International Journal of Population Data Science

Journal Website: www.ijpds.org

Evaluating the impact of dose reduction software on Computed Tomography radiation dosimetry using radiology information systems meta data: An example of the use of novel linkable data.

Moorin, Rachael^{1*}, Forsyth, Rene¹, and Fox, Richard²

¹Curtin University

²The University of Western Australia

Objectives

Recently concerns have been expressed regarding the cancer risk to patients undergoing CT scanning prompting the development of dose-reducing software. Experimental studies using phantoms, have shown the potential to significantly reduce radiation dose without compromising diagnostic accuracy. However since dose reduction requires acceptance of more noise in the image the findings from these studies may not be representative of the impact in routine clinical practice. The aim of this study was to evaluate the effect of introduction of iterative reconstruction software on radiation dosimetry in routine clinical practice over a range of CT examinations.

Approach

Random samples of CT scans pertaining to 10 commonly performed CT examination types undertaken at two hospitals in Western Australia (WA), before and after the introduction of iterative reconstruction software were extracted from the WA centralised Picture Archiving Communication System. Technical information about the scanning parameters used and radiation dose metrics were extracted from the Digital Imaging and Communications in Medicine (DICOM) information contained in the meta-data for each examination. Changes in the mean dose length product and effective dose were evaluated along with estimations of associated changes to annual cancer incidence using established radiation dosimetry techniques.

Results

We observed statistically significant reductions in the effective radiation dose for head CT (22-27%) consistent with those reported in the literature. In contrast the reductions observed for

non-contrast chest (37-47%); chest pulmonary embolism study (28%), chest/abdominal/pelvic study (16%) and thoracic spine (39%) CT were lower than expected based on experimental studies. Statistically significant reductions in radiation dose were not identified in angiographic CT. Dose reductions translated to substantial lowering of the lifetime attributable risk, especially for younger females, and estimated numbers of incident cancers.

Conclusions

Our study has demonstrated a reduction in radiation dose for some scanning protocols, but not to the extent experimental studies had previously shown or in all protocols expected, raising questions about the extent to which iterative reconstruction achieves dose reduction in real world clinical practice. In addition, our study showcases a practical application of the use of technical meta-data from CT scanning examinations to monitor radiation dose and evaluate the impact of dose reduction initiatives. These readily available data provide the ability to routinely monitor CT radiation dose (within and between providers) and, when linked to other administrative data, the opportunity to conduct large scale whole-of-population epidemiological studies evaluating the effect policies and practice on population radiation dose and cancer risk.

*Corresponding Author:

Email Address: r.moorin@curtin.edu.au (R. Moorin)