

Experiences of Patients with Computed Tomography (CT) Examinations: A Systematic Review of Qualitative Evidence

Osward Bwanga ^{1*}, Raphael M Kayembe ²

¹ Midland University Hospital Tullamore, Radiology Department, Co. Offaly, Ireland

² Blackrock Clinic, Radiology Department, Dublin, Ireland

* **Corresponding Author:** Osward Bwanga, Midland University Hospital Tullamore, Radiology Department, Co. Offaly, Ireland.
E-mail: o.bwanga@yahoo.com

Received April 3, 2021; Accepted March 24, 2022; Online Published June 5, 2022

Abstract

Introduction: Computed Tomography (CT) plays an important role in the diagnosis of diseases and injuries in medicine. The role of CT radiographers is to provide both patient care and high-quality images. This study was aimed at systematically reviewing all available empirical evidence on the experiences of patients with CT examinations to support evidence-based practice in radiography.

Methods: A qualitative research design was used to conduct this review. Five electronic databases including CINAHL, PubMed/MEDLINE, Science Direct, African Journals, and Google Scholar, as well as other relevant sources, were searched for primary studies in October and November 2020. Critical appraisal of the relevant studies was carried out using the Joanna Briggs Institute (JBI) Critical Appraisal checklists. The data were synthesized and analysed thematically.

Results: A total of 11 studies were identified and included in this review. Three main themes were identified: the before, during, and after experiences of patients with CT. It was clear that pre-knowledge about the CT examination, a warm welcome towards patients, an explanation of the procedure, comfort, a short scan time, empathy, effective communication, and distracting strategies positively affected patients. On the other hand, a long waiting time, fear and anxiety, embarrassment, discomfort and pain for some examinations, and an inadequate explanation of the process involved in obtaining the results negatively affected patients.

Conclusion: The experiences of patients with CT examinations largely depend on their interaction with radiographers. This review findings, which are grounded on evidence, can inform the development of training methods and tools for eliciting feedback from patients.

Keywords: Computed Tomography (CT), Experiences, Imaging Examination, Patients

Introduction

Computed tomography (CT) is a computerised imaging technique that uses X-radiation to produce images of a cross-section of anatomic structures.¹ The use of CT in medicine has increased dramatically since its introduction in the early 1970s.^{2,3} In England, CT examinations increased from 3.8 million in 2013 to 5.9 million in the year ending March 2020.^{4,5} In the United States of America (USA), over 80 million CT examinations were performed in 2020, compared with 3 million in 1980.⁶ The versatility of CT is illustrated by its wide range of applications including studies of the brain, spine, chest, abdomen, pelvis, extremities, angiography, and guided biopsy and drainages.^{3,7} However, CT is a high-dose imaging modality.^{3,8} Although CT examinations amount to only 16% of all the X-ray examinations

carried out annually in the UK, they contribute approximately 68% of the total collective radiation dose from medical exposures.⁸

In recent years, patient experiences have become a key quality outcome for healthcare; measuring it is seen to support quality improvement and public accountability.⁹ Patient experience describes an individual's experience of the care they receive from the medical facility and the professionals that work within it.¹⁰ In radiography, this involves the patient's journey through the radiology department, from receiving the patient at the reception through to exiting the department upon completion of the examination. The patient satisfaction of this journey, whether positive or negative, largely depends on their interaction with radiographers who

can help them negotiate an experience that may be mystifying, frightening, and disempowering.¹⁰

Literature shows that radiographers place a high value and focus on the operation of the imaging equipment and getting the patient imaged or scanned to aid diagnosis and subsequent treatment.¹¹ In addition, radiographers can be busy meeting the daily targets. As a result, patient care can often be ignored or overlooked, and this can have a negative impact on the experiences of patients with the delivery of imaging services.¹⁰ It should be stressed that the patient visiting the radiology department is often in a vulnerable state and out of their comfort zone.¹² To some patients, a CT scanner may cause apprehension.⁷ A careful explanation by the radiographer can ensure patient co-operation and a satisfactory study.¹³ This requires effective communication skills amongst radiographers.

Globally, there are several studies conducted on the experiences of patients with CT examinations. However, the reviewers were unable to find any published study which has systematically brought these findings together to inform evidence-based practice. It is essential to understand the experiences of patients to inform the development of evidence-based training methods and tools for eliciting feedback from patients. Therefore,

this study aimed at systematically reviewing all available empirical evidence on the experiences of patients with CT examinations to support evidence-based practice in radiography. In achieving this aim, the study sought to answer the following question:

“What are the experiences of patients with CT examinations?”

Materials and Methods

This review was conducted using a qualitative research design and six stages of conducting systematic reviews in healthcare reported by Glasziou et al.¹⁴ These stages include the eligibility criteria, literature search, screening and selection of relevant studies, critical appraisal, data extraction, and data synthesis and analysis.

Eligibility Criteria

Table 1 shows the inclusion and exclusion criteria for this review. There was no time limit because CT was initially a limited imaging modality in its application and availability. However, recent advancement in technology has seen an increase in its application and the availability both in developed and developing countries.

Table 1. Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
<ul style="list-style-type: none"> Studies that have investigated the experiences of patients with CT examinations or compared with other imaging examinations Studies conducted by qualitative, quantitative, and mixed methods research designs Studies published in English 	<ul style="list-style-type: none"> Studies on other imaging examinations such as general X-rays, ultrasonography, mammography, and magnetic resonance imaging (MRI) Reviews, case reports and expert opinions Studies not written in English

Literature Search Strategy

An exhaustive literature search was undertaken by two reviewers in October and November 2020. A scoping search was conducted at first to check the availability of studies on this subject and to test the keywords. A full search of databases was performed in CINAHL, African Journals, PubMed/MEDLINE, Science Direct, and Google Scholar using keywords: “experiences”, “patients”, “computed tomography”, and “examination”. The search strings were generated by combining keywords with Boolean operators “AND”, “OR”, and “NOT”. The search was expanded by searching the Radiography Journal (UK), Journal of Medical Radiation Sciences, and South African Radiographer Journal to identify relevant studies not

indexed in electronic databases. Reference harvesting for citations of previous reviews and grey literature was also conducted and searched, respectively.^{14,15}

Screening, Selecting and Critical Appraisal of Relevant Studies

The screening and selection of relevant studies were conducted using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.¹⁶ The initial search yielded a total number of 826 articles. During the screening stage, eight articles were removed due to duplication. Besides, 800 articles were excluded because they did not meet the inclusion criteria following the reading of their titles and abstracts. Eighteen articles remained and were retrieved

for eligibility assessment. Seven articles were excluded: two were reviews on imaging,^{12,17} two were MRI studies,^{18,19} a study on radiation protection,²⁰ a study on imaging,²¹ and a discussion paper on imaging and radiation therapy.¹⁰ Finally, 11 articles remained for a critical appraisal.

Eleven studies were assessed for quality using JBI Critical Appraisal tools for qualitative and quantitative studies.²² The JBL qualitative checklist had 10 questions. A qualitative study was rated as high (score between 7 and 10), moderate (score between 4 and 6) and low (3 or less) according to the proportion of the total items with which they comply with the tool. The JBL

quantitative checklist contained eight questions. A quantitative study was rated as high (score between 6 and 8), moderate (score between 3 and 5) and low (2 or less) according to the proportion of the total items with which they comply with the tool. This standard-setting was agreed upon by both reviewers before the commencement of the study. Any discrepancies between the two reviewers were resolved by consensus.^{14,15} All qualitative studies [N = 4] scored high, whilst the quantitative studies [N = 7] scored moderate (Table 2). Therefore, no study was excluded due to poor quality. Figure 1 presents the study selection process.

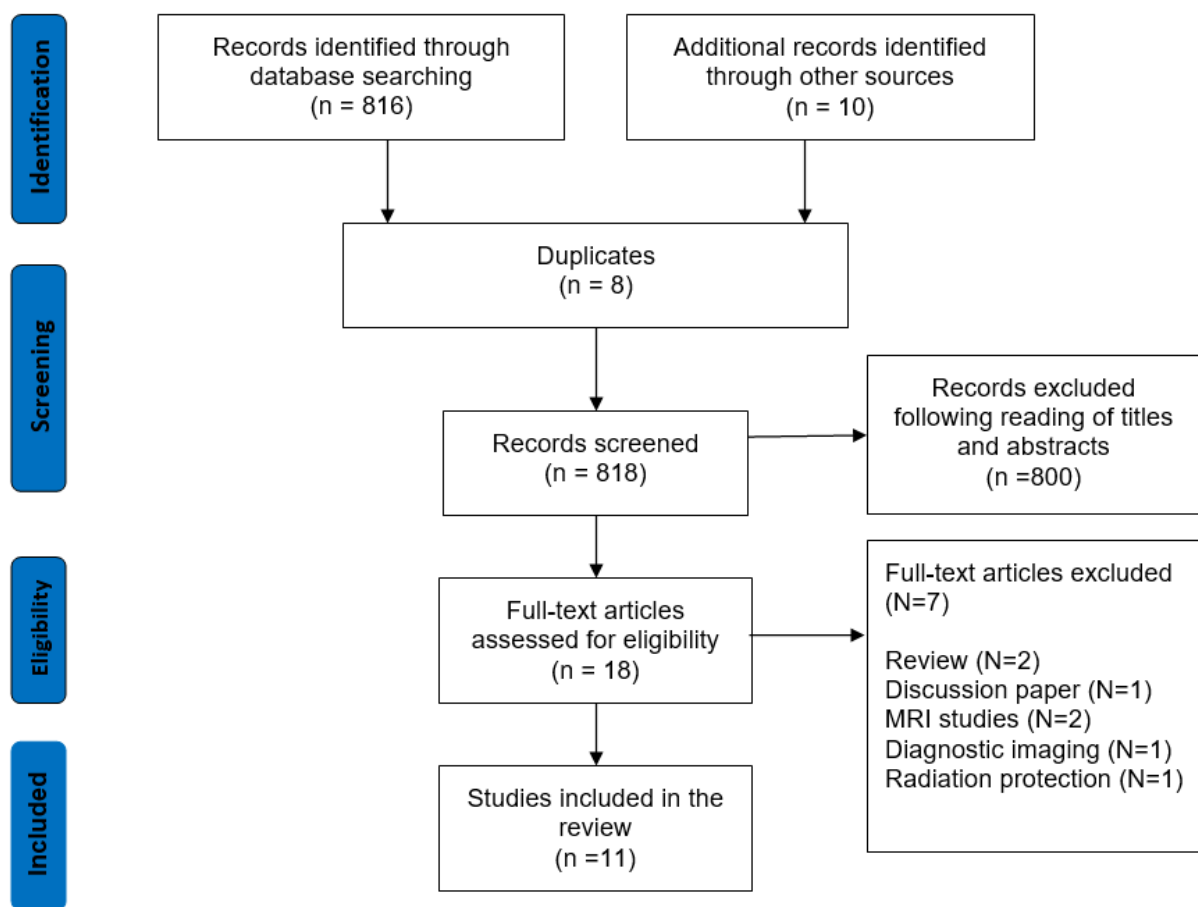


Figure 1. Flowchart of the Literature Selection Process According to PRISMA Guidelines.

Data Extraction, Synthesis and Analysis

The key descriptive information from each included study was organised and entered into a table (Table 2). The 11 studies eligible for this review were conducted from three countries: USA [N = 6], UK [N = 4] and Denmark [N = 1]. The rest of the characteristics of the included studies are presented in Table 2.

A thematic framework analysis was used to synthesis

and analyse data. The analysis started with the already known prior framework of patient care in radiography: before, during, and after the examination.^{3,7} These formed the three main themes: experiences of patients with CT before, during, and after the examination.

Results

Table 3 presents the three main themes identified in this review.

Table 2. Characteristics of Included Studies (N = 11)

No	Author	Year	Title	Study design and data collection method	Main findings related to experiences of patients with CT	Country
1	Akerkar et al. ²³	2001	Patient experience and preferences toward colon cancer screening: a comparison of virtual colonoscopy and conventional colonoscopy	Quantitative study-questionnaire	Abdominal discomfort and pain during CT colonoscopy. Feeling of embarrassment.	USA
2	Rajapaksa et al. ²⁴	2007	Racial/ethnic differences inpatient experiences with and preferences for computed tomography colonography and optical colonoscopy	Mixed method study-interviews and questionnaire	Abdominal discomfort and pain during CT colonoscopy. Feeling of embarrassment.	USA
3	Von Wagner et al. ²⁵	2009	Patient experiences of colonoscopy, barium enema, and CT colonography: a qualitative study	Qualitative study-interviews	Feeling of embarrassment. Concerned about radiation. Fear and anxiety. Some patients were confused about the doctor the results will be sent to.	UK
4	Ignjatovic et al. ²⁶	2010	Patient experience of CT colonography within the Bowel Cancer Screening Programme	Quantitative study-questionnaire	Abdominal discomfort and pain during CT colonoscopy. Inadequate communication after the examination. Waiting for the results.	UK
5	Baumann et al. ²	2011	Patient perceptions of computed tomographic imaging and their understanding of radiation risk and exposure	Quantitative study-questionnaire	Poor insight of the associated radiation exposure and risks.	USA
6	Nightingale et al. ²⁷	2012	'I thought it was just an X-ray': a qualitative investigation of patient experience in cardiac SPECT-CT imaging	Qualitative study-interviews	Pre-examination written information. Concern about radiation. Fear and anxiety. Long waiting times. Use of music as a distracting strategy.	UK
7	Pooler et al. ²⁸	2012	Screening CT colonography: multi-centre survey of Patient experience, preference, and potential impact on adherence	Quantitative study-questionnaire	Abdominal discomfort and pain during CT colonoscopy.	USA
8	Daramola et al. ²⁹	2015	Patient knowledge and perception of computed tomography scan in management of chronic rhinosinusitis symptoms	Quantitative study-questionnaire	Pre-knowledge about the CT examination positively affected the patients in the decision-making process.	USA
9	Plumb et al. ³⁰	2017	Patient experience of CT colonography and colonoscopy after fecal occult blood test in a national screening programme	Quantitative study-questionnaire	Explanation of benefits vs risks. Pre-examination written information. Abdominal discomfort and pain during CT colonoscopy.	UK
10	Roth et al. ³¹	2018	A qualitative study exploring patient motivations for screening for lung cancer	Qualitative study-interviews	Pre-knowledge about the CT examination positively affected the patients in the decision-making process.	USA
11	Raaschou et al. ³²	2019	Oncology patients' experience of a routine surveillance CT examination: relationships and communication	Qualitative study-interviews	Non-participation of patients in booking their CT examinations. Welcoming patients and interactions in the waiting area. Interactions between the patients and radiographers.	Denmark

Table 3. Three Themes on the Experiences of Patients with CT Examinations

Themes	Sub-themes
Theme 1: Experiences of patients before the CT examination	<ul style="list-style-type: none"> • Pre-knowledge about the CT examination • Booking of patients and waiting time • Pre-procedural fear and anxiety • Welcoming patients and interactions in the waiting area
Theme 2: Experiences of patients during the CT examination	<ul style="list-style-type: none"> • Communication (empathy and distracting strategies) • Embarrassment • Discomfort and pain • Comfort and duration of the scan
Theme 3: Experiences of patients after the CT examination	<ul style="list-style-type: none"> • Process of obtaining the results • Fear and anxiety associated with waiting for the results

Theme 1: Experiences of Patients before the CT Examination

A total of six studies contained data on the experiences of patients before the CT examination. This theme had four sub-themes: pre-knowledge about the CT examination, booking of patients and waiting time, pre-procedural fear and anxiety, and welcoming patients and interaction in the waiting area.

Sub-theme 1: Pre-knowledge About the CT Examination

Patients obtained pre-knowledge about CT examination and associated radiation risks from the referring medical practitioners, family members and friends, and previous experience. This helped patients to give their consent for the examination.

“I like my doctor immensely and trust her and she gave me the wide berth of a discussion about the CT examination.”³¹

“My father and husband died of cancer. So, when the doctor suggested the CT examination I said yes I will do it.”³¹

The written information supplied about the examination was reported as contributing to a positive experience as it helped the patients to prepare for CT.^{27,30} Although patients were satisfied with the pre-procedural information they suggested the inclusion of photos of the scanner to avoid over-use of their imagination and to minimise unknown fear.²⁷

In studies conducted by Daramola et al.,²⁹ and Baumann et al.,² most of the patients had previous experiences of CT examinations. The pre-knowledge positively affected these patients. Unfortunately, patients were less aware of the radiation doses involved in CT examinations.^{2,31} This negatively affected the patients' ability to weigh up the benefits versus the risks of the examination.

Sub-theme 2: Booking of Patients and Waiting Time

The long waiting times for the examinations negatively affected patients. Some patients received their appointments when their symptoms had reduced over time:

“Until waiting for the appointment letter to be dropped through the letterbox, I was not expecting it.”²⁷

In a study by Raaschou et al.,³² some patients were concerned about their lack of involvement in the booking of their examinations to suit the day and time convenient to them. Patients suggested an online CT booking system:

“Imagine if there was a booking system where I could book my appointment and also add special needs.”³²

The lack of opportunity for patients to assist in booking their appointment negatively affected the experiences of patients with CT examinations.

Sub-theme 3: Pre-Procedural Fear and Anxiety

Some studies indicated that patients who expressed pre-procedural fear and anxiety were those with suspected cancer and those with no pre-knowledge about CT examination.

“I am just hoping they don't find anything...I am dreading it might be cancer.”²⁵

Some studies reported that patients were concerned about the effects of ionizing radiation associated with CT examinations.^{25,27} The pre-procedural fear and anxiety and a lack of awareness about the effects of radiation on the human body negatively affected patients.

Sub-theme 4: Welcoming Patients and Interactions in the Waiting Area

The interaction of reception clerical staff was found

vital in welcoming patients to the radiology department. The interaction with other healthcare professionals while waiting to be called for the examination was also important for many of the patients.

“There are some health professionals, who say hello and smile, but not many. Why not look at people and smile? It makes me feel welcome.”³²

The pleasant greeting of the patients and a smile by clerical staff and other healthcare professionals were found to help to create a positive experience with CT examination and the lack of such gestures created a negative experience.

Theme 2: Experiences of Patients during the CT Examination

A total of nine studies reported data with the theme “experience of patients during CT examination”. The theme had four sub-themes: communication (empathy and distracting strategies), embarrassment, discomfort and pain, comfortability, and duration of the scan.

Sub-theme 1: Communication (Empathy and Distracting Strategies)

The interaction of patients with radiographers was centred on communication, empathy, and distracting strategies. Patients appreciated radiographers who maintained eye contact while talking and showed interest and empathy.

“It’s not that the radiographer has to know a lot about my disease. But empathy, yes, general kindness is important.”³²

Some patients were not informed in advance about the warm feeling of contrast media during IV injection.²⁵ The sudden feeling of warmth frightened some patients. The lack of explanation of the procedure by CT radiographers negatively affected some patients.

A study by Nightingale et al.²⁷ revealed how environmental factors such as soft music in the scan room reduced patients’ anxieties during the examination. This positively affected patients to CT as it distracted them from their fear during the examination.

The interactions between radiographers and patients during the examination through the microphone were found to be a vital communication strategy. Some patients felt a sense of loneliness once the radiographer had left the room during scanning and they appreciated that some form of contact was maintained through the microphone.

“It means a lot when somebody is talking to me through the speaker. It is like I am not alone, even though I am alone in the scan room. I feel constantly there is someone who takes care of the situation and I can relax.”³²

Sub-theme 2: Embarrassment

Three studies reported embarrassment associated with the CT examinations. Some patients reported a feeling of embarrassment due to an inadequate gown.

“I felt embarrassed because the provided gown was inadequate.”²⁵

Patients undergoing CT colonoscopy reported embarrassment associated with the insertion of a small tube into the back passage.^{23,24} The feelings of embarrassment negatively affected some patients during the examination.

Sub-theme 3: Discomfort and Pain

Six studies described patients’ discomfort and pain associated with examinations requiring intravenous (IV) cannulation and abdominal pain during CT colonoscopy. To avoid multiple failed IV cannulation attempts, some patients were psychologically prepared to wait for the competent radiographer (s).

“Well, that’s fine, I can wait all day for the right radiographer. I know there is one who is good at inserting the needle.”³²

In the other five studies,^{23,24,26,28,30} patients for CT colonoscopy complained about abdominal discomfort and pain associated with the inflation of the large intestines with gas during the examination. The abdominal discomfort and pain negatively affected some patients undergoing CT colonoscopy examinations.

Sub-theme 4: Comfortability and Duration of the Scan

In a study by Raaschou et al.,³² patients with an experience of MRI were compared with patients with a CT experience in terms of comfort and duration of the examinations. When comparing the two, patients preferred CT as more comfortable due to less noise and short scan time. The comfortability and short scan time positively affected patients.

Theme 3: Experiences of Patients after the CT Examination

Four out of 11 studies included data that reflected the

theme “experiences of patients after the CT examination”. This theme had two sub-themes: the process of obtaining the results, and fear and anxiety associated with waiting for the results.

Sub-theme 1: Process of Obtaining the Results

This review found the communication to the patient by radiographers about the process of obtaining the results of the examination, as vital in the delivery of CT imaging services. Most of the patients were told their results would be ready following the interpretation and reporting by a radiologist. However, some patients reported being confused about which doctor they would receive the results from, a General Practitioner (GP) or a hospital doctor.

“They said they would notify the doctor, but which doctor?”²⁵

Some patients were reluctant to ask radiographers about the results on the completion of the examination.

“Nothing at all and I was nervous to ask. I guess they are not allowed to say anyway?”²⁵

A study conducted by Ignjatovic et al.,²⁶ also reported a lack of communication by radiographers after the examination which negatively affected patients.

Sub-theme 2: Fear and Anxiety Associated with Waiting for the Results

A study by Nightingale et al.²⁷ found that most patients failed to justify their pre-procedural fear of the unknown after the imaging examination. However, patients with suspected cancer described feelings of fear and anxiety associated with waiting for the report. Some were apprehensive about what the results may reveal. This was exacerbated by the long waiting time.

“I am waiting, no test results yet. Everybody dreads cancer.”²⁵

In a study conducted by Ignjatovic et al.,²⁶ patients complained about the time it takes waiting for the results. This negatively affected patients with CT examinations

Discussion

Experiences of Patients before the CT Examination

This theme focuses on patient care and instructions before the CT examination. These include the referring medical practitioners’ engagement with the patient in the decision-making related to the justification process of the examination, booking, receiving the patient at

the radiology reception, and preparing the patient before entering the scanning room. For patients who have booked for an abdominal scan, this may involve taking oral contrast media.

This review found patients’ pre-procedural knowledge about the examination, including radiation protection, to be of paramount importance to patient care. For this reason, the referring medical practitioner has a responsibility to explain the benefits versus the risks involved in CT examination to the patient.⁸ This can assist the patient in making an informed decision. The review also found a lack of patients’ awareness of radiation doses involved in CT examinations to have negatively affected them. This matches other studies that have assessed the knowledge of patients about radiation.^{20,21} Munn and Jordan¹² found in their review that patients seek information before the imaging examination from different sources, which may be credible or not. It is, therefore, important to provide factual pre-procedural information during the booking to improve the experiences of patients.

Long waiting times negatively affected patients with CT examinations as it increased pre-procedural fear and anxiety, especially for those with suspected cancer. Long waiting times for the appointment also lead to a feeling of annoyances reported by Clark and Reeves.¹⁵ One of the strategies which could help to improve the experiences of patients regarding waiting times and bookings is to allow them to be involved in the decision-making process. Literature shows that patient participation in the decision-making process improves their experiences with health services.^{10,33} The online booking system for CT appointments would empower patients to participate in radiology services delivery and reduce the annoyance associated with the long waiting times.

The initial stage of an imaging examination consists of greeting and identifying the patient at the radiology reception to put the patient at ease.³⁴ This first direct interaction with the radiology staff was found in this review to be very important in the care of the patients. Patients valued clerical staff and healthcare professionals who greeted with a smile as a sign of welcoming them to the radiology department.³² Therefore, radiographers should greet and communicate with patients whilst establishing eye contact. Ehrlich and Coakes⁷ point out that when there is direct eye contact with an individual while speaking to them, it is usually perceived as an

expression of interest and is considered as a positive behaviour.

The identification and preparation for the patients by a radiographer before imaging is part of the care before the CT examination. Asking a patient to change into a hospital gown and questioning the pregnancy status of females of child-bearing age can be embarrassing to members of the opposite sex or different age groups.³⁴ Therefore, these tasks must be carried out with sensitivity. It is also essential that the patient is not asked to wait in a public waiting area whilst wearing a hospital gown as the patient may feel uncomfortable.^{7,24} All these scenarios can affect patients either positively or negatively.

Experiences of Patients during the CT Examination

This theme involves the interaction of radiographers with patients in the scanning room. A patient entering the CT imaging room for the first time may find the equipment quite daunting.³⁴ Effective communication can decrease the frightening experiences as well as the anxiety and distress felt by some patients.^{7,34} Therefore, radiographers should have effective communication skills. Ehrlich and Coakes⁷ state that effective communication is a two-way street and good listeners do more than just wait for their turn to speak. This review found that patients value radiographers who are empathetic to their problems. An empathetic response requires active listening, seeing the problem from the patient's perspective, and communicating that understanding back to the person in a sensitive and supportive way.^{7,34} In this review, patients found the use of soft music during a CT scan to have positively affected them in decreasing their fear.

Taking precautions and completing an IV questionnaire should be undertaken by the radiographer (s) for all patients receiving IV contrast media as part of patient care during the examination. This includes explaining the procedure and asking about allergies, thyroid disease, kidney failure, hypertension, and asthma.^{35,36} Literature shows that explaining the procedure alleviates fear and anxiety.^{13,17} Furthermore, patients receiving IV contrast media should be informed in advance that they may have feelings of nausea, warmth, flushing, and a metallic taste during the administration of contrast.¹³ Unfortunately, this review found that some patients were not informed about these sensations and they came as a surprise to them which

negatively affected their experiences with the CT examination. It should be noted that patients value radiographers who explain the procedure in a slow, careful manner and allow them to ask questions.¹⁷ The individual administering the contrast must also check that there are no contraindications to its use and ensure that the patient understands that it is to be given and agrees to the procedure by signing a consent form.³⁵ All these measures should be in place to ensure safety and improve the outcome and experiences of patients.

The feeling of embarrassment has been identified in the literature to negatively affect patients, especially procedures that threaten the patient's modesty and dignity.^{17,34} This agrees with our findings as some patients felt embarrassed with the inadequate hospital gowns provided and the CT colonoscopy. It should be mentioned that patients are likely to be much more sensitive in these situations than the healthcare professionals who perform these examinations daily.⁷ Therefore, patients should be provided with hospital gowns that suit them to avoid this embarrassment. For CT colonoscopy, a radiologist or radiographer should not be left alone with a patient of the opposite sex in the scanning room. Ehrlich and Coakes⁷ recommend the presence of a chaperone of the same sex as the patient. This can ease the patient's mind if fears such an encounter and provide a witness in case the patient later claims to have been assaulted or touched in an unprofessional manner.⁷

The discomfort and pain associated with some imaging examinations such as MRI and mammography have been reported in the literature.^{12,17} This agrees with our findings where patients reported experiencing discomfort and pain during IV cannulation and injection as well as during colonoscopy procedures. Being gentle and reassuring the patient can alleviate discomfort and pain during the examination.^{7,34} This includes communicating to and monitoring the patient all of the time, especially for any extravasation and reaction to contrast media. Patients preferred CT to MRI in terms of comfortability and duration of the scan. In MRI, most patients are uncomfortable due to long scanning times in a tightly enclosed space.^{7,12}

Experiences of Patients after the CT Examination

This theme relates to patient care following the completion of the CT examination. When contrast media is administered and the examination is completed, the

IV line should be discontinued and removed.¹³ After the examination, patients generally want to know the results.³⁴ Same findings were noted in this review as patients wanted to know about their results immediately. However, some patients knew that it is not within the scope of practice of a radiographer to inform them about the diagnosis resulting from the examination. This is the most challenging situation for radiographers, especially if there is an abnormality on the images.³⁴ Therefore, effective communication by the radiographer is essential to avoid any misunderstandings and to improve patients' experiences. Radiographers adhered to the best practice of informing the patients that the images will be reported by the radiologist later and the results sent to the referring medical practitioner.^{13,34} However, some patients were confused about whether the results would be sent to their GP or hospital medical doctor. It is, therefore, essential to mention the name of the referring medical practitioner to the patient to avoid this confusion.

Patients undergoing imaging often expect a health issue to be found during their scan which can then lead to anxiety and worry after the examination.¹² This concurs with our findings. Patients with suspected cancer experienced post-examination fear and anxiety. Waiting for results was an anxious and negative experience and this result was also found in a review conducted on the experiences of women to mammography by Clark and Reeve.¹⁷ Effective communication and stating the time when the results will reach the referring medical practitioner can reduce some of the post-procedural fear and anxiety.

Conclusion

This review has provided evidence on the experiences of patients before, during, and after the CT examinations. It is clear from the review findings that the quality of the experiences of patients with CT examinations largely depends on the attitudes, behaviours, and interpersonal skills of the radiographers. The understanding of patients' experiences can help policymakers in the formulation of strategies to improve the delivery of imaging services in a time-constrained clinical environment. It is recommended that more qualitative research be conducted, especially from developing countries due to the identified literature gap. The experiences of patients may differ between developed and developing countries due to

various factors such as basic education, culture, and technology advancements.

Conflict of Interest

The authors declare no conflicts of interest.

Acknowledgement

The authors would like to thank Ms. Atupele Munthali, a senior CT radiographer, for her help in reviewing this article before submitting it for publication.

References

1. Bwanga OB, Chanda EC, Mooya KM, Mwale AM, Maliti BM. Radiology nursing: a little-known speciality in Zambia. *Prof Nurs Today*. 2020;24(4):11-6. doi:10.36346/sarjnhc.2020.v02i04.003
2. Baumann BM, Chen EH, Mills AM, Glaspey L, Thompson NM, Jones MK, et al. Patient perceptions of computed tomographic imaging and their understanding of radiation risk and exposure. *Ann Emerg Med*. 2011;58(1):1-7. doi:10.1016/j.annemergmed.2010.10.018
3. Hsieh J. *Computed tomography: principles, design, artifacts, and recent advances*. 3rd ed. Washington: SPIE; 2015.
4. National Health Services. Diagnostic imaging dataset annual statistical release 2013/14; 2020. Available from <https://www.england.nhs.uk/statistics/wp-content/uploads/sites/2/2014/06/Annual-Statistical-Release-2013-14-DID-pdf-1118K-B.pdf> (accessed 20 December 2020).
5. National Health Services. Diagnostic imaging dataset 2019-2020 data; 2020. Available from <https://www.england.nhs.uk/statistics/wpcontent/uploads/sites/2/2020/05/Provisional-Monthly-Diagnostic-Imaging-Dataset-Statistics-2020-05-21-1.pdf> (accessed 20 December 2020).
6. Harvard Medical School. Radiation risk from medical imaging; 2020. Available from <https://www.health.harvard.edu/cancer/radiation-risk-from-medical-imaging> (accessed 10 November 2020).
7. Ehrlich RA, Coakes DM. *Patient care in radiography: with an introduction to medical imaging*. 10th ed. London: Elsevier; 2020.
8. Martin A, Harbison S, Beach K, Cole P. *An introduction to radiation protection*. 7th ed. London: CRC press; 2019.
9. Potts HW, Benson T. A short generic patient experience questionnaire: howRwe development and validation. *BMC Health Serv Res*. 2014;14:1-10 doi:10.1186/s12913-014-0499-z
10. Bolderston A. Patient experience in medical imaging and radiation therapy. *J Med Imaging Radiat Sci*. 2016;47(4):356-61. doi:10.1016/j.jmir.2016.09.002
11. Munn Z, Jordan Z, Pearson A, Murphy F, Pilkington D. 'On their side': focus group findings regarding the role of MRI radiographers and patient care. *Radiography*. 2014;20(3):246-50. doi:10.1016/j.radi.2014.03.011
12. Munn Z, Jordan Z. The patient experience of high technology medical imaging: a systematic review of the qualitative evidence. *Radiography*. 2011;17(4):323-31. doi:10.1016/j.radi.2011.06.004
13. Dutton A, Ryan T. *Torres' patient care in imaging technology*. 9th ed. Philadelphia: Wolters Kluwer; 2019.
14. Glasziou P, Irwig L, Bain C, Colditz G. *Systematic reviews in health care: a practical guide*. Cambridge: Cambridge University Press; 2008.
15. Bwanga O. How to conduct a qualitative systematic review to guide evidence-based practice in Radiography. *Int j basic appl sci*. 2020;52(1):205-13.
16. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines; 2015. Available from <http://www.prisma-statement.org> (accessed 12 December 2020).
17. Clark S, Reeves PJ. Women's experiences of mammography: a

- thematic evaluation of the literature. *Radiography*. 2015; 21(1):84-8. doi:10.1016/j.radi.2014.06.010
18. Funk E, Thunberg P, Anderzen-Carlsson A. Patients' experiences in magnetic resonance imaging (MRI) and their experiences of breath holding techniques. *J Adv Nurs*. 2014; 70(8):1880-90. doi:10.1111/jan.12351
 19. Evans R, Taylor S, Janes S, Halligan S, Morton A, Navani N, et al. Patient experience and perceived acceptability of whole-body magnetic resonance imaging for staging colorectal and lung cancer compared with current staging scans: a qualitative study. *BMJ Open*. 2017;7(9):e016391. doi:10.1136/bmjopen-2017-016391
 20. Asefa G, Getnet W, Tewelde T. Knowledge about radiation related health hazards and protective measures among patients waiting for radiologic imaging in Jimma University Hospital, Southwest Ethiopia. *Ethiop J Health Sci*. 2016;26(3):227-36. doi:10.4314/ejhs.v26i3.5
 21. Makanjee CR, Hoffmann WA, Bergh AM. Healthcare provider and patient perspectives on diagnostic imaging investigations. *Afr J Prim Health Care Fam Med*. 2015;7(1):801. doi:10.4102/phcfm.v7i1.801
 22. Joanna Briggs Institute Critical Appraisal checklists; 2017. Available from https://joannabriggs.org/ebp/critical_appraisal_tools (accessed 12 November 2020).
 23. Akerkar GA, Yee J, Hung R, McQuaid K. Patient experience and preferences toward colon cancer screening: a comparison of virtual colonoscopy and conventional colonoscopy. *Gastrointestinal Endoscopy*. 2001;54(3):310-5. doi:10.1067/mge.2001.117595
 24. Rajapaksa RC, Macari M, Bini EJ. Racial/ethnic differences in patient experiences with and preferences for computed tomography colonography and optical colonoscopy. *Clin Gastroenterol Hepatol*. 2007;5(11):1306-12. doi:10.1016/j.cgh.2007.05.023
 25. von Wagner C, Knight K, Halligan S, Atkin W, Lilford R, Morton D, et al. Patient experiences of colonoscopy, barium enema and CT colonography: a qualitative study. *Br J Radiol*. 2009;82(973):13-9. doi:10.1259/bjr/61732956
 26. Ignjatovic A, Burling D, Kallarackel L, Muckian J, Saunders BP, Patnick J. Patient experience of CT colonography within the Bowel Cancer Screening Programme. *Gut*. 2010;59:A58-9.
 27. Nightingale JM, Murphy FJ, Blakeley C. 'I thought it was just an x-ray': a qualitative investigation of patient experiences in cardiac SPECT-CT imaging. *Nucl Med Commun*. 2012;33(3):246-54. doi:10.1097/MNM.0b013e32834f90c6
 28. Pooler BD, Baumel MJ, Cash BD, Moawad FJ, Riddle MS, Patrick AM, Damiano M, Lee MH, Kim DH, del Rio AM, Pickhardt PJ. Screening CT colonography: multicenter survey of patient experience, preference, and potential impact on adherence. *AJR. AJR Am J Roentgenol*. 2012;198(6):1361. doi:10.2214/AJR.11.7671
 29. Daramola OO, Lidder AK, Ramli R, Chandra RK, Shintani-Smith S, Conley DB, et al. Patient knowledge and perception of computed tomography scan in the management of chronic rhinosinusitis symptoms. *Laryngoscope*. 2015;125(4):791-5. doi:10.1002/lary.24992
 30. Plumb AA, Ghanouni A, Rees CJ, Hewitson P, Nickerson C, Wright S, et al. Patient experience of CT colonography and colonoscopy after fecal occult blood test in a national screening programme. *Eur Radiol*. 2017;27(3):1052-63. doi:10.1007/s00330-016-4428-x
 31. Roth JA, Carter-Harris L, Brandzel S, Buist DS, Wernli KJ. A qualitative study exploring patient motivations for screening for lung cancer. *PLoS One*. 2018;13(7):e0196758. doi:10.1371/journal.pone.0196758
 32. Raaschou H, Pilegaard M, Klausen L, Danielsen AK. Oncology patients' experience of a routine surveillance CT examination: relationships and communication. *Radiography*. 2019;25(4):308-13. doi:10.1016/j.radi.2019.02.009
 33. Souliotis K. Patient participation in contemporary health care: promoting a versatile patient role. *Health Expect*. 2016;19(2):175-8. doi:10.1111/hex.12456
 34. Springett G, Dunmall K. Communication. In: Easton S, ed. *An introduction to radiography*. London: Churchill Livingstone Elsevier; 2009:23-39.
 35. Royal College of Radiologists. *Standards for intravascular contrast administration to adult patients*. 3rd ed. London: RCR; 2015.
 36. Irish Institute of Radiography and Radiation Therapy. *Intravenous cannulation/ administration by radiographers/ radiation therapists: guidelines on best practice*. 5th ed. Dublin: IIRRT; 2017.