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**Title: The radiographers' role in information giving prior to consent for computed tomography scans: a cross-sectional survey**

**Abstract:**

**Purpose:** Computed tomography (CT) use has increased in recent years with concerns regarding radiation risk. Informed consent requires that patients are informed of risks and benefits; however, it is known that radiation risk communication occurs infrequently between referrers and patients. This research aimed to explore the role CT radiographers play in giving information to patients prior to CT; specifically, whether they can give appropriate and accurate information to facilitate informed decisions.

**Results:** An on-line cross-sectional survey of UK-based CT radiographers returned 78 completed questionnaires. Participants predominantly saw their role as giving procedural information to reassure the patient. Only 23.1% stated that they discussed the risks of radiation at least sometimes; iodinated contrast risks were discussed more frequently (44.9% always, 28.2% sometimes). Participants felt referrers should take a greater role in discussing CT risk/benefit with patients. Although 92% of radiographers felt confident in giving CT information, when asked to respond to a patient regarding the radiation dose that would be received during a CT abdomen/pelvis scan, 45% would not give a dose or equivalence and only 23% could give accurate dose estimates, with 28% grossly underestimating the dose.

**Conclusions:** There is variation in practice for information giving and consent procedure in CT. Radiation information communication is infrequent between radiographers in this study and their patients, unless the patient specifically asks about the risks. Relatively few radiographers who completed the survey could give an accurate estimation of radiation doses in CT.

**Keywords:** Computed tomography (CT), consent, information giving, risk communication

## Highlights

- There is a need for informed consent in computed tomography.
- The requirements of informed consent for any procedure include the discussion of risks, benefits and alternatives.
- Radiographers predominantly saw their role in information giving as one of procedural explanation and reassurance.
- Radiographers do try to tailor information giving to patients
- Radiographers rarely discuss radiation risks and dose, nor are they always accurately able to do so

## **Introduction**

Valid consent is required legally and ethically prior to any intervention to a patient, including diagnostic radiographic procedures.<sup>1</sup> For consent to be valid, the patient must be suitably informed, have capacity and they must give their consent voluntarily.<sup>2</sup> Guidelines on consent set out by Society and College of Radiographers<sup>3</sup> state that “patients are entitled to know that they will receive a dose of radiation and should be informed of the benefits of the procedure” (p. 6) and that the radiographer must provide a “limited amount of accurate and relevant information in the form that the patient is able to grasp” (p. 14). However, discussion of radiation risk is a complex topic and the amount and format of information required may vary between patients, depending on their own cognitive ability and beliefs. Subsequently a radiographer must use their professional judgement to tailor the information given to the individual patient and ensure that they have understood it.<sup>4-6</sup>

The use of computed tomography (CT) in medical imaging has increased in recent years leading to concerns with regard to the radiation risks<sup>7</sup>. In 2009, Smith-Bindman et al.<sup>8</sup> suggested that radiation doses were much higher than previously thought, with some scans such as multiphase abdomen and pelvis amounting to 31 mSv. They claimed that when one accounts for the age and gender of the patient, some CT scans may carry a risk as high as 1 in 330 for developing cancer. Brenner and Hall<sup>9</sup> estimated that in the USA, 1.5-2% of all cancers may be attributable to CT scans, although more recent reports suggest typical UK CT doses may be lower<sup>10</sup>. Particular concern is raised over those having recurrent studies, and radiation exposures during childhood.<sup>11-12</sup> Despite debate regarding the appropriateness of current risk models in radiation,<sup>13-14</sup> it is argued that low dose radiation such as that used in CT is considered a carcinogen and should therefore be disclosed to patients for ethical and legal reasons.<sup>15</sup>

The need for informed consent for CT is identified in the literature; however, it is known that radiation risk communication occurs infrequently between referrers and patients, and questions have been raised over the ability of referrers to adequately estimate the radiation risks for CT scans.<sup>16-19</sup> This study therefore aimed to determine the role that CT radiographers currently play in informed consent and whether they were able to provide accurate and appropriate information.

## **Methods:**

A cross-sectional survey of diagnostic radiographers working within CT in the United Kingdom was undertaken utilising an on-line questionnaire (available on request). A convenience sampling strategy was used as the study was advertised via the Society of Radiographers web pages and Synergy News. Recruitment was therefore self-selection and interested participants could download an information sheet and access the survey in their own time. Inclusion criteria were radiographers working in the UK, in CT. Staff working outside the UK were excluded due to different working practices and guidance from professional bodies. The survey was open for a period of three months (5th March to 5th June 2015), during which the study was promoted by the SoR through social media.

The survey incorporated open and closed questions which explored current consent practice; how radiographers saw their roles and responsibilities in information giving; and what information they currently gave their patients. Ethical approval was obtained through the University of Hertfordshire, Health & Human Sciences Ethics Committee (HSK/PG/UH/00319). Survey completion was voluntary and anonymous. Informed consent was implied through submission and participants could withdraw at any point up until they submitted the completed survey.

Survey results were evaluated using descriptive and inferential analysis. Open questions were reviewed to identify themes that emerged, and these were subsequently categorised and coded by the researcher. Dominant themes were determined by the frequency of related statements expressed

by the radiographers. When considering whether accurate radiation dose or dose equivalencies were given, responses were compared to a range of reasonable answers as derived from tables published by the Royal College of Radiologists<sup>10</sup> and Public Health England.<sup>20</sup> For CT abdomen/pelvis, a range of answers between 5.6-10mSv or dose equivalency of 370-670 chest x-rays; 2.5-4.5 years' background radiation; or 70-125 transatlantic flights was therefore deemed acceptable. Radiation risk assessments were compared to broad risk categories published in the Committee on Medical Aspects of Radiation in the Environment report (COMARE),<sup>21</sup> in which CT heads are considered "very low risk" and CT abdomen/pelvis scans "low risk".

## Results:

### Current departmental procedure

In total, 78 UK CT radiographers completed the survey – their characteristics are given in Table 1, along with a summary of their departmental procedure for informed consent. Departmental policy for taking consent in CT varied. Verbal or implied consent was more common practice although 10 respondents employed some form of written consent; although this was often dependent upon the perceived risk or invasiveness of the scan; e.g. written consent was reserved for CT colonoscopy (CTC) and/or cardiac scans due to an increased risk of perforation or higher radiation dose respectively. Regarding pre-scan information sent to patients, the most commonly reported risk mentioned related to iodinated contrast, although radiation risks were sometimes mentioned. Specific risks for CTC and information regarding preparation and aftercare for iodinated contrast and oral contrast were also signposted. Of note, 31 radiographers were not sure what information was sent to patients prior to their CT appointment.

**Table 1: Participant characteristics and departmental procedure (number of responses)**

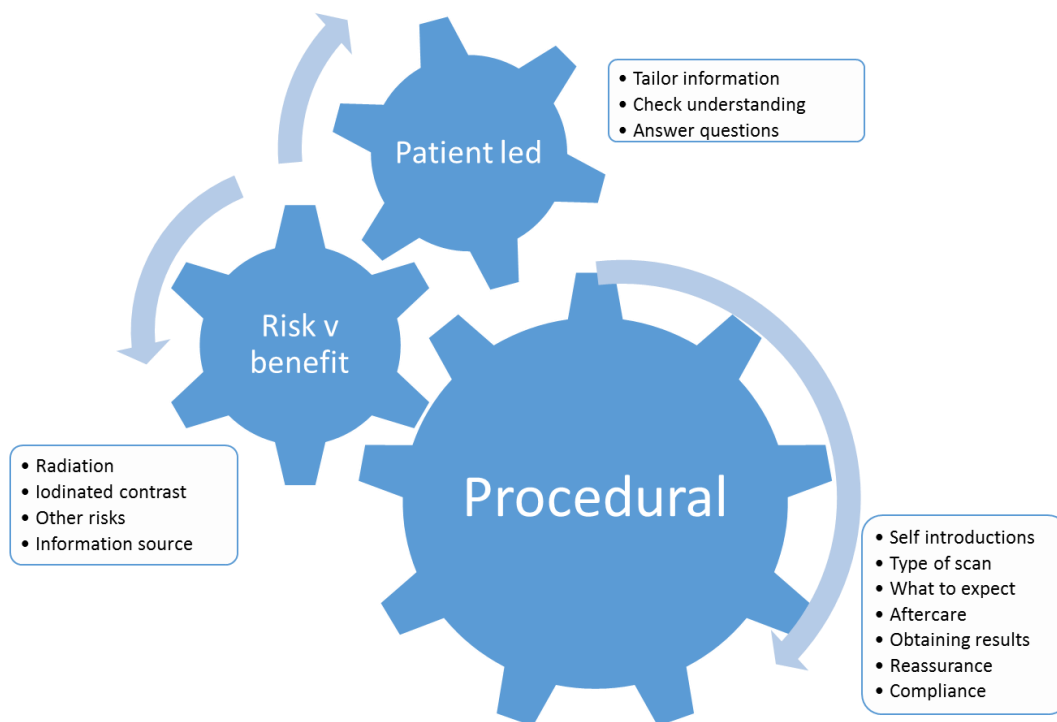
|   |    |
|---|----|
| <b>Gender</b>                                   |    |
| Male  | 20 |
| Female  | 58 |
| <b>Age</b>                                      |    |
| 20-29   | 26 |
| 30-39   | 28 |
| 40-49   | 14 |
| 50-59   | 10 |
| 60+   | 0  |
| <b>Number of years qualified</b>                |    |
| Under five years                                | 21 |
| Between five and ten years                      | 23 |
| Over ten years                                  | 34 |
| <b>Region of UK currently working in</b>        |    |
| Scotland  | 11 |
| Wales   | 0  |
| Northern Ireland                                | 0  |
| North East                                      | 2  |
| North West                                      | 4  |
| Yorkshire and the Humber                        | 5  |
| West Midlands                                   | 7  |
| East Midlands                                   | 3  |
| East of England                                 | 9  |
| London  | 22 |
| South East                                      | 7  |
| South West                                      | 6  |
| Rather not say                                  | 2  |
| <b>Policy on consent for CT</b>                 |    |
| Verbal consent is obtained                      | 28 |
| Implied consent is assumed by patient's actions | 19 |
| No departmental policy                          | 12 |
| Patient signs specific consent form             | 7  |
| Unsure of departmental policy                   | 5  |

\*Note: multiple responses were allowed for this question.

|  |    |
|--|----|
| Other  | 4  |
| Patient signs the request form                     | 3  |
| <b>Information sent by department prior to CT*</b> |    |
| Iodinated Contrast risks                           | 35 |
| Not aware  | 31 |
| Benefits of scan                                   | 20 |
| Radiation risks                                    | 17 |
| Other risks  | 13 |
| Radiation dose                                     | 5  |
| Alternatives to CT                                 | 5  |

### Perceived roles and responsibilities of radiographers in information giving in CT

Radiographers in this study varied in the way they perceived their roles and responsibility in information giving. The researcher identified three over-riding themes from the open responses of the radiographers (Figure 1). The dominant theme, expressed to some extent by 64 participants, was the perceived importance of procedural information, in ensuring the patient knew what type of scan was being done, what the examination would be like, and what would happen afterwards. Radiographers expressed the need to reassure and reduce anxiety in patients (n=14) while some felt this information would also aid compliance (n=4). This information also had important care aspects, for example recommending hydration after contrast injections (n=16).

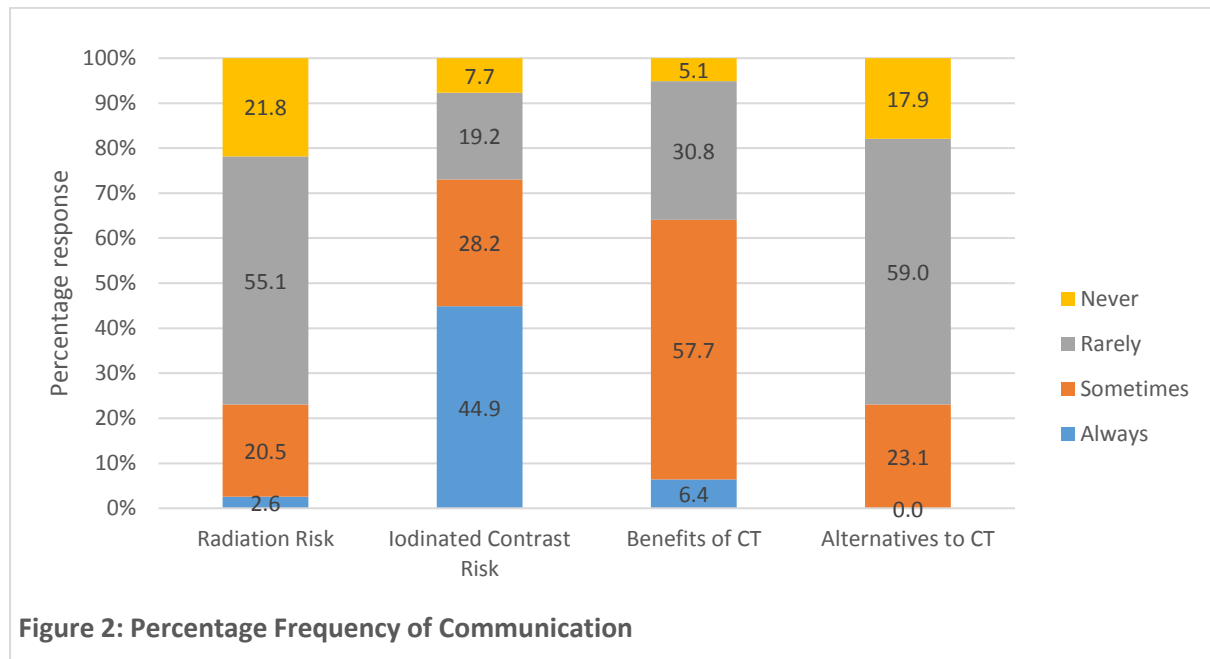


**Figure 1: Themes regarding the radiographers' perceived role in information giving**

The other two themes were less often reported by participants and related to the perceived risk-versus-benefit of CT scans; and the tailoring of information to the patient. Overall, radiographers expressed reluctance to discuss radiation risks unless specifically requested by the patient. Similarly, specific risks associated with the administration of contrast (extravasation, reactions, and contrast induced nephropathy), were only mentioned by a few participants, whereas the known side effects of contrast injections were commonly discussed. Other risks discussed with patients included drug-related risks, risks to a fetus in pregnancy, and risks of perforation in CTC. Benefits of the scan were rarely mentioned (n=7), with a few (n=6) arguing it was not a radiographers' role to discuss the

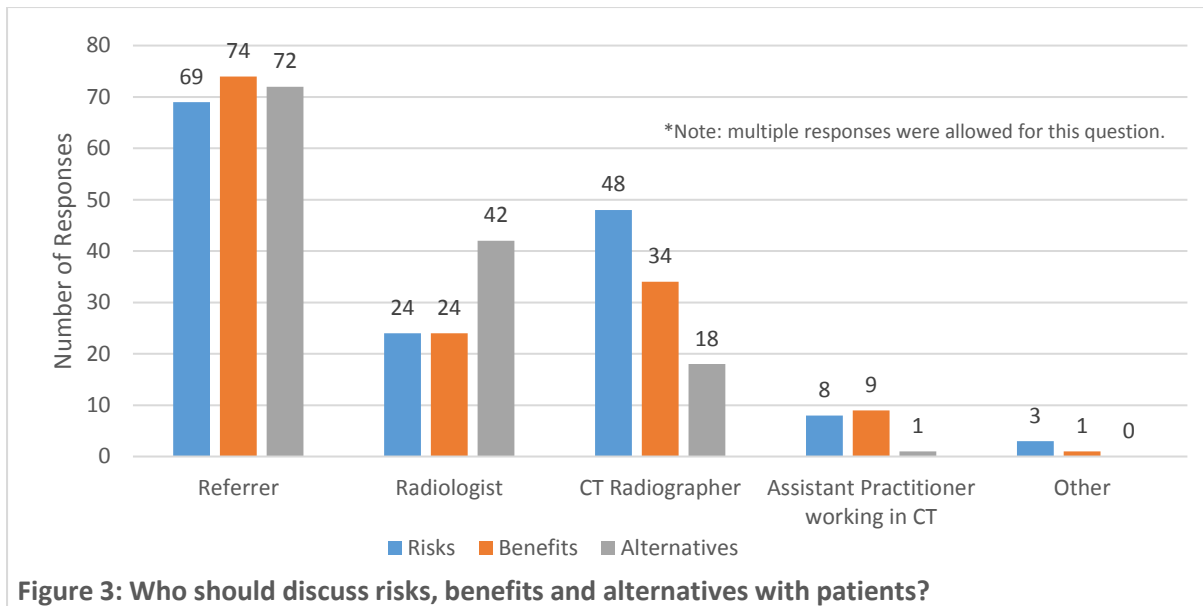
reasons why a patient had been referred for a scan; stressing the need for this to occur before patients attended their appointment. Very few (n=2) specifically mentioned discussing alternatives to CT scans. Radiographers appreciated the need to tailor the information to the patient, check understanding and to allow time for the patient to ask questions.

The qualitative statements were generally supported by data regarding the frequency of communication of CT risks, benefits and alternatives (Figure 2). These demonstrate that radiographers do not frequently communicate the risks of radiation to patients, but are more likely to discuss risks of iodinated contrast injections. Just over half the radiographers 'sometimes' informed patients about the benefits of a CT scan. However, alternatives to CT were rarely discussed with the patient, if at all.



Respondents were then asked who they felt should discuss CT risks, benefits and alternatives with the patient (Figure 3). Overall, referrers were seen as having the most knowledge of the patients' condition and treatment pathway thus warranted the greatest role in information dissemination. It was argued that it was not appropriate to discuss risks or alternatives whilst the patient was attending their CT appointment for both ethical reasons and time constraints. However, some voiced concerns that referrers should be better informed about the risks and alternatives to CT scans and suggested that radiologists had a role here in offering advice. It was also commented that patients rarely seemed to be informed of the risks of the scan, and sometimes were not even aware they needed a CT scan until sent an appointment letter.





Radiographers saw themselves as being most knowledgeable about radiation and contrast risks associated with CT scans, and 61.5% (48/78) of radiographers felt that they should have some role in discussing these risks with the patient. However, it was suggested that radiographers had a limited role in discussing benefits, as they did not know enough about the patients' clinical history; nor did they have enough understanding of the efficacy of all imaging modalities to be able to discuss alternatives. Overall, the radiologist was seen more as an advisor to both the referrer and the radiographer, particularly in discussing alternative imaging options. Few respondents saw assistant practitioners as having any role in discussing risks, benefits and alternatives with patients.

### Are radiographers able to give appropriate and accurate information confidently?

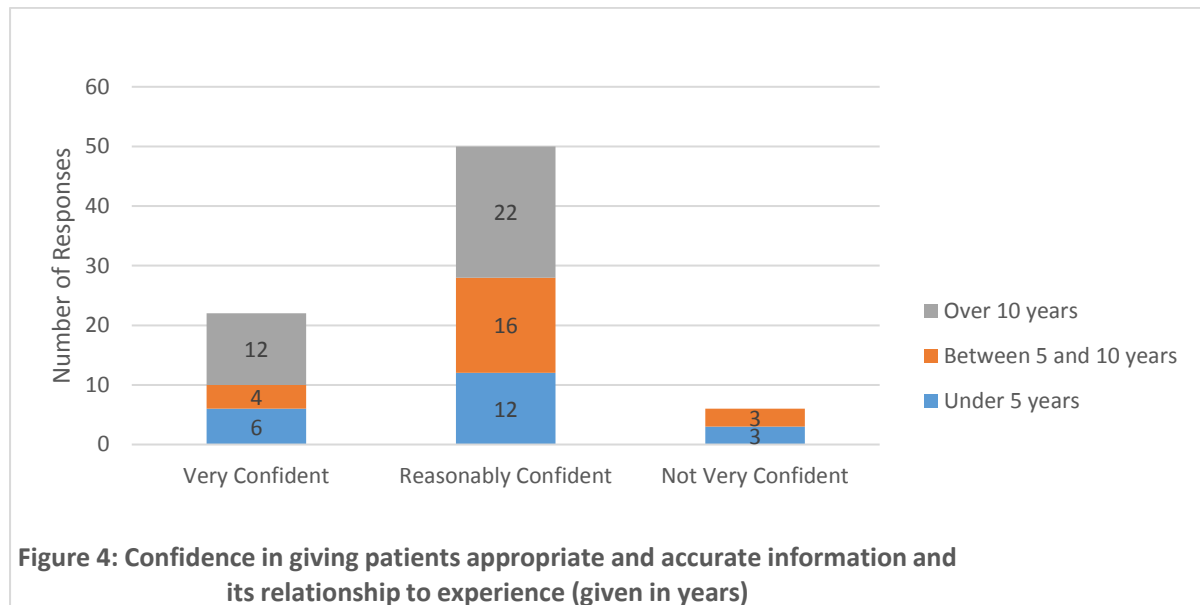
In relation to abdomen/pelvis CT scans, participants were asked how they would answer the following question: "I've heard these CT scans are dangerous – can you tell me what the risks are?" Many radiographers highlighted the need to discuss "risk-versus-benefit" rather than give specific risks of radiation such as the small increase in the risk of developing cancer, risks relating to foetal exposure, or radiation burns. Where radiation risks were mentioned, radiographers often chose to use simple terms, reminding patients that CTs "used X-rays", which were associated with a "low risk" to the patient.

Reassurance was also a common theme and radiographers explained that "modern scanners" kept the radiation dose as low as reasonably achievable. Some chose to reassure by stating a CT was "not dangerous" or used radiation at "safe levels", while others seemed reluctant to mention radiation unless the patient specifically asked about it. Again, the importance of patient led information was identified; choosing to check first what the concerns were so that their specific needs could be tailored for.

When asked specifically "How much radiation will I receive?" in relation to abdomen/pelvis CT scans, many radiographers highlighted the fact that radiation dose depends on the body area, patient habitus and other factors such as the use of multiphase imaging. Only 55% (43/78) of radiographers actually quoted a dose or equivalent. Most commonly, radiation dose was given as an equivalence in background radiation, followed by equivalency in transatlantic flights, chest x-rays, and finally, mSv. However, less than 50% of these radiographers (18/43) were able to give a reasonable estimate of radiation doses or dose equivalency using these methods; whilst 51% (22/43) underestimated the dose with some suggesting it was similar to the radiation dose of a transatlantic flight, or even a "few

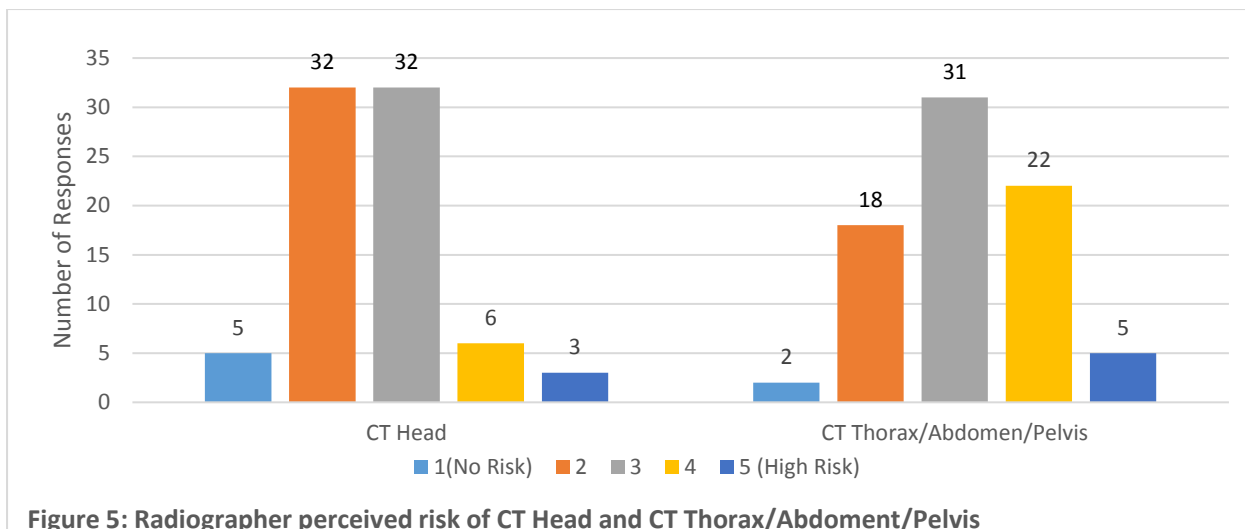
days in the sun". When using the chest x-ray equivalency, radiographers also underestimated the radiation dose (40-100 chest x-rays were suggested). One radiographer stated that they tried to avoid giving the dose in chest x-ray equivalency as the correct answer (around 500 chest x-rays), sometimes worried patients. This paternalistic sentiment of not wanting to worry patients was also echoed in the responses of others, and again the need to tailor information to the individual and provide reassurance by reaffirming the use of dose reduction techniques and risk-versus-benefits was expressed.

Over 92% of radiographers felt at least reasonably confident in giving information to patients in order to enable them to make an informed decision (Figure 4) and Spearman's test demonstrated no significant correlation between experience and confidence (Rho=-0.176; p= 0.121).



### Radiographers' perceptions of CT risks

Radiographers were then asked whether they considered a CT of the head and a CT of the thorax, abdomen and pelvis (CT TAP) dangerous, by rating the perceived risk on a Likert scale, where 1 would indicate "no risk" and 5 would indicate "high risk" (Figure 5). CT TAP was correctly perceived to be of greater risk than CT head. When compared to broad risk terms published in the 2014 COMARE report<sup>21</sup> for an average patient, 41.0% radiographers correctly considered CT heads as "very low" risk (Likert 2) and 39.8% correctly identified the risk for CT TAP as "low risk" (Likert 3). It should be noted however, that head CTs might be considered "low risk" and CT TAPs considered "moderate risk" for very young patients, as selected by a further 41.0% and 28.2% of radiographers respectively. In those over 90-years, both may be downgraded to minimal risk.



Qualitative answers from these questions revealed that radiographers were aware that the relative risks were dependent on age and gender, along with previous radiation exposure. Many stated that there is risk with any radiation exposure, and as radiation doses were higher in CT, the risks were greater. Radiosensitive areas were exposed during both scans and the importance of dose optimisation to reduce risk was emphasised, with particular concern for those undergoing serial CT scans and younger patients, in whom alternative imaging should be considered. Risks associated with iodinated contrast were again mentioned. Ultimately, respondents felt all risks were acceptable if the examination was justified. Conversely, some felt that too many CT were being performed as a “tick box” exercise in response to guidelines, and expressed the need for audit and review. Very few radiographers considered that CT scans carried no risk; however, one respondent suggested that risks of radiation at diagnostic doses were “vastly exaggerated”.

**Conclusion:**

Radiographers in this study predominantly saw their role in information giving as one of procedural explanation and reassurance. The requirements of informed consent for any procedure include the discussion of risks, benefits and alternatives. From the limited results from this study, and studies of referrer practice it can be suggested that these requirements are rarely being fulfilled when patients are sent for CT scans. It cannot be assumed by referrers that radiographers are giving this information, nor by radiographers, that patients are informed before they arrive. There is a dual role, as both are directly involved in the patient’s care. Both should tailor the information given to the patient and allow sufficient time for questions to be answered.

All information needs to be appropriate and accurate. This study has shown that some CT radiographers significantly underestimate the radiation dose and risks associated with CT scans; and hence are not able to adequately give this information. Further concerns must also be raised with regard to the education and training needs of such radiographers, as they are not meeting the standards for autonomous practitioners set out by the Society of Radiographers.<sup>22</sup> One suggestion is that standardised written information might be used to supplement either patient appointment letters and/or face-to-face contact. Written public information regarding radiation is freely available from the NRPB<sup>23</sup> and could be used to explain risks and provide reassurance. Similar documents could be used convey other risks, benefits and alternatives to CT scans. Care should be taken to ensure these documents provide a minimal amount of information, as too much information can be overwhelming and impact on a patient’s ability to make a decision<sup>3</sup>. Patients should be encouraged to ask any questions in advance of their appointment where feasible, or directed to other sources of information.

Radiographers should evaluate their ability to provide appropriate and accurate information, and use continual professional development to ensure they meet the requirements.

Written consent forms could potentially be used to ensure consistency in information giving and formalise the consent procedure, but there is need for this information to be piloted and audited amongst clinicians, radiographers and patients to ensure that it is fit for purpose. This would have implications on training, staffing and time constraints, so would need to be carefully considered before implementation.

### **Limitations**

This study utilised an on-line survey and convenience sampling method, both of which are associated with low response rates and self-selection bias, and subsequently the views expressed by the participants may have limited generalisability to other UK radiographers. The exact number of CT radiographers is not known, but according to the National Audit Office there were 426 National Health Service (NHS) CT-scanners in the UK in 2010.<sup>24</sup> If each scanner used a trained staff of 2-10 radiographers this would give an estimation of 852-4260 CT radiographers, but these estimates may be conservative and only take into account NHS scanners at that time. Based on the upper limit of this, the survey was completed by less than 2% of CT radiographers, and there were no participants from Wales or Northern Ireland; however other areas of England and Scotland were represented. This study did not fully evaluate other sources of information given to patients prior to the CT scan and assumptions cannot be made about these, nor did it look at the patients' perspective of what information they would like to be given prior to making informed decisions. Although these are important factors, they were not the remit of this research.

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