



Research

Communicating Radiation Risk to Patients: Experiences Among Radiographers in Norway

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ABSTRACT

Introduction: Risk communication related to radiation has become more important during the last decade. Informing patients of benefits, risks, and alternative imaging methods is necessary to make informed decisions. The purpose of this study was to investigate radiographers' knowledge of radiation dose and risk, and their experiences with radiation risk communication.

Methods: This study used a qualitative approach using semi-structured interviews with clinical radiographers. The participants were presented with three authentic cases describing situations where risk communication is necessary. The interviews were audio-recorded, transcribed, and analyzed in four steps before the transcript interviews were coded and collected in meaningful themes. Participation was voluntary and participants signed an informed consent form.

Results: Six radiographers from two hospitals took part in the study. The mean age was 34 years, their work experiences as radiographers varied from 3.5 to 30 years and with an equal number of women and men. The participants provided reflections on the cases, how they managed the patients' need for information, and how they dealt with concerned patients. They also reflected on the knowledge and skills needed to be confident with risk communication.

Discussion: The participants were insecure of their knowledge of radiation dose and risk. They expressed difficulties with informing patients of radiation risk, without raising unnecessary concerns among the patients. When informing patients of the amount of radiation dose, they compared the dose in the examination to flights, background radiation, and the number of chest x-rays. The participants expressed challenges around radiation risk communication. All participants used the principle of justification in radiation risk communication.

Conclusion: This study shows that risk communication among radiographers is challenging, and the key challenge is the lack of knowledge of radiation doses and lack of experience in risk communication. There is a need for increased focus to and knowledge of radiation dose and risk, and radiation risk communication among radiographers working in clinical practice. This should be amplified in the education of radiographers, focusing on theoretical knowledge and skills such as reflection and critical thinking. This could cause radiographers to be confident and able to offer adequate information of doses and risks to the patients, so the patients can make an informed decision.

RÉSUMÉ

Introduction : La communication des risques associés au rayonnement a gagné en importance au cours de la dernière décennie. Il est nécessaire d'informer les patients des avantages, des risques et des solutions de rechange en imagerie afin de permettre une prise de décision éclairée. Le but de cette étude était d'examiner les connaissances des radiographes en matière de dose de rayonnement et de risque, ainsi que leur expérience en matière de communication du risque associé au rayonnement.

Méthodologie : Les auteurs ont utilisé une approche qualitative avec des entrevues semi-structurées avec des radiographes en pratique clinique. Trois cas authentiques décrivant des situations dans lesquelles la communication du risque associé au rayonnement était nécessaire ont été présentés aux participants. Les entrevues ont été enregistrées, transcrites et analysées en quatre étapes avant que les transcriptions ne soient encodées et mises en thèmes significatifs. La participation

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était volontaire et tous les participants ont signé un formulaire de consentement éclairé.

Résultats : Six radiographes de deux hôpitaux ont participé à l'étude. L'âge moyen était de 34 ans, et le nombre d'années d'expérience en radiographie variant de 3,5 à 30 ans, avec un nombre égal d'hommes et de femmes. Les participants ont formulé des réflexions sur les cas, indiquant comment ils auraient géré le besoin d'information des patients, et comment ils auraient composé avec des patients inquiets. Ils ont également discuté des connaissances et des compétences requises pour se sentir à l'aise avec la communication des risques.

Discussion : Les participants étaient inquiets face à leurs connaissances des doses et du risque de rayonnement. Ils ont exprimé leur difficulté à informer les patients du risque associé au rayonnement sans susciter de préoccupations chez les patients. Lorsqu'ils informent les patients du risque associé au rayonnement, ils font des comparaisons entre la dose de l'examen et les vols en avion, le rayonnement de fond et le nombre de radiographies pulmonaires. Les participants

ont parlé des défis entourant la communication du risque associé au rayonnement. Tous les participants ont utilisé le principe de justification dans la communication du risque associé au rayonnement.

Conclusion : Cette étude démontre que la communication du risque chez les radiographes est difficile, et que le défi principal réside dans le manque de connaissance des doses de rayonnement et le manque d'expérience en communication. Il est nécessaire de mettre davantage l'accent sur la connaissance des doses de radiation et sur le risque associé au rayonnement, et sur la communication du risque pour les radiographes en pratique clinique. Ceci devrait être amplifié dans la formation des radiographes, en mettant l'accent sur les connaissances théoriques et les compétences comme la réflexion et la pensée critique. Ceci pourrait permettre aux radiographes d'être plus confiants et en mesure de fournir aux patients une information adéquate sur les doses et les risques, afin que ceux-ci puissent prendre des décisions éclairées.

Keywords: Risk communication; Radiographer practices; Informed consent; Ionising radiation; Medical imaging

Introduction

During the last decade, risk communication related to the use of radiation in medical imaging has become more important and there have been several publications on the subject.¹⁻⁴ Risk communication can be defined as information about the recommended examinations, benefits and risks, and alternative imaging methods.⁵ For the patients to make an informed decision this must be known to the patients, and also the risks occurring if they decided not to attend the examination.⁴ The patients themselves also want information concerning radiation doses and potential risks, related to their diagnostic x-ray examination.^{2,4} Both referrers, radiologists, and radiographers should be able to give information about doses and risks to the patients. However, the radiographer is most likely to provide information during the examination.¹

Studies have shown that radiographers do not provide patients with adequate information about doses and risks.^{2,3,6} One study shows that about 60% of radiographers (103/174) do not inform patients about doses and 53% did not inform about potential risks,² while another study shows that only 23% informs about potential risks.⁶ When they provide information about radiation doses, they often compare it to the equivalent of background radiation or transatlantic flights, or in the number of chest x-rays, and rarely in actual doses (milliSievert, mSv).⁶ Some radiographers also use justification as an answer to the patient on questions about doses and risks, instead of giving the specific answer.⁶ There may be several reasons radiographers do not provide adequate information to patients. Radiographers are afraid of creating unnecessary worry for the patients and are concerned that patients may refuse justified examinations.^{2,3} Further, if the radiographers do not have enough knowledge about radiation doses and risks, they cannot provide adequate information, which further could lead to reluctance in discussing risks

with patients.^{3,6} Some radiographers assume that information already has been provided by referrer and therefore there is no need to provide information about radiation doses and risks,^{2,6} and some radiographers also think there is no need for giving this information.²

There is a disparity between what the patients expect of information and the information provided by the radiographers.² The patients want to know about the dose and potential risks.⁷ Missing information means that it is difficult for patients to make informed decisions. Norwegian legislation determines that patients should have information about both risks and potential harms⁸ and doses and risks related to medical imaging.⁹ Radiographers working in Norway should have knowledge on radiation doses and risks and be able to give this information to the patients. The purpose of this study was to investigate diagnostic radiographer's knowledge about radiation dose and risk, and their experiences of radiation risk communication.

Methods

Qualitative research describes a phenomenon in words rather than numbers¹⁰ and phenomenology aims to understand and provide insights into a particular phenomenon. Phenomenology explores and describes the experiences of humans with a phenomenon in a context¹¹ with a focus on behavior, meanings, and interpretations.¹⁰ The interview is a suitable approach in studies that aims to explore meanings, attitudes, and experiences. The interview aims to obtain the participants' opinions on different themes and to delve beneath the surface of their responses to understand their true meanings and the complexity.¹⁰ This study used a qualitative approach, using interviews to investigate radiographers' experiences with risk communication, in association with patients undergoing medical imaging examinations.

The Data Protection Officer at OsloMet approved the study (reference 647523). An email with information about the study and an invitation to participate was sent to the X-ray department at two hospitals in Norway. The head of the section at the X-ray department recruited the participants for this study. Participant recruitment was by purposive sampling, and the head of the section was instructed to recruit radiographers with different ages and experiences. The interviews were semi-structured, individual interviews. At the start of the interview, the participants were informed that participation was voluntary, that they would be anonymized in the results and they signed a consent form. The interviews were conducted following an interview guide that was prepared for this purpose and the questions were based on recent themes from previous studies.^{2,6,7} The participants were presented with three authentic cases describing situations where it was necessary to inform the patients about doses and risks, like Computer Tomography (CT) examinations, pregnant patients, and radiation doses from different examinations. The cases were based on radiographers' experiences with risk communication and derived from authentically situations with patients. The participants were first presented to the case and then answered questions like "How do you manage this situation?" and "What knowledge do you need to manage such a situation?" (See Table 1). The participants also got more general questions like "How do you communicate doses and risk to patients?" and "How confident are you in your knowledge about doses and risk?"

The interviews were audio-recorded and later transcribed verbatim and analyzed. The analysis was performed in four steps; summary of meaningful content, coding, condense, and recontextualization.¹¹ The analysis was thematic, and the themes were derived from the results of the interviews. All interview transcripts were analyzed and coded and the participants' true meanings were collected in different themes (see Table 3). The themes representing the participants' knowledge and experiences.

This study's first author conducted both the interviews, the transcription, and the analysis. The second author checked the interview transcripts, and both authors interpreted the results and prepared the manuscript.

Table 1
The cases used in the interview guide.

Case 1:	A patient undergoes a CT abdomen scan and after the examination asks how dangerous the examination was. How do you manage such a situation? What do you answer? What knowledge do you need to manage such a situation? What skills do you need (care, communication, ethics)? What are your reflections on the situation?
Case 2:	A young woman gets a CT abdomen scan and calls you the next day. She informs you she has discovered that she is pregnant and is now clearly upset with the situation. She is particularly concerned about the fetus. How do you manage this situation? What do you answer? How will you deal with her fear of fetal damage? What knowledge and skills do you need to manage the situation?
Case 3:	A patient will contact you and want a dose estimate of all x-ray examinations he has undergone during the previous 10 years. He is afraid of the increased risk of cancer. How do you manage this situation? And how would you communicate the answer to the patient? What knowledge do you require for this situation?

Table 2
The participants in the study.

Respondent	Age (Years)	Experience (Years)
1	29	6.5
2	29	5.5
3	23	3.5
4	60	30
5	29	5
6	34	7
Average	34	9.6

Results

All the participants were radiographers and there was an equal number of women and men. The mean age was 34 years (range 29–60) and their work experience as a radiographer varied from 3.5 to 30 years (Table 2). There were three participants from each of the two hospitals included for this study, and they had experience in working with different modalities such as conventional radiography, CT, and interventional vascular radiography.

Each interview lasted between 40 min and 1 h. The participants provided their reflections upon the presented cases, explained how they managed these patients' need for information and how they dealt with concerned patients. In addition, they reflected on the knowledge and skills needed to be confident with risk communication. The data were categorized into four main themes derived from the participants' experiences, meanings, and knowledge (Table 3). The themes included risk communication, radiation doses, justification and risks and were not addicted to a specific modality CT was involved in all three cases, but the interviews contained also general questions about risk communication, which was relevant for other modalities.

Discussion

To perform risk communication successfully, radiographers need to have knowledge about radiation dose, including dose levels, factors influencing dose, and the risk associated with the dose. They also need to possess communication skills

Table 3
Main themes derived from the data analysis.

Risk communication
Radiation dose
Justification
Risks

to communicate dose and risk to the patients, without causing unnecessary concern.

Theme 1: risk communication

Radiographers only meet patients within a short time frame, which makes risk communication more difficult. Within a brief period, the radiographer must observe the patient and decide how much and how to provide information to the patient, as well as assess how much of the information the patient understands.⁶

“I would have explained to the patient why he should take this examination and told him that this is what your doctor has recommended ... wI don't think I would have given him the dose information I don't think he would have understood the values.” Respondent 6

True and factual risk communication in medical imaging is important to ensure good and safe communication about doses and risks to patients, relatives, and health professionals.¹² It is challenging because the information shall arouse caution without creating fear. Therefore, health professionals must have training in interpersonal communication, so they can learn how to show empathy, use active listening strategies, and show respect for the patient's concerns.¹²

The radiographers in this study were aware of the patients' concern about radiation. One of the radiographers pointed out that it was important to read the patients emotions related to how much information should be provided:

“You must read the patients and their need for information, what kind of information they really want. People are different and you should not give too much information either. Many patients experience that as scary.” Respondent 6

This shows how important it is to have skills in understanding and taking care of patients in medical imaging and competence in informing and communicating in such ways that the patients feel safe. The short time the radiographer spends with the patients is not solely about answering questions. Risk communication is also related to patient care.

“It is something about that; you don't want to say too much, you have a feeling when you stand in the situation how the information is received. The patients should not go home with more questions than they had when they arrived.” Respondent 6

This shows how difficult risk communication can be. Communication about doses and risks has particular challenges. One challenge is that patients in general often have a lack of knowledge about radiation doses and dose values.

Another challenge is to relate this lacking knowledge of effects and risks.^{12,13}

In addition, to have knowledge and communication skills, it is important to understand the patient, like how the patient responds to the information and how to give individualized information. All decisions made by patients are influenced by cognitive and affective responses.¹² The cognitive response is built on logical and scientific arguments, unlike affective responses that are caused by instinctive and intuitive reactions. Fear, anxiety, and pain are examples of affective reactions and the decision is often built on these automatically and experienced reactions and feelings.¹² Anxiety alone can reduce the patient's ability to make an informed decision because the fear can cause a situation where the patient does not understand the information. The respondents in this study were aware of these challenges and therefore carefully considered the patients, so they could give individualized information. They are afraid to cause unnecessary fear and can, consequently, choose not to inform about doses and potential risks.

Theme 2: radiation doses

Radiation doses can be communicated in diverse ways.^{7,12} Five of the six radiographers in this study used flights as a comparison, but only one of them clarified the distance of the flight. Flight comparisons were most commonly related to chest x-rays. To compare radiation doses with flights, the patients need to be aware that flights give them an increased radiation dose. For some patients, this information is new and can cause fear of flights. The radiographers must also have an overview of the different doses related to different flight distances, which causes a problem with this comparison.¹² Since different flights give different doses, this comparison becomes uncertain and the radiographers may risk misinforming the patients.

The number of chest x-rays is another way to explain doses to patients. Two radiographers in this study used this method. This method assumes that the radiographers know the ratio between chest x-rays and other examinations, and the patients must be satisfied with an answer that only compares to different x-ray examinations instead of a direct answer. This method also expects that the patient knows the dose level of chest x-rays.

Four of the radiographers presented the doses in the equivalence of background radiation. This is a common way to express doses.¹² One of the radiographers used background radiation generally and told the patients that you are exposed to radiation daily; while another explains that a chest x-ray is equivalent to 3–5 days background radiation. The challenge with this method is that background radiation dose rates can be variable¹² and that the patients must understand the concept of background radiation.

The last method of comparison used by the radiographers in this study was quality assurance. By referring to quality assurance, the radiographer uses the status of the equipment to approve the examination. However, quality assurances do not address benefits or risks in quantifiable manners within

medical radiation.¹² In this study, terms like “this equipment is new and give less dose than earlier” was used. Three radiographers in this study use this method. Clarifying doses by using optimization was not commonly used in this study. Only one of the radiographers choose to inform the patients about optimization and explained that the examination was optimized with low doses.

All six radiographers had good knowledge about practical radiation protection, such as time, distance, and shielding, but they had a lack of deeper knowledge within the theme radiation doses and how the radiation affect the human tissue.

Theme 3: justification

Justification is a common way of answering questions about both doses and risks.⁶ Justification is one of the three key principles of radiological protection and is about weighing benefits versus the risk of performing the examination. The radiation exposure should do more good than harm.¹⁴

The patients often accept justification as an answer, even though their questions about doses and risks are unanswered. All radiographers in this study used justification as a response when the patients were worried about the radiation dose and the related risks.

In Case 1, the radiographer had to explain to a concerned patient how dangerous an abdominal CT-examination was, and all of them used the justification and importance of the examination to explain the risk.

“First, I would answer that it depends on the necessity of the examination, primarily the justification, and that a decision had been made to investigate what is wrong with the patient. And then, if I had to, I would explain that it is not extremely dangerous and use comparison to background radiation.” Respondent 6

Another radiographer said:

“I would explain that this examination uses X-rays. This use must be weighed against the risk, and that risk is taken into account when the doctor ordered this CT scan.” Respondent 3

None of the radiographers would explain doses and risks alone, without using justification in the response to the patients, because justification was a key factor for doing the examination. The radiographers told the patients that the referrers already had considered the benefits and risks. Therefore, as the referrers had ordered the examination, the examination was considered as justified and the patients did not have to be concerned about dose and potential risks. When the patients expressed concern about the radiation doses and risks, the radiographers highlighted the importance and the benefits of the examination. They referred to the doctor’s review of benefits versus risks and thus avoided to explain doses and risks. The doctors have the responsibility for the medical decisions and have therefore a key role in justification. On the other side; the radiographers have knowledge about justification and skills in considering it. In addition, the radiographers

are responsible for the information to the patient, and this relationship between justification considering and information may explain why radiographers use justification as an answer instead of directly tell the patient about the doses and related risk. All the radiographers in this study experienced that the patients were satisfied with justification as an answer. There may be several reasons why radiographers use justification as an answer to the patient. One reason might be that they do not have enough knowledge about doses and how radiation affects the body.

“How dangerous is it ... It is abstract and a bit difficult to get a hold on. How much does it mean for the patient that was here today?” Respondent 1

So, by using justification instead of explaining doses and risks, the radiographers can hide their lack of knowledge. Another reason can be that radiographers are uncomfortable with how to communicate risks to the patients and lack communication competence. The radiographers in this study found risk communication difficult. By using justification as an explanation, they avoided using risk communication. These two reasons, the lack of knowledge and poor competence in risk communication, can affect each other. If the radiographer has the knowledge, but are uncomfortable in communicating it, justification can be like an “escape route.” Contrary, it is not enough to have skills in risk communication if you do not have knowledge on radiation doses and risks. In this study, the reason the radiographers thought it was difficult to communicate with the patients varied. In one case, they lacked knowledge, while in other cases they were uncomfortable with communicating it.

Using justification as an answer may also have some benefits. If the patients accept justification as an answer, the patient will feel safe and comfortable attending the justified examination. One reason the radiographer use justification as an answer is to avoid unnecessary anxiety and fear, leading to patients not performing justified examinations.² Thus, by using justification as an answer, we can secure necessary examinations and make the situations comfortable for the patients. Some of the radiographers were conscious of holding back information to avoid concerns so the justified examination will be conducted.

Theme 4: risks

In this study, the radiographers mostly used justification when informing patients about the risks. They did not use a verbal or numerical scale, the two methods preferred by patients.⁷ The radiographers in this study found it difficult to express the risks and felt they needed more knowledge about the risks related to different x-rays examinations and modalities. They experienced risk communication as challenging.

One of the radiographers describes the challenge as:

“Generally, I try to be honest and at the same time diplomatic. Because, to tell the patient that this will be all right and you do not have to worry about it, it feels unethical. I

think the patients must receive enough information to understand what they have been through and the potential risks. However, at the same time, I would say that they should not receive too much information, as patients often can become scared.” Respondent 5

This challenge can contribute significantly to radiographers avoiding informing patients about risks and then use justification as a response instead.

Implications for clinical practice/suggestions for improving risk communication among radiographers

In the future, it is important that radiographers feel more comfortable with risk communication. The radiographers have a critical position within this topic, as they meet the patient at the X-ray Departments. To raise the competence in risk communication between the radiographers and the radiographer students, must increase their knowledge about radiation doses and risks and practice communication skills. By using digital education in cooperation with practical exercises like group discussion and problem-based learning, the competence will increase.¹⁵ The radiographers will acquire knowledge and practice skills in communication, and they will be better prepared to perform risk communication within medical imaging.

Limitation

This study had few participants from only two hospitals, which can affect the results, but our experience was that we met a saturation point, where no new information was added. However, the findings of the study are not generalizable given this small sample. The participants were chosen by the head of the section, and this can create a bias. We asked the leaders to choose radiographers of different ages, gender, and different experiences as a radiographer, so we could ensure diversity.

This study illustrates that communication regarding risk and radiation dose is difficult. This itself can limit the credibility of the study. However, the authors of this study have extensive experiences with the theme of radiation protection and radiation science, and this should strengthen the credibility of the study. The credibility is also supported by the use of an open approach, awareness of own presumptions, and that the first author conducted the interviews and transcripts, which gave a proper insight into the interview material.

Since the results of this study are not generalizable, we consider it as further work to investigate a bigger sample on the same topic. We also consider investigating how the focus on risk communication at the Departments and in the Universities, can influence the radiographer’s confidence in risk communication.

Conclusion

The radiographers in this study found it challenging to inform the patients about doses and potential risks. Lack of knowledge about doses and lack of experience in risk

communication were the main challenges in risk communication. Justification was commonly used as a response to questions about doses and risks. Radiographers have a key role in risk communication as they meet the patients at the X-ray Departments, and radiographers must become more confident in risk communication. There should be increased focus in risk communication at the departments and Universities in order to have radiographers that can provide adequate information about dose and risk to the patients so that the patients can make informed decisions.

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