Title Page

Title: Exploring the Implementation of Evidence-Based Optimisation Strategies: A Qualitative Study of the Experience of Diagnostic Radiographers

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Abstract

Introduction: Radiographers are responsible for ensuring safe and effective use of ionising radiation. Through evidence-based practice (EBP), valuable optimisation strategies can be implemented to fulfil these responsibilities. This study aimed to explore radiographers' attitudes, perceptions, and experience of using evidence-based optimisation strategies.

Methods: A Grounded Theory approach using in-depth interviews. UK-based radiographers were recruited. Discussions focused on (1) the role of evidence-based optimisation strategies in daily practice, (2) assistance in implementing evidence-based optimisation strategies, and (3) the role of EBP and optimisation strategies in the future. Interviews were transcribed verbatim and analysed using open and axial coding.

Results: Participants (n=13) stated that EBP is not frequently used to implement optimisation strategies. Participants relied on the knowledge taught in education settings and their professional skills to optimise in daily practice, alongside departmental protocols. Barriers identified as affecting the implementation of optimisation strategies related to reluctance to change, a lack of support from superiors, and a lack of resources to engage with EBP. Some participants expected the use of optimisation strategies to become unnecessary due to technology advancements.

Conclusion: The results indicate that effective operationalisation of EBP is not part of daily practice among radiographers to implement valuable optimisation strategies in daily practice.

Implications for Practice: The potential barriers to implementing evidence-based optimisation strategies highlighted in this study suggest that improving access to resources and empowerment of individual radiographers is required to enable radiographers to implement optimisation strategies.

Introduction

There is an increasing demand to document the quality of care and to continuously enhance accessibility, organisation and the quality of health services provided to service users.[1, 2, 3] Engaging in activities such as evidence-based practice (EBP) is beneficial to meet the healthcare demands and standards.[4] EBP can be described as the delivery of healthcare based on the best available evidence in combination with clinical expertise, and consideration of the preferences of patients and their families.[5] EBP involves formulating clinically applicable questions; conducting efficient literature searches; critically appraising the obtained evidence; integrating the outcomes in combination with clinical experience and patient values; and evaluating the results of these outcomes in practice.[6, 7]

In the UK, healthcare professionals are increasingly confronted with challenges including workforce shortages, medical advancements and increasing healthcare needs. [8, 9] This has also impacted the radiography profession resulting in radiographer role developments and the increasing need to respond to the rapidly advancements in technology [10, 11, 12] Additionally, radiographers are responsible for the safe and effective use of ionising radiation, including to ensure that ionising radiation dose to patients is kept as low as is reasonably practicable.[13] To fulfil these responsibilities, EBP can be used to consult the best available research evidence for optimisation strategies to reduce radiation dose.[12, 14, 15]

Research evidence, however, suggests that valuable evidence-based optimisation strategies may not be implemented for optimal care delivery.[16, 17] Implementation research identifies a variety of factors that may relate to unsuccessful implementation of EBP including the characteristics of an organisational setting and their employees.[18, 19] Research has focussed on potential barriers to implementing EBP among healthcare professionals including radiographers. The main reported barriers relate to attitude and knowledge of professionals towards EBP and other factors such as guidance, support, time, and access to resources such as literature.[20, 21, 22, 23, 24, 25, 26, 27] Previous research has highlighted positive attitudes to evidence-based practice.[28]

The aim of this research is to gain novel insights into radiographers' attitudes, perceptions, and experience towards the use of evidence-based optimisation strategies, and potential barriers to implementing these strategies. Furthermore, it aims to provide an insight into radiographers' views on the future implementation of optimisation strategies.

Method

A qualitative research design was employed using in-depth, semi-structured interviews. A Grounded Theory approach was chosen to provide a clear data analysis paradigm and a basis for new theories or concepts.[29]

Radiographers based within the United Kingdom (UK) were recruited using social media. The participant information sheet (PIS) was attached to the announcement of the study or sent to the participants following their interest in participating. The PIS contained detailed information on the aim of the study, what participation involved and outlined the research process. Radiographers were only eligible to participate if they worked with ionising radiation on a weekly basis.

All interviews were conducted in April and May 2021. To ensure informed consent, the consent form was sent to the participants prior to their interview date to review and prior to commencing the interviews, questions were answered and information regarding the aim and procedure of the study was repeated verbally by the researcher. Additionally, the voluntary nature of participation, data anonymisation and the right to withdraw data were stressed. The interviews took place via online face-to-face meetings using FaceTime, Zoom and Signal. No incentives were offered to the participants.

The semi-structured interviews were conducted by the first author (FR) and followed using an interview guide based on literature related to implementation of EBP in radiography.[17, 21, 22, 23, 26, 30, 31, 32] The topics covered were (1) the role of evidence-based optimisation strategies in daily practice, (2) assistance in implementing evidence-based optimisation strategies, and (3) the role of EBP and optimisation strategies in radiographers' professional future. The interviews lasted on average 45 minutes, with a range of 28 minutes to 51 minutes. Ethical approval was granted from the Ethics Committee of Faculty of Health, Medicine and Life Sciences of Maastricht University. Data was collected, processed, stored, and disposed of in accordance with the General Data Protection Regulation (2018) and the Human Rights Act (1998).

All audio recordings were transcribed verbatim. A summary of the transcript was emailed to the participant for a member checking and any additional comments made were incorporated in the results.[33] Grounded Theory was used to inform the analysis.[34] This involved performing a simultaneous and iterative process to data gathering and data analysis to constantly compare, identify and pursue emerging phenomena. Interviews were analysed and interpreted to inform and refine subsequent interview questions. During the open coding phase, *in vivo* coding was conducted line by line from the transcripts. This involved words or sentences of the interview data that were recorded as codes. To increase the trustworthiness of the study, transcripts were secondarily coded (MW). Codes were integrated and refined for development of categories, and subcategories. In the second phase, axial coding was applied to discover relationships between categories and subcategories and form common themes. Codes were merged or removed where they were deemed to be too similar. It was aimed to achieve data saturation, where no new categories emerged. Fortnightly debriefs between the research team occurred throughout the project to discuss the codes and interpretation of the data.[35]

Findings

A total of 13 radiographers were interviewed and the age ranged between 21 and 59 years. Their experience level ranged between 9 months and 17 years. Seven radiographers held a BSc in Radiography, four held a PGCert and one held a PGDip in Radiographic Reporting, and one participant had a pre-registration MSc degree in Radiography. Participants were from across the United Kingdom

Four major themes emerged: (1) EBP optimisation strategies are highly valued, (2) infrequent engagement with EBP regarding optimisation, (3) workplace barriers to the implementation of EBP and (4) an evidence-based future in radiography.

<u>EBP optimisation strategies are highly valued</u>

All participants showed high awareness of the concept of EBP and deemed this important for practice improvements and the provision of high-quality care.

"It allows improvements, quality improvement… you are able to highlight mistakes, work upon that and improve" [RAD8]

"… in order to make practice safer, more efficient or just work better". [RAD3]

All participants deemed optimisation strategies important to ensure the safety of staff, patients, and themselves. According to the participants, using the least amount of radiation to generate a diagnostic image is one of the most important tasks of a radiographer. Additionally, the participants considered adherence to the Ionising Radiation (Medical Exposure) Regulations 2017 (IRMER) an important factor to implementing optimisation strategies.

"Optimising dose is important for patient wellbeing and anybody else who might be in that controlled area". [RAD4]

"That is by far the most important aspect of our job, creating diagnostic images with the least amount of radiation possible". [RAD7]

"… it's the IRMER what we strive to implement as best as we can and keeping the dose as low as reasonably achievable". [RAD4]

Although continuous dose optimisation was considered important, some participants reported that increasing service efficiency and productivity are rather prioritised in their departments.

"…the one thing we are trying to improve is faster service really… which isn't really an optimisation technique". [RAD3]

"It's more of productivity, less optimisation". [RAD9]

Infrequent engagement with EBP regarding optimisation

Participants stated that they apply optimisation strategies daily. These strategies are, however, mainly those taught in education or radiography training rather than recently introduced by research evidence. Additionally, most participants stated that they use their professional knowledge, skills, and autonomy to optimise.

"…in terms of new techniques… there's not really that many that we're aware of on a day to day. It mostly basically goes back to our education or degrees… we just tend to go by our inherent knowledge of reducing dose". [RAD7]

"…if it's not justified, they're not going to get that dose of radiation anyway. And I have had many arguments with the doctor as to why I'm not going to do it…" [RAD2]

"…there are some cases where you might need to deviate from the established, technical parameters… but in doing so, you've saved them from having another radiation exposure". [RAD13]

The advanced practitioners (those holding a postgraduate qualification) appeared to feel confident, motivated, and responsible to actively engage with EBP and implement new optimisation strategies.

"I've become more aware of things since doing the reporting course… until then I had done 14 years of radiography without doing any study. I think I got a little bit slapdash… it's been a kick of the backside to use journals and influence other people." [RAD6]

"…as an advanced practitioner… it's part of my role to be trying to find new ways of doing things and to be implementing them… I guess the onus is on us". [RAD4]

Most participants were of opinion that older and more experienced radiographers are *"set in their ways"*, and *"lost interest"* in engaging with EBP and implementing evidence-based optimisation strategies. Conversely, participants described young and newly qualified radiographers as being flexible to change but rather focused on developing their practice than engaging with EBP and implementing new practice.

"I think certain radiographers who might be slightly older are of the opinion that the way they do it is the best way. And they kind of won't listen to new research." [RAD5]

"… seniors for a long time have kind of got to that there's no progression there, they just kind of give up… they've lost interest". [RAD12]

"…the younger ones take it on board more because they are more newly qualified and they are more eager to listen…" [RAD6]

"…especially if you're the younger ones… you're just focusing on developing your own practice". [RAD5]

According to the participants, the main sources of new evidence-based optimisation strategies are word of mouth from colleagues, staff meetings, announcements from the trust and magazines from, for example, Society of Radiographers. Additionally, a few participants mentioned networking and new staff or students as a source of new optimisation strategies.

"…it has been brought up in meetings so all staff are aware… the new protocols has been put on like a spread sheet and has been put around the departments…" [RAD3]

"…I realised that it is important to network with other people, especially academics… they are very current on literature, so you got to use people to their advantages". [RAD6]

"… often we'll rely on people telling us what they've done in other hospitals". [RAD6]

Workplace barriers to the implementation of EBP

Participants stated that they experienced resistance from (older) radiographers, radiologists, and referrers. Several reasons for this resistance were given, including a lack of consensus on the implementation arising from a lack of communication, tradition, and to avoid missing findings or inaccurate diagnosis. Moreover, one participant suggested that optimisation strategies should also practically benefit radiographers for it to succeed.

"…and not just be dropped with 'this is a new protocol, off you go'… it confuses people…it's hard to do things when you haven't got a full understanding of why you're doing it". [RAD12]

"…some specialities use a lot of evidence in their practice whereas something like general x-ray, I think is a little bit more traditional. They may not adapt so much new techniques for optimisation". [RAD7]

"…some of the radiographers didn't want to risk cropping the bottom of the chest off (collimation) and just sort of kept doing what they've always done…" [RAD13]

"If you implement it so it might be good for the patient but it's going to make the radiographer's job three times harder, trying to get them to do it is a nightmare…" [RAD12]

Participants stated that engaging with EBP to implement an evidence-based optimisation strategy is considered radiographers' own initiative, hence support is not always provided. Some support may be given through the provision of resources and *"study"*, *"audit"* or *"admin"* time depending on the suggestion. Allocated time is however, not guaranteed as patients are prioritised. Therefore, the participants' perception was that engaging with EBP would require time taken out of their personal life which was not received positively by participants. Additionally, several participants highlighted a lack of access to literature.

"… I don't really get that much support to be honest, I just get on with things myself… if I wasn't proactive about things and try to change, I don't think things would change…" [RAD6]

"…I have admin time built into my week most of the time (to engage with EBP). However, if we have a reported backlog, then you lose your admin time to have to go and report…" [RAD5]

"…there's a lot of work you can do at home in your own time, but we also have lives and things we need to do." [RAD10]

"…resources aren't always readily available, so you're quite limited in what you can access". [RAD4]

Several participants felt not in a position to implement a new evidence-based optimisation strategy due to the hierarchical structure in their departments. Additionally, participants reported a lack of interest and unwillingness to engage with the principles of EBP.

"…if you are kind of at the bottom of the ladder you are not going to get fully listened to". [RAD9]

"…we are very much protocol driven, that's come down by the radiologists, medical physics and reporting radiographers… and we follow them." [RAD12]

"…generally, a lot of the attitude is kind of I turn up, I do my job, I do whatever I need to do… there would be a few people that showed interest, but I don't think it's as ingrained in the profession as we should probably have it". [RAD12]

"I personally don't go out of my way to look for evidence like that. It's not really my primary job role…" [RAD10]

<u>An evidence-based future in radiography</u>

Participants were of the belief that EBP is necessary to appropriately respond to the advancing technology and improve services in the future. Additionally, due to the increased emphasis on the concept by universities and the advancing role of radiographers, several participants expected it to become more ingrained in the culture.

"…EBP will become more important as technology develops. We've got to make sure that we keep adapting our practices to keep up with the advances in technology". [RAD4]

"…universities are pushing evidence-based concepts a lot more now. So I think as every generation leaves their training, it gets more and more drilled into them…" [RAD10]

"…there'll be a stronger drive and it will only get bigger in the future as more radiographers take on more complex roles." [RAD12]

According to most participants, optimisation strategies will become more important as there is more attention to radiation health effects and the increased use of medical imaging. A few participants, however, highlighted the limits of dose optimisations and believed that due to the advancements of technology, dose optimisations may not be required in the future.

"…more important because I think more attention is being paid to how much harm we are causing a patient by performing radiographs on them…" [RAD11]

"…there's a finite amount of optimisation that you can achieve…" [RAD4]

"…I could see an environment one day where you don't necessarily have lead shields hanging on the walls". [RAD6]

Participants mentioned the need for more encouragement, resources, training, meetings, and involvement from all professionals for an evidence-based culture. The two participants that returned the member check with additional comments emphasised the need for EBP related training and education in practice. One of the participants also commented that universities should create more awareness of radiation health effects to promote implementation of evidence-based optimisation strategies.

"…they should probably do regular training on it… cause currently there isn't any training on evidence-based practice…" [RAD3]

"…it needs to go beyond the radiology department because, you know, we've got doctors and nurse practitioners that need to understand whether it's sensible what they're requesting…" [RAD2]

"…an increased awareness on the risks of radiation exposure would aid in encouraging students and newly qualified radiographers to take an active role in suggesting improvements as there is a common perception of 'the x-ray radiation dose is pretty much miniscule'…" [RAD13]

Discussion

The results of the study indicate there is consensus among the participants that EBP is essential to improve the quality of services and practices in radiology departments. These views have previously been expressed by diagnostic radiographers.[35,36] All participants deemed optimisation strategies important to reduce radiation dose as much as reasonably practicable whilst being mindful that a correct diagnosis is not compromised. The participants indicated that the commonly used optimisation strategies in their practice were those that were primarily taught in their initial education; not strategies recently introduced by research evidence. There appears to be a disconnect here between highly valuing EBP which has been previously reported and applying the latest research to their own practice.[28,36] This links with participants discussions regarding their perceived barriers to the implementations of EBP. Additionally, they rely on their professional knowledge, skills, and autonomy to ensure dose optimisation in everyday practice, but without consulting the latest research on their strategies. This resonates with previous studies suggesting that radiographers rely on knowledge obtained from education and clinical experience instead of research evidence to justify decisions in practice.[1, 21]

Advanced practitioners stated that they felt motivated, confident, and responsible to actively engage with EBP and implement new optimisation strategies. According to the advanced practitioners, returning to university for a postgraduate qualification positively impacted their attitude, confidence, and knowledge of EBP and research. Moreover, they felt more responsible and confident to implement new evidence due to their superior role in the radiology department. These results are in line with previous literature suggesting that a higher education level is associated with a positive attitude and use of EBP among radiographers.[21,22]

Participants stated that major barriers to implementing evidence-based optimisation strategies included a lack of support and resources such as time and access to literature. These barriers have frequently been reported among healthcare professionals including nurses.[31,40] The perceived presence of a hierarchical structure may also be a barrier to implementation of evidence-based optimisation, for example where inexperienced or junior radiographers feel that they must follow the protocol; the reporting radiographers in our study felt empowered to implement and change protocols (e.g., RAD6 and RAD4). Ownership of the protocols and strategies themselves appeared to play a part in their operationalisation. This can be seen in other professions whereby protocols may be used as a means of control of the work undertaken by professionals. However, the increased confidence seen by

advanced practitioners may be enhanced through their ownership of the protocols and their apparent increased awareness of research implementation; this could indicate that ownership is switching to the radiography profession as they are being involved in the production of the tools that control the work undertaken (i.e., protocols)[41]. However, this still appears to be hierarchical, as the reporting radiographers were the ones mentioned by inexperienced participants. It might therefore be beneficial for radiology departments to provide regular optimisation and research related education and training in practice. However, this may need to be delivered in such a manner as to reduce the perceived hierarchies and promote individual radiographer's ownership and empowerment to implement their own, evidence-based, dose reduction strategies.[37] Changes that adhere to these concepts may help to reinforce and maintain radiographers' research skills and EBP knowledge, and consequently promote the implementation of evidence-based optimisation strategies. [38, 39]

The findings also suggest that participants perceived that there is a lack of time and access to literature and that this may promote a negative attitude towards engaging with EBP. Participants indicated that a lack of protected time in practice results in engaging with research in personal time which is undesirable among radiographers. The participants therefore expressed the need for support through time strictly allocated to EBP activities in practice and access to literature. Such resources might not only provide the opportunity to review and implement research findings, but also facilitate learning or professional development.[42] Reluctance to change practice was also deemed a major barrier to implementing evidence-based optimisation strategies. According to the participants, reluctance arises due to a traditional culture and mindset, and a lack of communication regarding new implementations in the department.[37,43] Moreover, the findings of this study suggest that radiographers may be reluctant to implement new optimisation strategies to avoid the consequences of missing findings or inaccurate diagnosis leading to unnecessary (over)utilisation of radiation.[44] Radiographers also appear to be applying alternate and pragmatic approaches to dose reduction, through judicious use of justification/authorisation and preventing repeating the exposure. Implementation of evidence-based practice may benefit from involving all radiographers and stakeholders, and organising regular meetings to collectively communicate and introduce new optimisation strategies.[45] This could create awareness and provide professionals the opportunity to suggest new practice, address concerns on an implementation and plan an effective implementation process and promote ownership of the strategies amongst the radiographers; however, the notice should be given to the implementation of change as being a multi-faceted and potentially problematic endeavour.[46,47]

Most participants agreed that EBP and optimisation strategies will become more important in the future. Some participants, however, highlighted the limits of radiation dose reduction and believed optimisation strategies might become unnecessary due to highly advanced technology in the future. These results underscore the already ongoing debate on the effectiveness of gonad shielding, and the benefits achieved from a change to digital radiography.[48, 49] Nevertheless, literature suggests that future technology advancements in radiology might also bring their own challenges and demands, requiring evidence-based optimisations to use the technology to its maximum advantage.[50,51]

Limitations

These results must be interpreted with caution and several limitations should be made explicit. Firstly, these results may not be applicable outside the UK due to, for example, differences in radiographers' training and education, resource availability, models of healthcare, and variation in professional and political factors internationally.[52,53] Conducting this research in other countries would be recommended. Secondly, the participants only included radiographers holding a university degree. Participation of radiographers with a diploma in radiography, the qualification awarded before radiography training changed to

degree level, may have yielded further insights into radiographers' perceptions and knowledge of EBP and optimisation strategies[54]. Hence, further research is required to uncover these insights and reveal any other potential barriers to implementing evidence-based optimisation strategies in radiology departments. Third, the study was announced on social media platforms, radiographers were not directly recruited from hospitals. Thus, it is likely that only radiographers who are interested in EBP and actively search for recent trends and research within radiography found the study announcement and participated, which may have introduced bias into the results.[55]

There are remaining questions this study could not address which require further research. Some participants briefly mentioned that differences exist between the use of evidence-based optimisation strategies in different radiography specialities. Future research may elaborate on this finding and reveal barriers to implementing evidence-based strategies associated with each speciality. Moreover, future research may focus on uncovering barriers to implementing evidence-based optimisation strategies related to the patients and their families.

Conclusion

The findings suggest that EBP is infrequently used among radiographers to implement valuable optimisation strategies in daily practice, with radiographers instead relying on previous training, education and protocols developed within the department, rather than engaging with literature and moving towards implementation in their own practice. Several barriers to implementing evidence-based optimisation strategies were brought forward relating to reluctance to change practice, lack of support from superiors, lack of empowerment and personal ownership of protocols, especially amongst those radiographers without advanced practice standing. This research findings raise several questions regarding how radiographers can be empowered to take ownership EBP implementation and optimisations strategies, within the clinical arena.

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Figures

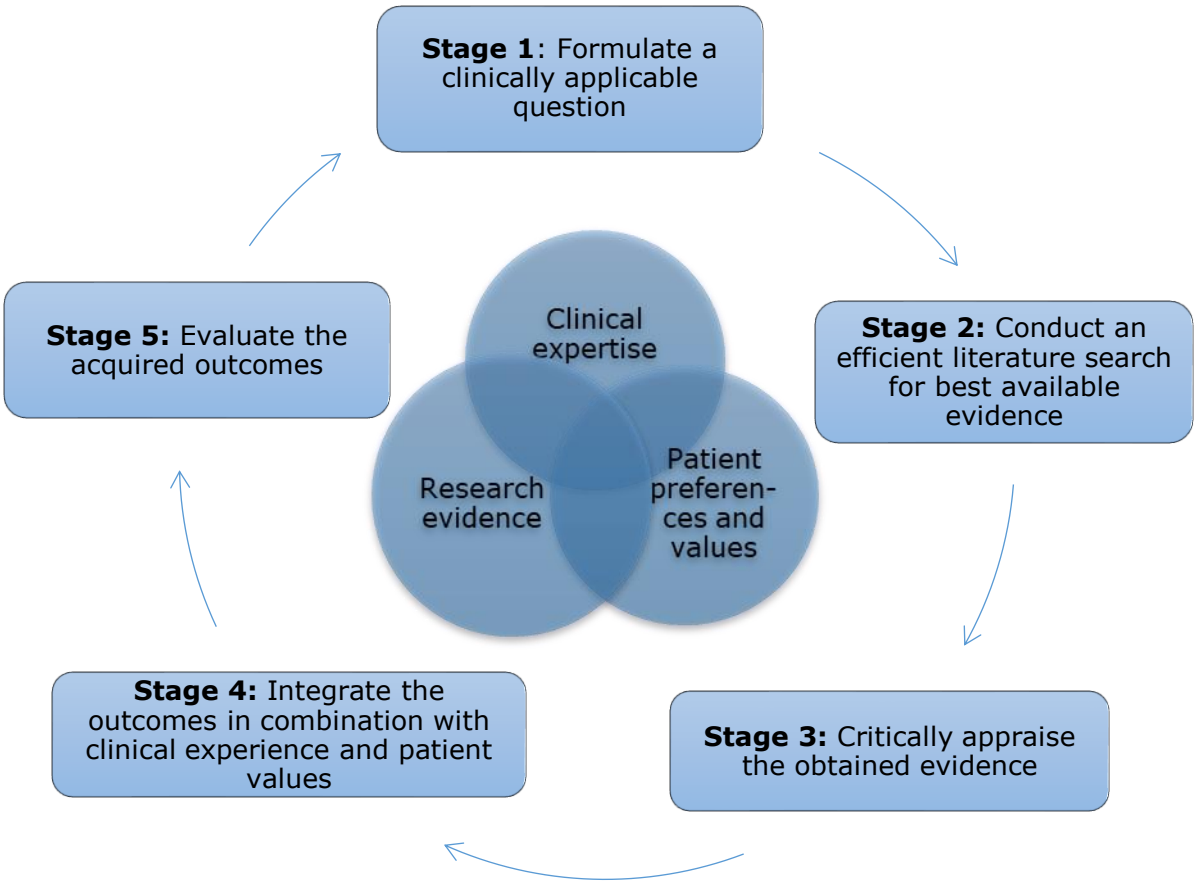

Figure 1: Evidence-Based Practice Cycle (adapted from Craig and Smyth, 2012; Booth and Brice (2004).