

# Understanding the use of diagnostic imaging for patients with low back pain in the Emergency Department: a qualitative study

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“ONDERGETEKENDE

Johan Blokzijl

bevestigt hierbij dat de onderhavige verhandeling mag worden geraadpleegd en vrij mag worden gefotokopieerd. Bij het citeren moet steeds de titel en de auteur van de verhandeling worden vermeld.”

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**ABSTRACT**

**Background:** Overuse of lumbar imaging in the Emergency Department is a well-recognised health care challenge. No intervention to date has shown robust reductions in overuse. For an intervention aimed at reducing imaging to be effective, insight into how both patients and clinicians view imaging tests is essential.

**Aim:** The aim for this research is to explore patients' and clinicians' views on the use of imaging in the Emergency Department and factors that might influence overuse of imaging.

**Methods:** We recruited participants from three hospitals in Sydney, Australia. We performed focus groups and/or interviews with 14 patients and 12 clinicians. Sessions were audio recorded and transcribed verbatim. We analysed the data using the framework analysis method within a team of four researchers with backgrounds in public health, sociology, musculoskeletal conditions, and low value care.

**Results:** Patients felt that the decision about imaging is made by the ED clinician, and they are not involved in this process. Potential drivers of overuse, from a patient's perspective, were strong expectations of imaging results, a reluctance to delay of diagnostic imaging, and external parties such as insurance companies requiring imaging. Clinicians stated that patient pressure and the inability to manage this pressure in busy emergency care setting (e.g. lack of time to develop a relationship with patients and to explain the reasons to avoid imaging) could drive overuse. Potential protective factors against overuse of imaging included providing patients with a good explanation and performing a thorough examination, and collaborative approaches to care involving good communication within ED and aligning management with primary care.

**Conclusion and key findings:** We found several factors that could drive overuse of imaging in emergency care setting. Solutions to reduce overuse of imaging in the ED should include: 1) training and support to assist clinicians to provide an adequate and well explained assessment for low back pain, 2) tools to involve patients in decisions about imaging, and 3) care pathways and communication strategies that encourage collaborative approaches to care.

**Keywords:** Low back pain, Emergency Department, Imaging, Overuse.

## INTRODUCTION

Low back pain is very common and globally the burden of low back pain rose in the last ten years, making it an increasingly important cause of years living with disability (1). Patients requiring treatment are ideally managed in primary care. However, people with low back pain often seek care in emergency settings. Around the world low back pain accounts for 4.4% of all emergency department (ED) presentations and in Australia, 120,219 ED visits in 2017-2018 (2,3).

Clinical guidelines advise against routine imaging of patients with low back pain unless there is suspicion of a serious pathology (4). There is evidence that early imaging for people without features of underlying pathology does not lead to better outcome for the patient in either short or long term (5). In 2011 the American College of Emergency Physicians included lumbar imaging for atraumatic low back pain in their Choosing Wisely List (6). With this, they state imaging is a commonly used diagnostic procedure, whose necessity could be questioned and discussed. In contrast with these recommendations, it is estimated that up to 30% of patients at the ED receive imaging, in many cases without indication (7). These diagnostic imaging tests can lead to increased use of healthcare services, both diagnostic and therapeutic (8,9). Patients that undergo imaging for low back pain are more likely to stay longer in hospital and receive unhelpful and potential harmful interventions, including surgery (9).

Beside these direct effects of diagnostic imaging, it can also have an indirect effect because of fear, worry, and loss of self-efficacy related to imaging results (10–12). Imaging in many cases finds degenerative abnormalities that are also common in asymptomatic people (13). These imaging results may result in patients becoming more fearful of damaging their back and avoidant of beneficial physical activities—so called ‘fear avoidance beliefs’ (14). Physiotherapists and other healthcare providers need to manage these fear avoidance beliefs during the treatment of patients with low back pain. Development of a strategy able to reduce the use of unnecessary imaging and its negative consequences could improve outcomes for patients and reduce healthcare expenditure.

A recent systematic review showed clinical decision support and changes in multidisciplinary protocols and guidelines could reduce imaging rates for patients with low back pain in the ED (15). Due to the low number of included studies, lack of robust study designs and large variety of reported study results, the authors highlighted an urgent need for high-quality studies of interventions to reduce imaging for low back pain in the ED.

For an intervention to effectively reduce imaging for low back pain in the ED, an understanding of patients’ and clinicians’ views on the use of imaging in the ED are essential (16,17). Understanding the drivers of and protective factors against overuse of imaging could inform the design and implementation of promising new interventions. Previous research in primary care shows patient drivers include over-reliance on imaging results, the imaging results validating their pain and expectations that imaging will be performed (18,19). Clinicians drivers include fear of litigation, beliefs about the added value of imaging, lack of confidence or

knowledge and time pressure (18–20). To our knowledge, no study has examined the views of clinicians and patients in ED. Therefore it is unclear to what extent previously identified contributors to imaging overuse apply to the ED, or whether a different set of drivers and protective factors are at play.

The aim for this research is to explore patients' and clinicians' views on the use of imaging in the emergency department and factors that might influence overuse of imaging.

## **METHODS**

We constructed this report to adhere to the COREQ-checklist (21). Complete methodological details are provided in a COREQ table in Appendix 1.

### **Sampling & recruitment**

#### *Patient participants*

Patients were identified through routinely collected ED presentation lists from Liverpool Hospital in Sydney, Australia and invited to participate via a text message from a clinical researcher. Patients over 18 years of age were eligible to participate if they presented to the ED with low back pain between April - August 2019. Patients were excluded if their low back pain was due to a serious condition (e.g. cancer), they had insufficient understanding of English or could not provide informed consent. Recent data showed that age, gender and ethnicity may influence imaging prescription in the ED (22,23). Therefore, purposeful sampling was performed to achieve variation regarding these characteristics (24).

#### *Clinician participants*

All ED physicians at Liverpool Hospital were invited to participate via e-mail from the head of ED. Additional clinicians were identified at Royal Prince Alfred Hospital at a continuing education meeting for trainee ED physicians, and through snowball sampling at Royal North Shore Hospital. Clinicians were eligible to participate if they worked in the ED as a physician or physiotherapist and were involved in care of patients with low back pain.

### **Data collection**

#### *Patient participants*

We combined semi-structured interviews with focus groups. Firstly, focus groups enabled us to gather a large amount of data from patients with the benefits of group interaction (25). Specific themes from the focus groups were further explored in additional individual interviews.

#### *Clinician participants*

Semi-structured individual interviews with clinicians enabled all clinician voices to be heard, regardless of their level of seniority.

Topics included participants' views on the use of imaging in the ED and factors that could influence this. Saturation was reached when no new major themes emerged from the interviews. We also asked participants about their impression of a draft campaign against the overuse of imaging (results in preparation).

### **Analysis**

We used the framework analysis method to analyse the data in an inductive way (i.e. without predefined ideas) (26). During the process seven steps can be identified (figure 1). All audio-recorded interviews were transcribed by an experienced external transcriber. During the initial step four members of the research team (JB, AT, RD & TC) individually read and coded a sample of the interviews. After this initial coding the team came together and discussed preliminary themes. With these initial codes JB coded all interviews and developed a working analytic

framework using NVivo 12. During the process regular input from the other team members was provided and a subset of 20% of the interviews was double coded by SS to check for consistent coding.

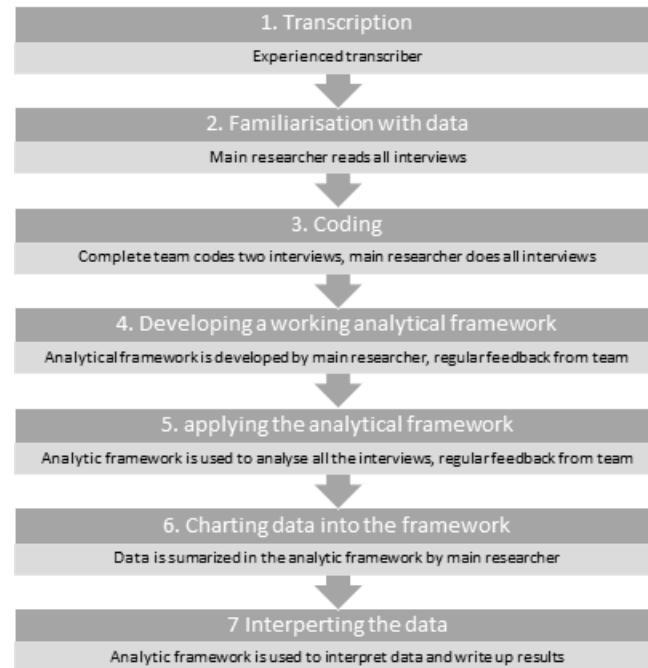


Figure 1: steps in the analysis process

## RESULTS

### Characteristics of population

#### *Patient participants*

Of 40 patients contacted to participate, fourteen agreed. Two, five-person focus groups were conducted, with an average duration of 85 minutes. Four individual interviews were then conducted, with an average duration of 41 minutes. For a complete overview of characteristics see Table 1.

*Table 1: Patient characteristics*

		<b>Total (n=14)</b>
Gender No. (%)		
	Female	9
	Male	5
Age groups - No. (%)		
	< 30	1
	31-45	9
	46-60	2
	>61	2
Age - mean (SD)		43.1 (10.6)
Born outside Australia		
	Yes	11
	No	3
Highest education		
	University degree	6
	Diploma cert.	6
	HSC or leaving cert.	1
	School cert. or Intermediate cert.	1
Currently in paid work		
	Yes, full-time	8
	Yes, part-time	2
	No	4

Cert. = Certificate, HSC = High school certificate, No.= Number, SD = Standard deviation



*Clinician participants*

Of the 115 ED-doctors invited, eight agreed to participate. All the four physiotherapists invited, agreed to participate. Resulting in a total of twelve clinicians. Interviews had an average duration of 36 minutes. For a complete overview of characteristics see Table 2.

*Table 2: Clinician characteristics*

		Interview (N=12)
Gender No. (%)		
	Female	5
	Male	7
Age groups - No. (%)		
	< 30	3
	31-40	5
	41-50	2
	> 50	2
Age - mean (SD)		38,6 (11,5)
Hospital		
	Liverpool Hospital	9
	Royal Prince Alfred Hospital	2
	Royal North Shore Hospital	1
Occupation		
	Doctor	8
	Physiotherapist	4
Level of seniority		
	Senior	6
	Mid-career	1
	Registrar	3
	Junior	1
	Unknown	1
Referral rate*		
	Almost never	1
	10%	3
	25%	2
	50%	5
	75%	1
	90%	0

No. = Number, SD = Standard deviation, \* Answer to the question; How often do you refer patients with musculoskeletal pain for diagnostic imaging?

## Themes

Findings were organised by patient and clinician participants into two overarching themes 1) potential drivers of overuse and 2) potential protective factors against overuse. Key findings were illustrated with use of selected quotes. Additional supporting quotes (numbered in text as Q1, Q2, Q3 and so on) are provided in Appendix 3.

### *Patient participants*

#### ***Potential drivers of overuse***

##### The responsibility lies with the clinician

All patients expressed that the decision for imaging was made by their clinician (Q1). Patients described limited to no involvement in the decision-making process. Trust appeared to play an important role in the majority of patients (Q2):

*"Because we don't know if we need to scan or not, once we see the doctor then we find out if [we] need a scan." (Patient Focus group 2)*

However, some patients then described disagreeing with the decision to avoid imaging and gave examples of when they either insisted on imaging or sought a second opinion (Q3-Q5).

##### Imaging finds the cause, validates pain

Beliefs and expectations regarding imaging appeared to be important drivers of imaging. The majority of patients expressed faith in imaging to locate the source of low back pain (Q6-Q8):

*"The best way to know [what's going on in my back] is to have an MRI scan." (Male, aged 34)*

Patients expressed that imaging would provide certainty about their condition and validate their pain (Q9, Q10). Mainly the benefits of imaging were discussed, with perceived harms limited to radiation exposure. Only one patient (who happened to be a healthcare provider), described the potential negative psychological effects of imaging results (Q11).

### Justification of imaging and reluctance to delay

Although patients generally supported to avoid or delay imaging unless there is suspicion of a pathology, many justified the need for imaging with their circumstances. Patients generally expected imaging when: 1) there was severe pain or physical limitation, 2) the pain was not resolving over time despite treatment, 3) they themselves suspected serious pathology, or 4) when they felt the current episode of back pain was different from previous episodes (Q12-Q16):

*"So, because my problem was not improving with exercise or with physiotherapy, that's when we went down the path of a CT scan." (Female, aged 44)*

Patients also discussed their beliefs about reasonable waiting times for imaging, with the majority stating they could only wait up to one week:

*"If you are in very much pain, how can you wait for three weeks? You can't wait even one day. But if you trust your doctor, you can wait for five days. [Waiting] longer than that, you can't." (Patient focus group 1)*

### External requirements and access to care

Requirements from work and insurance companies were also described to influence the need for imaging (Q17):

*"Then because it was a workcover situation a MRI was ordered." (Female, aged 50)*

In addition, some patients felt they could access care more easily or that costs would be covered if they accessed care through the ED, compared to the private sector (Q18, Q19).

### **Potential protective factors against overuse**

#### Trust in the healthcare provider, alternatives to imaging and information

Patients who trusted their provider described being more open to accepting advice to delay or avoid imaging. Patients also described some potential alternatives to imaging, such as exercise therapy, physiotherapy, massage and pharmacological therapies (Q20-21). Some patients stated the importance of being provided with information on the expected course of their back pain:

*[In reaction to being given an education tool]: "I like that [the education tool] says that your symptoms should improve and I like it that it tells you what you can do and that if pain persists that you can go back so it's not brushing the patient away." (Female, aged 44)*

*Clinician participants***Potential drivers of overuse**Patient pressure, expectations and knowledge

All clinicians perceived that the most important driver for imaging in ED was patient pressure and gave examples of these situations (Q22,Q23):

*"I've definitely had people that have come in and demanded imaging." (Male, Physician - junior)*

Clinicians described believing this pressure came from a need for information and reassurance (Q24-Q27), with patients forming expectations for imaging based on previous experiences, their relatives and/or media sources:

*"I think [overuse of imaging is driven] secondarily by patient's expectations as well though. They may have had a friend or they may have had a scan previously when they've had back pain and they expect each time to get it too." (Male, Physician – mid-career)*

Also raised by clinicians as patient drivers for imaging were low knowledge of the potential harms of imaging and overestimation of the benefits (Q28):

*"X-rays seem to have a mythical status amongst patients that they can diagnose anything." (Male, Physician - Senior)*

Complex sociodemographical and cultural factors were also raised by some clinicians as potential drivers of patient expectations for imaging in ED (Q29,Q30). Clinicians believed patients from some cultural backgrounds were more likely to expect imaging than others. Also system factors such as a need for imaging for an insurance claim, were mentioned by clinicians as drivers; patients would only be satisfied with the encounter if the insurance-mandated scan was provided (Q31).

Clinician's inability to resist patient demands

Some clinicians described feeling their colleagues may be unable to provide patients with adequate information or reassurance to replace the use of imaging, due to limited experience or knowledge of best care for low back pain. Others described a lack of confidence and fear of missing pathology as drivers of unnecessary imaging (Q32-Q34):

*"If [my colleagues] are uncertain or inexperienced then yeah it's not uncommon just to order an x-ray just to rule out acute things." (Male, Physician - junior)*

Clinicians also discussed a lack of awareness of the potential downstream consequences of imaging that meant some of their colleagues underestimated the potential harms of imaging (Q35):

*"I think even doctors won't understand the harm, their interpretation of harm would be radiation exposure." (Female, Physiotherapist )*

Clinicians felt that if patients demanded imaging, they would be less inclined to refuse it (Q36) and so imaging was used to satisfy the patient (Q37).

*"So in the end you can only fight so much." (Female, Physician - senior)*

Only one junior clinician described feeling vulnerable to malpractice claims from patients. Other clinicians stated medicolegal risk was in the back of their mind, but they were confident with their assessment and documentation in avoiding litigation (Q38,Q39). All senior clinicians described not worrying about risk of malpractice claims at all (Q40,Q41).

#### Context of Emergency care

Clinicians described some ED specific factors that could drive imaging in this setting, for example the simplicity of ordering imaging in the ED:

*"I guess the biggest driver would be probably because it is a pretty quick and easy scan to do." (Male, Physician - Junior)*

The majority of clinicians also mentioned time pressure in the ED to be a driving factor (Q42,Q43), as it is often quicker to perform imaging than take the time to explain to patients why they would not perform imaging. One clinician expressed a different view, stating that there was actually less time pressure in the ED because clinicians aren't paid per patient (Q44).

#### Lack of ongoing therapeutic relationship

The lack of an ongoing therapeutic relationship was mentioned as a reason for high imaging rates in the ED. These ED clinicians explained that patients sometimes doubted if they worked in their best interest (Q45,Q46).

**Potential protective factors against overuse**A good explanation

Clinicians indicated that explaining to patients why they didn't need imaging was the most important protective factor against overuse (Q47):

*"If you're able to sit there and explain to them exactly what it looks like is going on from the examination, and then you explain that you don't really need the imaging to prove this, then often they understand." (Male, Physician – junior)*

Increasing patients' knowledge on the lack of utility of imaging and the normal course of back pain was also mentioned (Q48-Q51):

*"I've found 99% of people if you explain [why imaging is not needed] they are more than happy with your explanation." (Female, Physiotherapist - Senior)*

Although all clinicians described the benefits of patient education, some were unsure if this would prevent patients from requesting imaging (Q52). Some clinicians stated that radiation risk could be a motivator for patients to avoid imaging if they weren't receptive to the 'lack of utility' explanation (Q53). Additionally, clinicians suggested shared decision-making could help reduce imaging:

*"I'm definitely pro things that encourage patients to ask questions and actually have a conversation about their treatment and make an informed decision." (Female - Registrar)*

Providing a good assessment and information

Clinicians indicated that conducting a well-documented good assessment is important to prevent the overuse of imaging, helping the clinician to confirm no indication for imaging and to reassure the patient (Q54,Q55).

*"Strategies to avoid imaging for lower back pain [are] good assessment, good documentation." (Female, Physiotherapist - senior)*

Better clinician education was also discussed as a way to increase knowledge of imaging indications (Q56,Q57). Clinicians suggested the use of digital or paper decision aids to help the clinician determine if there is an indication for imaging (Q58).

### Collaborative approaches to care

The majority of clinicians described working in a multidisciplinary team with multiple levels of seniority as beneficial for discussing cases with a senior clinician or another discipline (Q59):

*"At that stage if you feel like you can't get any further with them or you're not getting through to them I just consult with the consultant in charge, so the head doctor."  
(Female, Physiotherapist - senior)*

Some junior clinicians expressed different views, feeling that there were instances in which they were overruled in their decision not to perform imaging (Q60). Clinicians also discussed the importance of ensuring patients receive a good follow-up plan - with their GP, physiotherapist or provide them with a written plan (Q61,Q62), as aligning messages between the different health care providers is important.

One clinician indicated the importance of team performance in the ED with an illustrative statement:

*"I think actually a lower imaging rate is a genuine quality measure of decent patient-based care." (Male, Physician - senior)*

## **DISCUSSION**

### **Statement of principal findings**

This study demonstrates potential drivers and protective factors for overuse of imaging from the perspective of patients and clinicians in the ED. For patients, imaging was an important component of care for low back pain. The data suggested that patients may be reluctant to delay or avoid imaging in ED because: 1) they believed the test would find the cause of their pain, 2) they put faith in their doctor to make the decision, and/or 3) they felt their circumstances warranted imaging urgently. For clinicians, the primary driving factor for imaging overuse was perceived patient pressure. Factors such as a lack of confidence, experience, and an inability to resist patient demands could lead to overuse. Emergency Department-specific characteristics such as time pressure and the absence of an ongoing therapeutic relationship were also potential drivers of imaging overuse. Clinicians indicated that a good assessment would contribute to reduce overuse of imaging. Patients and clinicians believed in the added value of a good explanation which could provide an alternative to imaging. A collaborative approach to care – where a care team agreed upon the diagnostic workup of a patient – was also cited by clinicians as a key protective factor against overuse of imaging in ED.

### **Strengths and limitations of this study**

Our sampling strategy aimed to achieve variation in participant characteristics that have been indicated as potentially influential in imaging prescription and capture diverse perspectives from both patients and clinicians. Interviews were conducted by an experienced qualitative researcher and the analysis was performed by a team of researchers with a variety of clinical and research backgrounds in public health, sociology, musculoskeletal conditions, and low value care.

Data saturation may not have been reached on the influence of some patient characteristics, such as cultural factors, but many of the key themes (e.g. belief that imaging finds the cause, trust in the doctor to make the decision) overlapped irrespective of their cultural background. Combining questions on general views about imaging with opinions on a draft campaign to reduce overuse of imaging may have influenced some of the views regarding imaging. However, as questions on the draft campaign were asked at the end of the session, the influence of these materials on our results should have been minimal.

### **Findings in relation to previous studies**

Our findings are consistent with previous research done in the field of overdiagnosis. A review found low back pain patients believe imaging is important to locate the source of their pain and would provide validation of their pain (19). Patients included in this study also expressed this perceived added value of imaging. Drivers of overuse such as a lack of confidence or knowledge and a fear of missing pathology found in a narrative review (18), were also expressed by ED clinicians in this study.



We found some potential drivers of imaging that may be specific to emergency care settings. Patient flow, an absence of patient participation in decisions about imaging, and a lack of ongoing therapeutic relationship, appeared to be important drivers of overuse in ED. Time pressure in ED meant some clinicians would order imaging that was not medically necessary to manage patient flow. The effect of time pressure on clinicians' ability to communicate and overview of the department in ED was previously described (27). However, the effect of this time pressure on overuse of imaging was not yet indicated before. Patients in our study described not being involved in a shared decision about the need for imaging in the ED. Although previous research on analgesics choice in ED does indicate that over half of the patients do express a desire to be involved (28). Additionally, shared decision making has potential to reduce overuse of low value diagnostics in ED (29,30). From this study it appears that the potential of shared decision-making to reduce overuse of imaging is not fully realised.

In terms of protective factors, trust in the advice patients receive from their clinicians and collaborative approaches to care seem to be important. Our study findings indicate that patient education may be important in reducing overuse of imaging. A previous review of 14 randomised controlled trials found patient education could reduce health care utilization for low back pain in primary care (31). These approaches have been under-investigated in ED. Another potential protective factor from our study was the importance of a collaborative approach within the ED and with health professionals outside the ED. The importance of a collaborative approach in the ED was highlighted in a previous review that found that clinicians in general indicate teamwork and good communication to be key to high quality ED care (32). Additionally the ability to reduce healthcare costs by adopting a collaborative approach between hospitals and primary care has been illustrated in patients with Parkinson's disease previously (33). This suggests that, in concordance with suggestions of clinicians in this study, a collaborative approach within and outside the ED could help reduce unnecessary care without compromising patient outcome.

### **Implications**

This study indicates the importance of good communication in ED to ensure patients understand why imaging may not be needed. Avoidance of imaging may be counterintuitive for the general public; a clear explanation of the reasons to avoid imaging (e.g. limited value of results, potential downstream consequences and the absence of "red flags" indicating pathology) is likely to be essential. Clinicians should be aware of the role they play in this, especially as the majority of patients indicate they feel that the decision lies with the clinician. One strategy could be to encourage patients to participate in the decision to perform imaging. Clinicians could benefit from training in shared decision-making that is appropriate for ED settings. Another potential solution that is important for the ED is to achieve a collaborative approach within different disciplines. Aligning messages from different disciplines within the ED and with professionals outside the ED would help patients to receive consistent messages

about what they do and do not need. Clinical leaders should initiate communication strategies and develop care pathways that support this collaborative approach to care.

### **CONCLUSION**

This study identified several factors that may drive overuse of imaging in the ED. Patients expressed clinical (e.g. pain severity), cultural (e.g. beliefs), and system-related (e.g. work insurance requirements) reasons for desiring urgent imaging. Clinicians believed it was primarily patient pressure that drove overuse of imaging. Resisting this pressure is even more complicated because of the lack of time and the difficulty to establish or maintain an ongoing therapeutic relationship in ED. Furthermore, a lack of skill and confidence of clinicians working in ED appear to be important in this. Solutions to reduce overuse of imaging in the ED should include: 1) training and support to assist clinicians to provide an adequate and well explained assessment for low back pain, 2) tools to involve patients in decisions about imaging, and 3) care pathways and communication strategies that encourage collaborative approaches to care.

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**APPENDIX 1 - COREQ checklist**

The Consolidated Criteria for Reporting Qualitative Studies (COREQ): 32-item checklist

No.	Item	Guide questions/description	Notes
Domain 1: Research team and reflexivity			
The research team Johan Blokzijl physiotherapist, Master student; Adrian Traeger, physiotherapist, PhD ; Rachael Dodd, PhD; Tessa Copp, PhD-student; Sweekriti Sharma, PhD-student, Christiane Klinner, qualitative research assistant; Chris G Maher, Professor.			
Personal Characteristics			
1.	Interviewer/facilitator	Which author/s conducted the interview or focus group?	CK conducted all semi structured interviews. AT was the moderator during the focus groups.
2.	Credentials	What were the researcher's credentials? E.g. PhD, MD	AT: PhD, CK: GCert (qualitative health research)
3.	Occupation	What was their occupation at the time of the study?	AT: physiotherapist and research fellow, CK: qualitative research assistant
4.	Gender	Was the researcher male or female?	The focus group facilitators (AT) was a male. The interviewer (CK) was a female
5.	Experience and training	What experience or training did the researcher(s) have?	AT and CK had experience with qualitative methods including facilitating focus groups and conducting interviews
Relationship with participants			
6.	Relationship established	Was a relationship established prior to study commencement?	The research team did not have any contact with participants prior to obtaining informed consent. Researchers had no professional or ongoing relationship with the participants.
7.	Participant knowledge of the interviewer	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	Participants were aware that this was a research to explore the use of diagnostic imaging in the emergency department. The research team explained that the goal of the research is to improve evidence based care for patients with low back pain in the emergency department.
8.	Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	The research team had an interest in overuse of imaging in the emergency department and the reduction of low value care.

Domain 2: Study design		
Theoretical framework		
9. Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	The research team conducted a framework analysis with a thematic analysis. We analysed the data in an inductive manner (i.e. without preconceived ideas).
10. Sampling	How were participants selected? e.g. purposive, convenience, consecutive, snowball	We used purposive sampling strategy. We attempted to reach maximum variation regarding age, gender and cultural background for the patient participants.  Clinicians formed a convenience sample and were eligible to participate if they worked in the ED as a physician or physiotherapist and were involved in care of patients with low back pain.
11. Method of approach	How were participants approached? e.g. face-to-face, telephone, mail, email	We recruited all patients using the routinely collected ED presentations lists from the Liverpool hospital.  Clinicians were recruited through head of ED from the Liverpool hospital and via e-mail notification of the study by one of the researchers (AT). Clinicians were not be forced to participate in the study nor were they be disadvantaged when choosing not to participate.
12. Sample size	How many participants were in the study?	14 patient participants and 12 clinician participants.
13. Non-participation	How many people refused to participate or dropped out? Reasons?	Of the 40 patients who were invited and eligible, 10 agreed to participate in a focus group, and 4 in an individual phone interview. Resulting in a total of 14 patient participants.  We invited 85 ED physicians to participate in this study, in total 8 agreed to participate. Additionally we also invited 4 physio's who all agreed to participate, resulting in a total of 12 clinician participants.
Setting		
14. Setting of data collection	Where was the data collected? e.g. home, clinic, workplace	Focus group sessions were conducted in Liverpool Hospital library meeting rooms. Interviews with both patients and clinicians were conducted via telephone
15. Presence of non-participants	Was anyone else present besides the participants and researchers?	There were no people present during the data collection besides participants and researchers.
16. Description of sample	What are the important characteristics of the sample? e.g. demographic data, date	The average age of patient participants was 43. Of the participants in the focus groups all participants were born outside Australia. For the patients participating in the interviews all but one were born in Australia.

Data collection		
17. Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	Researchers used an interview guide and topic list for the interviews and focus groups. Interview guide was pilot tested and adjusted throughout the data collection. Final interview guide and topic list is provided in appendix 2.
18. Repeat interviews	Were repeat inter views carried out? If yes, how many?	There were no repeat interview with the same participants.
19. Audio/visual recording	Did the research use audio or visual recording to collect the data?	All interviews were audio recorded with permission of participants.
20. Field notes	Were field notes made during and/or after the interview or focus group?	Researchers did make any fieldnotes during the interviews or focus groups.
21. Duration	What was the duration of the interviews or focus group?	The focus groups had an average duration of 1 hour and 25 minutes and the individual interviews with patients had an average duration of 41 minutes.  The individual interviews with clinicians had an average duration of 36 minutes.
22. Data saturation	Was data saturation discussed?	Data saturation was reached on almost all major topics. We didn't reach saturation on the cultural aspects from a patients perspective.
23. Transcripts returned	Were transcripts returned to participants for comment and/or correction?	Transcripts were not returned to participants for comment and/or correction
Domain 3: Analysis and findings		
Data analysis		
24. Number of data coders	How many data coders coded the data?	All researcher coded two interviews individually and came together to compose a preliminary coding tree. One main researcher used this coding tree to code the remaining interviews with regular feedback of the rest of the analysis team.
25. Description of the coding tree	Did authors provide a description of the coding tree?	There is no description of coding tree provided by researchers
26. Derivation of themes	Were themes identified in advance or derived from the data?	Themes derived from the data in an inductive manner.
27. Software	What software, if applicable, was used to manage the data?	Researchers used NVivo during the coding of all interviews.
28. Participant checking	Did participants provide feedback on the findings?	There was no member check performed by the research team within this study.



Reporting		
29. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? E.g. participant number	key findings of this study were supported with selected quotes in text. Additional supporting quotes are provided in Appendix 3.
30. Data and findings consistent	Was there consistency between the data presented and the findings?	All finding derived from the data and all themes are supported by illustrative quotes.
31. Clarity of major themes	Were major themes clearly presented in the findings?	Major themes derived from the data and are clearly defined by a paragraph title.
32. Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	Themes on which there was a deviant opinion within the group or between the groups are discussed by the researchers. Themes that are only described by one participants are also discussed in the results section of this study.

## APPENDIX 2 – Interview guides

### Scan Your Options Project – One-to-one Interview Guide – PATIENTS

#### Switch on audio recorder

#### Introduction [For researcher to introduce themselves]

- Explain set-up of session (timeframe approx. 30-35 mins).
- *Explain that researcher cannot give medical advice.*
- We want to find out what you know about health care for low back pain and how you feel about it.
- We will also explain some information that may be new to you. Then we will ask you about your reactions and views regarding this information as well as if and how you think it should be provided to the community.
- The aim of today's session is to talk about your thoughts and feelings about the information presented and whether you understand this information. There are no right or wrong answers, we are interested in your opinions.
- The recording we make during this session today is for making sure we can accurately summarize our discussion. It will be transcribed into a written record of what is said. No one will hear or see it except for members of the research team.

#### Discussion Guide

##### **PART 1: Beliefs about diagnostic imaging tests**

Opening question; experience as a patient with back pain and with imaging

What is your understanding of the role of imaging tests (x-Ray, CT, MRI) for somebody with low back pain?

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What do you see as the advantages of imaging tests? What are the disadvantages?

How does patient feel about three best practice recommendations (stay active & avoid bed, refrain from immediate imaging and avoid strong pain medication)?

## **PART 2: Perceptions of an awareness campaign for low back pain**

### ***PRESENTATION OF SCAN YOUR OPTIONS POSTERS***

*5 sets of posters (nudge and neutral version)*

Do you have any thoughts or questions about these public health messages? What about the posters themselves? Was the message clear? Is there any other information you would have liked on a poster? What could be added, removed or changed from the posters?

How easy or hard do you think it is for people to understand the reasons for not having an imaging test (x-Ray, CT or MRI)?

Do you have any ideas about how best to explain the pros and cons of having an imaging test (x-Ray, CT or MRI) to other people?

How does the information on the posters compare with what you already knew?

## **PART 3: Perceptions of a decision-making tool for low back pain**

### ***PRESENTATION OF SCAN YOUR OPTIONS LEAFLET***

*1 slide per page of leaflet + hard copies for participant*

How would you feel if your doctor talked through this brochure with you?

Let talk through the brochure, page by page? Do you feel that you understand the information in the brochure? What are your thoughts on what the brochure is saying?

We're now just going to make a list of any advantages you can see about the brochure and also any concerns you may have. So can you see any advantages of the brochure? Do you have any concerns about the brochure?

Is there any more information you would like to help make a decision about having an imaging test (x-Ray, CT or MRI)?

## **PART 4: Perceptions of best practice care for low back pain**

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I'd like to get your perspectives on how low back pain should be treated. Here are some questions to get us started:

- a. What do you think are the most common causes of low back pain?
- b. What would you expect from your family doctor if you saw them for low back pain? What if you went to the emergency department?
- c. What do you think are the most effective treatments for low back pain?

Now I'd like to present you with some information from recent best practice guidelines for the management of low back pain and get your thoughts. I am going to present you with this information and then we'll have a discussion about what you thought and how you felt.

*PRESENTATION OF INFORMATION FROM ACI MODEL OF CARE*  
Information about diagnosis and management of low back pain in Australian Hospitals.

Has this information prompted **any more thoughts about the posters and leaflet I presented earlier?**

Do you have any questions or is there anything you would like me to clarify?

### Completion

- That is the end of the interview. Thank you for participating.
- Switch off audio recorder.
- Researcher to hand over gift card and get participant to sign gift card receipt form.

## Scan Your Options Project – One-to-one Interview Guide - CLINICIANS

### INTRODUCTION

Thanks for agreeing to help with the project. We are trying to understand how clinicians use diagnostic imaging of low back pain in the ED. We are also looking at tools to improve communication between doctors and their patients.

The interview will take 20-30min. Are you ok to begin? →switch on audio recorder

Can you tell me what your role is at [Liverpool / RPA]: \_\_\_\_\_

### PART I

1. What do you understand is the evidence-based management for acute musculoskeletal low back pain?
2. Can you tell me about some of the challenges you face providing evidence-based care for low back pain in the ED?
3. Can you tell me your thoughts regarding this statement:  
*I worry that not ordering a scan for a patient with low back pain could leave me vulnerable to a future malpractice claim*

*Prompts:* can you think of situations where this applies, or where this does not apply

4. Guidelines recommend against imaging for simple musculoskeletal back pain. It still happens frequently though. What do you think the biggest driver of unnecessary imaging is?
5. What are some strategies you use to avoid unnecessary imaging?  
*Prompts:* e.g. team related, guideline related

### PART II

Here is a set of posters and a patient leaflet. Could we first go through the **posters**? There are a two versions of each poster, and we'd like to get your preference. What do you think poster (1, 2, 3, ...) is trying to communicate? Any concerns about the message? Is there anything you'd change?

Here is the patient **leaflet** (Scan Your Options). Can you give it a quick read and then give me your thoughts? Would you use this with patients? What would make you use a leaflet like this?

Do you think any of these materials would change a patient's mind about the need for a scan? Would you feel comfortable endorsing the messages on the posters/leaflet?

Do you have any suggestions how we could make these messages visible in the ED?

**APPENDIX 3 – List of quotes****Patients****The responsibility lies with the clinician**

- Q1** "wherever they send you to that's where you go. It's not like I've gone out on my own and gone against the grain or anything." (Patient focus group 2)
- Q2** "I have a relationship with my doctor [...] I trust him, so if he tells me to do something then I'll go and do it." (Patient Focus group 2)
- Q3** "Maybe we find another doctor if you are in very much pain" (Patient Focus group 2)
- Q4** "if your doctor doesn't listen to you then you should get a second opinion." (Patient Focus group 1)
- Q5** "When I got into my first GP I kept asking him to do the scan. I went several times to see him because I had to report to the insurance and he kept saying you'll be better" (patient focus group 1)

**Imaging finds the cause, validates pain**

- Q6** "I don't know what my diagnosis is [...] to have a scan then I would be sure that I have that problem." (Patient focus group 1)
- Q7** "I think that back scans actually show the problem" (Patient focus group 2)
- Q8** "there is any other ways that the doctor will find out by touching or by any other stuff without a scan?" (Patient Focus group 2)
- Q9** "If I can't move that's the first thing that would pop into my head; I would want to get a scan and find out why I can't move." (Patient Focus group 1)
- Q10** Interviewer: "How did you feel about that test result?"  
Participant: "I was kind of happy actually that it wasn't all in my head." (Female, aged 44)
- Q11** "It's all the psychological effects of that when people know that there is something wrong with them then they tend to focus on that issue or ailment without getting on with their normal duties [...] they'll sit and focus on that and worry about it and potentially make things worse." (Male, aged 42)

**Justification of imaging and reluctance to delay**

**Q12** "The reason I came to Liverpool Hospital about April is because I experienced a really strong lower back pain." (Patient focus group 1)

**Q13** "This time it didn't improve that's why I went down the path of the scans" (Patient Focus group 1)

**Q14** "I was in so much pain couldn't get up, couldn't move, [...] so that's why I went to emergency. " (Patient focus group 1)

**Q15** so his concern then shifted to potential kidney stones as a cause of the pain which is why he decided to do the CT (Male, aged 42)

**Q16** "they did kind of say it's not a flare up? My flare ups tend to stay 3 to 5 days maximum, this felt very different I had it for like a month." (Patient Focus group 1)

**Economic drivers**

**Q17** "I went several times to see him because I had to report to the insurance" (Patient focus group 1)

**Q18** "my neurosurgeon was operating there that day and I thought that on the off chance that I would go in under him and I would see him at Liverpool that day" (Female, aged 44)

**Q19** "I know with the lower back pain the hospital covered it for me this time but if I went to a GP it would have been..." (Patient Focus group 1)

**Trust in the healthcare provider and alternatives**

**Q20** "So it flared it up and it went into spasm for probably about 4 or 5 days, so just standard bed rest and anti inflammatories helped the acute phase of it pass and then I commenced with some physiotherapy thereafter." (Female, aged 50)

**Q21** "So these exercises have helped me to recover a strength in my back, it was since the first week I noticed the change." (Patient focus group 1)

**Clinicians****Patient pressure, expectations and knowledge**

**Q22** "So when the people come in and you don't x-ray them, you don't refer them to a neurosurgeon they get very upset, often quite aggressive." (Male, Physician - junior)



**Q23** "overprotective relatives often they advocate for the patient and they see their relative in pain and they want a quick fix and the quick fix usually ends up being an xray or a CT scan." (Male, Physician - senior)

**Q24** "So they're desperate to have an answer, to have serious pathology excluded" (Male, Physician - mid-career)

**Q25** "What they generally really want is somebody to actually explain what's going on with them ... and more importantly how are they going to get better." (Male, Physician - Senior)

**Q26** "specially coming to the emergency department people expect you to do something." (Female, Registrar)

**Q27** " guess the other thing is just in general people have certain beliefs about their back pain and about how back pain should be managed and the expectations about how they should be managed when they come into hospital." (Female, Physiotherapist - senior)

**Q28** "There would still be a large proportion who still feel that despite all this evidence or despite the fact there's a formal poster that the risks are not great and the chances of them finding something is great despite the numbers." (Male, Physician - mid-career)

**Q29** "So we've got very complex patients out here, they're non English speaking patients, poor literacy, we have high refugees and they are much more complex in their pain management." (Female, Physiotherapist )

**Q30** "t's culturally drilled into them that a little difficulty needs some form of intervention" (Male, Physician - junior)

**Q31** "if all they want is to have a workers comp form you're not going to get them out the door until you do that." (Female, Physiotherapist )

#### **Clinicians inability to resist patients**

**Q32** "just don't have the confidence or experience to say listen you don't need a scan and here's some more information on it." (Female, Registrar)

**Q33** "I think clinicians especially possibly more junior clinicians or inexperienced clinicians don't have the educational toolkit to educate [...] and have the confidence to explain to patients [why they don't need a scan]." (Female, Physiotherapist - senior)

**Q34** "I think probably fear of missing a serious diagnosis is the main driver." (Female, Registrar)

**Q35** "not many of us see the potential harms of doing it [referring to imaging]" (Male, Physician - junior)

**Q36** "Sometimes it's just easier to do it than it is to argue." (Female, Registrar)

**Q37** "If a patient is extremely resistant they have at times sent for scans as a way of reassuring the patient. So it can be used as a reassurance tool as well." (Female, Physiotherapist - senior)

**Q38** "I think people image is more just to cover their bums from medical legal because they're not happy with how their assessments skills are." (Male, Physiotherapist - senior)

**Q39** "I mean there's always I guess thoughts in the back of my mind whether not doing an urgent imaging will lead to future malpractice. But in saying that if we have reasonable enough evidence in our history and examination to say that this particular person doesn't warrant imaging immediately then I wouldn't necessarily order one because I can justify it with the history and examination findings." (Male, Physician - junior)

**Q40** No, I think there's much better things I worry about (Male, Physician - mid-career)

**Q41** No, not at all. I believe that my practice is well supported by evidence and if that's the case then I don't have concerns about future malpractice. (Male, Physician - senior)

#### **Context of Emergency care**

**Q42** Look there's not much time that's the nature of emergency medicine is there's not a lot of time to have lengthy conversations with people (Female, Registrar)

**Q43** The other thing I guess is a need for patient flow within emergency departments (Male, Physician - Senior)

**Q44** "we don't get paid any differently depending on whether we see 5 or 15 patients." (Female, Physician - senior)

#### **Lack of ongoing therapeutic relationship**

**Q45** "I suppose getting that report initially so they at least have some trust in you and they don't have the feeling that you're denying them the scans." (Male, Physician - mid-career)

**Q46** " If they see a doctor that they've never seen before at a medical centre they're probably not going to trust them that much and they're going to say oh look I've got this back pain I want a scan." (Female, Physician - senior)

**A good explanation**

**Q47** "explain your decision thoroughly " (Male, Physician - mid-career)

**Q48** Just because you have this on the scan it doesn't correlate to your pain, it doesn't correlate to disability and it doesn't correlate to a prognosis. So a lot of people if you explain that well they seem to understand that. (Female, Physiotherapist - senior)

**Q49** "I tell them about the way that x-rays reinforces illness behaviour and stuff like that often. That rather than actually helping to figure out what the problem is if it's a simple back pain to encourage patients in terms of attitude and stuff." (Male, Physician - senior)

**Q50** "So I mean I would just explain to them what I thought was wrong with them and how I thought what the natural history of their illness would be. I would explain to them what circumstances for imaging" (Male, Physician - Senior)

**Q51** "So educating them, giving them that book and saying look most back pain gets better in 4 weeks." (Female, Physician - senior)

**Q52** "It [referring to education]definitely doesn't always work I think it depends on the patient and the personality." (Male, Physician - Junior)

**Q53** "The other thing is the radiation, it's so much radiation in a CT scan you don't want to do that. So you can use the radiation risk as a reason." (Female, Physician - senior)

**Thorough assessment**

**Q54** Taking a history is the most important thing and formulating a sensible differential diagnosis and identifying triggers for further investigation is the most important thing. (Female, Registrar)

**Q55** doing a really good examination which then makes the patient feel good. (Female, Physician - senior)

**Q56** "we have [received] some education when they rolled out that shaped trial in the RPA emergency department and I found that really helpful."(Female, Registrar)

**Q57** Participant: "Education is a big thing."  
Interviewer: "Who do you educate?"

Participant: "If I have the opportunity to educate the doctor I will."(Male, Physiotherapist - senior)

**Q58** "... a little card with back pain red and yellow flags to look out for. So sometimes I will look out for that to guide me as to whether or not I need to [request] imaging." (Female, Registrar)

#### **Collaborative approaches to care**

**Q59** "Now obviously I'm a senior, then you've got a lot of juniors who will see these patients first and it's hard because they will often put in an x-ray and they'll come through and I'll go no, they don't need an x-ray" (Female, Physician - senior)

**Q60** " I already try to reduce the amount of scans I do but it's just a bit difficult particularly at Liverpool and when your seniors tell you that you have to do it it's just necessary." (Male, Physician - Junior)

**Q61** "Yeah and I try to give them a few concrete things either some exercises or some activities or plans of that they've got tangible things to go home with, so it's not just here's a letter from your GP good luck." (Male, Physiotherapist - senior)

**Q62** "If they're low risk they don't need imaging here at all, as long as you have a safety net plan for them and the safety net is to see their GP in three days or a week, or whatever you deem appropriate, so that's the number one strategy for not imaging here." (Female, Physiotherapist)