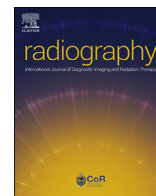




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Radiographers' involvement in research activities and opinions on radiography research: A Nordic survey

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ABSTRACT

Introduction: Radiographers' engagement in research is important for the development of evidence-based practice in radiography; however, radiographers' interest in research has rarely been reported. This study sought to ascertain radiographers' opinions about radiography research and investigate their involvement in research activities in four Nordic countries.

Methods: This study was conducted in Denmark, Finland, Norway and Sweden. A study-specific questionnaire was developed in English and adapted to each language of the study sample, and the content and face validity of the adaptations were evaluated. An online tool was used to collect the study data. The questionnaire link was distributed in September 2019 to radiographers working in clinical settings in four Nordic countries (n = 4572).

Results: The overall response rate was 14% (n = 662/4572). Research involvement was reported by 33% of the respondents; data collection was the main type of contribution. Radiographers who contributed to research were more likely to be male, have longer work experience, hold a master's or doctoral degree, work as managers and be employed in university hospitals. Nearly all agreed that radiography research is needed to promote the radiography profession and provide the evidence base for radiographic practice. However, only 14% were aware of the current research evidence regarding their professional field of specialisation, and 19% indicated that they developed current practices based on research evidence.

Conclusion: The findings indicate that, although radiographers had positive attitudes towards radiography research, their involvement in research and utilisation of research evidence in practice is low.

Implications for practice: Strategies should be developed to improve knowledge and skills related to evidence-based practice and stimulate radiographers' engagement in research.

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Introduction

Evidence-based practice (EBP) has become increasingly important for facilitating the transfer of research evidence into clinical practice in healthcare settings, including radiography.¹⁻⁷ EBP incorporates the use of the best available, current, valid and relevant research evidence with clinical expertise and patient values in clinical decision-making for achieving optimal outcomes.^{2,6,8,9} Although radiographers' attitudes towards research and

utilisation of research evidence have become more positive,^{3,4,7,10} and publication activity in the radiography field has increased over the past decade,¹¹ EBP within radiography is still not well established.^{2–4} Moreover, radiographers' reported involvement in research remains low,^{3,4,7,10} and those who participated mainly gained research experience during their studies.^{3,4,7}

The importance of research and EBP in radiography education and training curricula has been acknowledged.^{12–17} To strengthen EBP within the curriculum, the European Federation of Radiographer Societies (EFRS) suggested research-led teaching, research-oriented teaching and research-tutored practices in its *Statement on Radiography Education* (2019).¹⁴ Radiography educational programmes are also required to reflect the latest developments and responds to future healthcare needs.¹⁴ The commitment to research is expected to improve the radiographic practice, support the development of radiography education and enable our profession to grow and evolve.^{11,14}

EBP development in radiography is a process that necessitates changes in attitudes and behaviour and the establishment of a research culture.^{5,10,11} Engaging radiographers in research may influence their perceptions of the value of research evidence and help them embrace EBP within their professional domain.^{2,18,19} Radiographers' attitudes and behaviour in the context of research in the Nordic countries (Denmark, Finland, Norway and Sweden) is unknown due to limited number of empirical studies. This study aimed to address this gap by ascertaining radiographers' opinions about radiography research and investigating their involvement in research activities. The study's specific aim was to investigate and compare the personal, educational and professional characteristics of radiographers who contributed to research with those who did not. We also describe the development and validation of the questionnaire used for data collection. The study is part of a larger research project that aims to identify potential barriers and facilitators for research participation and the utilisation of research evidence by radiographers working in clinical settings in the Nordic countries. The results regarding potential barriers and facilitators will be reported in future publications. The results from the overall research project are intended to contribute to the development of a multinational strategy for radiography research and the establishment of EBP in radiography.

Methods

Study design and sample

This cross-sectional, observational study was conducted concurrently in four Nordic countries: Denmark, Finland, Norway, and Sweden (hereafter referred to as sites). Between September and November 2019, a sample of 4572 radiographers working in clinical settings was invited to complete an online questionnaire.

Questionnaire development and validation

A draft questionnaire in English was developed on the basis of previous study results.^{3,10} The draft questionnaire was evaluated in terms of its content and face validity,^{20,21} and the wording and comprehensibility of the questionnaire items and response categories were assessed. Three experienced radiographers with expertise in questionnaire development were informed of the questionnaire's purpose and conducted the evaluation separately. Based on their comments which mainly related to the wording of questionnaire items, the draft questionnaire was further developed in a panel discussion amongst the authors.

The questionnaire was translated into the target languages (Danish, Finnish, Norwegian and Swedish) and adapted to each site. This step included forward and backward translating and pretesting by a target group.^{22,23} One bilingual person with radiography knowledge translated the questionnaire from English into the target language at each site. The authors reviewed the forward translation at each site in case of inconsistencies between the English and the translated version. Inadequate expressions and concepts in the translations were identified and resolved. The translated version was translated back to English at each site by an independent bilingual person unfamiliar with the questionnaire and radiography. Discrepancies between the draft questionnaire in English and the back translations from the target languages were discussed amongst the authors until consensus was reached. Pretesting of the questionnaire in the target languages was performed with a sample of the intended respondents at each site ($n = 16$ for the total sites). Radiographers were asked to comment on the wording and comprehensibility of the items and response categories and the ease and duration of answering the questionnaire. The authors reviewed the feedback from the pretest, and minor adaptations to all the questionnaire versions were made.

The final version of the questionnaire (in English and the target languages) comprised 29 items, including sample characteristics, opinions about radiography research, participation in research activities, utilisation of research evidence and factors that might promote or prevent participation in research and utilisation of research evidence amongst radiographers. The questionnaire included open-ended, multiple-choice, yes/no and short specifying open questions and statements with a 6-point Likert-scale ('completely agree', 'strongly agree', 'somewhat agree', 'somewhat disagree', 'strongly disagree' or 'completely disagree'). The full version of the questionnaire in English is provided in Appendix A.

Data collection

To collect the study data, a survey and reporting online tool, Webropol 3.0 (Webropol Oy, Helsinki, Finland), was applied at all sites. The questionnaire link was distributed with a cover letter via the heads of radiology departments in Denmark and the national radiographer societies in Finland, Norway and Sweden. Up to two reminders to all invitees were sent.

Data analysis

The data was analysed with IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp. 2019, Armonk, NY, USA) using descriptive statistics methods. The chi-square test (X^2) was applied to investigate differences between the categorical variables. An independent samples t-test was used to compare the continuous variables. A p-value <0.05 was considered statistically significant. The 'completely agree' and 'strongly agree' responses were combined to represent full agreement with the statements, while 'strongly disagree' and 'completely disagree' were combined to represent full disagreement.

Ethical considerations

For this type of study, an ethical review is usually not required.^{24–26} However, ethical considerations were reviewed with reference to the Helsinki declaration.²⁷ The study did not encompass sensitive personal information and radiographers were informed in the cover letter that their participation was voluntary and anonymous. By completing the questionnaire and submitting their answers, the respondents consented to be involved in the study.

Results

The overall response rate was 14% ($n = 662/4572$) and per site as follows: Denmark 19% ($n = 173/902$), Finland 11% ($n = 256/2389$), Norway 17% ($n = 91/540$) and Sweden 19% ($n = 142/741$). In total, 640 responses were analysed to assess radiographers' opinions on radiography research and involvement in research activities; responses received from other than radiographers working in clinical settings ($n = 15$) and with missing values in open-ended questions were excluded ($n = 7$). Most respondents were female (81%), had a bachelor's degree (63%) and were employed as clinical radiographers (86%) (Table 1). The respondents' mean age was 43 years (standard deviation [SD] = 11, range 21–67). Work experience as a radiographer ranged from 0 to 43 years and averaged 14 years (SD = 11).

Fifty-four percent ($n = 345$) of the respondents had been involved in quality development activities at their workplaces after graduating, while involvement in research activities was reported by 33% ($n = 208$). Contribution to research was more common amongst males than females (50% vs 28%; $X^2(1) = 22.255$, $p < 0.001$) and more common amongst managers than those working in radiographer or other positions (54% vs 29% vs 44%; $X^2(2) = 17.163$, $p < 0.001$). The independent samples t-test revealed that those who contributed to research were slightly older ($t(638) = -2.985$, $p = 0.003$) and had longer work experience compared with those who did not ($t(638) = -5.231$, $p < 0.001$). Approximately 44% ($n = 116$) of the respondents employed in university hospitals were involved in research activities, while in the private sector or health centre, regional and central hospitals research involvement was reported by 22% ($n = 11$) and 24%

($n = 77$), respectively. Regarding educational background, contribution to research was indicated by 34% ($n = 50$) of the respondents without an academic degree, by 26% ($n = 107$) holding a bachelor's degree, by 57% ($n = 47$) holding a master's degree and all doctoral degree holders ($n = 3$). Data collection was the typical contribution to research activities (88%) (Table 2).

According to the results, 27% ($n = 170$) of the respondents indicated familiarity with their workplaces' research strategy, 26% ($n = 169$) were unfamiliar with it, 37% ($n = 235$) stated that they did not know if such a strategy existed, and 10% ($n = 66$) confirmed that they did not have it. Familiarity with the research strategy significantly influenced the frequency of involvement in research activities ($X^2(3) = 91.643$, $p < 0.001$). Of those who contributed to research, 51% ($n = 105$) were familiar with their workplaces' research strategy.

Nearly all the respondents agreed that radiography research is needed to promote the profession (83% fully agreed; 15% somewhat agreed) and to provide the evidence base for radiographic practice (81% fully agreed; 17% somewhat agreed) and that clinical decisions in radiographic practice should be based on research evidence (76% fully agreed; 21% somewhat agreed) (Fig. 1). The respondents did not perceive that radiographic research should be initiated and led by educational or healthcare institutions only; instead, cooperation between these two was regarded as important for conducting research in this field (73% fully agreed; 21% somewhat agreed). To a greater extent, radiographers with a doctoral/licentiate degree and master's degree were considered more competent to conduct radiography research than those with a lower degree (Fig. 1).

Table 1
Demographic characteristics of the study sample.

Variable	Denmark ($n = 172$)	Finland ($n = 240$)	Norway ($n = 89$)	Sweden ($n = 139$)	Total ($n = 640$)
Gender, n (%)					
Male	54 (31)	28 (12)	22 (25)	19 (14)	123 (19)
Female	118 (69)	212 (88)	67 (75)	120 (86)	517 (81)
Age, n (%)					
<30 y	50 (29)	29 (12)	17 (19)	15 (11)	111 (17)
31–40 y	52 (30)	78 (32)	30 (34)	34 (24)	194 (30)
41–50 y	41 (24)	57 (24)	20 (22)	29 (21)	147 (23)
51–60 y	26 (15)	65 (27)	17 (19)	43 (31)	151 (24)
>61 y	3 (2)	11 (5)	5 (6)	18 (13)	37 (6)
Educational level, n (%)					
No academic degree	34 (20)	74 (31)	4 (5)	34 (25)	146 (22)
Bachelor's degree	120 (70)	135 (56)	64 (72)	86 (62)	405 (63)
Master's degree or equivalent	18 (10)	31 (13)	20 (22)	13 (9)	82 (13)
Doctoral degree	0 (0)	0 (0)	1 (1)	2 (1)	3 (1)
Other	0 (0)	0 (0)	0 (0)	4 (3)	4 (1)
Time since graduation as a radiographer, n (%)					
<5 y	61 (36)	66 (27)	17 (19)	38 (27)	182 (29)
6–14 y	58 (34)	59 (25)	27 (30)	36 (26)	180 (28)
15–24 y	35 (20)	55 (23)	22 (25)	18 (13)	130 (20)
25–34 y	14 (8)	41 (17)	17 (19)	19 (14)	91 (14)
>35 y	4 (2)	19 (8)	6 (7)	28 (20)	57 (9)
Place of work, n (%)					
Health centre, regional or central hospital	97 (56)	103 (43)	25 (28)	96 (69)	321 (50)
University hospital	75 (44)	90 (37)	58 (65)	39 (28)	262 (41)
Private sector	0 (0)	42 (18)	5 (6)	3 (2)	50 (8)
Other	0 (0)	5 (2)	1 (1)	1 (1)	7 (1)
Main work position, n (%)					
Radiographer	148 (86)	214 (89)	69 (77)	116 (83)	547 (86)
Manager or equivalent	16 (9)	20 (8)	14 (16)	11 (8)	61 (9)
Other	8 (5)	6 (3)	6 (7)	12 (9)	32 (5)
Work experience as a radiographer, n (%)					
<5 y	61 (35)	68 (28)	20 (22)	39 (28)	188 (29)
6–14 y	61 (35)	61 (25)	32 (36)	36 (26)	190 (30)
15–24 y	30 (18)	62 (26)	19 (21)	21 (15)	132 (21)
25–34 y	15 (9)	38 (16)	14 (16)	18 (13)	85 (13)
>35 y	5 (3)	11 (5)	4 (5)	25 (18)	45 (7)

Table 2
Reported involvement in research activities (n = 208).

Type of research activity	Number of responses, (%) ^a
Planning the study	97 (47)
Writing the research protocol	63 (30)
Applying for project funding	21 (10)
Applying to ethics committee	31 (15)
Applying for hospital or other approval	36 (17)
Reviewing the background literature	54 (26)
Recruiting participants	62 (30)
Collecting the data	183 (88)
Analysing the data	76 (37)
Writing a scientific article	39 (19)
Writing an article in a professional magazine	28 (14)
Presenting results at a conference	51 (25)
Other activity	7 (3)
Total	748

^a Multiple responses allowed.

Fourteen percent (n = 89) of the respondents fully agreed and 38% somewhat agreed (n = 243) that they were aware of the current research evidence regarding their professional field of specialisation in radiography, and those who contributed to research perceived more awareness of evidence than those who did not ($X^2(3) = 41.621, p < 0.001$) (Fig. 2). Amongst the respondents, 19% (n = 121) fully agreed and 37% (n = 237) somewhat agreed that they developed current practices based on research evidence, and those who contributed to research developed EBP more than non-contributors ($X^2(3) = 48.649, p < 0.001$). The respondents preferred to discuss research evidence with their own colleagues (other radiographers), rather than with management or other professionals like physicists and radiologists (Fig. 2). Moreover, 15% (n = 93) reported that they discussed research evidence with radiography students (Fig. 3).

Discussion

Research is a key component of EBP in radiography and a fundamental pillar of radiography's identity and credibility as a distinct academic profession.¹¹ Engaging radiographers in radiography research and advancing radiographer-led research is crucial

to develop the profession's evidence base and to adopt new clinical practices.^{18,19} To the best of our knowledge, this was the first study concurrently conducted in four Nordic countries to ascertain radiographers' opinions about radiography research and involvement in research activities. A low level of research involvement (33%) was observed amongst radiographers after their graduation from radiography education, which, however, seems higher than corresponding percentages (14%–27%) in national studies.^{3,4,7,10}

Radiographers reported contributions to various research-related activities, with data collection being the main type of input. This finding is consistent with previous studies^{3,10} and indicates that radiographers are not actively involved in research. Assisting in data collection for clinical research studies, for example by taking x-rays or by conducting MRI scans to healthy volunteers, does not necessarily advance radiography research or add new knowledge to the radiography evidence base. Although radiographers contribute to data collection in such clinical studies, unfortunately their names are rarely added to the resulting article as an author. This is presumably because radiographers are not usually considered as a member of the academic research group and thus they do not have a substantive role in the research design, conduction or data analysis. Being active and joining the research group may provide a basis for excellent learning opportunities, help to advance the research skills, build up a valuable network with other researchers, and develop confidence in professional life.

This study revealed that radiographers who contributed to research were more likely to be male, have longer work experience, have a master's or higher degree, work as managers and be employed in university hospitals. The gender distribution of radiographers was unequal in the study sample; thus, the effect of gender on research contribution remains unclear. In contrast to Ooi et al.'s study,⁷ this study found that radiographers with longer work experience were more likely to be involved in research than those with less experience. One possible explanation could be that more experienced radiographers wish to take on new responsibilities and challenges within imaging departments besides their routine clinical work and thus are willing to engage in research.

The greater contribution to research was perceived amongst radiographers with a higher educational background.

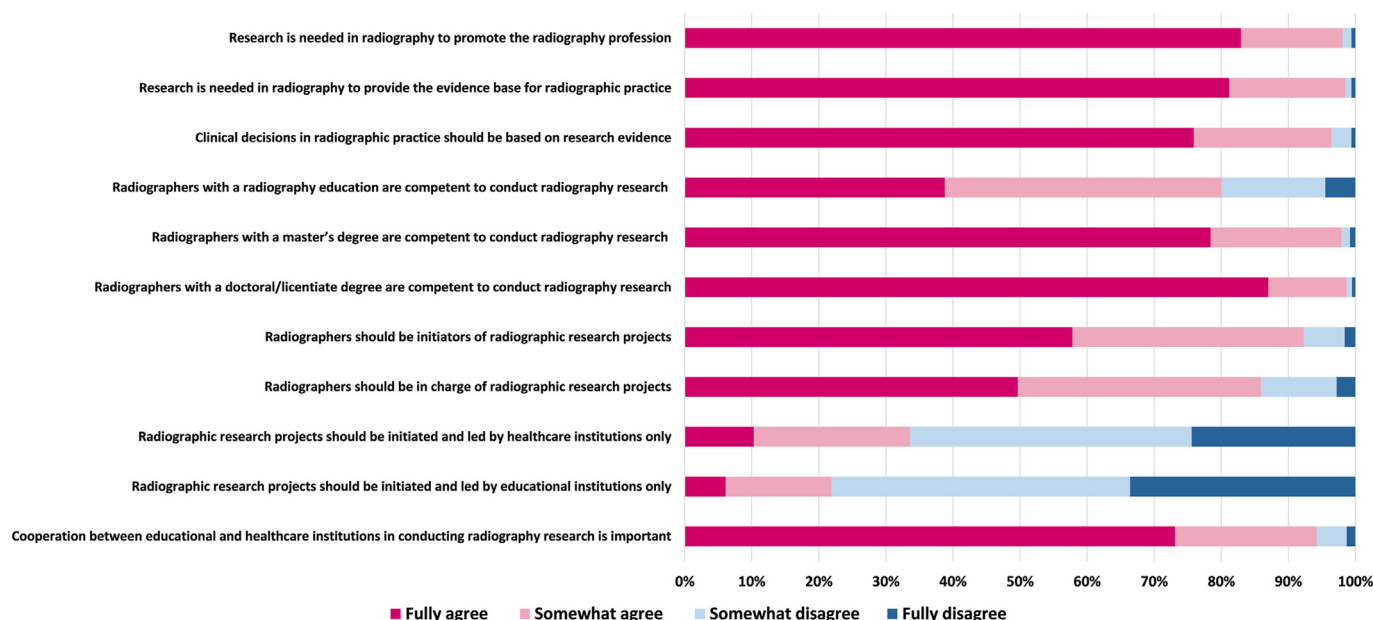


Figure 1. Opinions of responding radiographers in four Nordic countries (n = 640) about radiography research.

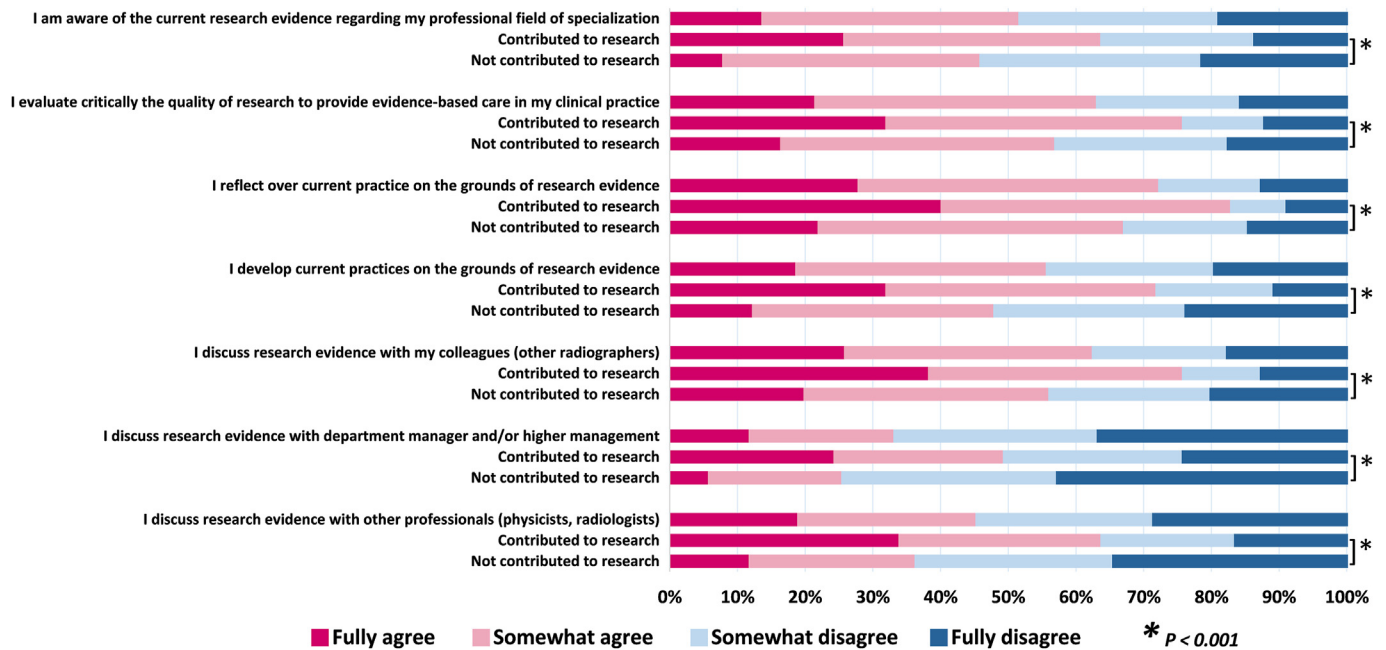


Figure 2. Level of agreement with statements regarding evidence-based practice (EBP) in radiography amongst radiographers in four Nordic countries (n = 640). Results are presented for the whole study sample and divided by the contribution to research. Chi-square analyses yielded significant differences in opinions regarding all statements between those who had contributed and those who had not contributed to research activities ($\chi^2(3) = 29.863-57.811$, $p < 0.001$ for all comparisons).

Master’s-level graduates, upon the successful completion of their studies, should be able to conduct research using appropriate methods, analyse and interpret data, write a manuscript for publication, disseminate findings locally, nationally and internationally and improve practice through EBP.²⁸ Nevertheless, in this study, only 57% of master’s degree holders reported research contributions. Further studies are needed to assess the experiences of new master’s graduates and whether the knowledge and skills obtained during their master’s degree programme meet their work requirements and responsibilities. In addition, the impact of radiographers with postgraduate education on clinical practice in imaging departments requires investigation.²⁹ The greater contribution of managers to research compared with those working as radiographers or other positions may be because most hold a master’s degree. Transitioning from being a clinical radiographer to a radiography management position after postgraduate education is a common career path in the clinical setting. The higher proportion of contribution to research amongst radiographers employed in university hospitals compared to other healthcare institutions is probably because research, innovation and education are integral to

university hospitals’ daily activities.³⁰ However, radiography research could and should be conducted in smaller healthcare institutions. They also may provide a unique research environment and facilities to conduct research in the radiography field.

As in previous studies,^{3,4,7,10} this study’s respondents had positive attitudes towards radiography research. Research was considered important for promoting the profession and providing the evidence base for radiographic practice. Although 76% of the radiographers fully agreed that clinical decisions in radiographic practice should be based on research evidence, only 14% were aware of the current research evidence regarding their professional field, and only 19% reported that they develop current practices on the basis of research evidence. Several respondents also found it difficult to critically appraise the quality of research for providing EBP. These findings imply that EBP in radiography is still not widely adopted. A shift towards EBP requires efforts to improve radiographers’ research knowledge and skills and strengthen their perceptions about the benefit of EBP. Mentoring by experienced radiographers with a higher academic degree may accelerate a shift towards EBP in radiography^{3,7} and enhance radiographers’

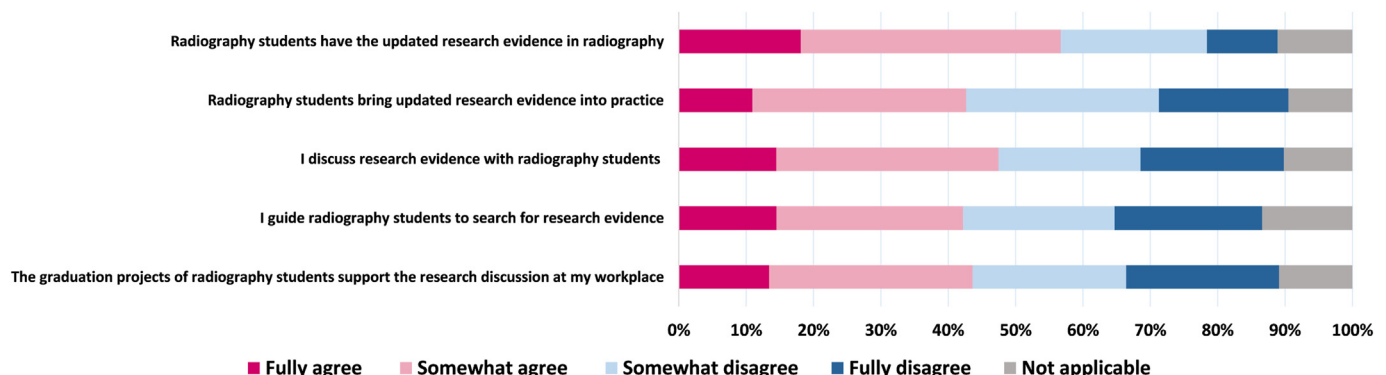


Figure 3. Opinions of radiographers in four Nordic countries (n = 640) on radiography students and evidence-based practice (EBP) in radiography.

engagement in research.¹¹ This is supported by this study's results, which showed that radiographers preferred to discuss research evidence with their own colleagues and that radiographers with doctoral and master's degrees were predominately considered competent to conduct radiography research. Discussing research evidence with radiography students seems to be uncommon among radiographers, as only 15% of the respondents fully agreed with this statement. The rush and heavy workload in daily work could partly explain this finding.

This study has strengths and limitations. The content validity evaluation of the questionnaire (literature review, evaluation by experts and field testing) used in this study supports the study results' validity. The 14% response rate is relatively low, but similar response rates have been reported.¹⁰ Despite the reasonably large sample size, the convenience sampling of radiographers may limit the representativeness of the findings and thus their generalisation to the whole population of radiographers across Nordic and other countries. The potential effects of selection bias cannot be completely excluded, as it is possible that radiographers who were unfamiliar with research and EBP declined to answer the questionnaire.

Conclusion

This study provided an overview of the research involvement and the opinions towards radiography research amongst radiographers in four Nordic countries. The results indicate that, although radiographers had positive attitudes towards radiography research and considered it important for their profession and radiographic practice, their involvement in research and utilisation of research evidence in practice is low. This highlights the need for strategies to improve radiographers' knowledge and skills related to EBP, stimulate their engagement in research activities and encourage them to take a leading position in radiography research.

Conflict of interest statement

The authors declare that they have no conflict of interest regarding the publication of this article.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.radi.2021.02.002>.

References

1. Snaith B. Evidence based radiography: is it happening or are we experiencing practice creep and practice drift? *Radiography* 2016;**22**(4):267–8. <https://doi.org/10.1016/j.radi.2016.06.004>.
2. Hafslund B, Clare J, Graverholt B, Nortvedt MW. Evidence-based radiography. *Radiography* 2008;**14**(4):343–8. <https://doi.org/10.1016/j.radi.2008.01.003>.
3. Ahonen S-M, Liikainen E. Radiographers' preconditions for evidence-based radiography. *Radiography* 2010;**16**(3):217–22. <https://doi.org/10.1016/j.radi.2010.01.005>.
4. Abrantes AFCL, Ribeiro LPV, da Silva CA, England A, Azevedo KB, Almeida RPP, et al. Evidence-based radiography: a new methodology or the systematisation of an old practice? *Radiography* 2020;**26**(2):127–32. <https://doi.org/10.1016/j.radi.2019.09.010>.
5. Munn Z. Why isn't there an evidence-based radiography? Reflections and a call to action. *Radiography* 2020;**26**(Suppl. 2):S14–6. <https://doi.org/10.1016/j.radi.2020.05.005>.
6. Murphy CN, Sharp RL. Evidence-based practice for medical radiation technologists. *J Med Imaging Radiat Sci* 2009;**40**(4):148–54. <https://doi.org/10.1016/j.jmir.2009.09.006>.
7. Ooi C-C, Lee SH-E, Soh BP. A survey on the research awareness and readiness among radiographers in Singapore General Hospital (SGH). *Radiography* 2012;**18**(4):264–9. <https://doi.org/10.1016/j.radi.2012.06.004>.
8. Sackett DL, Rosenberg WM, Gray JA, Haynes RB, Richardson WS. Evidence based medicine: what it is and what it isn't. *BMJ Clin Res Ed* 1996;**312**(7023):71–2. <https://doi.org/10.1136/bmj.312.7023.71>.
9. Smith T. Evidence based medical imaging (EBMI). *Radiography* 2008;**14**(3):233–7. <https://doi.org/10.1016/j.radi.2007.02.006>.
10. Vikestad KG, Hafskjöld L, Kjelle E, Sebuødegård S, Hofvind S. Radiographers' opinions on radiography research in Norway – a national survey. *Radiography* 2017;**23**(2):135–40. <https://doi.org/10.1016/j.radi.2010.01.005>.
11. England A, Thompson JD. Evolving the landscape of research. *Radiography* 2019;**25**(Suppl. 1):S1–3. <https://doi.org/10.1016/j.radi.2019.07.003>.
12. Metsälä E, Ström B, Kurtti J, Wedfall L, Pulkkinen M, Hafslund B. Evidence-based radiography in education. *J Clin Radiogr Radiother* 2012;**6**(1):4–11.
13. England A, McNulty JP. Inclusion of evidence and research in European radiography curricula. *Radiography* 2020;**26**(Suppl. 2):S45–8. <https://doi.org/10.1016/j.radi.2020.04.018>.
14. European Federation of Radiographer Societies. *EFRS statement on radiography education*. Utrecht: European Federation of Radiographer Societies; 2019.
15. European Federation of Radiographer Societies. *European Qualifications Framework (EQF) level 6 benchmarking document: radiographers*. Utrecht: European Federation of Radiographer Societies; 2018.
16. Higgins R, Hogg P, Robinson L. Towards a research informed teaching experience within a diagnostic radiography curriculum: the level 4 (year 1) student holistic experience. *Radiography* 2013;**19**(1):62–6. <https://doi.org/10.1016/j.radi.2012.08.006>.
17. Higgins R, Robinson L, Hogg P. Integrating research-informed teaching within an undergraduate diagnostic radiography curriculum: results from a level 4 (year 1) student cohort. *Radiography* 2014;**20**(2):100–6. <https://doi.org/10.1016/j.radi.2014.02.002>.
18. Hogg P, Alrehily F, Sá dos Reis C, Buissink C, Erenstein H, Voet M. Inspiring radiographers to engage in research. *Radiography* 2020;**26**(Suppl. 2):S69–70. <https://doi.org/10.1016/j.radi.2020.04.006>.
19. Paulo G. Radiographer research in radiation protection: national and European perspectives. *Radiography* 2020;**26**(Suppl. 2):S42–4. <https://doi.org/10.1016/j.radi.2020.05.006>.
20. Streiner DL, Norman GR, Cairney J. *Health measurement scales: a practical guide to their development and use*. 5th ed. Oxford: Oxford University Press; 2015.
21. Vetter TR, Cubbin C. Psychometrics: trust, but verify. *Anesth Analg* 2019;**128**(1):176–81. <https://doi.org/10.1213/ANE.0000000000003859>.
22. World Health Organization. Process of translation and adaptation of instruments. http://www.who.int/substance_abuse/research_tools/translation/en/.
23. Sousa VD, Rojjanasrirat W. Translation, adaptation and validation of instruments or scales for use in cross-cultural health care research: a clear and user-friendly guideline. *J Eval Clin Pract* 2011;**17**(2):268–74. <https://doi.org/10.1111/j.1365-2753.2010.01434.x>.
24. Finnish National Board on Research Integrity TENK. *The ethical principles of research with human participants and ethical review in the human sciences in Finland*. Helsinki: Finnish National Board on Research Integrity TENK; 2019.
25. The Swedish Rikstad. *Act (2003: 460) on ethical review of research involving humans*. Ministry of education and research; 2003.
26. European Parliament, European Council. Regulation (EU) 2016/679 of the European Parliament and of the council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing directive 95/46/EC (general data protection regulation). *Off J Eur Union* 2016;**59**. L 119/1.
27. World Medical Association. World Medical Association Declaration of Helsinki. Ethical principles for medical research involving human subjects. *Nurs Ethics* 2002;**9**(1):105–9. <https://doi.org/10.1191/0969733002ne486xx>.
28. European Federation of Radiographer Societies. *European Qualifications Framework (EQF) level 7 benchmarking document: radiographers*. Utrecht: European Federation of Radiographer Societies; 2017.
29. Mubuuke AG, Pope E. Factors that influence radiographers' decisions to pursue postgraduate education: an exploratory qualitative study. *J Med Imaging Radiat Sci* 2015;**46**(2):223–30. <https://doi.org/10.1016/j.jmir.2014.11.002>.
30. Oslo University Hospital. Research strategy 2016–2020. https://oslo-universitetssykehus.no/Documents/Research_strategy_2016-2020_Oslo_University_Hospital_Final.pdf.