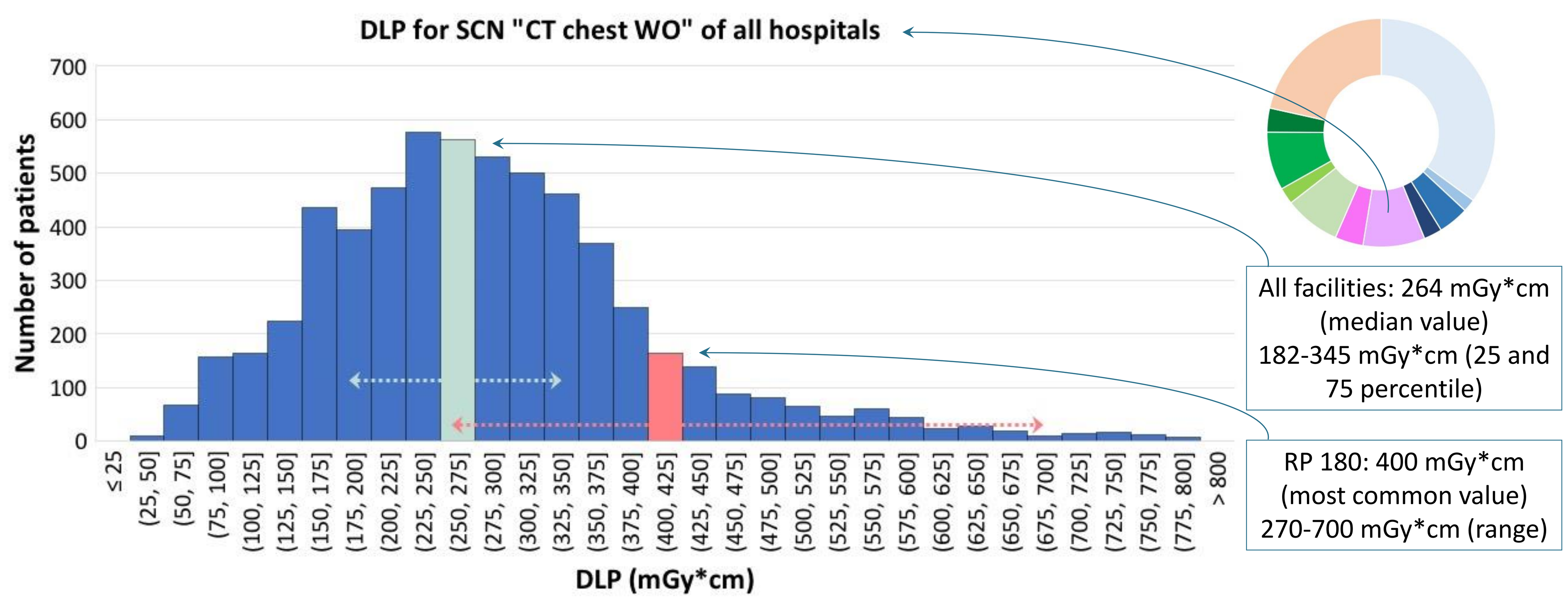

Figure 3. Distribution of DLP values for the Study Common Name "CT chest WO" considering data from all hospitals.

Effect of exams not in line with SCN "CT chest WO"

	In line with SCN	Not in line with SCN
Exams from all hospitals	83%	17%

	All data	Data in line with SCN	Δ %
DLP [mGy*cm]	264	281	6%
CTDIvol [mGy]	6.7	7.1	6%
Scan length [cm]	39	40	3%

Table 1. Analysis of heterogeneity within series. Median values of DLP, CTDIvol and scan length for the Study Common Name "CT chest WO" considering data from all hospitals.

Conclusions

The use of RadLex label is a good way to compare exams from different hospitals with statistical and dosimetric aims.

In this way it is easier:

- to evaluate the exposure risk for procedures with the same RadLex label,
- to compare exams with the same RadLex label from different hospitals or with different devices.

Because of the great quantity of data, some inaccuracies were expected, however they do not affect heavily the dosimetric analysis obtained through the database.

Contact

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