



Radiographers' actions and challenges when confronted with inappropriate radiology referrals

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Abstract

Objectives To explore radiographers' actions toward inappropriate referrals and hindrances to assessing referrals.

Methods An online survey was distributed to radiographers via the International Society of Radiographers and Radiological Technologists (ISRRT) networks. The questionnaire consisted of 5-point Likert scale questions on radiographers' actions to supplement referral information, actions for unjustified referrals and hindrances to referral assessment. The questionnaire was validated using a test–retest reliability analysis. Kappa values ≥ 0.6 were accepted. SPSS software was used for data analysis and chi-square tests to compare subgroups.

Results Total responses received were 279. The most reported actions to supplement missing referral information were to ask the patient or relative, examine the body region of concern and check medical records (73%, 70%, 67%, responded often/always, respectively). The actions when confronted with unjustified referrals were reported equally to consult the radiologist, referring clinician and radiographer (69–68% often/always responses). The hindering factors ranked high (agreed/strongly agreed responses) pertained to inadequate information in referral forms (83%), ineffective communication among healthcare professionals (79%), lack of training (70%) and allocated time (61%). Statistically significant associations were observed for a few actions and hindrances with education level, modality of practice and responsibility to screen imaging referrals.

Conclusion Radiographers consult colleagues about suspected unjustified referrals. Effective communication pathways, training and time allocation to improve radiographers' skills to assess referrals may enhance appropriate imaging and delivery of quality patient care.

Key Points

- Radiographers' actions of supplementing missing information in radiology referrals facilitate provision of high-quality health services.
- Radiographers' strategy when confronted with inappropriate referrals is to consult radiologists and referring clinicians.
- Better inter-professional communication and organisation of tasks can facilitate radiographers' participation in referral assessment to ensure appropriate imaging.

Keywords Referral and consultation · Radiology department hospital · Delivery of health care

Abbreviations

ISRRT International Society of Radiographers and Radiological Technologists

Introduction

In referring a patient for a radiological procedure, a medical clinician (or physician) sends a referral form to consult the radiology department for possible imaging [1, 2]. The referral is evaluated against the clinical data supplied by the referrer [3] with adherence to referral guidelines [2]. The referrer must provide sufficient patient clinical information to enable the radiologist to determine whether there is a sufficient net benefit in performing the procedure [4]. This adheres to the radiation protection principle of justification, to determine that the use of a given radiological procedure yields benefits to the individuals undergoing the procedure.

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Justification of imaging aligns with basic patient safety and accepted ethics in medicine [5], and ensures better use of radiology resources from a health economic perspective [6].

Radiographers possessing advanced education and specialised training in justifying imaging may have an agreed scope of entitlement to perform justification tasks depending on state legislations [7]. Authorisation or using pre-justification guidelines as determined by the radiologists is also available for radiographers to assess referrals for imaging [8]. As part of routine clinical practice, radiographers also review the referral information before performing the radiological procedure [9]. If discrepancies are observed, the radiologist or referring clinician should be consulted. In this study, justification, authorisation and general pre-procedural review of referral information are termed ‘referral assessment’.

Radiographers are vital in the justification process as they are centrally positioned to act as an interface between the referring clinician, radiologist and patient [1, 4]. The role of radiographers in the radiology referral process is poorly mapped and needs careful evaluation to ensure quality radiology services. This study aims to explore the radiographers’ participation in assessing referrals concerning justified imaging in clinical practice. The actions that radiographers do to supplement missing information and when confronted with unjustified referrals, and the hindrances faced during the referral assessment tasks are analysed. Furthermore, the study analyses associations between the actions of radiographers when confronted with clearly unjustified referrals and the hindrances to referral assessment participation with their education level, delegated responsibility for screening imaging referrals and modality of practice.

Methodology

Ethical approval was obtained from the Norwegian Centre for Research Data (NSD) reference number 472337 in Norway.

Development of online questionnaire

A questionnaire (Supplementary Appendix 1) was developed informed by literature review on the topic including a survey on radiographers’ competencies in referral assessment [10]. A pilot online survey was conducted in January 2020 through sending the questionnaire using ‘Nettskjema’ [11] to radiographers working in 6 different countries (Norway, United Kingdom (UK), Canada, Uganda, Ireland and South Africa). The survey was sent twice 10 days apart to allow for test–retest reliability. A final of 8 responses were received. A weighted kappa analysis was used to determine agreement for categorical data between the repeated measures.

McHugh [12] states that kappa values below 0.6 indicate inadequate agreement among the raters, thus reduced reliability. All questions that were below 0.6 kappa value were removed or adjusted according to the participants’ comments for the final survey.

The final questionnaire consisted of two main parts in addition to the background information. This study reports on the first part covering the questions on actions of radiographers when confronted with inappropriate referrals. The following two questions were asked with six actions listed and using a 5-point Likert scale (always, often, sometimes, rarely, never):

- Assuming you receive referrals with missing or unclear information, how often do you supplement the information by the following actions?
- Assuming you receive referrals with all relevant information included, but the requested examination is clearly not appropriate/justified, how often do you carry out the following actions?

The participants were also asked to rate their agreement (scale: strongly agree, agree, undecided, disagree, strongly disagree) on reasons that hindered them from taking part in referral assessment. A set of 10 possible reasons were listed.

The background section included demographics and professional characteristics of the participants. The participants were asked to state their main area (modality) of diagnostic radiography experience with options including conventional radiography, one advanced imaging (computed tomography (CT), magnetic resonance imaging (MRI), ultrasound, mammography or nuclear medicine) or multiple areas. The participants were further asked to indicate the final referral assessor before a patient’s radiology examination is scheduled to be performed for each imaging modality in their work place. The participants also stated if they were delegated a responsibility for screening imaging referrals in their clinical practice.

Recruitment of participants and data collection

The final survey was distributed using ‘Nettskjema’ [11]. The target population were radiographers who follow activities organised by the International Society of Radiographers and Radiological Technologists (ISRRT). This target group was chosen because it mainly constitutes radiographers who are active in the profession and familiar or well orientated with practice regulations in their country. The survey was distributed to radiographers through the ISRRT networks, which included registered participants of the cancelled ISRRT 2020 World Congress due to the coronavirus (COVID-19) and active radiographers on ISRRT Facebook page or within ISRRT member state national societies. The

acknowledgements to distribute the survey were received from eight ISRR national societies. The data was collected in 5 months, initially in April 2020 before the COVID-19 measures were implemented and between September and December 2020. The number of national society's members was registered to get an idea of how many radiographers the survey invitation could have possibly reached.

Data analysis

The data was analysed using IBM SPSS statistical software version 26. Descriptive analysis was used to show frequency in percentages. In the analysis, the 5-point Likert scales were re-coded into a 3-point scale, by merging the two responses at each end of the scales, to ease the interpretation and presentation of distribution of responses. The chi-square test of independence was used to determine association for the radiographers' actions when confronted with clearly unjustified referrals and hindrances to assessing referrals, with the independent variables: dichotomised *education level* (bachelor degree/equivalent versus master/PhD degree), *delegated responsibility to screen imaging referrals* (not sure/no versus yes) and 3 split *modality of practice* (conventional radiography versus one advanced modality versus multiple modalities). A p value ≤ 0.05 was considered statistically significant.

Results

Respondents and setting characteristics

The total number of respondents was 279. This represents a range from 0.1 to 6.8% of total member numbers as listed by the national radiography society. The respondents' demographics are displayed in Table 1. The majority of the respondents were from Asia (Indonesia/Taiwan) ($n=77$), the UK ($n=64$), Scandinavia (Norway/Denmark) ($n=33$) and Australia ($n=31$). The mean age was 38 years. The majority (74%) of the participants' education level was at bachelor's degree or equivalent. A total of 84% of the respondents reported currently working in clinical practice. The respondents worked or had experience from a broad range of modalities: conventional radiography (35%), one advanced modality (32%) and multiple areas (33%) which were inclusive of all imaging modalities and interventional radiography.

Radiographers' responsibility in referral assessment

A total of 75% of respondents who reported currently working in clinical practice ($N=233$) stated they are delegated the responsibility to screen imaging referrals. The radiographer

Table 1 Demographic and professional characteristics of respondents ($N=279$)

Demographic and characteristics		n (%)
Continent/country	Asia (Indonesia/Taiwan)	77 (28)
	UK	64 (23)
	Scandinavia (Norway/Denmark)	33 (12)
	Australia	31 (11)
	Canada	12 (4)
	African countries ¹	21 (7)
Gender	Other countries ²	41 (15)
	Male	131 (47)
Age (years)	Female	148 (53)
	< 30	71 (26)
	30–44	127 (46)
Education level	45+	80 (29)
	PhD	16 (6)
	Master	56 (20)
Currently in clinical practice	Bachelor or equivalent	207 (74)
	Yes full/part time clinical	233 (83)
Modality of main experience	No	46 (17)
	Conventional X-ray	98 (35)
	One advanced imaging modality ³	90 (32)
	Multiple imaging modalities	91 (33)

¹African countries; majority of respondents from Rwanda

²Other countries included Bangladesh, Cambodia, China, Estonia, Germany, Greece, Guyana, Ireland, Italy, Myanmar, Nepal, Netherlands, New Zealand, Palestine, Philippines, Singapore, Sultanate of Oman, the USA and Vietnam

³Advanced modality included CT, MRI, ultrasound, mammography or nuclear medicine

was stated as final assessor before a patient's radiology examination is scheduled for conventional radiography by 55% of the respondents. The overall commonly reported practice, across the imaging modalities, is that radiographers mainly perform the referral assessing tasks together with the radiologists particularly for advanced modalities (Table 2).

Radiographers' actions to supplement information

The respondents' main actions to supplement missing information were reported as often/always, to ask for information from the patient or accompanying relative (73%) and examining the body region of concern 70% (Fig. 1). These were followed by checking patients' medical records (67%). The respondents further reported slightly more often/always to discuss with the referring clinician (59%) than with the radiologist (55%) when seeking to supplement information.

Fewer respondents (34%) reported often/always to discuss with the patients' care provider.

Actions to justify imaging

The respondents reported to equally often/always consult the radiologist (69%), referring clinicians (69%) and a

fellow radiographer (68%), when confronted with clearly unjustified referrals (Fig. 2). Fewer respondents reported to often/always return the referral along with a reason (36%) or change the referral to an appropriate examination (32%). The least frequent reported action was to conduct examinations as requested; however, 25% of the respondents reported the action as conducted often/always.

Table 2 Reported final assessors before a patient's radiology examination is scheduled for various modalities (percentages), *N* = 233

Modality	Not applicable	Other	Radiologists only	Radiographers/Radiologists	Radiographers only
Conventional radiography	5	4	5	32	55
CT	13	1	18	50	18
MRI	20	0.4	19	48	13
Ultrasound	11	6	24	40	20
Mammography	37	2	10	26	25
Nuclear medicine	54	3	14	23	7

Fig. 1 Radiographers' reported actions to supplement missing referral information, percentages (*N* = 233); only participants currently working in clinical practices responded

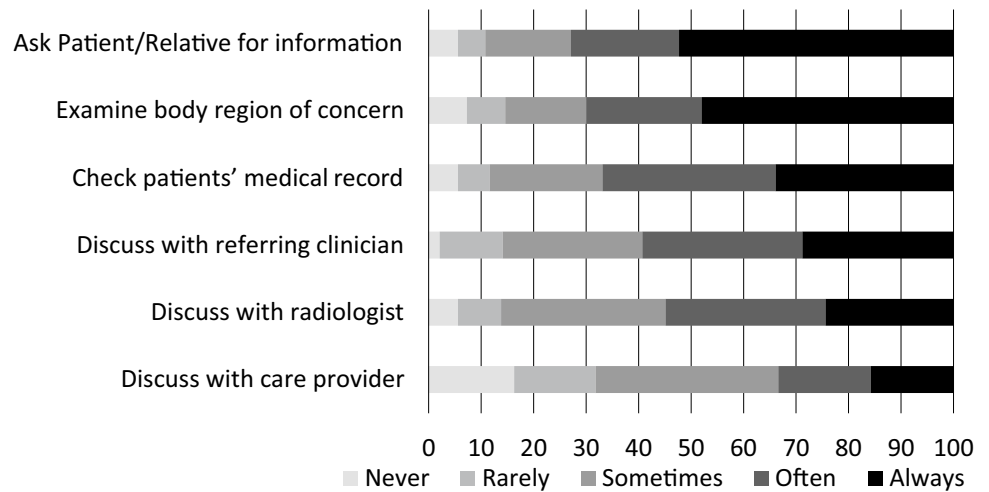
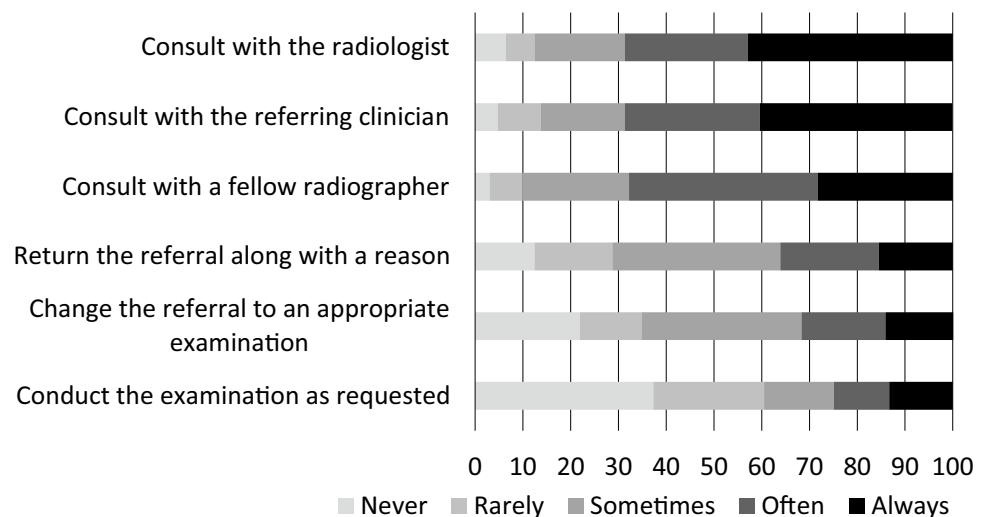


Fig. 2 Radiographers' reported actions when confronted with unjustified referrals, percentages (*N* = 233); only participants currently working in clinical practices responded



A chi-square test showed statistically significant association as follows: Radiographers with bachelor's degree or equivalent more often reported to consult the radiologist compared to radiographers at masters or PhD level (70% vs. 63% often/always answers, $\chi^2 = 7.697$ (df)2, $p = 0.021$) and a fellow radiographer (73% vs. 51.0% often/always answers, $\chi^2 = 9.125$ (df)2, $p = 0.010$). Furthermore, the radiographers working in advanced or multiple modalities reported to consult the radiologist more frequency than those in conventional radiography only (77% and 73% vs. 56.3% often/always answers $\chi^2 = 11.210$, df (4), $p = 0.024$). Finally, radiographers with the delegated responsibility to screen imaging referrals reported to more often return an unjustified referral to the referring clinician with giving a reason than those without the delegated responsibility (39% vs. 28% often/always answers, $\chi^2 = 14.450$, df (2), $p = 0.001$). There were no observed statistically significant associations for other analysed actions.

Hindrances for radiographers' referral assessment

The main reported hindrances to radiographers' referral assessment are related to communicational and organisational factors in the referral process (Fig. 3). The communication factors ranked high agree/strongly agree, as hindrances for assessing referrals were inadequate information in referral forms (83%) and ineffective communication among

healthcare professionals (79%). The least reported hindrance in the communication category was lack of response from radiologists when ask about referral appropriateness (54%).

For the organisational factors, 70% of the respondents agreed/strongly agreed that lack of training in systematic assessment of referrals and 61% agreed/strongly agreed that lack of time allocation for assessing referrals were a hindrance. The least hindrance in the organisational category was patients showing up in the department before the referral is assessed, reported agree/strongly agree by 56% of the respondents.

The other factors relate to the radiographers' professional role and ability. A total 68% of respondents agreed/strongly agreed that cultures of medical profession dominance was a hindrance. The three suggested hindrances receiving the lowest scores for radiographers ability were lack of knowledge of clinical benefits of different imaging modalities, assessing of referrals perceived as not radiographers' responsibility and lack of knowledge of radiation dose rated 57%, 46% and 37% agree/strongly agree responses respectively.

A chi-square test showed few significant associations between hindrances and the three background variables (level of education, modality of practice and delegated the task to screen referrals). Only two significant associations were observed in the professional role and ability category. Radiographers delegated the task to screen referrals tend to consider perceiving referral assessment not a radiographers' responsibility as a hindering factor (43% vs. 26% strongly agree/agree answers, $\chi^2 = 5.915$ (df)2, $p = 0.05$).

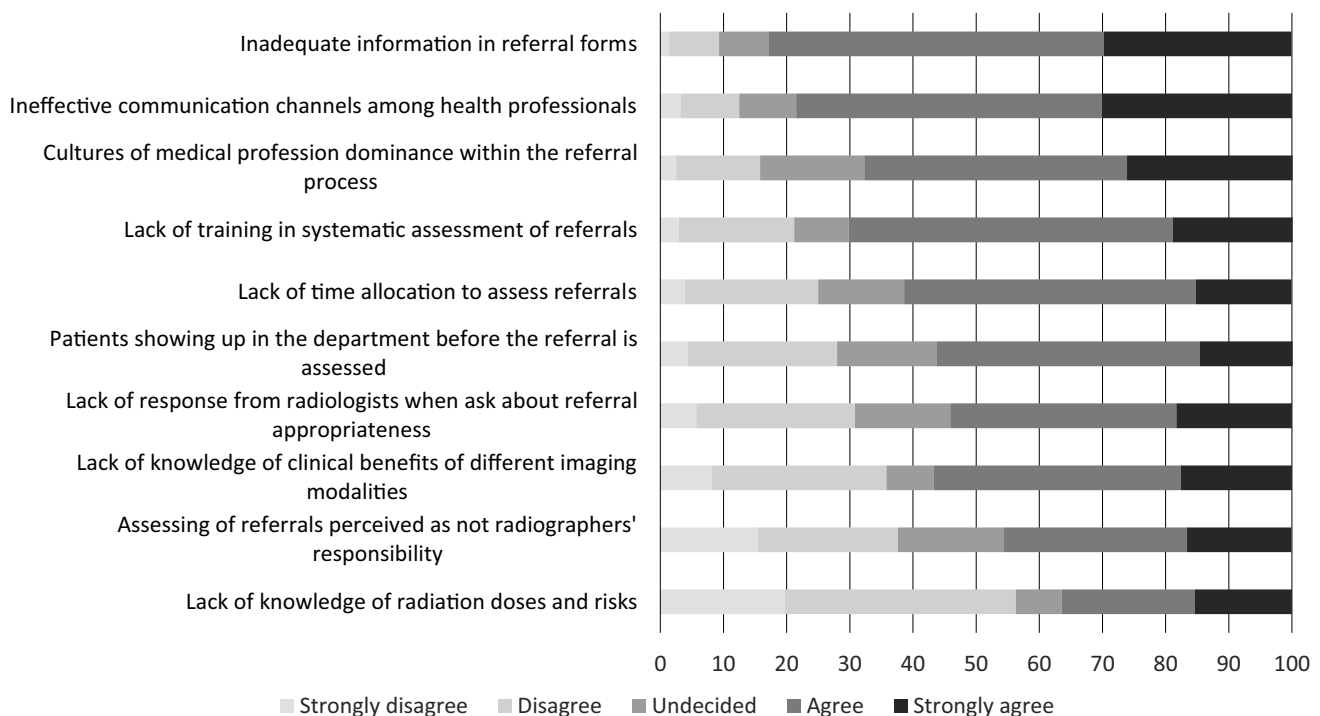


Fig. 3 Radiographers' reported hindrances to assessing referral percentages ($N = 279$)

Radiographers with a bachelor's degree or equivalent reported lack of knowledge of clinical benefits of different imaging modalities as a hindrance to participation compared to those with masters or PhD degree (33% vs. 43% strongly disagree/disagree answers, $\chi^2 = 6.286$ (df)2, $p = 0.04$).

Discussion

This study shows radiographers' participation in referral assessment in several ways and across all imaging modalities, which is important for delivery of quality care in radiology departments [1, 9], and potentially enable solutions for organised task-sharing between radiologists and radiographers [1].

Radiographers' actions to improve the referral assessment process

Our study shows radiographers supplementing missing information mainly through patient interactions. The radiographer-patient interactions are reported to assist radiographers to validate the referral information before conducting the radiological examination [13]. During such interactions, radiographers can recognise discrepancies in the referral form and obtain more information about the patient's medical condition, thus improving the quality of clinical information [9]. This assists to improve the justification process [14]. Furthermore, high-quality patient clinical information positively affects the radiologists' selection of imaging protocols [15], image interpretation accuracy and the radiology reports [16]. The clinical information also assist radiographers with decisions of patient positioning, imaging projections, exposure parameters and dose-optimisation, adding to patient safety [17].

When confronted with clearly unjustified referrals, our respondents tend to seek advice from the radiologist, referring clinician or a fellow radiographer. Particularly for advanced imaging, radiographers in our study report mostly to consult the radiologist. Consultation among healthcare professionals is advocated to enable effective justification of medical exposures [2]. Particularly imaging for non-standard protocols requires consultation and approval by the radiologist [3, 18]. Consultations among healthcare professionals are also important to clarify the best path for the patient and to ensure that all involved are looking out for the patient's needs [13]. Therefore, actions of consulting and discussing with both the referring clinicians and radiologist when confronted with unjustified referrals add to the patients' healthcare management.

In our study, few radiographers (36%) reported to often/always return an inappropriate referral to the referrer with a reason. Encouragingly the radiographers assigned the task to screen referrals showed to more likely return a referral with

giving a reason. Returning a referral could be due to factors such as the requested examination not the best to answer the clinical question [19], repeated referrals without clear rationale [20] or improper timing of the procedure [21]. Patient's safety or contraindications are other factors, such as imaging for pregnant patients or in MRI referrals where the patient has metal implants in the body [22]. Where a referral is returned, it is advisable to document the reasons and inform the referring clinician. This further improves the patients' clinical information and adds to the quality of patient care [23].

Challenges to radiographers' participation and effects on patient care

Our study identifies two main categories of local circumstances that hinder radiographers to effectively participate in referral assessment: communicational and organisational factors. Inadequate information in referral forms and ineffective communication among healthcare professionals were identified as the main communication factors. Inadequately filled clinical information hinders an effective justification process [4]. Promoting the importance of sufficient clinical information, accompanied by use of referral guidelines and decision support tools, could be of benefit [24–26]. The quality of inter-professional communication is vital to reduce adverse effects that could affect the patients' referral management [22, 27]. Fatahi et al. [28] recommend joint discussions on indications, imaging methodology and routines, including imaging prioritisation ethics. Fatahi et al. [27] specifically report that quality radiologist-radiographer communication enhances the radiographers' skills in clinical practice, thus adding to the patients' safety and care. To promote smooth workflow and reduced interruptive verbal communication among the healthcare professionals, informatics tools with instant messaging systems could be of value in busy departments [29]. Strong inter-professional relationships further allow for direct communication among healthcare professionals, promoting better exchange of patient information [30].

In this study, lack of training and of time allocated to referral assessment tasks were reported as organisational hindrances for radiographers' participation. Training and time allocated for referral assessment tasks improve radiographers' skills and competencies within the justification process [31, 32].

The other reported hindrances relate to radiographers' professional role and ability. Cultures of medical dominance were rated quite high as hindrances in our study. This could be an indication of the reported prevalent cultures of medical dominance in radiology departments [33–35]. However, it could also reflect the radiographers' feeling of being in a subordinate position due to their lower medical and clinical knowledge to perform the task. Our study indicates that participation in tasks of referral assessment promotes a sense

of professional responsibility for the radiographers. This can create a platform for positive accountability where one critically assesses their way of clinical practice [36]. This further adds to the radiographers' vigilant practices to ensure presence of the justification process [9].

Potential bias, limitations and strengths of the study

The number of responses in the study is certainly very low compared to the high number of radiographers worldwide. In adherence with the European General Data Protection Regulation, the survey was not distributed directly to individual participants, but through the ISRRT networks to avoid collection of personal emails. Therefore, the study is potential to selection bias as only participants who had access to and information from ISRRT organisation networks were able to view and respond to the survey. This further reduces the amount of potential participants reached. Language also contributed to non-responses as the survey was only in English. The sample analysis for the hindrances to referral assessment included a proportion of radiographers (17%), not currently working in clinical practice. This could further affect the representative nature of respondents. However, this group was included to gain knowledge of the issue from both clinical and administrative or academic perspectives. Various other organisational settings and country legislations pertaining to the individual radiographers' work environment are not considered. The radiography education level and content vastly vary among countries and institutions of learning. The competencies and level of responsibility in referral assessment will therefore differ among radiographers at similar degree level internationally. Only the radiographers' perceptions are investigated; thus, the reported challenges could be bias in support of the profession. The study was however explorative to get an impression on the role and attitudes of radiographers' participation in referral assessment, broadly across settings and countries. The sample group was mainly radiographers well versed in the profession. Despite the low response rate, the results create a platform for further research on how the radiography profession can contribute efficiently to justification of imaging referrals.

Conclusion

The radiographers' actions of supplementing clinical information and consulting colleagues about inappropriate referrals improve the workflow and the quality of patient services. Promoting inter-professional relationships, providing training and allocating time for referral assessment will improve participation and competencies of radiographers. Policies on

the required training for radiographers assessing referral at the stages of justification, authorisation and general referral review are vital. Future research should focus on clearly identifying education requirements including theoretical and practical aspects for radiographers performing justification and authorisation tasks.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s00330-021-08470-z>.

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Declarations

Guarantor The scientific guarantor of this publication is Professor Kristin Bakke Lysdahl, Department of Optometry, Radiography and Lighting Design, Faculty of Health and Social Sciences, University of South-Eastern Norway (USN).

Conflict of interest The authors of this manuscript declare no relationships with any companies whose products or services may be related to the subject matter of the article.

Statistics and biometry No complex statistical methods were necessary for this paper.

Informed consent Written informed consent was obtained from all subjects in this study.

Ethical approval Institutional Review Board approval was obtained from the Norwegian Centre for Research Data (NSD), approval reference number 472337.

Methodology

- prospective
- observational
- multicenter study

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