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Exploring end of life care provision during medical imaging in hospitals: Analysis of survey data from the UK radiography workforce

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ABSTRACT

Introduction: Patients receiving end-of-life care often undergo medical imaging examinations in hospitals to inform symptom management and care. Yet little is known about the experiences of the radiography workforce who deliver it. This study aims to describe and explore experiences of the UK radiography workforce delivering medical imaging as part of patients' end-of-life care.

Methods: A mixed method cross-sectional online survey disseminated via social media and national organisations from September 2023 to January 2024. Diagnostic radiographers, assistant practitioners and radiology assistants involved in the medical imaging of patients receiving end-of-life care in UK hospitals.

Results: 120 valid responses were received. Most respondents received no education/training (91.6%) on the role of medical imaging in end-of-life care, despite 87.7% expressing a need for education, particularly around adopting supportive/palliative-centric communication techniques. Although most respondents (89.2%) had heard of end-of-life care, some had difficulty understanding the role of medical imaging in end-of-life care. Insufficient information provided on imaging requests hindered the workforces' ability to determine and understand the appropriate use of medical imaging during end-of-life care. These uncertainties exacerbated negative emotions, with 80.8% of respondents indicating that they felt emotional during or after imaging patients on end-of-life care.

Conclusion: Educational and policy needs were identified around facilitating more supportive/palliative-centric communication techniques and providing the radiography workforce with the knowledge to better understand, explain, deliver and where necessary, challenge the use of medical imaging in end-of-life care.

Implications for practice: This study has evidenced the important role the radiography workforce play in generalist end-of-life care. However, there is a need for training to support practitioners as well as appropriate policies to develop supportive and high-quality end-of-life care in medical imaging.

Introduction

A person's end-of-life care needs and associated complexity of these, will fluctuate throughout their end-of-life journey.[1] Therefore, although end of life care aims to avoid unnecessary treatment that will not benefit the individual, commonly medical interventions are required to alleviate symptoms, alter care management and track disease progression.[2,3] Medical imaging is one intervention commonly used and this involves taking images of the body, for example images of the brain, chest and abdomen, to measure disease progression and support care needs.[4,5] The radiography workforce comprises of diagnostic radiographers, assistant practitioners and imaging assistants who are responsible not only for the medical imaging examinations but also providing care and support for patients and their significant others during the procedure.[6]

A recent exploratory study in the United Kingdom (UK) provided some of the first insights into radiography staffs' experiences of providing medical imaging as part of patients end-of-life care.[7] Despite this work drawing attention to the important role radiography staff play in patients' end of life care, findings suggested that the radiography workforce lacked knowledge and training to be able to provide evidence-based end-of-life care. Akin to these findings, wider research exploring end-of-life care provision in other non-specialist healthcare staff (healthcare staff not directly

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specialising in end-of-life care) has similarly reported that a lack of education and poor communication exacerbated poor practice in hospitals.[8] This is concerning given that that non-specialist healthcare providers working in hospitals are commonly responsible for the care of those nearing the end-of-life.[9]

Although the body of research exploring end-of-life care delivered by non-specialist healthcare staff in hospitals is increasing, current literature has not elicited the experiences of the radiography workforce. There is therefore a need to develop on the aforementioned exploratory research to provide a more comprehensive and deeper understanding end-of-life care provided during medical imaging examinations in hospitals. Addressing this gap is important given the high use of medical imaging during patients last 12 months of life,[10–12] For instance in the UK, it was identified that almost 30% of inpatients receiving end of life care died within 12 months of being hospitalised and were frequent users of inpatients services, such as medical imaging.[13] Similar trends have been identified in Europe, where it has been reported that out of 541 hospice patients, 463 (85.6 %) undergone at least one medical imaging procedure.[10]

Consequently, there is a critical need to build upon the previous exploratory research to develop a better understanding end-of-life care provision in medical imaging across the UK. The aim of this study was to describe and explore the experiences of the UK radiography workforce delivering medical imaging as part of patients' end-of-life care.

Methods

Aim: To describe and explore experiences of the UK radiography workforce delivering medical imaging as part of patients' end-of-life care.

Design

This was a mixed method cross-sectional online survey exploring the experiences of the radiography workforce responsible for delivering medical imaging to patients as part of end-of-life care. A concurrent nested (embedded) design[14] was used with both qualitative and quantitative data being collected at the same time to address our research aim. The survey contained both closed and free text questions and reported in accordance with the CHERRIES guidelines for reporting e-surveys.[15]

Sample

This study included a mix of both purposeful and snowballing sample strategy. Purposeful sampling was utilised as potential participants needed to meet the eligibility criteria of:

- **Population:** Participants included assistant/associate practitioners, radiology/imaging assistants and Health and Care Professions Council[16] registered Diagnostic Radiographers.
- **Intervention:** All participants had experience of being involved in the medical imaging of patients receiving end of life care.
- **Setting:** all worked in a department within a UK hospital which delivered imaging to patients at the end-of-life. Other locations where medical imaging may take place such as hospices or care homes were excluded. See Table 1 for a breakdown of participant roles.

In addition, a snowballing technique was also used where potential participants were invited to share the survey with their colleagues and key contacts. Furthermore, the study had an open method of recruitment, in that anyone with access to the survey link was able to participate. Given the novelty of the research topic, our previous work,[7] and the numerous free text qualitative questions, a response of between 100 and 150 participants was deemed appropriate. The numbers for the survey were not restricted.

Recruitment

The survey link and information about the study were widely shared via the Society and College of Radiographers website, personal networks, and social media. No incentives to complete the survey were offered. All potential participants were required to answers mandatory screening questions to ensure they met the eligibility criteria and a consent form. Our mandatory screening questions included: 'I work or have worked in a hospital medical imaging department based in the UK' and 'I confirm that I have read the participant information sheet for the above study'.

Data collection

The online survey was developed using JISC[18] and is included in supplementary material 1. The survey used both closed and free-text questions to gather data on the radiography workforces' experiences of providing medical imaging as part of patients' end of life care, education and policy, as well as relevant demographic data. The survey questions were developed from our previous exploratory study.[7] Pilot testing can help improve question clarity and ensure questions are asking what the researchers intended, as well as identify any potential error to establish both validity and reliability of the survey.[19,20] Pilot testing was carried out by five radiographers who provided feedback which led to changes to question wording, structure and the overall survey navigation and layout to establish the validity and reliability of the survey. For example, the demographic section was moved from the beginning to the end of the survey. Participants could only complete the

Table 1
Participant role descriptions.

Participant	Roles and responsibilities
Diagnostic Radiographer/ technologist	In the United Kingdom Diagnostic Radiographers are registered healthcare professionals responsible for operating imaging equipment, taking medical images and caring for the patients and their significant others during imaging examinations. Diagnostic radiographers specialise into diverse roles and modalities such as general X-Ray, Computed Tomography (CT) and Magnetic Resonance Imagining (MRI). They can also progress into enhanced, advanced and consultant level practice as well as education, managerial and training roles.[17] Diagnostic Radiographers working in the UK must be registered with the statutory regulator; the Health and Care Professions Council.[16]
Assistant/associate Practitioner	Assistant practitioners work in support roles and can operate the medical imaging equipment, care for patients and produce medical images under the supervision and direction of Diagnostic Radiographers. The level and direction of supervision is often determined by the assistant practitioner's level of training and experience. They are not registered with the Health and Care Professions Council.
Imaging/radiology assistant	Imaging assistants work under the direction and supervision of Diagnostic Radiographers to support medical imaging examinations. Although there is a degree of variability, the roles and responsibilities of imaging assistants commonly involve retrieving patients from waiting rooms, greeting patients and their significant others and talking them through elements of the medical imaging examination. Imaging assistants are not registered with the Health and Care Professions Council.

Table 2
Response numbers for the free-text questions.

Question number	Number of responses
8.a	104
9.a	89
11.a	85
12.a.i.	82
12.b.i.	13
13.a	44
14.a	24
15.a	81
16.b	43
16.c	33
17.	32

survey once, and it was only available in English language. The survey was open from September 2023 to January 2024.

Data analysis

Qualitative data from the free-text entries was downloaded into Microsoft Excel and analysed using a six-stage guide in reflexive thematic analysis.[21] Two researchers (A.S and V.H) read and re-read the free-text comments to familiarise themselves with the data. Codes were independently identified and recorded. Coding was inductive as new codes were identified, and deductive as codes were aligned to the central research aim and loosely around categories developed from our exploratory study[7] (a smaller qualitative study using thematic analysis to explore end of life care in medical imaging). The final codes and sub-themes and themes were then agreed on and developed through consecutive discussions between A.S and V.H and any discrepancies were settled by the third researcher K.S. This process was used to sense-check ideas and explore multiple interpretations of the data in a reflexive manner to develop richer interpretations rather than reach a consensus. The response numbers for each of the 11 free-text questions is detailed in Table 2.

Quantitative data were downloaded from JISC[18] into Microsoft Excel and cleaned to remove any duplicates or incomplete entries. Entries were deemed to be sufficiently complete when all four sections of the survey had been attempted, even if all available questions had not been answered. Descriptive statistics were prepared using Microsoft Excel to analyse respondents' demographic data, preferences, and awareness of education and policy initiatives related to end of life care in medical imaging. The quantitative analysis was integrated within relevant qualitative themes.

Ethics

Ethical approval was granted (Ref: 11989) on 11/09/2023 by the ethics committee at the University of Salford. Informed consent was provided by all the participants in the study. Participants were directed to the Society and College of Radiographers support resources if they felt upset during or after completing the survey.

Findings

A total of 120 valid responses were included in our analysis (completion rate 19.6%). The total study sample comprised 101 diagnostic radiographers, 13 imaging assistants and 6 assistant/associate practitioners. Table 3 summarises the characteristics and demographics of the respondents.

From the free text questions, three themes were identified: Role of medical imaging in end of life care, Delivery of medical imaging as part of end of life care and Education, Training and Policies.

Table 3
Respondent characteristics.

Characteristics	*N* (%)
Age	
18–30	33 (27.5)
31–40	50 (41.7)
41–50	24 (20)
51–60	9 (7.5)
61–70	3 (2.5)
Prefer not to say	1 (0.8)
Gender	
Female	75 (62.5)
Male	42 (35)
Prefer not to say	3 (2.5)
Ethnicity	
White (English/Welsh/Scottish/Northern Irish/British)	97 (81.5)
Mixed/Multiple Ethnic groups (White and Black Caribbean/ White and Black African/White and Asian)	8 (6.7)
Asian/Asian British (Indian/Pakistani/Bangladeshi/Chinese)	6 (5)
Black/African/Caribbean/Black British (African/Caribbean)	4 (3.4)
Prefer not to say	4 (3.4)
UK region	
North West England	51 (42.5)
North East England	12 (10)
West Midlands	11 (9.2)
East of England	9 (7.5)
London	9 (7.5)
Scotland	7 (5.8)
South West	6 (5)
South East	5 (4.2)
Wales	5 (4.2)
East Midlands	2 (1.7)
Yorkshire and The Humber	2 (1.7)
Prefer not to say	1 (0.8)
Years experience in medical imaging	
<1 year	1 (0.8)
1–10	54 (45)
11–20	41 (34.2)
21–30	20 (16.7)
31–40	3 (2.5)
40+	1 (0.8)
Job title/role	
Diagnostic Radiographer/technician	88 (73.3)
Imaging assistant	12 (10)
Assistant practitioner	5 (4.2)
Consultant radiographer	3 (2.5)
Associate practitioner	1 (0.8)
Other	11 (9.2)
Modality	
General X-ray	48 (40)
Computed tomography (CT)	28 (23.3)
Magnetic resonance imaging (MRI)	9 (7.5)
Nuclear medicine	6 (5)
Mammography	7 (5.8)
Interventional radiography	5 (4.2)
Ultrasound	4 (3.3)
Other	13 (10.8)

Role of medical imaging in end-of-life care

Responses indicate that 107 (of 120; 89.2%) respondents had heard of the term end of life care with only 3 (of 120; 2.5%) responding 'no' and 10 (of 120; 8.3%) 'unsure' (Table 4).

Table 4
Understanding of end of life care.

	$n = 120$	Percentage
Have you heard of the term end of life care?		
Yes	107	89.2
No	3	2.5
Unsure	10	8.3

Analysis of the free text comments (N = 104) highlighted that most respondents understood that end of life care was supportive rather than curative, associating it with comfort and family inclusion.

"[End of life care] is the care of a patient who has a terminal condition, and is aimed towards making the patient comfortable rather than actively trying to treat or cure the condition." **[Female radiographer working in general X-ray]**

"Patient is helped to live as full a life as possible in their last months …. Should be on a support plan considering the person's wishes, family, social services." **[Female Educator working in general X-ray]**

Yet, some respondents did not associate these key tenants of end-of-life care with medical imaging – which they associated with a curative and often uncomfortable intervention. Thus, some respondents had difficulty understanding the potential benefit and role of medical imaging for someone who is terminally ill.

"The moving and handling during a chest X-ray or a CT scan is uncomfortable for even a well patient never mind someone who might be incredibly elderly, frail or terminally ill. It's just cruel" **[Female radiographer working in general X-ray]**

"I often feel that imaging is not the best option for those receiving end of life care." **[Female radiographer working in CT]**

Consequently, although respondents were confident with the practical and technical aspects of providing medical imaging as part of patients' end-of-life care, they were much less confident authorising and justifying the use of medical imaging and struggled to understand the potential benefits for patient care.

"I'm confident in my imaging but the issue is more about justification. Do we need to subject the patient to something uncomfortable when it won't impact their care." **[Male radiographer working in general X-ray]**

Our analysis suggests that the lack of confidence prevented respondents from challenging or questioning the use of medical imaging even in cases where they felt it was of no benefit to patients.

Often - if it is clearly not the right thing to do and any benefit to the patient I feel cruel. Our mantra is to help people, in these scenarios you do not feel you are helping them. **[Female radiographer working in general X-ray]**

Further analysis indicates that respondents wanted to develop a better understanding of the role of medical imaging in patients' end-of-life care to have the confidence to challenge imaging requests when they feel uncertain about the appropriateness of medical imaging. Respondents commented on the importance of being able to discuss the benefits and negatives of medical imaging in the context of end-of-life care with referrers, accounting for patients wishes.

"Radiographers should have an understanding of what end-of-life care is and when imaging is or isn't appropriate. Radiographers should feel empowered to discuss the justification and benefits of the imaging with the referring clinician prior to disturbing a patient and their family." **[Female practice educator working in general X-ray]**

"To understand better if diagnostic imaging really is necessary for these patients at end of life care." **[Female radiographer working in MRI]**

In sum, although respondents understood end-of-life care as being about comfort and supportive care, they struggled to understand the role of medical imaging in it. A lack of understanding around the role of medical imaging in end-of-life care appeared to reduce respondents' confidence to challenge or question the use of medical imaging in cases where they were unsure or felt it was inappropriate.

Delivery of medical imaging as part of end-of-life care

Analysis of the free-text comments (N = 89) identified that the delivery of medical imaging as part of end-of-life care is often dependant on the quality of information provided, and availability of information. Specifically, not being provided with sufficient clinical information or information pertaining to patients wishes by referrers hindered radiography staffs' ability to explain and communicate the relevance of the imaging examination to relatives and patients.

"This information is rarely cascaded to the imaging department. I have been confronted by distressed relatives asking why an exam is appropriate during this stage!" **[Female radiographer working in general X-ray]**

"Clarity on why certain things are important would be beneficial, and would make it easier to explain to a patient why we are doing the test." **[Female radiographer working in CT]**

"The doctors could be clearer why some of the scans are requested. This would help me understand why the patient is going through it." **[Male radiographer working in CT]**

Furthermore, 73 respondents (of 120; 60.8%) highlighted that they were only 'sometimes' able to recognise that a patient was receiving end-of-life care during medical imaging. Moreover, 41 participants (of 120; 34.2%) indicated they were 'not often' able to recognise patients on end-of-life care who come for medical imaging (Table 5).

Free text responses (N = 89) suggest that radiography staff were provided with little to no formal information about patients end-of-life care status and struggled to retrieve information from accompanying healthcare staff. It was however acknowledged that more detailed clinical information pertaining to the patients' care can often be found in patients' medical notes.

"Rarely mentioned in the clinical requests for radiology examinations, and we usually have no need to review patient notes that may mention this. Furthermore, normally any accompanying escort is just a random healthcare assistant off the ward that does not really

Table 5
Recognition and awareness.

Are you able to recognise if a patient is receiving end of life care (e.g. their physical appearance) or recognise via other means (e.g. patient notes)?		
	n = 120	Percentage
Always	1	0.8
Sometimes	73	60.8
Not often	41	34.2
Never	2	1.7
Not sure	3	2.5

know anything about the patient." **[Female radiographer working in general X-ray, CT, MRI and international radiography]**

Although it was recognised that the workforce seldom review patient notes, respondents did acknowledge that they could spend more time reviewing patients' medical notes prior to examinations, especially if they feel key information is missing from the imaging request.

"This has got me thinking, I should spend more time and read the patient notes. Not many of us do this." **[Female radiographer working in CT]**

"If the patient says something or the nurse … but a lot of the time I think we as a profession do not realise. We could certainly do more." **[Female radiographer working in general X-ray]**

The free text comments (N = 32) commonly highlighted the need to improve communication between multidisciplinary teams and radiology services. It was expressed if radiography staff were provided with more information about patient needs, they would be able to better adapt care during medical imaging, such as imaging at quieter times.

"… it would make a big difference if we could increase the communication with the imaging department … As previously stated we could make sure to book porters for them in a timely manner and to make sure the x-ray room is properly staffed and not too busy when the patient arrives." **[Radiographer working in general X-ray]**

In cases where respondents were aware that patients were dying, 97 (of 120; 80.8%) indicated that they felt emotional during or after imaging patients. Despite this, the majority of respondents were unaware of the support available to them or how to access it (Table 6).

Analysis of the free text comments (N = 81) identified mixed feelings and emotions amongst respondents when imaging patients on end-of-life care. Respondents felt deep empathy with patients, and accompanying family members, and in some cases were overwhelmed by these emotions.

"Being able to empathise with their concerns and fears for themselves and their family. I have felt overwhelmed by emotions when talking to a patient recently, but I think they appreciated having someone who could take a moment and listen to them, and we both had a cry together." **[Female radiographer working in general X-ray]**

Table 6
Emotions and feelings of the workforce.

	$n = 120$	Percentage
Do you ever feel emotional during or after an imaging examination of someone receiving end of life care?		
Yes	97	80.8
No	14	11.7
Unsure	9	7.5
Is there any emotional support available in your hospital?		
	$n = 117$	Percentage
Yes	51	43.6
No	10	8.5
Unsure	56	47.9
If yes, do know how to access support or feel comfortable seeking support		
	$n = 94$	Percentage
Yes	44	46.8
No	9	9.6
Unsure	41	43.6

The emotional toll felt by staff tended to be heightened in cases where the patient was young or where the examination required uncomfortable positioning techniques which may cause discomfort.

"Particularly with young people, it can be upsetting to be aware that the person I am imaging is dying. It can also be upsetting if the examination requires something which causes the patient discomfort, e.g. *leaning against a hard x-ray detector, or moving a patient from a bed to a scan table for CT."* **[Female radiographer working in general X-ray]**

"I have children and when a patient is of a similar age or I've felt a connection with a parent or primary caregiver it can be emotional as your empathy is more focused." **[Practice Educator working in general X-ray]**

Moreover, it was apparent that emotions do not cease following the examinations and in many cases, patients were remembered by staff. This was particularly apparent for those staff who regularly see the same patients coming back for cancer staging scans. Our analysis indicates that respondents built relationships with patients' overtime, and thus a greater emotional toll was felt when these patients died or deteriorated between imaging examinations. This also shows that despite the shorter interactions typically seen in radiography, relationships with patients were still developed.

"Can be upsetting afterwards for many reasons … If they were patients that came regularly for imaging for staging scans then it was upsetting when we found out they had died as we got to know these patients more than other patients." **[Male radiographer working in general X-ray]**

Furthermore, despite the short interactions, patients would still open up and talk about death and dying. However, due to a lack of time and commitment to other patients, respondents felt unable to give patients enough time. The lack of time needed to provide adequate care and communication tended to worsen respondents' negative emotions and emotional toll.

"Situations can be distressing especially because imaging for example CT can be quite a quick interaction … Patients often open up in those situations talking about their life or the prospect of dying but due to time constraints of fully booked lists you often feel like you can't give the patient the time they need." **[Male radiographer working in CT]**

The emotional toll seemed to be further compounded by uncertainties around the use of medical imaging during end-of-life care. Specifically, in many cases respondents felt guilty that medical imaging was being used and could not see the benefit in taking the patients time away from their families.

"Guilty, as will this procedure having a positive impact on the patient? Or is it just taking time away from spending with their family?" **[Female radiographer working in general X-ray]**

"I have felt sorry for the patient and also angry because it wasn't clear what benefit the imaging was to the patient." **[Male radiographer working in general X-ray]**

Despite the emotional toll, it was apparent that respondents tended to feel more comfortable accessing non-formal mechanisms

of support such as peer support from their colleagues. However, this may be due to an unawareness as 56 (of 117; 47.9%) respondents indicated that they were unsure what if any emotional support was available to them.

"The best way I find is to just talk to one of your team. This is the patient that you have been upset by but this will unlikely be their one. A cup of tea and 10 minutes away generally does the trick." **[Female radiographer working in CT]**

Education, training and policy

Most respondents (109/119; 91.6%) indicated that they had not received any education or training around the role of medical imaging in end-of-life care. Furthermore, most (100/114; 87.7%) felt there is a need for education and training to better support care for patients receiving medical imaging as part of end-of-life care (Table 7).

It was apparent from the free text responses (N = 82) respondents felt that introducing some form of education is needed to better enable evidenced-based care and to improve awareness.

"I would like to have some training to gain a better understanding of how we can best support those with end-of-life care in my profession." **[Female radiographer working across multiple areas within the radiology department]**

"There is no education and I feel education on this topic would help me improve my practice." **[Male radiographer working in interventional radiography]**

In terms of content, analysis identified that respondents felt that education needed to provide guidance on how to communicate with patients in terms of what to say, what not to say and how to involve significant others in imaging examinations, particularly parents in cases of paediatric end-of-life care. It was evident that respondents wanted to learn and adopt more supportive and palliative-centric, avoiding phrases such as 'help get you better', and know what to say and how to interact in end of life care scenarios.

"I think it would be good for all healthcare professionals to be aware, especially as some of our key imaging phrases in paediatric imaging can include 'to help see what's the matter, so we can help you get better' etc which is unhelpful. It can help to educate what to say to parents and loved ones, how best to interact with the patient and families." **[Female radiographer working in general X-ray, CT and MRI]**

"Education is needed. I am not aware of any at the moment. I would like to learn how to speak with this patient group." **[Male radiographer working in CT]**

Another key training need identified was related to understanding imaging requests made for patients on end-of-life care. As mentioned earlier, our analysis revealed that radiography staff did not always understand the role of medical imaging in end-of-life care, which negatively impact on the delivery of care. Most respondents felt they lacked knowledge and training to discuss and challenge imaging requests with referrers despite being sceptical about the appropriateness.

"It puts us in a horrible position. I do not feel … that I would have sufficient knowledge to question the referrer as to whether it [medical imaging] was really necessary." **[Female radiographer working in general X-ray]**

In addition to a lack of education, 103 (of 118; 87.3%) of respondents indicated that they were not aware of any policy guidance around the role of medical imaging in end-of-life care (Table 8). Nonetheless, respondents reported mixed levels of confidence with 56 (of 117; 47.9%) respondents indicating they felt confident delivering end-of-life care with their current level of knowledge. However, 38 (of 117; 32.5%) and 23 (of 117; 19.7%) respondents were not confident or unsure with their current level of knowledge (Table 8).

The graph (Fig. 1) below shows the confidence of delivering end-of-life care compared to years of experience, with the percentage of the total within each range.

The importance of experience, both professional and personal (e.g. experienced the death of a family member), were cited throughout the free text comments as reasons for feeling confident despite a lack of training.

"I have worked in oncology for almost 10 years and in my personal life I have dealt with death." **[Female reporting radiographer]**

Nonetheless, a lack of education and guidance were the most common factors cited by respondents as inhibiting their confidence. It was expressed that education and guidance programmes designed specifically for the radiography workforce would help to improve their knowledge and subsequently confidence delivering medical imaging for those receiving end-of-life care.

"Support in terms of training around care practices would really help I think to build confidence that I am doing the right thing as well." **[Male radiographer working in nuclear medicine]**

Table 7
Education and training.

	$n = 119$	Percentage
Have you received any education or training around the role of medical imaging in end-of-life care?		
Yes	8	6.7
No	109	91.6
Unsure	2	1.7
If no, do you feel there is a need for education and training to support you to care for patients receiving end of life care?		
	$n = 114$	Percentage
Yes	100	87.7
No	7	6.1
Unsure	7	6.1

Table 8
Awareness of policy guidance and confidence.

	$n = 118$	Percentage
Are you aware of any policy and guidance around the role of medical imaging in end of life care?		
Yes	6	5.1
No	103	87.3
Unsure	9	7.6
With your current knowledge and training, do you feel confident providing medical imaging for those receiving end of life care?		
	$n = 117$	Percentage
Yes	56	47.9
No	38	32.5
Unsure	23	19.7

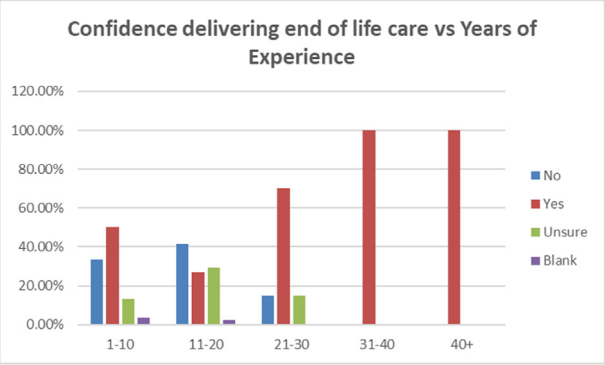

Figure 1. Confidence delivering medical imaging as part of patients end of life care Vs experience.

"Having training in communication, and care tactics would improve my confidence." **[Female imaging assistant working in CT]**

"Without training I can't say I am confident" **[Male associate practitioner working in general X-ray]**

Respondents expressed that for education to be useful and applied, it would need to be tailored to the needs of the radiography profession. Most notably, education would need to account for the often, short interactions radiography staff have with patients and families.

"Education would help but it would need to be specifically radiography based so what we can do in the short time periods we are with patients." **[Male radiographer working in general X-ray]**

"If the education is about radiography and what we can do in the short time we have with patients." **[Female assistant practitioner working in general X-ray]**

Discussion

Main findings

The findings revealed that the radiography workforce associated end-of-life care with supportive, comforting care which was inclusive of family. Yet, most participants did not associate these key tenants of end-of-life care with medical imaging – which they associated with a curative and often uncomfortable intervention. Consequently, our analysis suggests that some respondents had difficulty understanding the potential benefit and role of medical imaging in end-of-life care.

Most respondents had received no education or training around the role of medical imaging in end-of-life care. Similarly, awareness of policy guidance related to end-of-life care was lacking amongst respondents. Our analysis identified the need for education and guidance related to sensitive communication (fostering supportive rather than curative language) and the role of medical imaging in end-of-life care. These gaps in knowledge were found to negatively impact on the delivery of patient care, for example, uncertainties related to the use of medical imaging during end-of-life care led to some staff being unable to explain why imaging was necessary to patients and relatives. However, it is recognised that although some level of explanation can come from the radiographer, the main responsibility lies with the referrer to provide the necessary clinical information. Lastly, despite short interactions, the radiography workforce expressed feeling mixed emotions during and after imaging patients on end-of-life care, with some being overwhelmed by emotions during interventions with patients.

What this study adds

Several areas requiring education were identified in our study. Firstly, our findings suggest that radiography staff wanted training and education to help them to develop more supportive/palliative-centric imaging phrases during examinations with patients receiving end-of-life care. Research by Hynes et al.[22] on nurses working in respiratory units also identified that they struggled to move from curative disease-centred conversations to more supportive palliative discussions, so it appears this is a common issue amongst non-specialist healthcare staff. A systematic review of international literature also reported similar communication difficulties amongst non-specialist healthcare staff caring for patients on palliative and end of life care pathways.[8] These difficulties are however unsurprising given the well documented lack education and training for non-specialist healthcare staff.[22–25]

Aside from communication challenges, we also identified the need for education around the role of medical imaging in end-of-life care to enable radiographers to better understand the appropriateness, or not, of medical imaging as part of end-of-life care. This is important as wider research has shown that uncertainties related to the use of medical intervention can increase the likelihood of non-beneficial and inappropriate treatment at the end-of-life.[26] However, uncertainties were not just a result of a lack of education, our findings reveal that referrers often did not provide radiography staff with sufficient clinical information to make an informed determination on the use of medical imaging during patients' end-of-life care. Under IE(ME)R 2017 guidelines[27] qualified radiographers must be provided with enough clinical information to authorise or 'vet' the use of medical imaging.[28]

However, being able to determine the appropriateness of medical intervention at the end-of-life is often complex; determined not only by clinical information, but also the wishes of patients and their families.[29] Nonetheless, previous research has shown that clinicians rarely communicate clinical uncertainty to patients, often equating uncertainty with ignorance and failure.[30] Similarly, our findings suggest that radiography staff had difficulty discussing uncertainties with referrers as well as patients and relatives. Thus, it is not only important for referrers to provide radiographers with sufficient clinical information, but also information appertaining to patients' wishes and advanced plans to enable a more shared approach to decision making.

Increasing awareness of patients' end-of-life care needs within the radiography workforce was also a key finding. Specifically, some staff had difficulty recognising patients receiving medical imaging on end-of-life care. One method currently used in the UK to promote awareness is the Signal, Words, Action, Needs (SWAN) model, which uses identifier symbols such as placing SWAN signage on doors and curtains to promote awareness of the last days of life.[31] Moreover, the use of identifier symbols on imaging requests to promote awareness has already been suggested and is in use for other patient groups such as those living with dementia.[32] Despite this, recent research conducted in the UK has found that although visual identifier symbols for patients living with dementia can improve staff awareness of care needs, clear issues including uncertainties regarding patient and family views on being identified using symbols were identified.[33] Thus, before recommending the use of identifier symbols for those on end-of-life care in medical imaging; patient and carer views need to be explored in future research, and any use should align with patients' wishes and care plans.

Lastly, our findings imply that imaging patients on end-of-life care had a notable emotional toll on staff during and after the examinations. It is common for staff working in settings such as hospices and care homes to develop relationships with those they care for, often over long periods of time, where burnout and compassion fatigue are commonly reported.[34–36] Although the relationships healthcare staff develop with patients during short interactions (typical of non-specialist end-of-life care delivered in acute hospital settings) are far less reported, tangential evidence suggests strong emotions are felt by radiographers when imaging patients living with cancer regardless of the length of interaction.[37] Similarly, our findings evidence that relationships with patients and strong emotions were felt despite interactions being short. Yet staff were unaware of the support services offered, were unlikely to access them, or were unaware how to access them.

Limitations

The survey utilised both closed and free-text questions to develop understanding and achieve our research aim. However, predominantly free-text questions were used, which despite producing rich in-depth qualitative data from across the UK, may have limited the completion rate. Moreover, the closed answer questions produced predominantly yes/no answers; utilising a wider array of quantitative question designs such as Likert or ranking scales may have improved the insight generated. Geographical clustering of respondents is also acknowledged with greater uptake in the England, particularly the Northwest and East regions. It was however not possible to analyse regions individually given the small numbers in many regions. Furthermore, the self-selecting sample may not be representative of the entire UK radiography workforce.

Additionally, the low completion rate (19.6%) is recognised and is likely the result of the lack of awareness, education and training regarding the role of medical imaging in end-of-life care. Previous work in the field has also evidenced similar recruitment difficulties.[7] Also, although the survey gained valuable insight from the radiography workforce; patient and carers' views and experiences were not collected, and thus future research is recommended to address this gap. Moreover, this survey collected data from the UK, thus given the absence of insight internationally, further research exploring end-of-life care in medical imaging (from staff and patient perspectives) internationally is required in both low and middle income countries.

Lastly, given the first author's background in medical imaging and end of life care research, there was a potential for bias and subjectivity. This was mitigated through the multiprofessional research team. Moreover, reflexivity was considered throughout our study[38] from design through to analysis via the piloting of the survey questions, reflexive communication during analysis and regular discussion.

Conclusion

This study has provided a novel insight into how end-of-life care is provided and understood in a medical imaging context from the perspectives of those who deliver it. Findings revealed that the radiography workforce associated end-of-life care with supportive, comforting care inclusive of family. Yet, most participants did not associate these key tenants of end-of-life care with medical imaging – which they associated with a curative and often uncomfortable intervention. Consequently, some respondents had difficulty understanding the potential benefit and role of medical imaging in end-of-life care. We therefore recommend education and training which explains and describes the role of medical imaging in end-of-life care.

Findings imply that equipping radiographers with a better understanding of the role of medical imaging in patients' end of life care may also enable them to more confidently judge and authorise the appropriate use of medical imaging during end-of-life care. We also identified the needs for communication training to facilitate more supportive communication during medical imaging examinations.

High quality end-of-life care delivered during medical imaging was often dependent upon the quality of information provided, and availability of information. Thus, we highlight the need for radiography staff to be provided with more clinical information and information pertaining to patients' wishes via imaging requests to not only promote better awareness of patients end of life care needs, but to help reduce uncertainty and the subsequent likelihood of non-beneficial medical interventions.

Lastly, despite short interactions, respondents felt strong emotions when caring for patients nearing the end-of-life. However, the majority of respondents were unaware of the support available to them or how to access it.

Author contributions

AS conceptualized the study and collected the data. AS, VH and KS were involved in the data analysis. AS drafted the manuscript, with the support of VH and KS. All authors contributed and agreed to the final manuscript.

Conflict of interest statement

None.

Data management and sharing

The datasets are available from the corresponding author on reasonable request.

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