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# Exploring radiographers' understanding of pain: an Australian survey study

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ABSTRACT

*Introduction:* Inadequate pain literacy among health practitioners has shown to negatively influence patient experiences and outcomes. While misunderstandings of pain are prevalent among many allied health and medical professions, the state of pain knowledge among radiographers is currently unknown. This study aimed to explore radiographers' conceptualisation of pain, determine radiographer exposure to pain education in their radiography training program, and determine radiographer confidence in their understanding of pain.

*Methods:* An online survey was distributed to radiographer members of the Australian Society of Medical Imaging and Radiation Therapy (ASMIRT). Pain-related knowledge, education and confidence were explored using the "Revised Neurophysiology of Pain Questionnaire" (RNPQ), Likert-scale, and qualitative short-answer questions. Clinical reasoning was explored using image analysis. Quantitative data was imported to Microsoft Excel and IBM SPSS Statistics™ and analysed using descriptive statistics and correlation analysis. Qualitative data was thematically analysed using an inductive in-vivo coding approach.

*Results:* Participants (n=228) scored an average of 6.57/12 (SD=2.11) on the RNPQ. Only 11.8% reported receiving previous pain education, though 75.4% reported feeling variably confident in their understanding (49.1% somewhat confident; 24.1% quite confident; 2.2% very confident). Thematic analysis revealed four key themes: self-reported uncertainty of pain neurophysiology, inaccurate pain understandings, contemporary pain understandings, and approaches to clinical reasoning.

*Conclusion:* Results indicate that evidence-based pain knowledge and education are lacking within the radiography profession. Primary recommendations for future research include: an exploration of patient pain experiences within imaging departments, an audit of radiography curricula, and the development of contextualised pain education for radiographers.

*Implications for practice:* Poor pain literacy may negatively impact patient experiences, and a cultural shift in radiographers' conceptualisation of pain is required to align the profession's understanding with current evidence and recommendations.



## Introduction

Pain is a complex human experience, and its management remains one of the greatest challenges of modern medicine.[1,2] While historically understood to be a direct symptom of tissue damage or disease,[3] scientific developments have revealed that pain emerges as a protective output of the brain, produced in response to a range of biopsychosocial factors, based on level of perceived threat to the body.[4,5] Importantly, contemporary models highlight that pain can exist in the absence of pathology, and that factors including a person's thoughts, beliefs and past experiences, other body systems, and environmental and contextual cues, all have the ability to influence pain perception.[4] Despite these developments, there remains a pervasive biomedical approach to understanding and treating pain among healthcare professionals,[1] which may partially be explained by a lack of evidence-based pain education within many undergraduate allied health and medical programs.[6,7] A reliance on objective clinical data (such as image

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findings) to validate patient reports of pain is commonplace, and feelings of invalidation, stigmatisation and distress have been reported by patients experiencing pain when interacting with healthcare professionals.[8,9,10]

These insights are important to consider in the radiography context, given there is often an incongruence between image findings and pain due to the complexity of factors that influence pain perception.[11–15] While it is evident that radiographers have a clear desire to reduce patient pain during imaging examinations,[16,17,18] it has been suggested that radiographers may have low proficiency in clinical pain assessment and management.[18,19,20] This may be partially attributed to insufficient pain-related education within radiography training programs, with an international cross-sectional study finding that the radiography courses included did not contain any dedicated pain education.[7] Shephard & Dahlenburg (2023)[21] argue that radiographers who are misinformed about pain may dismiss or disbelieve patient reports of pain during imaging examinations, particularly in instances where image findings do not provide a clear pathoanatomical cause that "justifies" the patient's pain levels. Further, concern has been raised that practitioner empathy, clinical decision-making, and patient experiences could be negatively compromised within these interactions.[21,22] For these reasons, research into the current state of pain literacy among radiographers is critical.

The primary aim of this study was to explore radiographers' conceptualisation of pain. Secondary aims were to determine radiographer exposure to pain education in their radiography training program, and determine radiographer confidence in their understanding of pain.

## Methods

This study was conducted via an online survey, distributed by the Australian Society of Medical Imaging and Radiation Therapy (ASMIRT) to their professional membership via direct email and website access between October and November 2023. Ethical approval was obtained from the Charles Sturt University Human Research Ethics Committee (CSU HREC protocol number H23838).

### *Eligibility criteria*

Participants were required to be registered as a diagnostic radiographer with the Australian Health Practitioner Regulation Agency (Ahpra), and working clinically as a diagnostic radiographer in Australia. The survey automatically excluded participants who did not meet the inclusion criteria.

### *Outcome measures*

Questions exploring the demographic characteristics of participants were included. A range of multiple choice and Likert-scale questions were developed to explore sources of pain knowledge and prior pain education, confidence in understanding of pain, and confidence in clinical pain management. To explore pain knowledge, the survey included the 12-item 'Revised Neurophysiology of Pain Questionnaire' (RNPQ),[23] which is a validated tool for assessing how individuals conceptualise the biological mechanisms underpinning pain. Adapted from the original 19-item 'Neurophysiology of Pain Questionnaire',[24] it's previous use in healthcare research enables comparisons with other multidisciplinary cohorts, and the discipline-agnostic nature of the tool is suitable for the assessment of pain knowledge among radiographers. As per the RNPQ[23] guidelines, participants mark each individual statement as 'true', 'false' or 'undecided'. Correct answers receive one point, and answers that are incorrect or marked 'undecided' receive zero points, with higher scores generally indicating a greater (more contemporary) understanding of pain neurophysiology. In addition, two Likert-scale questions were adapted from the Health Care Providers' Pain and Impairment Relationship Scale (HC-PAIRS),[25] and a further question relating to pain threshold was developed and included to further explore pain understandings.

Three qualitative short-answer questions were also included to gain a deeper understanding of pain knowledge, and to explore how that understanding may be influencing clinical reasoning within the context of radiography practice. Clinical reasoning was explored by prompting radiographers to reflect on their understanding of pain, consider comparative x-ray images (Figs. 1 and 2), and justify their rationale for which patient they believed would be experiencing more pain.

### *Data analysis*

Quantitative data was imported to Microsoft Excel[30] and IBM SPSS Statistics™ Version 28[31] and analysed using descriptive statistics and correlation analyses to explore relationships between demographic and predictor variables with RNPQ[23] score. The

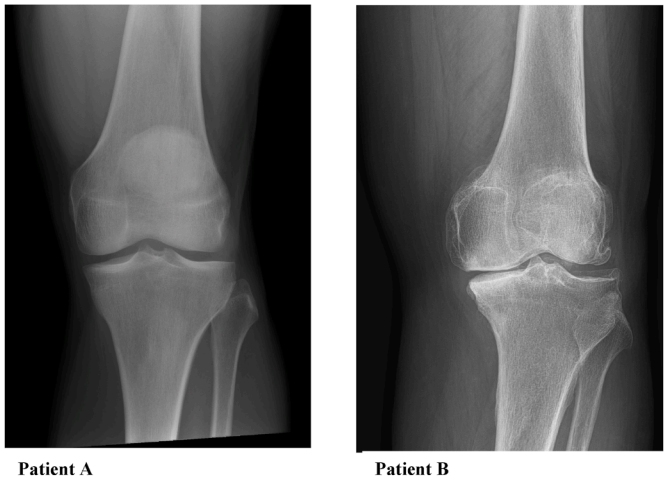



**Figure 1.** Knee x-ray comparative images (patient A[26] and patient B[27]).

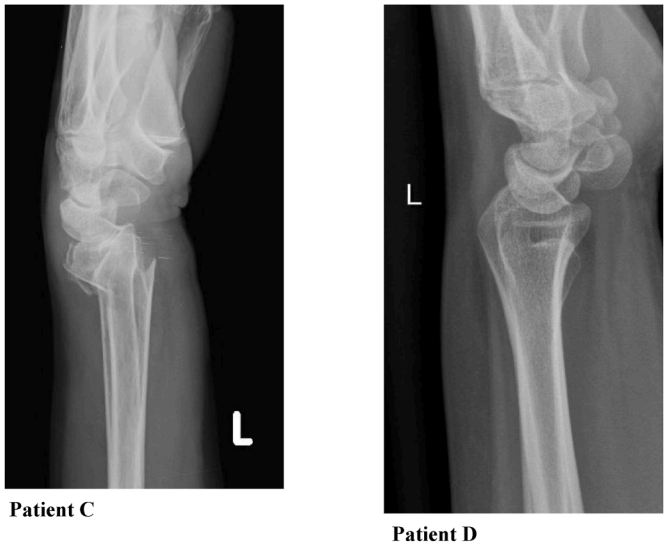



**Figure 2.** Wrist x-ray comparative images (patient C[28] and patient D[29]).

normality of the data was determined using the Shapiro–Wilk test. For the categorical variables with two categories, either the parametric T-test or the non-parametric Mann–Whitney U test was performed. For the categorical variables with more than two categories, either the parametric ANOVA one-way test (with corresponding Tukey HSD post-hoc tests) or the non-parametric Kruskall–Wallis test (with corresponding Dunn's post-hoc tests) was used. Statistical significance was reported at $p<0.05$.

Qualitative data was thematically analysed using an inductive in-vivo coding approach.[32] Responses were independently and inductively coded by two authors (KD and SS) within a bespoke Microsoft Excel[30] data spreadsheet. Independently coded in-vivo codes were compared, and in cases where codes differed, this was resolved through discussion and consensus. Secondary code categories were then developed to group primary in-vivo codes, which were analysed to develop overarching themes. The original dataset was revisited to re-test the reliability of the themes and ensure they were an authentic representation of participant data.

## Results

### *Participants*

There were 228 complete surveys (Table 1). Most participants (77.6%) had real-world experience with chronic pain, either personally (28.1%), through a close family member/friend (23.7%), or both (25.9%). Almost all participants (n=218, 95.6%) were trained in two or more imaging modalities. Data captured training from 19 Australian and 25 overseas educational institutions.

### *Sources of pain knowledge and prior education*

Participants indicated what they considered to be their main source(s) of pain knowledge from six options. Clinical and personal experience ranked highest (78.9% and 68.4% respectively), followed by own research (26.3%) and continuing professional development (CPD) activities (20.2%). Formal education (course of entry to the profession) ranked lowest (12.7%) alongside options for 'other' (6.1%) which included sources such as formal education (non-radiography based), other employment (non-radiography based), and informal learning. Only 11.8% (n=27) of radiographers in this study reported receiving education dedicated to pain neuroscience in their radiography training program, while 23.7% (n=54) indicated that they were unsure. Only 12.7% (n=29) reported undertaking pain-related CPD.

### *Confidence in pain understanding and management*

In regard to confidence in understanding of pain, 75.4% reported feeling confident to varying degrees (49.1% somewhat confident; 24.1% quite confident; 2.2% very confident) (Fig. 3). Of note, there were significant positive but weak correlations between participants' confidence in their understanding of pain and their confidence in managing it clinically in cases of acute trauma ($\tau=0.22$, $p<0.001$) and severe chronic pain ($\tau=0.27$, $p<0.001$) (Fig. 4).

### *Pain knowledge and clinical reasoning*

#### *Revised Neurophysiology of Pain Questionnaire (RNPQ)[23]*

The study cohort scored an average of 6.57/12 (SD=2.11) on the RNPQ[23] (Table 2). Of note, statement one received only a 4.4% correct response rate.

Only four variables were found to have a small but statistically significant relationship with RNPQ[23] score (Table 3). Course inclusion of pain education ($p=0.013$) and CPD completion ($p<0.001$) were both associated with a higher score. In regard to self-reported confidence in understanding of pain ($p=0.022$), scores were greater for participants who felt 'quite confident' than for those who felt 'not very confident' ($p=0.036$) and those who felt 'somewhat confident' ($p=0.029$). Age group was also found to have a statistically significant relationship with RNPQ[20] score ($p=0.047$). However, no statistically significant comparisons were identified between age groups.

**Table 1**
Demographics:

| Variable | N (%) |
|---|---|
| **Gender** | |
| Female or Woman | 172 (75.4) |
| Male or Man | 54 (23.7) |
| Prefer to self-describe | 1 (0.4) |
| Prefer not to say | 1 (0.4) |
| **Age** | |
| 20-24 | 14 (6.1) |
| 25-34 | 44 (19.3) |
| 35-44 | 50 (21.9) |
| 45-54 | 51 (22.4) |
| 55-64 | 58 (25.4) |
| 65 or over | 11 (4.8) |
| **Years of Clinical Experience** | |
| Less than one year | 8 (3.5) |
| 1-2 years | 16 (7.0) |
| 3-4 years | 15 (6.6) |
| 5-9 years | 20 (8.8) |
| 10-19 years | 48 (21.1) |
| 20 or more years | 121 (53.1) |
| **State of Work** | |
| Australian Capital Territory | 2 (0.9) |
| New South Wales | 58 (25.5) |
| Northern Territory | 3 (1.3) |
| Queensland | 67 (29.4) |
| South Australia | 22 (9.6) |
| Tasmania | 7 (3.1) |
| Victoria | 45 (19.7) |
| Western Australia | 24 (10.5) |
| **Geographic Setting (of most clinical experience)** | |
| Metropolitan | 140 (61.4) |
| Regional/Remote/Rural | 88 (38.6) |
| **Clinical Setting (of most clinical experience)** | |
| Public Hospital | 97 (42.5) |
| Private Hospital | 19 (8.3) |
| Private Practice | 105 (46.1) |
| Other | 7 (3.1) |
| **Level of Education (radiography-based)** | |
| Certificate (TAFE) | 1 (0.4) |
| Diploma | 31 (13.6) |
| Associate Diploma | 11 (4.8) |
| Bachelors Degree | 113 (49.6) |
| Professional Certificate | 3 (1.3) |
| Graduate Certificate | 19 (8.3) |
| Graduate Diploma | 18 (7.9) |
| Masters Degree | 27 (11.8) |
| Doctorate | 3 (1.3) |
| Other | 2 (0.9) |
| **Real-World Experience with Chronic Pain** | |
| Personally | 64 (28.1) |
| Through a close family member/friend | 54 (23.7) |
| Both personally and through a close family member/friend | 59 (25.9) |
| No experience | 51 (22.4) |

#### *Adapted HC-PAIRS[25] questions*

Nearly half of participants (45.6%) agreed to varying extents that 'an increase in pain is an indicator that a person with chronic pain should stop what they are doing until the pain decreases', while 16.2% felt neutrally about the statement. Similarly, 46.9% agreed to varying extents that 'people with chronic pain have to be

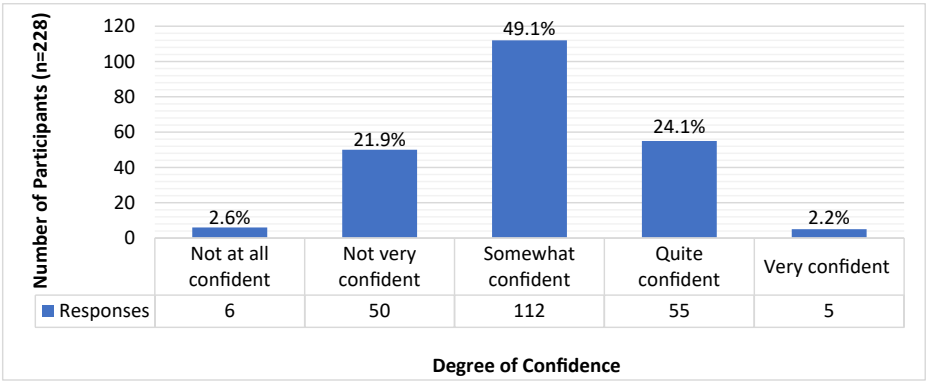



**Figure 3.** Degree of confidence in understanding of pain.

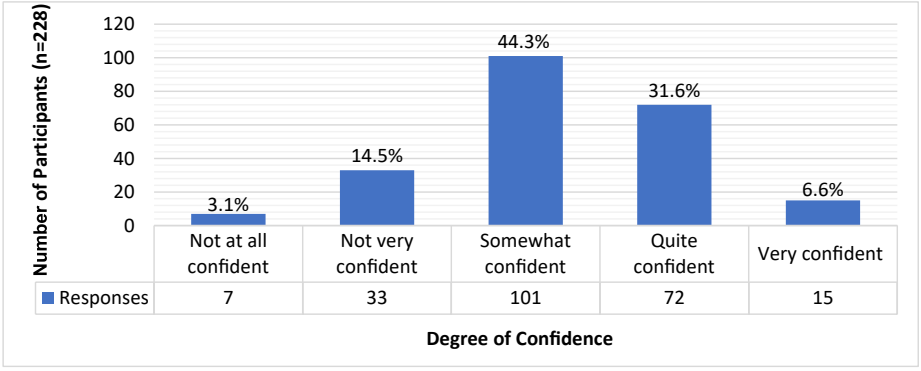
careful not to do anything that might make their pain worse', while 14.5% felt neutrally about the statement. No significant relationship existed between responses to the adapted HC-PAIRS[25] questions (Supplementary File A), and confidence in managing severe chronic pain clinically.

*Insight to pain threshold*

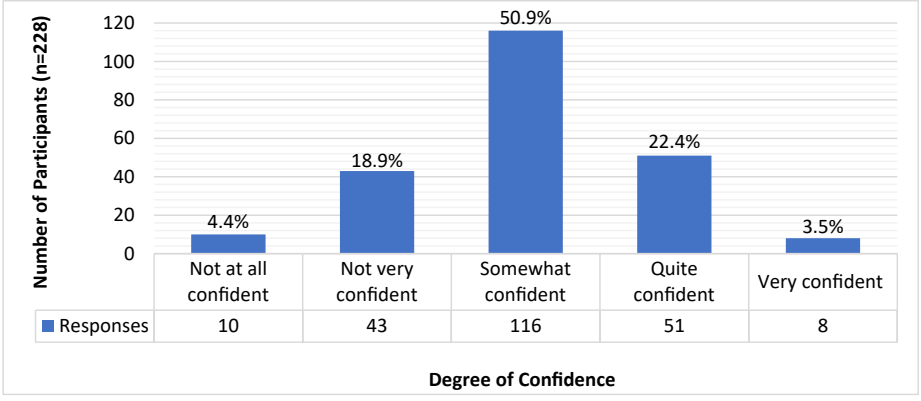
A third of participants (32.9%, n=75) agreed that 'an individual's pain threshold (i.e. how much stimulus/load is required before they experience pain) may be different to others, but does not significantly increase of decrease'. The majority (52.2%, n=119) correctly indicated this statement was false, while 14.9% (n=34) were undecided.

*Short-answer responses*

Thematic analysis of responses to the three short answer questions revealed four key but overlapping themes: uncertainty regarding pain neurophysiology, inaccurate or outdated pain understandings, contemporary pain understandings, and approaches to clinical reasoning when considering pain. These themes contained 13 related sub-categories (Supplementary File B).




***a: Degree of confidence in managing pain of patients with acute trauma***




***b: Degree of confidence in managing pain of patients with severe chronic pain***

**Figure 4.** Degree of confidence in clinical pain management.
a: Degree of confidence in managing pain of patients with acute trauma.
b: Degree of confidence in managing pain of patients with severe chronic pain.

**Table 2**
RNPQ[23] results summary:

| RNPQ Statement | Correct Answer | Answered True n (%) | Answered False n (%) | Answered Undecided n (%) |
|---|---|---|---|---|
| 1. When part of your body is injured, special pain receptors convey the pain message to your brain. | False | 207 (90.8) | 10 (4.4) | 11 (4.8) |
| 2. Pain only occurs when you are injured or at risk of being injured. | False | 13 (5.7) | 201 (88.2) | 14 (6.1) |
| 3. Special nerves in your spinal cord convey "danger" messages to your brain. | True | 146 (64.0) | 24 (10.5) | 58 (25.4) |
| 4. Pain occurs whenever you are injured. | False | 50 (21.9) | 157 (68.9) | 21 (9.2) |
| 5. The brain decides when you will experience pain. | True | 139 (61.0) | 29 (12.7) | 60 (26.3) |
| 6. Nerves adapt by increasing their resting level of excitement. | True | 114 (50.0) | 6 (2.6) | 108 (47.4) |
| 7. Chronic pain means that an injury hasn't healed properly. | False | 39 (17.1) | 158 (69.3) | 31 (13.6) |
| 8. Worse injuries always result in worse pain. | False | 18 (7.9) | 190 (83.3) | 20 (8.8) |
| 9. Descending neurons are always inhibitory. | False | 10 (4.4) | 31 (13.6) | 187 (82.0) |
| 10. When you injure yourself, the environment that you are in will not affect the amount of pain you experience, as long as the injury is exactly the same. | False | 14 (6.1) | 184 (80.7) | 30 (13.2) |
| 11. It is possible to have pain and not know about it. | False | 138 (60.5) | 47 (20.6) | 43 (18.9) |
| 12. When you are injured, special receptors convey the danger message to your spinal cord. | True | 121 (53.1) | 27 (11.8) | 80 (35.1) |
| **Total: Mean(SD)=6.57(2.11), Median(IQR)=7(5–8), Range=0–12** | | | | |

**Table 3**
RNPQ[23] significant variables:

| Variable | | N | Mean (SD) | Median [IQR] | P-Value |
|---|---|---|---|---|---|
| Pain Education | Yes | 27 | 7.5 (1.80) | 7 [6.5–9] | $p = 0.013$[1] |
| | No | 147 | 6.43 (2.11) | 7 [5–8] | |
| | *Unsure (not included in comparative analysis)* | *54* | *6.46 (2.17)* | *7 [5–8]* | |
| CPD Completion | Yes | 29 | 8.07 (2.10) | 8 [7–9] | $p < 0.001$[1] |
| | No | 199 | 6.35 (2.03) | 7 [5–8] | |
| Self-Reported Confidence in Pain Understanding | Not at all confident | 6 | 6.17 (1.17) | 6 [5.25–6.75] | $P = 0.022$[2] |
| | Not very confident | 50 | 5.96 (2.16) | 6 [5–7] | |
| | Somewhat confident | 112 | 6.46 (2.12) | 7 [5–8] | |
| | Quite confident | 55 | 7.22 (1.92) | 7 [6–8.5] | |
| | Very confident | 5 | 8.40 (2.19) | 8 [8-8] | |
| Age Group | 20–24 | 14 | 7.21 (1.72) | 7 [7–8] | $p = 0.047$[2] |
| | 25–34 | 44 | 6.89 (2.01) | 7 [5.75–8] | |
| | 35–44 | 50 | 6.60 (1.74) | 6 [5.25–8] | |
| | 45–54 | 51 | 7.04 (2.14) | 7 [5.5–8] | |
| | 55–64 | 58 | 5.76 (2.27) | 6 [4–7] | |
| | 65 or over | 11 | 6.45 (2.66) | 7 [4.5–8.5] | |

[1] Mann–Whitney U Test.
[2] Kruskal–Wallis Test.

*Uncertainty regarding pain neurophysiology.* When participants were prompted to briefly explain how pain arises in the body, 46.9% (n=107) indicated that they were unsure, demonstrating a significant self-identified knowledge gap regarding pain neurophysiology among participants.

- *"Unsure – but it's the body's way of letting us know something isn't right …"* - P200

- *"Unsure. Mechanism of pain generation is not something I've ever had cause to think about."* - P215

Some participants also indicated that while they felt they understood the cause of acute pain, their uncertainty was in relation to the mechanisms underpinning chronic pain specifically:

- *"Pain is a response to a stimulus (acute). Chronic pain is something I am not sure of how and why it occurs."* - P19

*Inaccurate or outdated pain understandings.* Inaccurate or outdated pain understandings were evident, either implicitly or explicitly, within responses. Participants often incorrectly conflated notions of nociceptors/nociception and pain (e.g. using terminology or descriptions such as 'pain receptors' or 'pain signals').

- *"Nociceptors (pain receptors) detect some kind of tissue injury and transmit the sensation to the brain via the spinal cord, which then sends back a response to the affected area …"* - P65

This was extended in some responses to suggest that pain may or may not be not be something that a person is necessarily aware or conscious of:

- *"A painful stimulus activates nociceptors which convey pain messages to the brain where the person may become aware of the pain."* - P149

- *"… there is also a message sent to the brain to register the pain and [elicit] a more conscious response to the pain …"* - P217

Similarly, pain was often described to be the direct result of pathology, indicating that pain was often considered a direct marker of injury or disease, rather than a marker of a perceived need to protect body tissue:

- *"Pain is your body's way of telling you an injury has happened …"* - P373

- *"You injure yourself and pain receptors from that area tell the brain that you are experiencing pain/have injured yourself."* - P29

Interestingly, some responses made statements that on face value appeared consistent with contemporary models of pain, but the underlying reasoning or explanation given was inaccurate or reflective of a biomedical understanding. For example, P217 (correctly) explained that worse injuries don't necessarily result in worse pain, but their explanation of why this occurs more likely reflects a biomedical understanding:

- *"… There are pain and pressure receptors in the skin … The amount of pain can be worse with lesser injuries. I.e. a graze can be really painful as it [elicits] a response from many nerves. However a deep slice may not be as painful as only a few nerves may be affected/damaged …"* - P217

In addition, there were also several instances where participants used threatening, catastrophic, or nocebic language to describe image findings:

- *"… They would feel aching, swelling, grinding of* ***bone on bone [emphasis added by authors]*** *with movement and poor gait affecting hip and lower spine also …"* - P12

- *"Patient B has severe osteoarthritis with almost* ***complete obliteration of the joint space [emphasis added by authors]****, which would cause a large amount of pain."* - P281

*Contemporary pain understandings.* While the majority of responses reflected outdated or biomedical understandings of pain, many responses indicated much more sophisticated understandings of pain that are coherent with current models. The role of the brain in producing pain was made explicit by many participants:

- *"When nerve receptors in body are damaged or injured, a signal travels to the brain to indicate this. The brain then causes the body to feel pain in response."* - P105

- *"All pain is perceived/originates in the brain."* - P109

Also common was the idea that pain serves a protective role, either by alerting an individual to "danger", or by prompting a reflex, response, or change in behaviour:

- *"… pain is a danger signal. We have a sensation in the body which is sent as a message to the brain and the brain can perceive it as pain if looked at through a lens of danger."* – P280

- *"… The brain uses pain to get the body to stop doing what it's doing and protect itself. For example, if you put your hand in a pot with boiling hot water, the nerves in the hand will pick up the heat signal and tell the brain. The brain realises this [is] dangerous, so sends pain signals down to the hand. The pain in the hand makes the person remove the hand from the pot."* - P5

Some participants identified that pain is complex, and influenced by a range of biopsychosocial factors within an individual and in their environment:

- *"… Pain is a complex phenomenon … It can also be affected by social, emotional and cultural aspects."* - P354

- *"… The environment socially and the individual's emotional state may influence their perception of pain."* - P277

Some responses highlighted that pain is a unique and individual experience, and that different people with similar injuries or pathology may not feel the same level of pain:

- *"… not all individuals will perceive the same pain from the same injury."* - P116

Regardless of whether or not participants were accurate in their description of pain mechanisms, there appeared to be a broad understanding among most study participants that pain processing occurs within the nervous system:

- *"Neuro-electrical signals from both peripheral and central nervous system …"* - P8

- *"Sensory neurons are stimulated and relayed to the brain* via *the spinal cord which are then read and recognised as stimuli that is not good for the body, resulting in the feeling of pain."* - P372

*Approaches to clinical reasoning when considering pain.* When radiographers were presented with questions relating to clinical scenarios, the vast majority articulated the reasoning behind their decision about which patient would be experiencing more pain on the basis of pathoanatomical findings from the radiographic images:

- *"Patient B would be experiencing more pain, due to OA and reduction of knee cartilage."* - P92

- *"Patient C has an acute Colles fracture of the distal radius. This fracture is usually a result of a FOOSH indicating trauma to the wrist and surrounding tissues which will be more painful than the patient D who has a normal wrist."* – P141

Participants also used their skills in image interpretation and pathoanatomic knowledge to 'identify' the type of pain a patient would be experiencing based upon image findings, often specifying it as acute or chronic:

- *"Patient C would be experiencing more pain as they have fractures through their radius and ulna. This would be acute pain."* - P147

- *"… Patient B would be experiencing chronic pain as the knee is more arthritic compared to patient A."* - P262

Many responses identified that x-ray images alone were insufficient to determine pain levels – however, there were nuanced and important differences in the clinical reasoning underpinning these responses. Whilst still reflective of a pathoanatomical approach to clinical reasoning, one subset of radiographers demonstrated a higher level of clinical reasoning in regard to the limitations involved in x-ray, at times indicating that additional imaging modalities may be required to help determine pain level:

- *"Patient B based on x-ray appearance, due to degenerative disease, but patient A could have soft tissue injuries undetected on x-ray."* - P157

- *"Patient B would more likely be experiencing more pain, barring any soft tissue trauma in Patient A that we can't see …"* - P225

Conversely, a number of responses also identified the insufficiency of x-ray in determining pain, but the reasons for this related to the multifactorial nature of pain experience and that pathoanatomical imaging findings may not always correlate with pain:

- *"Both could be experiencing the same intensity of pain. A "normal" radiograph does not indicate no experienced pain."* - P279

- *"Unable to answer without the clinical information and understanding of patient's presentation. Although patient C has a Colles fracture and would have acute pain, patient D could also have an acute injury not visualised in this image or a chronic pain condition. Patients also have differing pain thresholds."* - P158

Several responses revealed that participants were reflecting on their own clinical or personal experiences to inform their reasoning:

- *"I would think that the patient with the severe Colles fracture would be experiencing correspondingly severe pain … I have had a similar injury - really painful!"* - P131

- *"In my experience and clinical teaching, the amount of OA on an X-ray is not a reliable indicator of how symptomatic the patient is …"* - P284

Furthermore, one respondent reflected upon their clinical experience to provide insight that practitioner reliance on image findings to assess and treat patient pain may be a common practice:

- *"… Patient D does not demonstrate such an obvious injury but it doesn't mean they aren't in pain. Measuring and treating someone's pain based on X-ray findings is the biggest failing with most of the ED clinicians I have met in my career. Treat the pain not the x-ray …"* - P261

## Discussion

A growing pain burden is placing significant pressure on Australian healthcare systems,[2] and the education of health practitioners has been recognised as a priority target to improve person-centred care and pain outcomes.[33] Research has shown that contemporary pain education can result in improved pain knowledge, attitudes, and practice among healthcare professionals[34]; factors which are critical in ensuring positive experiences within imaging departments.[21,22] However, there appears to be a dearth of pain education within radiography training, with only 11.8% of radiographers in this study reporting the inclusion of pain education within their training program. Furthermore, one participant (P134) provided insight that they had learnt about 'pain receptors' at university, which may suggest that in instances where pain education is being delivered, the content may not be aligned with current evidence. These findings are consistent with literature highlighting that inaccurate or insufficient pain education is a prevalent issue among many allied health and medical training programs,[6,7] which may help to explain why evidence-based pain knowledge was generally found to be lacking among radiographers in this study.

While there is no established value for what is considered an 'acceptable' score on the RNPQ,[23] the average score in this study (6.57) was consistent with student radiographers in a multidisciplinary cross-sectional study, in which first-year radiography students (n=9) scored an average of 7.3 and final-year radiography students (n=31) scored an average of 6.0[7]. The revelation that clinical experience in radiography does not appear to improve pain knowledge (as measured by RNPQ[23]) is not unexpected when considering pain is not well-understood systemically, however it does provide reason that perhaps a direct educational intervention is required to support improved pain literacy among radiographers. It is also highly relevant to note that despite the high number of responses indicating participants had outdated, inaccurate, or incomplete pain knowledge, only 24.6% of respondents indicated they were not confident in their understanding of pain. This indicates that radiographers likely already hold established but potentially incorrect conceptualisations of pain, which in itself presents a challenge for future education initiatives.

Contemporary approaches to pain neuroscience education aim to shift one's conceptualisation of pain from a direct marker of pathology to a marker of perceived need to protect body tissue.[35] However, conceptual change frameworks highlight that varying levels of misconception exist, and pain education that actively challenges established beliefs generally faces more resistance than when it is simply filling gaps in knowledge.[36] Given the results of this study, the authors anticipate this will pose a challenge to the uptake of evidence-informed pain knowledge among radiographers in future. For example, contemporary pain models emphasise the important differentiation between nociception and pain. However, participants in this study often conflated nociception and pain into a singular concept when describing pain mechanisms, and 91% of participants indicated within the RNPQ[23] that they believe 'when part of your body is injured, special pain receptors convey the pain message to your brain'. Thus, participants largely considered pain itself to be something that is 'detected' in the body tissues, which is a conceptualisation deeply reflective of historical pain models.[3] The pervasiveness of biomedical views may also help to explain why neither years of experience nor clinical setting correlated with RNPQ[23] score, despite clinical experience being the most commonly reported source of pain knowledge in this study. For these reasons, the authors propose that a broad, long-term approach to incorporate tailored pain education in radiography training programs will be required to achieve a cultural shift in knowledge and practice. Further, the widely established misconceptions identified in this study should be carefully considered when designing future pain education initiatives.

Regarding clinical pain management, limiting patient pain is considered to be integral to patient care and is known to be a key factor influencing radiographers' clinical decision-making during medical imaging examinations.[17,18] However, a concerning number of radiographers in this study reported that they do not feel confident managing patient pain clinically (approximately one in six in cases of acute trauma and one in four in cases of severe chronic pain). Further, O'Regan et al. (2025)[18] reported that challenges and concerns relating to pain management during medical imaging examinations can negatively affect both patients and practitioners. Therefore, this finding represents an unacceptably high rate of radiographers who don't feel confident with this aspect of clinical practice and warrants further research.

Importantly, this study revealed a statistically significant relationship between confidence in understanding of pain and confidence in clinical pain management. Interestingly however, the

study also revealed that although participants may feel confident in their understanding of pain, it is also likely that their understanding is not accurate. Therefore, the authors suggest that using evidence-informed pain education to improve pain knowledge (and thus confidence in understanding) may provide opportunity to improve radiographer confidence in clinical pain management and subsequent patient experiences, and should be explored with further research.

Further, Shephard et al. (2024)[22] note that while exam modification is a common pain reduction technique used in radiography practice, equipping radiographers with an understanding of how psychosocial factors such as patient autonomy, communication, and environment could be modified to promote person-centred care and reduce pain, may help to improve overall patient experiences. A previous study supports this notion, finding that the attitude of radiographers and the act of advising patients that they could stop the examination if their pain became too much were related to pain risk during mammography examinations.[37] Given that biopsychosocial contributors to pain were identified as a qualitative sub-theme in this study and 80.7% of radiographers correctly indicated within the RNPQ[23] that one's external environment can influence pain perception, the authors believe the profession would be receptive to embracing a greater range of biopsychosocially informed pain management techniques.

Lastly, the results suggest that theoretical contemporary pain understandings may not be translating into practice in a way that helpfully informs radiographer clinical reasoning. While 83.3% of participants correctly indicated within the RNPQ[23] that worse injuries don't always result in worse pain, the majority relied on biomedical explanations when articulating their answers to the clinical reasoning questions, referring solely to pathoanatomical features present in the images. This is consistent with findings by Talevski et al. (2023),[17] who found that radiographers may use their skills in image interpretation in an attempt to understand patient pain levels during trauma x-ray examinations. While image interpretation is an important skill that radiographers can employ to help identify potential contributors to pain, Shephard & Dahlenburg (2023)[21] have raised concerns that there is a risk that radiographers who lack a contemporary understanding may solely rely on image findings to validate patient reports of pain; a practice that could potentially inhibit effective person-centred care and negatively influence patient experiences. This study not only supports this hypothesis, but goes further to suggest that a theoretical understanding of modern pain science may not be enough, and that radiography-specific adaptation focused on relevant clinical application is likely needed to improve practice. Further exploration of the real-world outcomes of radiographer pain knowledge, and particularly how they influence patient care and experiences, should be considered a critical priority for future research.

## Limitations

Not all practicing radiographers in Australia are members of ASMIRT, and distribution of the survey beyond the ASMIRT membership relied on snowballing, thus creating a potential recruitment bias. Assessing the inclusion of pain education within radiography training programs was based on self-report and therefore cannot provide a comprehensive or definitive account of pain education within current programs. Additionally, while participants were encouraged to use the 'undecided' option of the RNPQ, the true/false nature of the assessment tool makes it susceptible to random guesses. While radiographers' confidence with clinical pain management was reported, self-reported confidence does not necessarily correlate to clinical competence, and further research is required to explore the impact of radiographer pain knowledge on clinical practice in real-world settings. Most importantly, a short survey is not capable of providing a comprehensive or nuanced assessment of each individual's understanding of pain, and future research should consider more in-depth qualitative studies of radiographer pain conceptualisations.

## Conclusion

Evidence-informed understandings of pain are critical in ensuring positive experiences within imaging departments. However, to the authors' knowledge, this is the first study that has aimed to explore pain conceptualisations among qualified radiographers. While it is evident that some radiographers do hold highly accurate conceptualisations of pain, the results indicate that evidence-based pain knowledge is generally lacking within the radiography profession, and a cultural shift in how radiographers think about pain is required to align the profession's understanding with current evidence and recommendations. Importantly, a deficit of pain education in radiography training potentially contributes to this issue, suggesting a need for curricula review and reform. Despite these findings, however, the majority of radiographers reported feeling at least some confidence in their understanding of pain, highlighting a concerning disconnect between perceived and actual knowledge; and signifying the need for a carefully designed, widespread approach to future radiographer pain education.

This study contributes to the growing body of multidisciplinary pain literacy research, and lays essential groundwork for future research and education initiatives within the radiography profession. An exploration of the experiences of patients in pain within imaging departments should be considered a critical priority for future research. More in depth qualitative exploration of radiographers' understandings and attitudes towards pain, and an investigation of how pain understandings influence radiographers' clinical decision-making and experiences, should also be considered. From an education perspective, an audit of Australian radiography training curricula for the inclusion of pain education is warranted. These components are likely to facilitate the development and evaluation of tailored pain education interventions for radiography practice, helping to pave the way forward for the profession to adopt a more person-centred, pain-informed approach, and improve patient experiences within imaging departments.

## Ethics approval and consent to participate

Ethical approval was obtained from the Charles Sturt University Human Research Ethics Committee (CSU HREC protocol number H23838).

Implied consent was obtained due to the voluntary nature of online survey participation. Participants were informed that by proceeding to the survey, they were consenting for anonymised data to be analysed.

## Availability of data

Data required for this study may be made available by the author(s) upon reasonable request.

## Author contributions

KD: Conceptualisation, Methodology, Analysis, Writing – Original Draft, Visualisation.

KS: Supervision, Conceptualisation, Methodology, Writing - Reviewing and Editing.

SS: Supervision, Conceptualisation, Methodology, Qualitative Analysis, Writing - Reviewing and Editing.

WP: Quantitative Analysis, Writing - Reviewing and Editing.

## Declaration of Generative AI and AI-assisted technologies in the writing process

Not Applicable.

## Conflict of interest statement

No conflict of interest.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.radi.2025.103007.

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# QUESTIONNAIRE
# A11(26)
# Exploring radiographers' understanding of pain: an Australian survey study

**INSTRUCTIONS**

- Read through the article and answer the multiple-choice questions provided below.
- All questions have only **ONE** correct answer

### Introduction and Background

**Question 1:** What was the primary aim of the study?

- **A:** To evaluate radiographers' technical imaging skills
- **B:** To explore radiographers' conceptualisation of pain
- **C:** To assess patient satisfaction with radiography services
- **D:** To compare radiography curricula internationally in terms of how the pain topic is covered

**Question 2:** Pain is now understood as:

- **A:** A direct symptom of tissue damage only
- **B:** A protective output of the brain influenced by biopsychosocial factors
- **C:** A purely psychological phenomenon
- **D:** A marker of disease severity

**Question 3:** Which traditional approach still dominates many healthcare professionals' understanding of pain?

- **A:** Biopsychosocial approach
- **B:** Holistic approach
- **C:** Biomedical approach
- **D:** Neurocognitive approach

**Question 4:** Pain can exist in the absence of pathology.

- **A:** TRUE
- **B:** FALSE

### Methods and Study Design

**Question 5:** How was the study conducted?

- **A:** Online survey distributed via ASMIRT
- **B:** Randomized controlled trial
- **C:** Focus group interviews
- **D:** Clinical observation study

**Question 6:** Which validated tool was used to assess pain knowledge?

- **A:** HC-PAIRS
- **B:** Visual Analogue Scale
- **C:** McGill Pain Questionnaire
- **D:** RNPQ (Revised Neurophysiology of Pain Questionnaire)

**Question 7:** How many items are included in the RNPQ?

- **A:** 12
- **B:** 10
- **C:** 15
- **D:** 19

**Question 8:** In the study, participants marked RNPQ statements as "true," "false," or "undecided."

- **A:** TRUE
- **B:** FALSE

### Participants and Demographics

**Question 9:** How many radiographers completed the survey?

- **A:** 150
- **B:** 200
- **C:** 228
- **D:** 300

**Question 10:** What percentage of participants reported real-world experience with chronic pain (personally or through family/friends)?

- **A:** 50%
- **B:** 77.6%
- **C:** 25%
- **D:** 90%

**Question 11:** Which source ranked lowest as a contributor to radiographers' pain knowledge?

- **A:** Clinical experience
- **B:** Personal experience
- **C:** Formal education in radiography
- **D:** CPD activities

**Results: Pain Knowledge and Confidence**

**Question 12:** What was the average RNPQ score achieved by participants?

- **A:** 5.0/12
- **B:** 6.57/12
- **C:** 8.0/12
- **D:** 10.0/12

**Question 13:** What percentage of radiographers reported receiving dedicated pain education in their training program?

- **A:** 5%
- **B:** 11.8%
- **C:** 20%
- **D:** 30%

**Question 14:** How many participants reported undertaking pain-related CPD?

- **A:** 12.7%
- **B:** 20%
- **C:** 25%
- **D:** 50%

**Question 15:** What percentage of participants reported feeling "somewhat confident" in their understanding of pain?

- **A:** 10%
- **B:** 24.1%
- **C:** 49.1%
- **D:** 75%

**Key Findings and Implications**

**Question 16:** Which of the following themes emerged from qualitative analysis?

- **A:** Self-reported uncertainty of pain neurophysiology
- **B:** Inaccurate pain understanding
- **C:** Contemporary pain understanding
- **D:** All of the above

**Question 17:** The study concluded that radiographers' pain literacy was……?

- **A:** Strong
- **B:** Evidence-based
- **C:** Generally lacking
- **D:** In need of a cultural shift in terms of how radiographers think about pain

**THE END**

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## ANSWER SHEET

### A11(26)

Exploring radiographers' understanding of pain: an Australian survey study

***Time spent on activity** **hour** **min**

| | A | B | C | D | E | | A | B | C | D | E |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | 10 | | | | | |
| 2 | | | | | | 11 | | | | | |
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| 4 | | | | | | 13 | | | | | |
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| 7 | | | | | | 16 | | | | | |
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| 9 | | | | | | | | | | | |

| How relevant was the content of this activity to your scope of practice? | | | |
|---|---|---|---|
| Not at all | Somewhat | Mostly | Extremely |
| | | | |

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