

PATIENT DOSE AUDIT EMPLOYING ELECTRONIC EXAM RECORDS

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1) Introduction

In 1956 a study group of ICRP and ICRU established by UNSCEAR enquired into methods for evaluating the exposure of man to ionising radiation arising from medical exposures.⁽¹⁾ The group rejected the universal recording of doses from diagnostic radiology for the entire population due to :

- Excessive cost
- Difficulty in obtaining dose values
- Assessment and management of resulting data

The time is now ripe to re-evaluate the feasibility of undertaking patient dose assessments for the whole patient population as a routine aspect of an x-ray examination protocol given the technical advances that have taken place in the intervening period.

This paper will describe methods for undertaking patient dose assessments for every x-ray examination by employing information available from electronic patient examination records

2) Method

The system that has been investigated employs electronic examination records either from a hospital's Radiology Information System (RIS) or from PACS by means of DICOM header examination details included within the digital image data set. The RIS data is relatively easy to collect but has been shown to contain errors due to the nature of data recording.

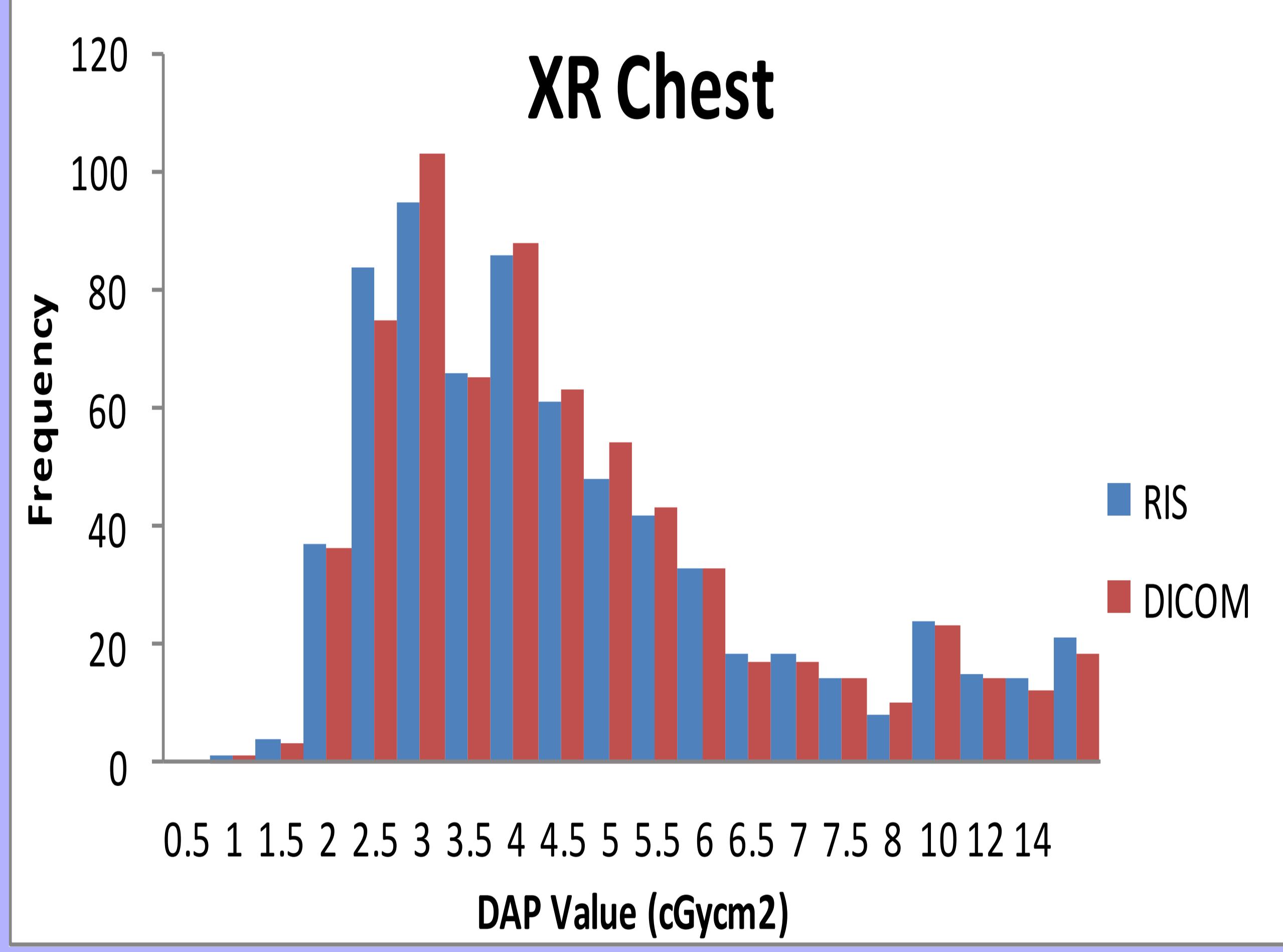
By comparing the statistical profile of the RIS data with the profile of equivalent records from the PACS by means of DICOM header examination information, which is known to be correct, the RIS data set can be calibrated using various statistical filtration methods and verified as accurate for the purpose of patient dose audit.

The exposure parameter data can be then combined with x-ray tube and generator calibration data already collected as part of quality assurance measurements in order to calculate the entrance surface dose (ESD). Alternatively, the dose-area product (DAP) or for CT the examination DLP can be used directly.

3) Results

	XR Abdomen		XR Chest		XR Lumbar Spine	
	RIS	DICOM	RIS	DICOM	RIS	DICOM
N	495	495	689	689	534	534
Mean	134.97	132.15	4.83	4.71	102.59	101.70
St Dev	122.89	122.88	3.46	3.07	76.67	73.40
Min	7.40	8.40	0.77	0.77	8.00	10.40
1st Quartile	55.12	53.63	2.80	2.81	46.80	47.14
Median	95.00	89.70	3.86	3.90	80.95	82.44
3rd Quartile	165.42	162.15	5.40	5.39	141.15	137.52
Max	814.00	814.60	27.96	23.78	436.01	436.01
RIS/DICOM Correlation	0.98		0.86		0.93	
Mean difference in quartiles	3.42%		-0.40%		0.01%	
Difference in Means (%)	2.09%		2.45%		0.86%	

Table 1 is a comparison of the data sets for both DICOM and RIS for three examinations in 4 rooms across a single Trust.



Graph 1 is a histogram of the data sets for both DICOM and RIS for Chest examinations in 4 rooms across a single Trust.

4) Discussion

The RIS & DICOM data sets showed good correlation in terms of record-for-record comparison, the difference in the mean value and the mean difference of the quartile values. Table 1 shows the comparisons for three common radiographic examinations all rooms across a Trust.

The same comparisons have been made at individual room level within the same Trust and repeated at five different trusts. This work has also been repeated for CT examinations.

Due to the Trust-specific nature of the systems and sources of errors, a periodic calibration of the RIS data should be done at each Trust.

Such periodic calibration also serves as an audit of RIS examination record accuracy & encourages staff to maintain accurate data entry. The aim of this work is to show that a DICOM calibration could replace the IPEM 88 recommended three-yearly audit with more regular RIS audits becoming the norm.

In conclusion, this method shows that RIS data can be used for audit purposes as long as it has been calibrated against a known correct data set. Data from the DICOM header of images can be used as the known data set.

References:

- Statutory Instruments. *The Ionising Radiation (Medical Exposure) Regulations 2000*. London : The Stationery Office Limited, 2000. SI 2000/1059. The Ionizing Radiation (Medical Exposure) Regulations 2000, SI 2000 No 1059. London: HMSO 2000.
- Statutory Instruments. *The Ionising Radiations Regulations 1999*. London : The Stationery Office Limited, 1999. SI 1999/3232.
- Wilde R, Baily S, Baker C, Charnock P, McCreavy D, Moores BM, Automating patient dose audit and clinical audit using RIS data. *IFMBE Proceedings*, 2009, Volume 25/3, 128-131, Munich
- Charnock P, C Baker, S Baily, J Fazakerley, R Jones, BM Moores, R Wilde, Radiology workload analysis: Role and relevance in radiation protection in diagnostic radiology. *IFMBE Proceedings*, 2009, Volume 25/3, 128-131, Munich
- Fazakerley J Charnock P, Higgins M, Jones R O'Conner J. The development of a 'gold standard' patient dose audit data set. IPEM Proceedings of the 14th Annual Scientific Meeting, Bath, UK, pp61. 2008
- Hart D, Hillier MC, Wall BF. *Doses to Patients from Radiographic and Fluoroscopic X-ray Imaging Procedures in the UK - 2005 Review*. Didcot : Health Protection Agency, 2007. ISBN 978-0-85951-600-6.
- Institute of Physics and Engineering in Medicine. *Report 88 - Guidance on the establishment and use of diagnostic reference levels for medical x-ray examinations*. York : IPEM, 2004. ISBN 1 903613 20 5.

