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Australasian radiographers' choices of immobilisation strategies for paediatric radiological examinations

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ABSTRACT

Introduction: Immobilisation may be necessary to ensure patient safety and examination success in paediatric medical imaging. Little guidance exists regarding the selection of different immobilisation methods. The purpose of this study was to explore radiographers' selection of immobilisation methods in paediatric medical imaging and the influences on their choices.
Methods: Ethical approval was obtained. A mixed methods approach consisting of online questionnaire distribution followed by individual interviews was used to explore Australasian radiographers' self-reported patterns of immobilisation use and the underlying reasons and beliefs. Quantitative data were described using frequency data, with a Fisher's Exact test used to determine any association between demographic variables and immobilisation methods. Qualitative data were evaluated using content analysis.
Results: Sixty-five radiographers returned completed questionnaires, with seven participating in interviews. Psychological immobilisation methods were preferred to minimise patient pain and distress, but physical methods were considered more effective, with parental holding the most likely method to be used (63/65, 96.9%). Participants assumed certain methods to be more appropriate based on patient age and examination type, but adapted their choices based on many other factors, seeking to provide personalised care. Further training was strongly desired (48/64, 75.0%). Participants disagreed on whether introducing written guidance would be beneficial (33/62, 53.2%).
Conclusion: Choosing an immobilisation method appears to be a case-by-case activity requiring critical assessment of multiple factors in order to balance patient care with examination success.
Implications for practice: Improvements in quality and quantity of education are recommended to enhance radiographers' ability to make choices based on all relevant factors.

Introduction

Paediatric healthcare procedures may be challenging when patients, due to distress or other causes, do not keep still.[1–3] Patient movement in medical imaging may cause image artefacts or positioning errors, often requiring further imaging to obtain diagnostic results. This may create a risk of increased radiation exposure in some modalities such as radiography, computed tomography (CT) or fluoroscopy.[3,4] Radiographers should always strive to minimise patient radiation dose, especially for paediatric patients, who are more radiosensitive than adults and hence more vulnerable to radiation-induced cellular damage.[3,4] Action may therefore be taken to restrict patient movement and ensure safe and successful examinations; this is known as 'immobilisation' or 'restraint'. There is a distinction between these terms; immobilisation refers to actions taken with patients' consent and without using excessive physical force, whilst restraint refers to the use of force without consent.[5] This study used 'immobilisation' as a general term, both to reflect its common usage in Australia, and the difficulties of defining the threshold between the two.[4,5]

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Immobilisation may take a variety of forms: physical (manual application of force), mechanical (using equipment), chemical (sedation or sleep induction), or psychological (distraction or communication).[4,6,7] Radiographers must consider their options carefully because some methods pose a risk of physical injury, distress or long-term psychological harm for patients, family members and staff, whilst some methods are more effective than others, determining the success of the examination.[3,4,6,8–11] Limited information is available delineating the best immobilisation practices. Consequently, radiographers are likely to rely on their own attitudes, beliefs and experiences. They may make decisions that are not evidence-based, potentially putting patients and families at risk, and may be more vulnerable to complaints and disciplinary action.[2] There are also a variety of factors (demographic, situational and educational) which may influence their decisions.[8,12–15] It is therefore important to study this topic in order that a foundation may be built on which to ensure that best practice is defined and followed. Identifying important factors may also be useful for education and governance, providing direction as to which aspects of immobilisation practice should be targeted for improvement.

Only three previous studies have directly explored radiographers' immobilisation practices.[4,12,13] These authors investigated reasons for the use of immobilisation, and enquired about which methods were used, but did not investigate the reasons for choosing particular methods. Their studies were also limited by restricted geographical coverage or small sample sizes.[4,12,13] Other medical imaging research has assessed the safety and effectiveness of individual methods, but has not explained the reasons for their use,[16–18] while the findings of other healthcare literature may not be applicable to medical imaging contexts.[6–9,14,15,19–21] Exploring this topic could also act as a stimulant and foundation for further research. A timely study appears warranted to build upon recent research[4] in order to encourage discussion and inquiry which has been sporadic or absent. This is especially pertinent as immobilisation may be a daily issue for radiographers, yet best practice remains undefined.

The purpose of the study is to explore radiographers' selection of immobilisation methods in paediatric radiological examinations, and the factors influencing these choices.

Methods

Previous studies have used questionnaires, individual interviews or focus groups to explore immobilisation practice in healthcare.[4,6–9,12–15,20–22] Questionnaires can reach a large population and assess response patterns, whilst individual and focus group interviews provide rich data and unexpected insights, although these are less generalisable.[23] Ultimately, a mixed methods design was chosen to combine the advantages of both questionnaires and interviews, and to improve validity and reliability through triangulation.[23,24] As this research was about exploring different perspectives, rather than seeking consensus, individual interviews were preferred over focus groups,[23] considering that arranging individual interviews was also logistically easier.[23,25] The chosen design, a quantitative questionnaire phase followed by a qualitative interview phase, is a common exploratory methodology where little is known about the topic.[24] This enabled the interviews to explore some of the questionnaire findings in further depth.[23,24] Curtin University Human Research Ethics Committee approved the study before data collection (HRE2018-0126). Participant confidentiality was protected by de-identifying all responses and informed consent was obtained.

Study population and sampling criteria

The population for this study was all radiographers in Australia and New Zealand. Respondents were included if they worked in general X-ray, fluoroscopy or CT. Magnetic resonance imaging or sonography were not included as immobilisation is not required for reducing the risks of ionising radiation in these modalities. Students were also eligible in order to provide a different perspective on training and attitudes. Non-probability sampling was used throughout the study due to the unavailability of all radiographers' contact information and the difficulty of obtaining data on the population size.[26]

Data collection for first phase

A convenience and snowball sampling approach was used to maximise the number of questionnaire responses.[23] The professional bodies for medical radiation professionals in Australia and New Zealand, the Australian Society of Medical Imaging and Radiation Therapy (ASMIRT) and the New Zealand Institute for Medical Radiation Technology (NZIMRT), were asked to advertise the questionnaire to their members via their online newsletters. Personal contacts were also invited to participate via email. All participants were encouraged to forward the link to other contacts. The questionnaire was distributed online for the purposes of cost, time and geographical coverage,[23,27] using Qualtrics Research Core (Qualtrics, Provo, United States [US]). This provided a greater range of question construction options and more robust security than the other two software packages considered (Google Forms [Google, Mountain View, US] and SurveyMonkey [SurveyMonkey, San Mateo, US]).

Prior to distribution, the questionnaire was reviewed by six academics with medical radiation science backgrounds. The survey questions were derived from previous research,[4,12–15] and aimed at addressing the study's purpose. The questionnaire was in three sections: a demographics section (10 questions); a section addressing the use of immobilisation methods (3 questions) and the situational factors contributing to these choices (10 questions); and a section on training, guidance and other concerns (11 questions). Multiple-choice questions and checklists were used to ascertain descriptive information[28] about demographics and access to training and guidance, while four-point rating scales were used to evaluate the strength of radiographers' preferences for different immobilisation methods and concern about different situational variables.[28] Supplementary open-ended questions allowed participants to briefly elaborate on some answers, which added depth and aided triangulation.[23] The questionnaire was accessible between 13th June and 7th July, 2018.

Data collection for second phase

Survey participants who voluntarily provided their contact details were invited by email to a follow-up interview. These were conducted face-to-face or via Skype (Microsoft Corp., Redmond, US), depending on each participant's location.[23] A semi-structured interview schedule was developed to explore the questionnaire topics and initial findings in further detail. The semi-structured approach ensured that the study purpose was addressed in its entirety, but it also provided flexibility to discuss other ideas as they arose.[23] Saturation was considered to have been reached when no new themes emerged from the interviews.[29–31] Interviews were audio-recorded using GarageBand v10 (Apple Inc., Cupertino, US), and transcribed manually by the lead researcher. These transcripts

were reviewed by all participants prior to analysis to ensure accuracy of transcription.[23]

Data analysis

Microsoft Excel v16 (Microsoft Corp., Redmond, US) and SPSS Statistics v25 (IBM Corp., Armonk, US) were used for quantitative data analysis. Data were treated as nominal or ordinal, and described by frequency and percentage.[23] To identify any association between demographic variables and immobilisation method selection (both of which were categorical variables), the chi-square test would typically be used. Given the small sample size of this study, however, more than 20 percent of expected values had values less than 5 for most variables, and hence Fisher's exact test was used as a more accurate way to determine any association between variables.[32,33] Statistical significance was assumed at $p < 0.05$.[23,28]

Qualitative data were assessed with content analysis performed by two researchers working together, to reduce interpretation bias.[23,30,34] Key ideas were identified, grouped into categories and themes, and the occurrence of similar ideas was assessed across all interviews[34] to reveal which immobilisation methods were most preferred and which factors were most important to the participants.

Results

Eighty-two questionnaires were received. Sixteen were incomplete and one did not meet inclusion criteria, yielding a sample of 65 participants. Based on information obtained from the ASMIRT's annual report[35] and a personal communication from the NZIMRT, this was a response rate of approximately 0.71% from an estimated accessible population of 9200. Seven respondents (10.8%) participated in follow-up interviews. The interview group was generally representative of all participants (Table 1).

Immobilisation method use and preferences

Table 2 shows the questionnaire findings regarding the frequency of immobilisation method use by radiographers in the three modalities of interest. Immobilisation was most frequently used in general X-ray, followed by fluoroscopy and CT. Fig. 1 illustrates their preferences of using individual immobilisation methods, physical (parental and staff holding), mechanical (sandbags/sponges, swaddling, strapping, specialised devices and Perspex paddles), chemical (sedation/anaesthesia and feed-and-sleep), and psychological (distraction, negotiation/incentives and play therapy).[4,6,7] Parental holding was the most likely immobilisation method to be used (63/65, 96.9%), followed by a mix of psychological and mechanical techniques. Psychological methods were generally ranked higher than mechanical ones. The least likely choice was sedation/anaesthesia (10/65, 15.4%).

Table 2
Frequency of immobilisation use by modality (questionnaire, n = 65).

Frequency	General X-ray	Fluoroscopy	CT
Once a fortnight or more	47 (72.3%)	11 (16.9%)	5 (7.7%)
Less than once a fortnight	18 (27.7%)	54 (83.1%)	60 (92.3%)

Although parental holding was most commonly used, interviewees indicated that they preferred psychological methods where possible to minimise patient distress and pain. They acknowledged, however, that distraction, negotiation or play were not always effective, and that this made it necessary to use physical methods in order to complete the examination. Forceful immobilisation was also seen by some participants as the only option for very young children who lacked the intellectual capacity to understand what was occurring. Hence psychological methods were perceived as more preferable but were less often used.

- *"I always try play and explaining and everything. Obviously if it doesn't work I've got no choice but to, you know, get them to put them down and hold them down …"* (I2)
- *"…in all other instances where restraint is not necessary, I'd prefer to use play or distraction rather than holding."* (I7)

Mechanical methods were less preferred; perceived as more likely to cause distress or discomfort. Physical holding was thought to be more comfortable and, additionally, allowed the amount of force to be adapted to the patient's resistance.

Demographic influences

Table 3 shows the results from the Fisher's exact test evaluating any significant associations between individual demographic factors and various immobilisation method uses identified in the survey. The type of centre did not influence radiographer practices except on holding strategy preferences. Staff holding was significantly less likely to be used in paediatric centres, while Perspex was a more likely approach when compared to general departments. In contrast, interviewees claimed that radiographers in paediatric departments had greater access to resources and mechanical techniques and so were more comfortable with immobilisation. Mechanical and chemical techniques were more likely to be utilised by radiographers frequently using immobilisation in fluoroscopy (swaddling, Perspex and sedation/anaesthesia) or CT (specialised device, swaddling, sedation/anaesthesia and feed-and-sleep).

Some factors, such as radiographer gender ($p = 0.139–1.000$) or parental status ($p = 0.066–1.000$) were not significant influences on practice, according to questionnaire results. Interviewees

Table 1
Participant characteristics across the two study phases.

Characteristic		Questionnaire (n = 65)	Interview (n = 7)
Gender	Female	48 (73.8%)	4 (57.1%)
	Male	17 (26.2%)	3 (42.9%)
Had role as parent/guardian	Yes	25 (38.5%)	2 (28.6%)
	No	40 (61.5%)	5 (71.4%)
Registration	General	49 (75.4%)	6 (85.7%)
	Student	16 (24.6%)	1 (14.3%)
Country of practice	Australia	51 (78.5%)	6 (85.7%)
	New Zealand	14 (21.5%)	1 (14.3%)
Clinical centre type	Paediatric	11 (16.9%)	1 (14.3%)
	General	54 (83.1%)	6 (85.7%)

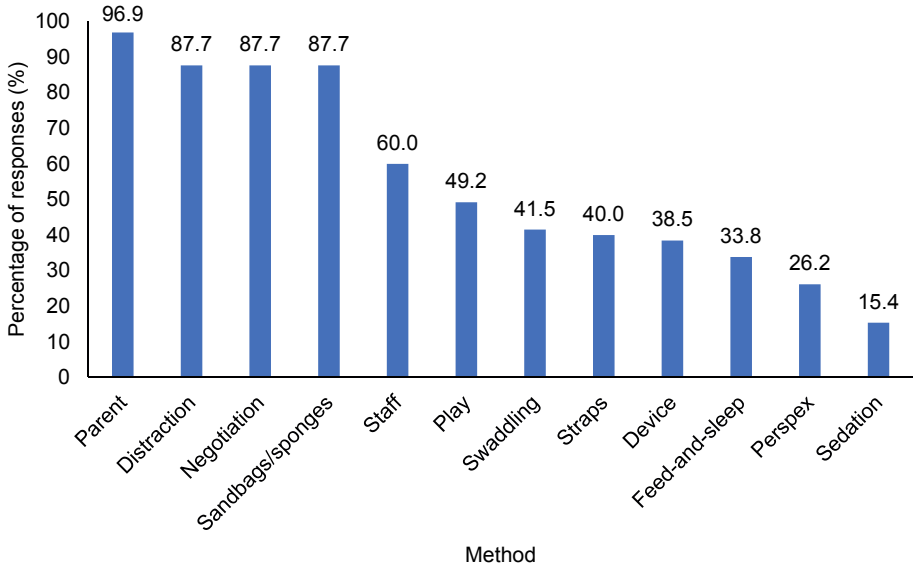

Figure 1. Likelihood of use of immobilisation methods (questionnaire, n = 65).

however, perceived radiographers who are parents as being more capable of managing patients and their parents, although such skills could be developed.

- *"I've got a ten-month-old and a three-year-old now, so I can appreciate their behaviour, and I feel better equipped in terms of mentally handling them, because I know what they're like, in general."* (I2)

Situational influences

The questionnaire responses show the most important situational factor affecting the use of physical, chemical and psychological methods was patient age, while the examination type had the most influential effect on selection of mechanical approaches. Both factors were highly ranked across all methods, along with patients' distress, safety, understanding and cooperation (Table 4).

Table 4 also shows the interconnection between factors when their ranks were similar. For example, younger patients were considered to be particularly in need of immobilisation because their age made them more prone to distress and less likely to understand the need to remain still, predisposing them to be uncooperative. All interviewees used patient age and examination type as a guide to the appropriateness of different methods; however, they acknowledged that in many cases patients did not match stereotypes.

- *"…much as we like to categorise things, individuals will develop differently, and so you might have a six-year-old who's developmentally more of like a three, four-year-old sort of level."* (I6)

Patients' safety and distress were also consistent concerns, reflected in the questionnaire and interviews. Participants worried about causing pain or distress for the patient, and also experienced feelings of guilt about doing so. Choices therefore became about minimising the impact of a 'necessary evil' without compromising examination success.

- *"I think it goes back to that fear of – the stakes are higher, 'I don't wanna irradiate this kid, and I don't wanna repeat, and I don't wanna hurt them, and I don't wanna make them cry', and all that sort of plays on your mind, or at least it does for me."* (I1)

The least influential factors identified in the questionnaire were radiographer workload or staffing, and whether they had been trained to use a particular method, followed by the presence or cooperation of an accompanying person. Despite this, parental influence was seen as important by all interviewees. Parental distress or level of willingness to cooperate affected the patients' fear and compliance, and the ease with which the chosen immobilisation method was applied.

- *"…if the parent's nice and calm, and wants to help, and says it's easy, and 'You can do it', and if they work with the child, it's very helpful … Whereas if the parent kind of just supports the tantrums or supports the behaviour that's uncooperative, then that becomes very difficult."* (I2)

The overall theme across the interviews, also evident in the variety of questionnaire responses, was that immobilisation methods were chosen case-by-case. Participants stated that each interaction with a patient was unique and decisions were influenced by many factors in every case. They therefore claimed that the essential skill was being able to adjust their practice to best suit each situation.

- *"I think adaptability is the key"* (I6)
- *"… the real skill comes in being able to adapt … you apply your knowledge, because each patient is different."* (I3)

Training and guidance

The majority of immobilisation education according to questionnaire respondents appeared to take the form of informal workplace training (56/64, 87.5%), followed by personal experience (45/64, 70.3%) and pre-registration training (43/64, 67.2%). All seven interviewees agreed that they learnt from experience, with five (71.4%) also discussing learning in the workplace. Many questionnaire respondents (20/64, 31.3%) believed that their training

Table 3
Association between demographic factors and immobilisation method use (questionnaire, n = 65).

	Immobilisation method	Gender (female/male)	Has role as parent/guardian (yes/no)	Registration (student/general)	Country (Australia/New Zealand)	Clinical centre (paediatric/general)	X-ray immobilisation frequency (≥fortnightly/<fortnightly)	Fluoroscopy immobilisation frequency (≥fortnightly/<fortnightly)	CT immobilisation frequency (≥fortnightly/<fortnightly)
Fisher's exact test p-value	**Physical**								
	- Parent holding	0.458	1.000	1.000	0.387	1.000	0.480	1.000	1.000
	- Staff holding	1.000	0.795	0.076	0.218	**0.005***	0.779	0.325	0.382
	Mechanical								
	- Specialised device	1.000	0.798	0.768	0.762	0.311	1.000	0.311	**0.006***
	- Sandbag/sponge	1.000	1.000	0.395	1.000	0.333	1.000	0.333	1.000
	- Straps	0.776	0.614	0.389	0.768	0.325	1.000	0.743	0.148
	- Swaddling	0.268	0.606	0.393	**0.015***	0.178	0.785	**0.041***	**0.010***
	- Perspex	0.523	1.000	**0.049***	**0.037***	**0.001***	0.119	**0.028***	0.107
	Chemical								
	- Sedation/anaesthesia	1.000	0.165	0.429	0.203	0.057	0.713	**<0.001***	**0.001***
	- Feed-and-sleep	0.139	0.066	**0.007***	0.527	0.737	1.000	0.487	**0.041***
	Psychological								
	- Distraction	0.191	0.243	0.668	0.675	1.000	0.202	0.614	0.493
	- Negotiation/incentives	0.191	1.000	0.395	0.675	0.333	0.675	0.614	0.493
	- Play therapy	0.574	0.612	1.000	1.000	0.108	0.408	0.108	0.672

*Significant at $p < 0.05$.

Table 4
Relative importance of situational factors on selection of immobilisation method groups (questionnaire, n = 65).

Factor Rank	Physical	Mechanical	Chemical	Psychological
1	Patient's age (52.3%)	Examination type (42.2%)[a]	Patient's age (25.9%)[a]	Patient's age (52.4%)[a]
2	Patient distressed (49.2%)	Patient's age (37.5%)[a]	Examination type (24.1%)[a]	Patient's physical/radiation safety (38.1%)[a]
3	Patient uncooperative (46.9%)[a]	Patient's physical/radiation safety (37.5%)[a]	Patient does not understand (17.2%)[a]	Patient distressed (37.1%)[a]
4	Patient does not understand (41.5%)	Accompanying person's physical/radiation safety (34.4%)[a]	Patient distressed (15.8%)[a]	Examination type (36.5%)[a]
5	Patient's physical/radiation safety (40.6%)[a]	Patient distressed (29.7%)[a]	Patient's physical/radiation safety (13.6%)[a]	Patient uncooperative (36.5%)[a]
6	Examination type (38.5%)	Patient uncooperative (26.6%)[a]	Patient uncooperative (13.6%)[a]	Patient does not understand (33.3%)[a]
7	Accompanying person's physical/radiation safety (35.4%)	Method easy to use (25.8%)[a]	Accompanying person's physical/radiation safety (10.3%)[a]	Accompanying person's physical/radiation safety (33.3%)[a]
8	Method easy to use (33.8%)	Patient does not understand (23.4%)[a]	Accompanying person uncooperative (6.9%)[a]	Someone accompanying the patient (31.7%)[a]
9	Method effective in the past (27.7%)	Patient has physical/intellectual disability (21.9%)[a]	Examination is urgent (6.8%)[a]	Method easy to use (27.4%)[a]
10	Patient has physical/intellectual disability (27.7%)	Accompanying person uncooperative (21.9%)[a]	Trained to use particular method (5.3%)[a]	Method effective in the past (27.4%)[a]
11	Someone accompanying the patient (24.6%)	Method effective in the past (20.3%)[a]	Patient has physical/intellectual disability (5.2%)[a]	Patient has physical/intellectual disability (25.4%)[a]
12	Examination is urgent (23.1%)	Examination is urgent (20.3%)[a]	Someone accompanying the patient (5.2%)[a]	Examination is urgent (24.2%)[a]
13	Accompanying person uncooperative (15.4%)	Workload/staffing pressures exist (12.7%)[a]	Method effective in the past (3.5%)[a]	Accompanying person uncooperative (17.7%)[a]
14	Trained to use particular method (12.5%)[a]	Someone accompanying the patient (12.5%)[a]	Method easy to use (3.5%)[a]	Trained to use particular method (16.1%)[a]
15	Workload/staffing pressures exist (10.8%)	Trained to use particular method (9.4%)[a]	Workload/staffing pressures exist (1.7%)[a]	Workload/staffing pressures exist (16.1%)[a]

Data ranked by highest to lowest percentage of participant response "always" to the question "how often do the following factors influence your decision to use [method group]?".
[a] Some data were missing.

was poor or absent, and most participants (questionnaire 48/64, 75.0%; interviews 6/7, 83.0%) believed that they would benefit from further training. Key suggestions included exposure to paediatric clinical environments to gain experience, skills and confidence with paediatric patients and knowledge of different immobilisation methods; increased education in paediatric development and psychology to facilitate better patient management; and being formally taught proper immobilisation technique.

- *"I think certainly, theoretical training on child development and what techniques can be used with children of different ages [is important] rather than trying to lump them all into, 'This is a kid, this is how we deal with a kid' … but I think encouraging as many practitioners as possible to even go and do stints at children's hospitals, as part of that, would be beneficial."* (I6)

Thirty-two of 64 participants (50.0%) lacked access to written guidance and about half (33/62, 53.2%) believed that having guidelines would be helpful. Whilst some participants (questionnaire 6/48, 12.5%; interviews 3/7, 42.9%) said that guidelines would assist inexperienced radiographers to practice more effectively (questionnaire 12/48, 25.0%; interviews 2/7, 28.6%), others stated that prescriptive protocols would be restrictive, setting rules which might not be effective given the uniqueness of each patient and situation.

- *"I think it would be helpful maybe more for students or for people in other hospitals, other facilities, where there's not as much paediatric work … for more experienced staff I don't think it would be very useful, because even though there's general techniques you use for each age … I don't think it's easy to make hard-and-fast rules for particular cases."* (I7)

Discussion

The findings of this study reveal that radiographers generally preferred physical and psychological immobilisation techniques for paediatric radiological examinations. Although they assumed certain methods to be appropriate for different examination types and patient ages, various other factors determined what could actually be used. Consequently, radiographers based their immobilisation practice on the critical analysis of each situation, adapting to each patient to complete examinations without causing undue distress. Immobilisation practice could be improved by further training and education and potentially, by the provision of advisory guidelines.

Immobilisation method use and preferences

Previous research has shown that physical methods have been the most frequently used approach to immobilise paediatric patients because they are readily available, easy to use, and have the potential to comfort patients through human contact.[4,6,8,9,12–15,19,20] Psychological immobilisation did not appear to have been well-used in medical imaging, a finding which is in contrast to the results of this study.[12,13] As suggested by some participants, changing standards of practice or training might account for this; there is a strong focus on patient-centred care in current healthcare literature[10,36,37] and professional capabilities documents[38] which would require radiographers to think critically about the effects of their actions on patient safety and quality of care. This concern was evident in the interview responses. Psychological immobilisation is well-regarded for minimising physical and psychological patient safety risks and respecting children's legal rights to autonomy,[6,7,9,39] meaning that most radiographers in this study are engaging in good practice from a legal and clinical point of view. Attempting psychological immobilisation in each situation should therefore be encouraged, and as suggested in this study, radiographers should be taught how to use such techniques effectively. This should not only protect patients from the unnecessary application of force, but also help radiographers to develop child management skills that can be used in conjunction with any immobilisation method. However, in light of the fact that psychological methods are not always effective or feasible, the appropriate use of other techniques should also be taught to increase radiographers' ability to complete examinations with minimal patient distress in various situations.

Demographic influences

Mechanical and chemical immobilisation methods were used more frequently in CT and fluoroscopy, presumably as the increased radiation dose in these modalities may present a safety risk from primary or scatter radiation to parents or staff who would be holding patients in the examination room.[4,40] The longer examination duration and frequently moving examination table typical of these modalities[41,42] may also make it more difficult to use physical immobilisation. Aside from this, the influence of demographic factors on immobilisation practice appeared to be inconsistent. Although department type and radiographers' parental status were not influential factors according to questionnaire results, interviewees perceived them as being important. This might suggest that these factors do not influence radiographers' choices, but do affect their confidence. In previous studies, paediatric sites have not shown markedly different practices to general departments, which supports this explanation.[4] It would appear that demographic influences are less pivotal to choices of immobilisation methods and practice than may be expected. Whilst they will have some bearing on radiographer choice of method, they are not major contributors to professional judgements. Confidence would seem to be a significant determinant of radiographer method selection, although this is not specifically addressed in this study.

Situational influences

The most important situational influence identified in this study was patient age, which also figures strongly in previous research on immobilisation practice.[4,6,12–15,21] Younger patients are more likely to require immobilisation as they are typically more distressed; may not understand the need to remain still; and are more at risk of physical injury if they cannot be immobilised.[6,12,21] Patient age is thus interwoven with many other factors. It was clear from radiographers' responses, however, that patients did not all fit a standard profile. Using age as a guide is therefore useful, but radiographers need to be careful not to make a choice solely on this basis, as method choices could be ineffective or inappropriate for the individual patient. The examination type, another strong influence, was not so connected to other factors, but it must be recognised that for the same examination there may be several possible immobilisation methods. Radiographers will still need to account for other factors before deciding which immobilisation method is most appropriate.

The importance placed on patient safety and minimising patient distress have been significant themes in prior research, in which immobilisation practice has been considered to be a balance between the risks of patient injury, patient distress, and unsuccessful procedures.[6–9,21] Radiographers' concerns about patient distress and pain in this study are encouraging signs that patients are being considered as people rather than cases to be completed. This aligns

with the philosophy of patient-centred care and should promote better holistic health outcomes.[43] Excessive radiographer worries about pain and distress, however, may hinder effective immobilisation, which could be a problem when medical imaging examinations are needed in order to guide further potentially life-saving care.

Training and guidance

The level of immobilisation training and guidance received by the participants of this study appears higher than previously reported, but is still relatively low, which is consistent with other research.[4,6,9,12–14,22] Without adequate training or guidelines radiographers' choices of immobilisation methods would vary and best practice may not be achieved, which may put patients, families and radiographers at risk of unnecessary radiation exposure, physical injury or psychological harm.[9,12] Future training programs should focus on teaching radiographers critical thinking skills along with immobilisation techniques, in view of the uniqueness of each patient and situation. Taking this approach would encourage professionals to consider the effects of immobilisation on patients.[15] Critical thinking would enable professionals to make decisions which improve safety and quality of care, including its personal aspects.[44,45] Educational institutions could consider using problem-based learning approaches when teaching paediatric immobilisation skills.[22] Similarly, written guidelines may be useful tools in clinical environments, but should focus on providing appropriate options, rather than prescribing the use of a particular technique.[7,12,22] The development of guidelines based on this premise would also help to protect radiographers against any legal or ethical issues that may arise when using immobilisation.[2]

Additionally, as interviewees suggested, radiographers' skills and confidence would improve after having the opportunity to gain experience in paediatric departments, along with education on child psychology and management. It would give them a store of previous situations on which to draw in the future and provide skills to manage children when using any immobilisation method, providing the best possible care and outcomes. Mandatory clinical placements in paediatric departments should therefore be considered for medical imaging students.

Study limitations

This study was subject to several limitations. Firstly, the response rate was low, and non-probability sampling was used. The findings of this study are therefore not statistically generalisable beyond the sample.[23] A larger study using probability sampling could confirm the results reported. Additionally, the period for which the questionnaire was open for access could have been extended to obtain more responses, although the previous Australasian study on the current topic with greater questionnaire access time had a similar, low response rate.[4] The interviews were also potentially limited by the small sample size. However, after seven interviews data saturation was considered to have been reached, and the process of data triangulation would improve the trustworthiness of the study findings as well.[25,29] Furthermore, other studies on immobilisation or restraint have had a similar number of interviewees, even as pure interview studies.[7,20] In the future, more interviewees could be possibly recruited by offering small incentives, although this would need to be considered carefully to avoid introducing bias.[23,46] Sending multiple personalised emails to remind participants of the chance to express their opinions might also increase participation.[23,47,48]

The use of personal contacts for participant recruitment might introduce bias to the study. However, this strategy was in line with the recruitment approach of convenience and snowball sampling. It was anticipated that additional bias that could be introduced should be minimal.[32] Data triangulation employed in the current study could further address the potential impact of the use of this recruitment approach.

Another limitation was that the findings of this study relied on participant self-reports, which may not accurately represent their real behaviours.[9,23] This may be due to social desirability or self-deception bias, as immobilisation can be a controversial issue.[6,32] Participant observation in a variety of clinical environments would be necessary to fully understand which methods are used in practice and why.[9,23,25] Finally, there may be a self-selection bias as radiographers uninterested in immobilisation would be less likely to participate.[4,14,49]

Conclusion

This study has demonstrated typical patterns of immobilisation method used by radiographers. Physical and psychological methods were most commonly chosen but other techniques were also considered to be possible options. The inconsistency of demographic influences, the complexity of each situation, the individuality of each patient, and the informal nature of immobilisation training all indicate that immobilisation practice is typically based on professional judgement. When choosing which methods might be applied in a given situation, some variables such as patient age and examination type may be useful guides. There is a need to improve training and guidance to increase radiographers' knowledge and ability to critically select different methods.

This study has also revealed several possible directions for future research. Firstly, radiographers' immobilisation practices should be observed in clinical environments, to see which methods are selected and when they are used. Secondly, experimental studies could be conducted to evaluate which methods are more effective for paediatric immobilisation. It has also become apparent that further research into radiographer confidence and skills for immobilisation may be advantageous in order to improve professional performance. Finally, action research could be conducted to enhance current immobilisation training for radiographers and therefore improve patient care.

Conflict of interest statement

None.

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