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Radiographers’ role in justification of medical imaging examinations

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ABSTRACT

Introduction: Justification is one of the fundamental principles in radiation protection and according to the ICRP justification means that any decision that alters the radiation exposure situation should do more good than harm. The purpose of this study was to explore diagnostic radiographers’ attitude towards their role in justification, and to assess the perceived need for justification discussions with peers and the ability to reject unjustified referrals during day, evening, and night shifts.

Methods: This study was conducted in Norway and Denmark. A questionnaire was developed in Norwegian and translated into Danish, and two experienced radiographers assessed content validity. A secure online data capture solution was used, and the questionnaire was distributed to radiographers working in clinical settings in March and April 2022 (n = 1215).

Results: A total of 202 radiographers were included in the study, 93 from Norway and 109 from Denmark, respectively. Seventy-nine per cent of the radiographers reported that they had a duty to assess justification and 86 % did so daily. Their role in justification assessment was reported as relatively important, where CT and MRI had significantly different results than the total respondents. Radiologists were designated as being most responsible in the assessment, closely followed by referring doctors and radiographers. The most important criterion for justification assessment was the referring doctor’s clinical assessment. The need to confer was highest during daytime when there were also more opportunities to confer.

Conclusion: The need to discuss justification of examinations is greater during daytime when access to radiologists is also high, while both access and need are low during night shifts. Further research is needed to explain the latter finding. Radiographers who engage in daily justification assessments, and perceive it as a duty, find justification important and report having sufficient knowledge to carry out these assessments.

RÉSUMÉ

Introduction: La justification est l’un des principes fondamentaux de la radioprotection et, selon la CIPR, elle signifie que toute décision qui modifie la situation d’exposition aux rayonnements doit faire plus de bien que de mal. L’objectif de cette étude était d’explorer l’attitude des radiographes diagnostiques vis-à-vis de leur rôle dans la justification, et d’évaluer le besoin perçu de discussions sur la justification avec leurs pairs et la capacité à rejeter les références injustifiées pendant les quarts de jour, de soir et de nuit.

Méthodologie: Cette étude a été menée en Norvège et au Danemark. Un questionnaire a été élaboré en norvégien et traduit en danois, et deux radiographes expérimentés ont évalué la validité du contenu. Une solution sécurisée de saisie des données en ligne a été utilisée et le questionnaire a été distribué aux radiographes travaillant en milieu clinique en mars et avril 2022 (n = 1 215).

Résultats: Au total, 202 radiographes ont été inclus dans l’étude, 93 en Norvège et 109 au Danemark. Soixante-dix-neuf pour cent des radiographes ont déclaré qu’ils avaient le devoir d’évaluer la justifica-
tion and 86% of those surveyed felt that the justification was relatively important, the results of the TDM and the IRM were significantly different from those of the ensemble of respondents. The radiologists were rated as the principal responsible for the evaluation, followed by the medical practitioners and the radiographers. The criteria for the evaluation of justification were the evaluation clinic of the medical practitioner. The use of this concert was the highest during the day, where the occasions of not to concert were also more numerous.

Keywords: Radiation protection; Justification; Professional issues

Introduction

Justification is one of the fundamental principles in radiation protection alongside optimisation and dose limitation. According to the International Commission on Radiological Protection (ICRP), the principle of justification is that “any decision that alters the radiation exposure situation should do more good than harm” [1]. Medical exposure of patients calls for a detailed approach to the process of justification. All medical use of radiation should be justified, and the responsibility for justification lies with the relevant professions. Relevant medical practitioners need to have special training in radiation protection to take responsibility for justification [1].

The principle of justification applies at three levels in the use of justification in medicine. At the first level, the use of radiation in medicine is accepted and taken for granted, since the radiation is doing more good than harm to the patient. The next level focuses on the procedures, and justification is needed at this level to establish whether a procedure can be used for a specific indication. The aim of this level is to judge whether the procedure will improve the diagnosis or treatment or provide necessary information [1]. At the third level, the individual patient is in focus and the particular examination or treatment should be judged to do more good than harm to the patient.

Choosing Wisely is a campaign to promote conversations between clinicians and patients to help the patients to choose care that is supported by evidence, not duplicated by other procedures already received, and ensure procedures and treatments that are free of harm and truly necessary [2]. The campaign is largely evidence-based and meant to target unnecessary and overused X-ray examinations [3]. Choosing Wisely started as an initiative of the ABIM Foundation, but is now applied by medical societies in many different countries, including radiological societies [4,5]. The aim of the campaign is to reduce overtreatment and overdiagnosis in the health care system [6]. Many examinations and treatments are not only unnecessary, but can also be harmful to patients [2].

Despite well-established referral guidelines and clinical decision support systems [7], there is strong evidence of imaging overuse across countries. For example, Klang et al. [8] recently found 37% of superfluous Head CT examinations in younger patients with minor trauma. Similarly, Rego and Nagiah [9] found that 40% of patients with simple low-back pain were referred for imaging despite the absence of relevant symptoms.

In the daily work at clinical medical imaging departments, both the second and third level of justification are an important part of the work to ensure that examinations and treatments are justified. According to ISRRRT [10], using a team approach to the justification process and the optimisation works is recommended. Collaboration between radiologists, radiographers and medical physicists may be appropriate to establish good procedures concerning justification in medical imaging departments. It is also important to include referring physicians in this work [11].

A qualitative study by Sitareni et al. [12] found that continuous communication between radiographers and referring departments is crucial. The radiographers found that such communication increased the standard of referrals and supported the radiographers in their profession.

In daily practice, it is not feasible for radiologists to assess all patient referrals. In CT and MRI, the referrals are often assessed by a radiologist prior to the examination, but this may not be the case in projectional radiography. In this situation, the radiographer will confer with a radiologist when the referral is not appropriate because of missing information or if the patient history does not support the request for imaging [10]. It is important that the radiographers understand their role in the justification process, since they have a duty to assess the justification before the exposure is undertaken [10].

The practice of justification has sufficient clinical merit, and the current guidelines require radiographers to consider justification prior to X-ray examinations [1]. According to Vorn [7], this is not a consistent practice. Barriers include medical dominance between radiographers and radiologists, and workplace culture, which may inhibit the practice of justification among radiographers [7]. On the other hand, radiographers can be gatekeepers for patients and avert unjustified X-ray exposure by discussing inadequate referrals and unjustified examinations with referring physicians and radiologists. Radiographers who participate in the decision-making process of justification may contribute to better and safer patient care [7].

Conclusion: The need to discuss the justification of examinations is more important during the day when access to radiologists is generally higher, whereas access and need are lower during the night. Further research is necessary to explain this last finding.

Les radiographies qui s’engagent dans des évaluations quotidiennes de la justification, et qui perçoivent cela comme un devoir, trouvent la justification importante et déclarent avoir des connaissances suffisantes pour effectuer ces évaluations.
In 2011, Koutalonis and Horrocks [13] conducted a survey with the aim of mapping the current situation regarding knowledge of the risks of X-ray exposure and the justification criteria applied. According to this study, radiologists and radiographers are aware of relevant legislation concerning justification of medical exposure, but there seems to be a lack of knowledge about radiation doses and related risks [13]. In terms of justification, the patient’s medical condition, age and gender, and alternative methods were the main criteria on which they based their assessment [13]. However, the agreement between radiographers’ and their peers’ perception of whether an examination is justified and the availability of relevant peers is unknown.

The purpose of this study was to explore diagnostic radiographers’ attitude toward their role in justification and to assess the perceived need for justification discussions with peers and the ability to reject unjustified referrals during day, evening and night shifts.

Methods

Study design and sample

This cross-sectional observational study was conducted in Denmark and Norway. Between March and April 2022, the questionnaire was distributed to 1215 clinical radiographers of whom 204 replied resulting in a response rate of 17%.

An electronic draft questionnaire in Norwegian was developed based on previous study results [14] using a secure online data capture solution hosted by the University of Oslo, Norway (nettskjema.no). Two experienced radiographers assessed content validity and the specific items in the questionnaire and their comprehensibility, leading to minor adjustments in the wording of one question and removal of one redundant question. The final questionnaire consisted of 21 multiple choice and Likert scale questions including demographics, involvement, opinions and experience regarding justification of radiologic examinations. The questionnaire was translated into Danish by one of the authors who is Danish but works in Norway.

Department managers at clinical radiology departments were asked to distribute the questionnaire to clinical radiographers in their departments. Potential respondents were informed in writing that participation was voluntary and anonymous, and that they gave their informed consent by answering the questionnaire.

Responses from radiographers working solely in mammography screening units were excluded from the analysis (n = 2) as the justification of screening examinations is decided politically.

Statistical analysis

Numerical data were analysed using one-way ANOVA, and categorical data were analysed using the Kruskal-Wallis test. P-values <0.05 were considered statistically significant. All analyses were performed using SPSS version 27 (IBM corp., Armonk, USA).

Ethical considerations

This cross-sectional, observational study was approved by the Norwegian Centre for Research Data (Journal no. 321808) and conducted in Norway and Denmark in accordance with the Helsinki Declaration [15].

Results

In this study, 204 radiographers were included, 93 radiographers from Norway and 109 from Denmark, respectively (Table 1). About 50% of the radiographers in both countries had more than 10 years’ experience and 25% had less than 5 years. Only a small number of the radiographers held a M.Sc or a PhD. The division between the size of the hospitals showed that a larger proportion of the radiographers worked at hospitals with more than 50 radiographers (Table 1). No apparent differences between participants from Norway and Denmark were found (table 1) and thus, the population of radiographers from the two countries will be reported as one group.

In this study, 86% of the radiographers assess justification on a daily basis, and 79% of the radiographers reported that they have a duty to assess justification. Most radiographers worked in several modalities (Table 2). The results in this study

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Demographic characteristics of the study sample.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Norway (n = 93)</td>
</tr>
<tr>
<td>Experience</td>
<td>≤5 years</td>
</tr>
<tr>
<td></td>
<td>5–10 years</td>
</tr>
<tr>
<td></td>
<td>&gt; 10 years</td>
</tr>
<tr>
<td>Academic degree</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Bachelor</td>
</tr>
<tr>
<td></td>
<td>Master</td>
</tr>
<tr>
<td></td>
<td>PhD</td>
</tr>
<tr>
<td></td>
<td>Other</td>
</tr>
<tr>
<td>No. of radiographers in department</td>
<td>≤ 50</td>
</tr>
<tr>
<td></td>
<td>&gt; 50</td>
</tr>
</tbody>
</table>

<sup>a</sup> = one-way ANOVA
<sup>b</sup> = Kruskal-Wallis Test
will mostly be presented as the combined group of all modalities, and not broken down by the various modalities.

Of the radiographers who reported that they have a duty to assess justification, 92% also assess justification during a normal working day. Among the radiographers who worked in projectional radiography, 84% reported that they had a duty to assess justification, and 94% of them also assessed justification during a normal working day. In CT and MRI, 80% and 74%, respectively, reported they had a duty, and over 90% of them assessed justification daily. The radiographers who did not report having a duty still assessed justification (Table 2).

The respondents rated the importance of the radiographer’s role in the assessment of justification on a Likert scale ranging from 1 (not important) to 10 (very important). The radiographers’ role in the justification assessment was reported as relatively important with scores from 6.31 to 8.00 as the extremes, where CT and MRI had significantly different results than the total respondents (Table 3).

The radiographers who reported they had a duty to assess justification rated the role of the radiographer as more important in the justification assessment than those who did not report having such a duty. The radiographers who assessed justification in their daily work scored higher on the importance of the role than radiographers who did not assess justification daily. The few (n = 38) who had attended a course focusing on justification in the last three years rated the importance of the radiographers’ role higher, compared to those who had not. However, this finding was not significant (p = 0.11). The difference between small and large hospitals was not significant (p = 0.085) when it comes to the rated importance of radiographers’ assessment of justification (Table 3).

In terms of responsibility, the radiographers in this study answered that the radiologist has the greatest responsibility for the assessment of justification together with the referring doctor. The radiographers themselves perceived their own profession as having great (25%) or some (52%) responsibility. Medical physicists and administrative staff were considered to have much lower levels of responsibility (Figure 1).

When assessing justification, it is most common to confer with a radiologist or another radiographer. According to the respondents, it is less common to confer with the referring doc-

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Table 2

Respondents’ answers to the question “Do you assess justification on a daily basis?” and “Do you as a radiographer have a duty to assess justification” and ratio of radiographers (n = 202) who assess justification on a daily basis in the three different possible responses on duty to assess justification, as a function of modalities.

<table>
<thead>
<tr>
<th>Respondents working in different modalities (n = 202)</th>
<th>Assess justification on a daily basis</th>
<th>Have a duty to assess justification</th>
<th>Ratio doing justification daily in the three different answers on duty</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td>Don’t know</td>
</tr>
<tr>
<td>-----------------------------------------------------</td>
<td>-----</td>
<td>----</td>
<td>------------</td>
</tr>
<tr>
<td>Projectional radiography</td>
<td>69%</td>
<td>86%</td>
<td>84%</td>
</tr>
<tr>
<td>CT</td>
<td>65%</td>
<td>85%</td>
<td>80%</td>
</tr>
<tr>
<td>MRI</td>
<td>27%</td>
<td>91%</td>
<td>74%</td>
</tr>
<tr>
<td>Ultrasound</td>
<td>46%</td>
<td>87%</td>
<td>83%</td>
</tr>
<tr>
<td>Nuclear medicine</td>
<td>1%</td>
<td>50%</td>
<td>0%</td>
</tr>
<tr>
<td>Angio / Intervention</td>
<td>17%</td>
<td>74%</td>
<td>74%</td>
</tr>
<tr>
<td>Mammography</td>
<td>2%</td>
<td>80%</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
<td><strong>86%</strong></td>
<td><strong>79%</strong></td>
</tr>
</tbody>
</table>

Table 3

Respondents’ answers to the Likert scale question “How important is the radiographer’s role in justification assessment” (1 = Not important and 10 = Very important) correlated with answers from different questions, including standard deviation (SD).

<table>
<thead>
<tr>
<th>Questions</th>
<th>Answer (n)</th>
<th>Mean</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Different modalities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projectional radiography</td>
<td>7.09 (2.02)</td>
<td>0.143</td>
<td></td>
</tr>
<tr>
<td>CT</td>
<td>6.73 (2.07)</td>
<td>0.047</td>
<td></td>
</tr>
<tr>
<td>MRI</td>
<td>7.48 (1.74)</td>
<td>0.014</td>
<td></td>
</tr>
<tr>
<td>Ultrasound</td>
<td>6.82 (2.04)</td>
<td>0.418</td>
<td></td>
</tr>
<tr>
<td>Nuclear medicine</td>
<td>7.00 (1.41)</td>
<td>0.965</td>
<td></td>
</tr>
<tr>
<td>Angio/Intervention</td>
<td>6.31 (2.26)</td>
<td>0.071</td>
<td></td>
</tr>
<tr>
<td>Mammography</td>
<td>8.00 (1.23)</td>
<td>0.120</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>6.95 (2.08)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duty to assess justification</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>7.27 (1.94)</td>
<td>0.002</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>5.71 (1.95)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of radiographers at your workplace</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 50</td>
<td>7.25 (1.93)</td>
<td>0.085</td>
<td></td>
</tr>
<tr>
<td>Over 50</td>
<td>6.74 (2.16)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attended course in the last 3 years?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>7.30 (2.13)</td>
<td>0.110</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>6.77 (2.09)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assess justification on a daily basis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>7.23 (1.96)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>5.24 (1.98)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The radiographers in the study rarely or never confer with patients or relatives (Figure 2).

The need to discuss justification is highest and the opportunities for doing so are greatest during the daytime on weekdays. When it comes to rejecting an unjustified referral, this is most often possible during the day, with least opportunity at night (Figure 3).

The criterion rated highest in terms of importance in a justification assessment was the referring doctor’s clinical assessment. Other criteria with a high score were the patient’s age and sex, the patient’s medical condition, radiation risk from the current examination and alternative modalities with less or no radiation. What radiographers considered least important when assessing justification was the examination’s financial cost and access to equipment. The patient’s psychosocial status was not highly emphasised in the assessment of justification (Figure 4).

The participants were also asked to rate the extent to which they felt they had sufficient knowledge to assess justification, using a scale from 1 to 10, where 1 indicated insufficient knowledge and 10 indicated sufficient knowledge (Table 4). There was no significant difference in relation to the modality in which the radiographers worked, compared to the overall mean score of 6.93. However, radiographers who perceived a duty to assess justification and who assessed justification on a daily basis had a significantly higher level of perceived knowledge for assessing justification compared to those who answered “no” to these two questions. The small group of radiographers who had taken a course within the last 3 years also rated their knowledge higher than the average, and significantly higher than those who had not taken such a course. There were no significant differences between radiographers working in hospitals with more or less than 50 radiographers (Table 4).

**Discussion**

The results clearly show that justification is an important part of a radiographer’s daily routine. The ICRP points out that radiographers play a key role in radiation protection [1] and they can act as gatekeepers to prevent unjustified examinations [7]. Most radiographers in this study reported that radiographers have a duty to assess justification for all modalities, and 86% of the radiographers assess justification during a normal working day. This shows that radiographers are heavily involved in the assessment of justification. The radiographers who reported that they had a duty to assess justification, also assessed justification more often than those who did not. This indicates that radiographers who focus on their role and duty in the justification assessment also carry it out to a greater extent. On the other hand, radiographers who reported that they did not have a duty to assess justification, did so nevertheless. This may indicate that they do not see justification assessment as a duty, but that it is nonetheless an important task for the radiographer profession.

The radiographers in MRI rated their role in the justification assessment as more important than the radiographers in CT, even though MRI does not expose patients to radiation. This shows that radiation is not the only factor included in the justification assessment. MR safety may be one such aspect, which can be related to both level two and three in the justification assessment; procedures and the individual patient level [1]. More than 90% of the MRI radiographers reported that they assess justification, and most of them assessed it daily. Similar results were seen in the Projectional radiography and CT, with 85% and 86%, reporting they had a duty to assess justification, respectively and more than 90% assessing justification on a daily basis.

Nevertheless, the radiographers do not believe that they have the greatest responsibility for the assessment. There is broad agreement among the radiographers that radiologists have the greatest responsibility for the justification assessment together with the referring doctor. This may relate to current legislation which indicates that it is the medical officer who has this responsibility [1]. However, this may also relate to different levels of justification. Referring doctors must assure that the examination is justified, and radiologists have a great deal of responsibility in the assessment of referrals, but usually does not see the patient. Therefore, radiographers are responsible for the final justification assessment, which may explain why they reported having great or some responsibility.

Few of the radiographers have completed courses on justification in recent years, even though they consider their own
Figure 3. At what time of the day is there A) a need to confer about justification with the referring doctor and/or radiologist, B) when is it possible to confer about justification with the referring doctor and/or radiologist and C) when is it possible to reject an unjustified examination?

Figure 4. The three most important criteria in a justification assessment. * MRI Safety (n = 5), Risk with Intra venous cannula (n = 2) and Treatment consequences (n = 1).

role in justification assessment important. This may be explained by the great focus on justification within hospitals, and that the sense of responsibility for carrying out justification assessment is not dependent on course completion, and that this is an integral part of radiographers' professional practice. The few radiographers who had attended a course in the last three years rated the importance of their role and their perceived knowledge in relation to justification as somewhat higher than those who had not attended a course. This may mean that increased knowledge helps radiographers to see the importance of their role in a different way. Lack of course implementation in recent years can be seen in the context of the
COVID-19 pandemic, where many courses were cancelled or postponed.

The criterion considered most important for assessing justification is the referring doctor's clinical assessment, underscoring the importance of referrals being adequate and containing sufficient information. Assessment of referrals promotes the professional responsibility of radiographers, and it also facilitates good cooperation with radiologists and referring doctors [16].

The five criteria that the radiographers in this study consider most important may represent different perspectives in the justification assessment: the referring doctor through their clinical assessment criterion, the patient via gender, age and medical condition, and the radiographer and radiologist through the choice of modalities and knowledge of radiation risk. This can reflect different roles in a justification assessment. The referring doctor's role as medically responsible, the patient's role based on their medical condition and rights in the form of autonomy and shared decision-making, as well as the radiographer's and radiologist's role in possessing professional knowledge of radiation doses and risks, where the radiologist will have medical responsibility.

The need to confer with a radiologist or referring doctor is present throughout the day but is greatest during the daytime when patients are largely outpatients. During daytime, the examinations are planned and may involve several specialised procedures, which may affect the need to confer. During the evening, weekend and at night shifts, the degree of immediate help is higher and the indication for the examination is possibly clearer in terms of justification. Patients who have waited for a long time for scheduled examinations during the daytime will have different medical indications than acute patients during the evening and night, potentially impacting the level of justification. Although this may explain to some extent why radiographers have less need to confer at this time of the day, it is surprising that the need to confer at night is lower than during the day.

Regarding the possibility to confer at night, we found that it is lower than during the day, with 40% of the radiographers answering that they rarely or never have an opportunity to confer at night. It may be interesting to discuss whether the lack of opportunity to confer at night means that the radiographer's need to confer is suppressed, and whether this may lead radiographers to act more autonomously over time and assess justification on their own. This demonstrates a link between the possibility to confer and the need for it. On the other hand, the lack of need to confer at night may be a consequence of the nature of the examinations in that patients often require immediate help, and indications might be obvious. In such cases opportunity to confer might be less important.

The possibility to reject unjustified examinations is greatest during daytime shifts, which is probably linked to the opportunity to confer about justification. The possibility to reject an unjustified examination is least on night shifts, which may reflect the staff situation and access to a medical officer such as a referring doctor or radiologist at this time of day. This study only points to the need and opportunity to confer and reject unjustified referrals and does not look at the consequences. However, one consequence could be that unjustified examinations are carried out due to a lack of opportunity to confer.

The fact that radiographers often confer with other radiographers is an interesting finding in this study. As radiographers do not have the option to reject an unjustified examination, they probably confer about other things, for example exchanging experiences and taking turns in previous situations or those with more experience providing guidance to others. In these situations, knowledge and experience of justification could be discussed, which may increase both awareness and knowledge of the subject. The fact that the radiographers also confer regularly with the radiologist will also increase expertise; a mutual
exchange of knowledge that not only benefits radiographers, but also radiologists.

Limitations

In this study, we do not have an overview of the number of examinations or referrals the radiographers assess justification for, only whether they assess justification throughout the day. Nor do we know how many radiographers work on the different shifts. Both of these factors could affect justification assessment.

This survey primarily looked at subjective perceptions of justification, such as access to a radiologist, and we have not looked at the actual access. We have also only focused on the possibility and need for assessment of justification and not the consequences a lack of opportunity may represent. Finally, we have not measured the knowledge of justification as a topic, and only sought the subjective opinions of the individual radiographer’s knowledge.

Further research

More research is needed on the consequences of not having the opportunity to confer or reject an unjustified examination to determine whether more unjustified examinations are carried or whether most of the evening and night examinations are already justified.

Conclusion

Across modalities, radiographers consider justification of radiographic examinations important and state that the main responsibility lies with the radiologist. However, most radiographers assess justification on a daily basis and they attach most importance to the referring physician’s clinical assessment. Radiation risk, medical condition, alternative modalities and patient age and sex were also considered important factors in the assessment.

The need to discuss justification of examinations is greater during daytime when access to radiologists is also high, while both access and need are low on night shifts. Further research is needed to explain the latter finding.

Radiographers who perceive a duty and engage in daily justification assessments find justification important and report having sufficient knowledge to carry out these assessments.

Acknowledgments

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References