



‘Dose Creep in Action’: Contemporary Insight into the UK Radiology Environment

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Declaration of Conflict of Interest Faculty 2015 Joint Congress

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Declaration of Conflict of Interest

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Introduction

- Rationale
- Literature
- The Study
- Findings
- Conclusion





Rationale

- General radiography (combined with fluoroscopy) constitutes to approximately 90% of all radiological examinations undertaken (Health Protection Agency, 2011).
- ICRP principles justification, optimisation and dose limits (ICRP, 2012).
- UK legislation ensuring ionising radiation is kept 'as low as reasonably practicable' (ALARP) (IR(ME)R, 2000).
- Imaging technology in radiology regarded as one of the 'most expanding specialties' in recent years (NHS, 2013:1).
- Without appropriate research and education digital radiography has the potential to increase radiation doses (ICRP, 2005a).



Literature

- Digital radiography (DR) 'may result in fewer retakes and a low X-ray dose for your patients' (Philips DR Brochure, 2011:3).
- Dose reduction to chest and skeletal examinations up to 33-80% (Völk *et al*, 2000; Strotzer *et al*, 2002; Manning-Stanley *et al*, 2012; Mai *et al*, 2013).
- Transitional process from film screen (FS) to digital could increase patient doses by up to 40-103% as DR systems may auto-correct exposures up to 500% (McConnell, 2011).
- 'Exposure creep' or 'dose creep': Operators favouring excellent image quality thus a higher exposure than normal is selected (Seeram, *et al*, 2013).
- 'Image Gently - Refocusing professional attention to digital radiography (Image Gently, 2014:1).

Cont...

- Harry Braverman (1974:319)

‘The more machinery that has been developed as an aid to labour, the more labour becomes a servant of machinery’.



Gap in literature

Radiography Observed: An Ethnographic
Study Exploring Contemporary
Radiographic Practice.



The Study

- PhD study undertaken in the UK
- Four research sites (National Health Service)
- Explored the use of digital radiography in contemporary practices
- Ethnography: The selected methodology
 - Provided close engagement with radiographers.
 - Participant observation, semi-structured interviews and X-ray experimentation.
 - Examined the culture, uncovered attitudes and feelings of radiographers within the digital radiography environment.





Findings – Exposure factors

- *“A health care professional who is entitled in accordance with the employer’s procedures to take responsibility for an individual medical exposure”.*

(IR(ME)R, 2000:2)

Autonomy with exposure factors:

“I try to keep the mAs down as much as I can really... I feel that you can bring the kV up a bit, take a bit of the mAs off with DR.”

(Band 6 Radiographer)

“But with DR, it’s so sensitive that you would tend to alter the kV more than the mAs.”

(Band 5 Radiographer)

Findings – Exposure factors



Lack of autonomy with exposure factors:

“So I was told just to use the pre-set, and not actually fiddle with it.”

(Band 5 Radiographer)

“So far I haven’t actually adjusted any exposure factors, because compared to CR they’re pretty low on exposure. So I think it’s a good... I think they’re pretty accurate, because I haven’t had any problems with them.”

(Band 6 Radiographer)

Findings – ‘Cropping’ Collimation

- Strict collimation enhances radiographic contrast (Jeffery, 1997)
- Demonstrated to reduce dose to irradiated area and scatter to radiosensitive organs (Carlton and Adler, 2013; Hayre, 2014)

Radiographers felt that cropping ‘did not benefit the patient’.
(Band 7 Radiographer)

Important to practice ‘proper collimation’.
(Band 5 Radiographer)

Cropping is ‘down to poor practice’. (Band 6 Radiographer)

Yet.....

- ‘Collimation may be inefficient’ (Titley and Cosson, 2013:5).... Why??

Findings – ‘Cropping’ Collimation

“When you’re doing something on CR, you do think suddenly “Ooh, I better not open it out too wide because I can’t collimate on the CR and whatever I take is going to go through.” Whereas you don’t think that when you’re on DR - the thought’s not there.”

(Band 5 Radiographer)

“You tend to leave it a little bit wide and you think “Oh, I’ll just crop it afterwards.” Which is not great - you know it’s more radiation.”

(Band 6 Radiographer)

“You become a bit relaxed about your collimation - you just sort of think, “Oh, I’ll crop it”.

(Band 6 Radiographer)



Source to Image Distance

Observation:

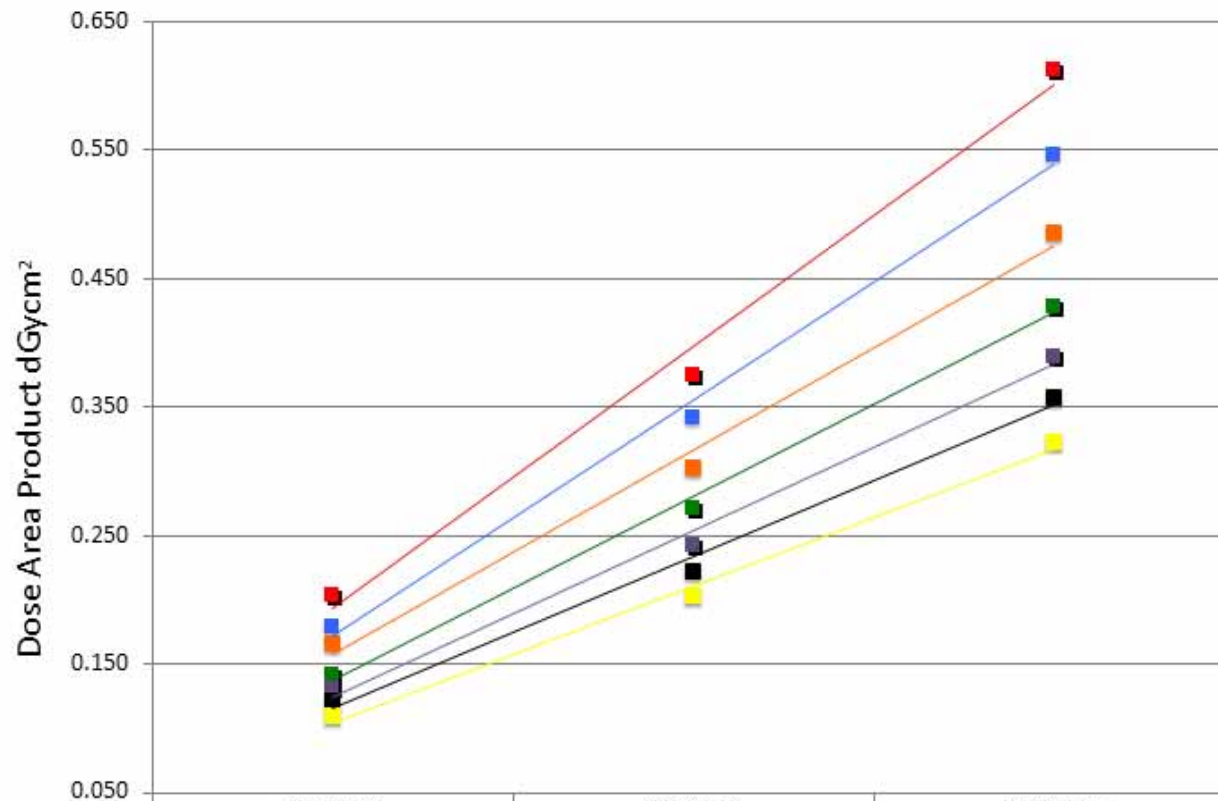
Variation in SID apparent throughout radiological examinations when X-ray tube was not required to be 'locked into position'. As a result the SID varied amongst X-ray operators with distances varying between 77cm to 120cm for extremity radiography.

This suggested that operators may not apply strict SID rules during certain radiographic examinations within the clinical environment.



SID and Collimation

DP Hand – SID and Collimation effect on DAP



	FS 19 x 17	FS 26 x 23	FS 33 x 29
SID (80 cm)	0.204	0.375	0.612
SID (85 cm)	0.179	0.342	0.546
SID (90 cm)	0.165	0.301	0.484
SID (95 cm)	0.142	0.272	0.429
SID (100 cm)	0.131	0.242	0.389
SID (105 cm)	0.121	0.222	0.358
SID (110 cm)	0.108	0.202	0.322



An increase in collimation significantly ($p < 0.001$) increased the DAP to the anthropomorphic phantom.

An increase in SID significantly reduces the DAP ($p < 0.001$)

Conclusions

- Radiographers may require additional mentoring with advancing technology in order to 'connect theory with practice'.
- 'Dose creep' could be multi-faceted in general radiography environments following technological advances.
- Suggests that critical reflection of radiographic techniques is required to ensure that optimum ionising radiation is delivered 'as low as reasonably practicable'.
- The central tenets of radiographic practice may be becoming increasingly problematic.



Future Research?



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