Radiography xxx (xxxx) xxx

Contents lists available at ScienceDirect

Radiography

journal homepage: www.elsevier.com/locate/radi

Facilitators for and barriers to radiography research in public healthcare in Nordic countries

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ARTICLE INFO

Article history:
Received 8 May 2021
Received in revised form
17 August 2021
Accepted 19 August 2021
Available online xxx

Keywords:
Radiographer
Radiography research
Evidence-based practice
Role transition
Research culture
Inter-professional research

ABSTRACT

Introduction: It has been suggested that the future of diagnostic imaging relies on engagement in research and evidence-based practice. This implies a role transition from a clinical radiographer to a clinical radiographer-researcher. Clinical radiographers' stimuli for engaging in research in Nordic countries are unknown. This study aimed to address this gap.
Methods: Cross-sectional data collection via an online questionnaire on facilitators for and barriers to participation in radiography research was carried out among 507 clinical radiographers in public healthcare in the Nordic countries: Denmark, Finland, Norway and Sweden.
Results: Support from colleagues (odds ratio [OR] 2.62) and other professionals (OR 2.74), and self-esteem in research skills (OR $\geq$ 2.21), were facilitators for radiography research. Lack of knowledge and skills to conduct research (OR 2.48) was revealed to hinder radiographers' participation in research. The absence of a radiography research culture in the workplace explained non-participation in research (OR 1.75).
Conclusion: This study revealed significant factors for clinical radiographers' participation in research.
Implications for practice: A strategy for establishing a radiography research culture in healthcare is proposed that is novel for the context. Management support for knowledge development and activity leading to inter-professional research projects across knowledge fields, provision of a radiography research lead and acknowledgement of radiography research among colleagues signify the establishment of the culture. These prerequisites might provide a paradigm change towards not only the symbiosis of a clinical radiographer and an autonomous researcher but also a partner who adds radiography research to evidence-based practice in diagnostic imaging.

Introduction

It has been suggested that the future of diagnostic imaging relies on engagement in research and evidence-based practice (EBP).[1–4] While radiologists and physicists have a long tradition of conducting research in medicine and radiation physics, radiographers are still in the initial stages of radiography research, but academic development of radiographers is ongoing while they usually perform research studies alongside university teaching.[5–7] Radiography research has been found to address, for example, radiographic technology and patient well-being and care.[8,9] There are several reasons to investigate clinical radiographers' stimuli for engaging in radiography research. One is radiographers' responsibility for and expertise in patient care in diagnostic imaging.[10–14] Provision and

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https://doi.org/10.1016/j.radi.2021.08.007

development of patient care should be conducted on the basis of research evidence along with clinical experience, patient preferences and healthcare financial resources, also referred to as EBP.[15–17] Consequently, radiographers should take an active role in performing research from a patient perspective. Another reason is the rapid and continuous technical development in diagnostic imaging, for example, advances in digital imaging and patient administration systems, the introduction of hybrid imaging and, recently, the advent of artificial intelligence.[18–21] These advances, together with the fact that radiographers are the link between the technology and the patient, claim that clinical radiographers should engage in the progression of radiography research. Radiographers today cannot only follow technical developments but must actively participate in these advances from the perspective of the patient and contribute with research in healthcare and technology. This implies a role transition from a clinical radiographer to being a researcher as well.

In the Nordic countries, the first cycle of higher education in radiography provides a professional qualification in radiography as well as a Bachelor's degree.[10–13,22] The Bachelor's degree level in radiography has been implemented in most higher educational institutions across Europe.[23] The academic degree in radiography introduces lifelong professional learning and the capacity for reflective practice.[1,24,25] Further education at the postgraduate level is available for radiographers at several universities in the Nordic countries[26,27] and enables postdoctoral research in radiography and evidence-based patient care. The profession of radiographer has been an academic profession in the Nordic countries for almost three decades,[10–13] which obligates radiographers to undertake professional development and contribute to EBP through radiography research and scholarship. Still, there is a shortage of radiographers with PhDs in the Nordic countries,[7] and radiography research is mostly performed at universities.[6,7] However, collaboration in radiography research between academic institutions and university hospitals has evolved during recent years.[6,7] Our recently published survey among radiographers in Nordic countries revealed that while the vast majority of the respondents (83%, 532/640) considered radiography research important for EBP in diagnostic imaging and nearly all agreed (98%) that radiography research is needed to promote the profession, involvement in research was low (33%).[28] It has been proposed that engaging in research requires an attitude and behaviour change.[29–31] Therefore, this paper focuses on clinical radiographers' perceptions of facilitators for and barriers to participation in research in public healthcare, and it is the second part of the survey to be published. The terms facilitators and barriers have been used in implementation research that aims to study context-specific processes of change to gain an understanding of the translation of theory into practice.[32,33] A facilitator may be defined as a condition or resource that promotes implementation of or compliance with a guideline.[32,33] Conversely, factors are considered barriers when they hinder expected events. The same factor can be both a barrier and a facilitator.[32,33] The study results are intended to contribute to the development of strategies for radiography research.

Methods

Study design and data collection

This paper is based on cross-sectional data collection amongst clinical radiographers in public healthcare in four Nordic countries: Denmark, Finland, Norway and Sweden. The sample was a cohort of 507 radiographers who responded to an online questionnaire in our recently published survey about their opinions on radiography research and involvement in research activities.[28] In the selection of the cohort, responses from radiographers working in the private sector, from managers and when such records were unavailable were excluded (133/640) as the current study addressed radiographers in clinical practice in public healthcare. The survey is described in detail in the previous report.[28]

Following an invitation letter, radiographers gave informed consent by answering the questionnaire. The questionnaire was responded to anonymously, and no sensitive data were collected, and, in accordance with the regulations in the European Union[34] and in the Nordic countries,[35–38] no ethical approval was required, but the Helsinki declaration was applied.[39]

Radiographers were asked whether they participated in research or not with a yes/no question. They were also asked about potential facilitators for and barriers to participation in research. The factors were introduced to the questionnaire on the basis of a Norwegian study[29] and further developed by the research group to a Nordic perspective. The development and validation of the questionnaire has been reported previously.[28] Multiple-choice questions and statements with ordered response categories (completely agree, strongly agree, somewhat agree, somewhat disagree, strongly disagree or completely disagree) were used.

Data analysis

Data were analysed using IBM SPSS Statistics 26 with a two-tailed significance level of $p < 0.05$. Multivariate logistic regression[40] was performed to investigate the odds of participation in research, depending on the potential facilitators for or barriers to engagement. The responses to the multiple-choice questions received a value of 1 when scored, otherwise 0. The scores for the ordered response categories were dichotomised as follows: the value of 1 was assigned to completely agree, strongly agree and somewhat agree, and 0 was assigned to the disagreement responses. The analyses were controlled for differences between countries.

Results

Characteristics of the sample

The characteristics of the sample are presented in Table 1. Participation in research was associated with being male (odds ratio [OR] 3.81; p-value < 0.001; 95% confidence interval [CI] 2.32–6.27), having a postgraduate degree (OR 5.03; p-value < 0.001; 95% CI 2.31–10.93) and being affiliated to a university hospital (OR 2.91; p-value < 0.001; 95% CI 1.90–4.48).

Results of the study outcome

Receiving support from radiographer colleagues and from other professionals facilitated participation in research (OR 2.62 and 2.74, respectively) (Table 2). The frequency of such responses amongst those participating in research was 34% (n = 51) and 31% (n = 47), respectively. Radiographers' confidence in their capability to participate in research (89%, n = 134) and to initiate a radiography research project (62%, n = 94) demonstrated at least twice as high an OR (2.21 and 2.56, respectively) for engagement in research (Table 3).

Lack of knowledge of how to conduct research (57%, n = 204) and about potential research projects in which to participate (51%, n = 183) were identified as barriers for radiographers' participation in research (OR 2.48 and 2.00, respectively) (Table 4). Lack of a radiography research culture at the workplace (37%, n = 130) was also associated with non-participation in research (OR 1.75).

Table 1
Characteristics of the sample.

	Radiographers participating in research	Radiographers not participating in research
Age, Mean (SD)	43 (11)	41 (11)
Gender[a]		
Female	102 (68)	305 (86)
Male	49 (32)	49 (14)
Workplace		
Health centre, regional or central hospital	56 (37)	215 (60)
University hospital	95 (63)	141 (40)
Academic degree[b]		
No academic degree	34 (23)	75 (21)
Bachelor degree	85 (56)	258 (73)
Master degree or higher	31 (21)	21 (6)
Years as graduated radiographer,[c] Mean (SD)	16 (11)	12 (11)
Country		
Denmark	53 (35)	95 (27)
Finland	40 (26)	139 (39)
Norway	34 (23)	30 (8)
Sweden	24 (16)	92 (26)

Data are given as n (%) unless otherwise noted; n, amount of the sample; %, frequency amongst participants and non-participants in research.
SD, standard deviation.
Missing data.
[a] 2.
[b] 3.
[c] 1.

Table 2
Multivariate logistic regression model[a] of the external facilitators for radiographers' participation in radiography research.

Facilitators for participation in research[b]	Odds ratio	P-value	95% CI
Get assigned working time to conduct research	1.90	0.010	1.16–3.09
Receive support from radiographer colleagues	2.62	<0.001	1.68–4.15
Receive support from other professionals	2.74	<0.001	1.72–4.38

Hosmer–Lemeshow goodness-of-fit test, P = 0.906; Nagelkerke's pseudo R-square, 0.094; number of participants in the model = 507.
CI, confidence interval.
[a] Participate in research = 1; not participate in research = 0.
[b] Independent variables entered into the model of forward stepwise (likelihood-ratio) multivariate logistic regression: get research training opportunities, get assigned working time to conduct research, get funding and other material resources, receive support from radiographer colleagues, receive support from department manager/higher management, receive support from other professionals, employing experienced radiography researchers for mentorship, recognition at organisational level and being a member of a research group. All variables were coded as follows: the value of 1 was assigned to completely agree, strongly agree and somewhat agree, and 0 was assigned to the disagreement responses. Independent variables that are not presented in the table were not significantly associated with participation in research. The model was controlled for differences between countries (Denmark, Finland, Norway and Sweden).

Table 3
Multivariate logistic regression model[a] of radiographer's confidence in their knowledge, skills and capability for participation in radiography research.

Knowledge, skills and capability for participation in research[b]	Odds ratio	P-value	95% CI
Capable of participating in radiography research projects	2.21	0.012	1.19–4.09
Capable of initiating a radiography research project	2.56	<0.001	1.64–4.00

Hosmer–Lemeshow goodness-of-fit test, P = 0.827; Nagelkerke's pseudo R-square, 0.123; number of participants in the model = 507.
CI, confidence interval.
[a] Participate in research = 1, not participate in research = 0.
[b] Independent variables entered into the model of forward stepwise (likelihood-ratio) multivariate logistic regression: have sufficient knowledge about scientific research process, have sufficient skills to search background literature, have sufficient skill to critically evaluate research articles, have sufficient English language skills, have sufficient knowledge about research methodology, have sufficient knowledge about statistical analyses, capable of participating in radiography research projects and capable of initiating a radiography research project. All variables were coded as follows: the value of 1 was assigned to completely agree, strongly agree and somewhat agree, and 0 was assigned to the disagreement responses. Independent variables that are not presented in the table were not significantly associated with participation in research. The model was controlled for differences between countries (Denmark, Finland, Norway and Sweden).

Table 4
Multivariate logistic regression model[a] of the barriers to radiographers' participation in radiography research.

Barriers to non-participation in research[b]	Odds ratio	P-value	95% CI
Lack of knowledge and skills to conduct research	2.48	<0.001	1.65–3.73
Lack of knowledge about potential research projects to participate in	2.00	0.001	1.37–3.06
Lack of radiography research culture at workplace	1.75	0.012	1.13–2.71

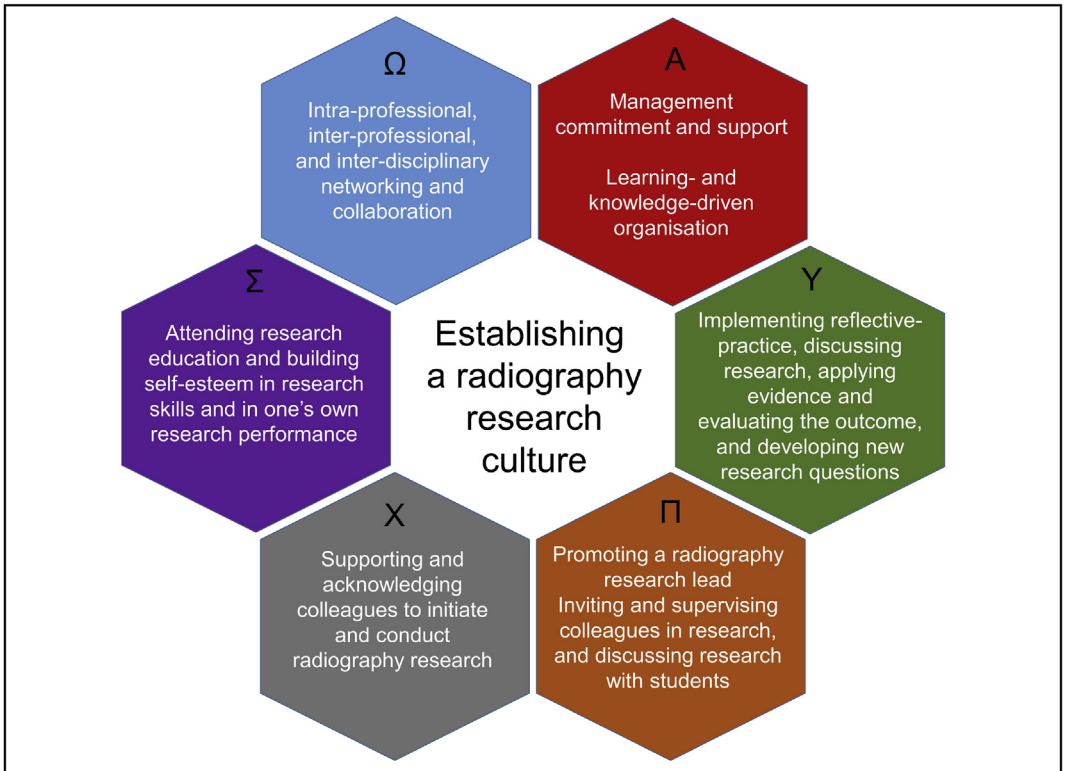
Hosmer–Lemeshow goodness-of-fit test, P = 0.478; Nagelkerke's pseudo R-square, 0.095; number of participants in the model = 507.
CI, confidence interval.
[a] Not participate in research = 1, participate in research = 0.
[b] Independent variables entered into the model of forward stepwise (likelihood-ratio) multivariate logistic regression: lack of knowledge and skills to conduct research, insufficient time at work to conduct research, lack of interest and motivation, lack of funding and other material resources, lack of support from my colleague radiographers, lack of support from department manager/higher management, lack of support from other professionals, lack of knowledge about potential research projects to participate in, lack of experienced radiography research mentors and lack of radiography research culture at workplace. All variables were coded as follows: the value of 1 was assigned to completely agree, strongly agree and somewhat agree, and 0 was assigned to the disagreement responses. Independent variables that are not presented in the table were not significantly associated with non-participation in research. The model was controlled for differences between countries (Denmark, Finland, Norway and Sweden).

Discussion

Although facilitators for radiography research seemingly have not been described in the literature, barriers have been addressed for other healthcare professions, particularly for research activities among nurses.[41,42] Lack of knowledge and skills to perform research, deficient management support, poor teamwork and lack of role models have been reported, also among radiographers.[41–44] Our study results also demonstrate that lack of knowledge about scientific methods is a barrier, along with limited knowledge about potential research projects and the absence of a radiography research culture at the workplace. The research culture has been scarcely described, but the lack of it has been mentioned in the context of radiography research.[45] It has been suggested that a culture should be defined in its context and how it may affect the opportunity for change.[46,47] For example, shortcomings in radiation protection in diagnostic imaging may be explained by the features of a radiation safety culture.[46,47] A literature review revealed that an understanding of attitudes, norms and values among radiographers and radiologists may explain their radiation safety behaviour and provide clues for a culture change.[46,47] Hence, a culture seems to consist of attitudes, norms and values, and a research culture relates to research activities and the prerequisites for these. For example, an attitude of

acknowledging fellow radiographers to conduct research, a norm of intra- and inter-professional collaboration in research and valuing EBP in the workplace. Keeping this line of reasoning together with the study outcomes and our previous results,[28] we propose a strategy for establishing a research culture in radiography (Fig. 1). The development of such a culture can be seen as an effect of management towards a knowledge-driven and learning organisation.[42] Therefore, it is important to define the management's responsibility to implement the concept of a research culture (Fig. 1:A). When establishing a research culture, tradition and history play an important role, and the process takes time.[46,47]

Another aspect to account for is the challenge of balancing the busy healthcare environment in diagnostic imaging and contribution to EBP, two seemingly contradictory and competitive goals.[48] However, with an attitude change towards EBP comes awareness that research provides the prerequisites for not only high-quality healthcare but also improved workflow.[49] One way to invoke such an attitude change is to introduce radiographers to the concept of EBP,[31] which is also expected to strengthen the



A	Management's responsibility to develop awareness in the workforce that participation in research and evidence-based practice is important. Dedicated leadership to facilitate radiographers' involvement in conducting research and their transition to being clinicians and researchers.
Y	Creating an environment of reflective practice towards evidence-based practice amongst radiographers.
Π	Promoting a radiography research lead who is a postdoctoral radiographer inspiring and supporting colleagues in radiography research. Discussing clinically relevant research questions with students to develop their awareness of the research process and the value of evidence-based practice.
X	Building together an environment of support for and pride in colleagues who conduct radiography research and recognising the value of radiography research. The workplace discourse should be permeated by a positive attitude towards research activities in the profession.
Σ	Continuing academic education and professional development. Management support for Master's and PhD education. Strengthening self-esteem by support for and recognition of radiography research amongst colleagues and other professionals.
Ω	Creating a culture of valuing research across knowledge fields and mutual interest in collaboration in research. Radiographers being prone to and working for inter-professional and inter-disciplinary collaboration in research. Other professionals supporting and inviting radiographers in research groups. Awareness that radiography research adds further perspectives to evidence-based practice.

Figure 1. Strategy for establishing a radiography research culture in diagnostic imaging.

radiography research culture. In a learning organisation, employees are encouraged to work continuously based on evidence, to encourage radiographers to critically examine their own activities, to define knowledge gaps and to seek scientific evidence to provide answers (Fig. 1:Y). To further develop the radiography research culture, radiographers holding a doctoral level research award and with research experience are needed, which is also supported by our previous study results demonstrating that postgraduate radiographers are predominately considered competent to conduct radiography research.[28] A radiography research lead is proposed,[50] namely a postdoctoral radiographer who has the management support to develop radiography research, and also to initiate research projects and encourage fellow radiographers (Fig. 1:Π). Consequently, an increase of opportunities in radiography research opens up the development of a shared understanding of the value of radiography research for EBP in diagnostic imaging. However, it is important to be aware that the radiography research culture cannot be signified by a single event but requires a continuous process to be sustained.

Support from colleagues facilitates participation in research, according to our study results, presumably due to the social context of the radiographers' working environment, as radiographers usually work in teams or in pairs. Consequently, acceptance and acknowledgement from colleagues of participation in research and conducting research projects is important (Fig. 1:X). Valuing radiography research and a positive attitude towards research activities in the profession should permeate workplace discourse.[30,31] Management towards knowledge-driven and learning organisations may create such a climate. In contrast, when working in a destructive social environment, jealousy and rivalry may emerge. The need for a supportive habitat in developing clinician led research activities is well described in the healthcare environment.[51] Unfortunately, clinical experience reveals that collegial support for professional development in healthcare workplaces is often scarce, and hierarchy may dominate. There is a need for dedicated leadership to introduce radiographers to research and let them grow in the role transition of being a clinician and also a researcher (Fig. 1:A). Also important to bear in mind is that colleagues' support is not limited to one's workplace, and therefore national and international networking in research and getting support from fellow researchers is an acknowledged cornerstone of research.[52] Collaboration is crucial for the development of radiography research (Fig. 1:Π and, 1:Ω), in cooperation with colleagues at universities as well, which may also strengthen a supportive environment and help translate research findings into EBP.[53,54]

Another study result is the importance of support from other professionals in enabling radiographers to participate in and conduct research projects. In diagnostic imaging, radiologists and medical physicists, two professions that have academic education and extensive research experience, are other academic professions besides radiographers. Our observations reveal that it is common for these professions to receive research training and perform research along with their clinical work. In contrast, the tradition of radiographers is rather not to be involved in PhD studies and research when working in a radiology department.[7,48] Therefore, it is important to have the opportunity to collaborate with other academics (Fig. 1:Ω), not least because research questions arise from the same context when working together. The advantages of performing inter-professional and inter-disciplinary research may then be mutual. The research question could be investigated from different perspectives, such as clinical and diagnostic evaluation of a new imaging method and patient-reported outcomes of the new imaging method. Conversely, as the research fields of physicians and physicists are well established, there is a risk of becoming dependent on these professions as a consequence of investigating research questions only in medicine and radiation physics. Thus, radiography research needs to develop autonomy as well, most reasonably in the field of connecting the patient with technology to provide additional perspective to inter-professional and inter-disciplinary research and EBP in diagnostic imaging and patient care.

Furthermore, autonomy in research provides the basis for self-esteem in one's own ability to initiate a research project and to participate in research (Fig. 1:Σ), and self-esteem was also revealed as an important facilitator in our study. It is about confidence in one's own knowledge, skills and ability to develop research questions, to discuss an adequate research method and to carry out a project.[55] Postgraduate academic education, at first a Master's degree followed by doctoral education, is expected to develop such confidence.[56] Furthermore, aforementioned support from the radiography research lead may not only encourage performing radiography research, but also support self-esteem in a younger colleague making an entrance into research.[50–52]

The data collection across the four Nordic countries provides a Nordic perspective on facilitators for and barriers to radiographers' participation in research. However, the study results need to be seen in light of the fact that not all radiographers were reached nor chosen at random, nor did the majority answer the questionnaire, which is an issue discussed in detail in our previous report.[28] Additional data by the use of focus group interviews among radiographers, other academics and managers would probably have provided additional insights into the concept of a research culture.

Conclusion

This study revealed factors of significance for clinical radiographers' participation in research across four Nordic countries: support from colleagues and other professionals, the importance of self-esteem in their own capability for performing research and the presence of a radiography research culture at the workplace. The same factor can be both a barrier and a facilitator, for example, the absence of a research culture at the workplace hinders radiography research. A strategy for establishing a radiography research culture is proposed. It includes activities leading towards a knowledge-driven organisation and development of inter-professional research that should be conducted from a range of complementary perspectives across knowledge fields. We propose a radiography research lead and stress the need of acknowledgement of radiography research amongst colleagues. These prerequisites might provide a paradigm change towards not only a symbiosis of a clinical radiographer and an autonomous researcher but also a partner who adds radiography research to EBP in diagnostic imaging.

Author contributions

All authors contributed to the study, were involved in writing and revising the paper and approved the submitted version of the manuscript.

Availability of data

The data are available from the corresponding author upon reasonable request and with the permission of the study group.

Conflicts of interest

None.

Acknowledgements

The authors would like to thank the management of radiology departments in Denmark and the national societies of radiographers in Finland, Norway and Sweden for assistance with the questionnaire distribution. We are also grateful to the radiographers for their contributions to the study.

Anetta Bolejko received financial support from the Allmänna Sjukhusets i Malmö Stiftelse för bekämpande av cancer, Sweden. Ekaterina Saukko received financial support (EVO grant) from Turku University Hospital, Finland. The founder had no role in the design of the study, data collection, analysis and interpretation or writing of the report. No other grants from funding agencies in the public, commercial, or not-for-profit sectors were allocated to this research.

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