Research Square

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A Mixed Methods Evaluation of Pleural Procedural Experience and Training in Intensive Care Trainees

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Research Article

Keywords: Intensive Care, Procedural training, Pleural intervention

Posted Date: May 13th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9128711/v1

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Additional Declarations: No competing interests reported.

Version of Record: A version of this preprint was published at BMC Medical Education on August 27th, 2026. See the published version at https://doi.org/10.1186/s12909-026-10206-w.

Abstract

Background

Pleural procedures are key skills for Intensive Care Unit (ICU) doctors but can be associated with serious complications. We aimed to explore ICU junior doctors' training, experience, and confidence in performing pleural procedures.

Methods

The study was a prospective, multi-centre, convergent parallel, mixed-method design, consisting of a survey of 21 questions with concurrent semi-structured interviews. The study involved four ICUs (two metropolitan and two regional) in New South Wales, Australia, which provide public intensive care services to 1.2 million Australians. All Postgraduate Year (PGY) 3 and above doctors working in these units were invited to participate (N= 70). Consultants were excluded.

Results

Of 70 doctors invited to participate, 40/70 (57%) completed the survey. 26/40 (65%) of survey respondents were PGY 5 or above. Purposive sampling was used to identify 8 (20%) of the survey respondents across a range of seniorities. They then underwent semi-structured interviews.

Of the respondents, 19/40 (47.5%) had received formal training in pleural interventions, and 14/40 (35%) had received formal training in thoracic ultrasound.

In the 12 months prior, 19/40 (47.5%) of respondents had not performed a chest drain of any type. Of those who had, 3/40 (7.5%) had completed more than 5.

Across their careers 13/40 (32.5%) had not performed a Seldinger chest drain and 15/40 (37.5%) had performed five or less. Half of respondents had not performed a blunt dissected drain in their career.

15/40 (37.5%) of respondents felt that they were confident to independently insert a chest drain. Almost all (38/40, 95%) felt they would benefit from simulation-based training in this area.

The interviews highlighted factors that increased or decreased opportunities for gaining experience in performing pleural procedures. These factors were categorised into subthemes: patient, operator, situational, and organisational.

Conclusions

This study demonstrates low levels of procedure volume, and confidence in ICU junior doctors. Qualitative findings highlight barriers and opportunities to enhance training.

BACKGROUND

Pleural disorders are common in the Intensive Care Unit (ICU) [1] and procedures such as pleural aspiration and the insertion of chest drains are considered essential skills required for the practice of Intensive Care medicine. [2, 3]

Pleural procedures, however, are associated with the potential for significant complications, including bleeding, damage to vital organs and death. [4–6] The UK National Patient Safety Audit of complications related to chest drain insertion found that poor outcomes were often the result of inadequate supervision, lack of awareness of guidelines, and poor clinical decisions made by proceduralists in various settings, including ICUs. [6]

There is increasing interest in junior doctors' practice in pleural intervention. However, there has to date been little data on the quantity or quality of their procedural experience in this area, and even less investigation of the barriers and facilitators of improving this experience. International survey-based studies have found heterogenous training and experience in medical trainees, (7–10) and poor levels of knowledge and experience in Intensive Care and anaesthetic trainees. (11,12) Australian

data is limited to a single sub-question on “thoracentesis” in a broader, 39-question survey of training capacity in Australian ICUs. This lacked granular detail, did not consider thoracic ultrasound, and was limited by a poor response rate. [7]

The College of Intensive Care Medicine, Australia, New Zealand (CICM) requires junior doctors to demonstrate competency in pleural procedural skills during their training program. [3] Additionally, junior doctors not yet part of a training program, such as senior resident medical officers (SRMOs), or trainees from other specialties may also be required to perform pleural interventions as part of their work within the ICU. While CICM does not set a standard definition for competency, or number of pleural interventions required to achieve or maintain competency, the British Thoracic Society ‘Aspirational Statement’ recommends a formal training program, and minimum of five pleural interventions be performed to achieve “emergency operator” standard. [8] The Thoracic Society of Australia and New Zealand requires attendance at a training program, twenty procedures, and five pleural procedures per year to maintain competence. [9]

METHODS

Aim

To date there has been no exploration of the experiences of Australian doctors in the ICU in learning to perform chest drain insertions, pleural aspiration, and thoracic ultrasound. This study aims to fill this gap by investigating and exploring the ICU junior doctors’ training, experience, and confidence in this area.

Design

This is a multi-centre convergent-parallel mixed method study comprising of an online survey, and concurrent semi-structured interviews.

The survey and interview guide were designed by a subset of the study team, comprising of a respiratory physician with expertise in pleural disease and procedural training (VG); an ICU consultant with education expertise and qualitative research training (CP); an ICU trainee (KK); and a physician trainee with experience in qualitative interviewing (LF). Questions were reviewed by internal (MG) and external advisers with experience in qualitative research and survey methodology. A copy of the survey and the interview guide are provided in Appendix 1.

Setting

The study was conducted across four ICUs in Australia. Participants were invited to participate from 25 January 2022 to 22 July 2022 with responses received up to 19 September 2022. General information regarding participating hospitals is included in Table 1.

Table 1
General information regarding participating hospitals

Hospital 1	**ICU Bed capacity**	**Metropolitan/regional**	**Respiratory/Cardiothoracic support**
	29	**Tertiary metropolitan**	**Respiratory and Cardiothoracic**
Hospital 2	6	Metropolitan	Limited
Hospital 3	8	Regional	No
Hospital 4	12	Regional	No

Participants

All non-consultant doctors (“junior doctors”) post-graduate year 3 (PGY 3) and above, working within the participating ICUs were invited to participate. Those invited included those training through CICM (“junior” and “senior registrars”), SRMOs not currently in a training program, and trainees from other specialist colleges (“other trainees”). “Fellows” working on the consultant roster, but not yet qualified as specialists, were also included.

Recruitment

Survey

Invitations were emailed to 70 doctors working in the participating ICUs, based on departmental records. The email contained an explanation of the trial, a link to the survey, an invitation to participate in the interviews, and the Participant Information Sheet. A reminder email was sent out three weeks after the initial invitation. Posters and discussions in group settings were utilised to increase awareness.

Interview

Participants were invited to participate in semi-structured interviews both in the initial email, as well as at the end of the survey. An effort was made to include an element of purposive sampling to gather data across multiple groups with different levels of seniority and experience.

Data collection

Survey

The anonymous survey was conducted online via SelectSurvey. [10] It consisted of 21 questions, including demographic, multiple choice, Likert scale and open-ended questions. Demographic data included year of training and role within the ICU. Participants were asked about previous training and the number of procedures they had performed in the 12 months prior and over their careers. Pleural procedures were divided into surgical and Seldinger chest drains, pleural aspiration, and thoracic ultrasound. Likert scales were used to gauge confidence, level of supervision expected, and desire for additional training.

Interview

The interview followed an interview guide with scope for additional prompts. The interviews were held either in-person or over videoconference. The interviews were conducted by an investigator (LF) with experience in qualitative research, who was not responsible for training or supervising the participants. Interviews were audio-recorded and transcribed via an online transcription program, which was cross-checked by the interviewer (LF). The transcription was de-identified prior to coding.

Analysis

Quantitative data were analysed using descriptive statistics, including proportions and percentages, with analyses in Microsoft Excel.[11] The study was not designed or powered for centre level comparisons. The qualitative data was thematically analysed using NVivo. [12] One member of the team with experience in qualitative analysis (CP) used an inductive coding process to analyse the data; a section of the coding was also cross-coded (LF) to provide additional clarification for the coding book.

RESULTS

Demographics

Of 70 doctors invited to participate, 40 (57%) completed the survey. 8 individuals were selected, using purposive sampling, and agreed to participate in semi-structured interviews.

26/40 (65%) of those who responded to the survey were PGY 5 or above, with 12/40 (27.5%) senior registrars or fellows, considered “Senior Trainees”. The overall breakdown of survey respondents can be seen in Fig. 1.

Procedural education and experience

Of the respondents, 47.5% (19/40) had received formal education in pleural intervention, with the most common training being completion of courses such as Advanced Trauma Life Support (15/40 respondents or 37.5%).

Clinical experience of all respondents in both the previous 12 months and throughout their career is shown in Fig. 2. In the 12 months preceding the survey 19/40 (47.5%) of the respondents had not performed a chest drain of any type. Of those who had completed a drain, 3/40 (7.5%) had completed more than 5, and only one of those had completed more than 10. Across their careers 13/40 (32.5%) had never performed a Seldinger chest drain, with 15/40 (37.5%) having performed between 1 and 5. 8/40 (20%) had performed between 6 and 20 in their career, with four reporting performing over 20.

20/40 (50%) had not performed any blunt dissection chest drains in their career, with 11/40 completing between 1 and 5, and 5/40 (12.5%) completing more than 5. Of those 5, 2 reported completing over 20 blunt dissection chest drains across the course of their career.

Ultrasound

Only a third, 14/40 (35%) had received formal training in thoracic ultrasound. In the past 12 months, 19/40 (47.5%) had performed any ultrasounds, and 24/40 (60%) had performed any in their career, of these, 4/40 (10%) respondents reported completing over 40.

Proceduralist confidence

Respondents were asked to rate on a Likert scale their confidence independently performing procedures, and desire for further training (Fig. 3). Approximately 40% of trainees agreed or strongly agreed that they were confident inserting a chest drain (15/40) or performing pleural aspiration (16/40). Almost all (38/40) felt they would benefit from simulation-based training in this area.

Seniority

The reported experience of Senior Trainees is shown in Fig. 4. The majority felt they had good theoretical knowledge, 91% (10/11), confidence in pleural aspirations 82% (9/11) and for inserting pleural drains 63% (7/11).

Of the 40 respondents, 6 (15%) had completed the CICM Pleural Drain insertion Workplace Competency Assessment, the required evidence for accreditation for chest drains by the CICM. [3] Two were fellows and four were senior registrars. The majority (5/6, 83%) had received formal training in pleural procedures and half (3/6) had received formal training in pleural ultrasound. In the previous 12 months, one had performed ≥5 Seldinger drains, and none had completed ≥5 blunt dissection drains, with 3/6 completing ≥5 in their career. All felt they rarely required supervision, and 5/6 (83%) agreed or strongly agreed that they had good confidence in chest drain insertion.

Qualitative Findings

Eight participants volunteered or were purposively selected to be interviewed and agreed. This was to gain insight into the experiences of trainees at a range of seniorities. Of these 3 were SRMOs, 3 were junior registrars and 2 were senior registrars. Due to the small pool of Fellows, they were not invited to participate in interviews due to difficulties in maintaining anonymity. Analysis of the interviews identified two overarching themes, each with four sub-themes, that captured the barriers and enablers to gaining experience in pleural procedures.

Barriers to gaining experience.

Patient factors

Interview participants identified patients with complex anatomy, coagulopathy or who were clinically unstable as potential barriers.

…. Sometimes if someone was very sick...then it might need to be done more urgently.

“[Reflecting on not performing a procedure in a clinically unstable patient] ... Safety first, right?”

Proceduralist factors

Participants frequently identified their own feeling of inadequate skills and confidence as creating barriers to gaining the required experience.

“Inexperience [is] one of the biggest challenges in getting experience”.

Several participants reflected on what they perceived as missed opportunities due to a lack of assertiveness on their part.

I probably can tell you more about the opportunities that I’ve watched passed out in front of my eyes.

Some noted that being more junior, or not yet on a specialist training programme, affected the likelihood of being asked to perform a pleural procedure.

...there’s always someone in line for it. Someone more senior in line for it.

...there tends to also be a bit of a hierarchy of who’s gonna do it before someone else has a shot.

Situational factors

Situational barriers included infrequent opportunities in their place of work. In smaller hospitals, this was attributed to a lower number of patients requiring pleural procedures. In the tertiary centre, it was attributed both to pleural procedures being performed elsewhere (such as the Emergency Department) or a perceived ‘queue’ of trainees from various specialities needing to perform procedures for training purposes.

Competing clinical responsibilities were also seen as a significant barrier.

Maybe I shouldn’t be the one to do this because its gonna take twice as long [compared to a more experienced person] ...you know that there’s a helicopter coming in 30 minutes … and you’ve got three more patients on the go...

Organisational factors

Organisational barriers to gaining experience included a lack of familiarity with local equipment or guidelines, or inadequate access to an appropriately qualified supervisor.

Factors increasing opportunities for experience.

Patient factors

Participants described that they were more likely to volunteer to perform pleural procedures in patients who were clinically stable or in circumstances felt to be less challenging, such as large volume effusions. Paradoxically, many participants also felt they would be more confident in inserting chest drains in patients for whom the procedure was critical or urgent, even if this meant they were more unstable.

I guess it depends on the circumstances in the patient population, right? …in a life-or-death situation, yeah, I’m confident.

Operator factors

Participants reported recent experience, volume of experience, or familiarity with equipment increasing their confidence, and therefore, opportunities. A repeated theme was the importance of their own assertiveness.

“I think I was really belligerent and was like ‘I’m doing this’”.

This assertiveness was also described as relevant to carving out time to perform pleural procedures despite completing clinical priorities.

...being able to be like no, I need…I need to do this for my training...and just be a bit selfish for an hour and get this procedure done.

Situational factors

A number of participants saw their exposure to pleural procedures as being influenced by chance.

I think I was just lucky

Organisational factors

Participants reported organisational factors such as education, terms and supervision were helpful in gaining experience.

Several noted the importance of familiarity with the equipment used in their institution, either due to recent experience or education. Most saw value in simulation-based training to develop greater familiarity with the equipment. Additionally, some suggested that training videos or guidelines focused on available equipment would be useful.

Rotations to areas in which pleural procedures were more common, such as Respiratory or Cardiothoracics were seen as valuable, as were opportunities to attend procedural lists.

Finally, the availability of willing supervisors was also seen as increasing procedural opportunities, including support that it may take more time, and reassurance that the participant had backup if required.

Maybe it was just my [supervisor] being really nice.

DISCUSSION

This multi-centre study reveals the experiences of Australian ICU trainees as they develop pleural procedural skills. Participants outline several challenges associated with gaining experience, and implications of this on their confidence. They also raise opportunities which may be relevant to departments and educational teams for developing these skills.

Procedural confidence is associated with the number of procedures performed, [13, 14] with recency of clinical experience potentially mitigating the decline in confidence over time. [15] Similar to the literature, participants in this study often reported a lack of confidence in performing pleural procedures [16–18], with access to procedures frequently cited as a problem. [16–19] Two-thirds of respondents would not meet the numerical threshold for an “Emergency operator standard’, based on a recent British expert statement. We also observed a mismatch between the level of recent experience and the level of individual confidence, particularly in the senior trainees.

Several factors beyond clinical experience were raised as contributing to confidence, such as supportive supervision, education, and the clinical situation. Conversely, participants often perceived that a lack of confidence impaired their opportunities to gain experience. The overall low level of thoracic ultrasound training and experience is also likely to have impacted on pleural procedural confidence, as ultrasound is increasingly seen as an integral part of procedural safety in this area. [5]

Expectations for competence assessment remain inconsistent across medical training bodies. CICM requires all trainees to complete a Workplace Competency Assessment [3] for pleural drain insertion during their training. This relies, rather than on a numerical target, on a supervisor’s assessment of whether a trainee can be entrusted with this task. However, this may mean

that trainees have had only a few procedural opportunities before being assessed competent, or do not maintain recency of experience, as seen in the limited recent experience of participants who have completed the Workplace Competency Assessment. Overall, 50% of respondents who had completed this assessment would not meet the numerical threshold for competence as per the Thoracic Society Australia New Zealand guidelines.

In the interviews, lack of access to procedures was often attributed to factors such as a hierarchical queue of proceduralists, a limited number of interventions being performed in the ICU and competing clinical priorities. Due to lack of opportunities to train, relying purely on volume as a measure of competency, or relying on trainee assertiveness to access procedures, may lead to an inability to adequately credential trainees for whom this is a core skill. [2, 3]

Considering the demands of training a large pool of clinicians, simulation may improve access to, and consistency of, training. [15, 20–22] In our survey, most respondents, regardless of experience, felt they would benefit from simulation-based training. Whilst interview participants acknowledged that mannequin-based simulation was not entirely comparable to 'real' procedures, it particularly provided benefit by improving familiarity with equipment and processes.

Similarly, as learners may take more time to complete procedures than a more experienced operator, mediating clinical workload and supportive supervisors are vital. Rotations in other areas and may also represent an opportunity for increasing experience and confidence.

Strengths and Limitations

This is the first mixed-methods study to explore the experience of pleural procedure and procedural confidence among training ICU doctors. It explores the lived experience of trainees across multiple centres, including smaller, regional centres that are frequently underrepresented in studies of procedural training. Additionally, this reveals opportunities for how educators and supervisors might assist in developing procedural competencies.

The survey achieved a response rate of 57% of eligible trainees across participating units, which compares favourably to previous literature in the area. [7] Combined with the well-defined sampling period, this reduces the risk that non-responders had systematically differing levels of confidence, training, and experience. The response rate also enabled purposive sampling for the qualitative component across a range of trainee seniority levels. Embedding interviewees within the survey population also allowed the qualitative findings to be interpreted alongside broader quantitative patterns of procedure volume and confidence.

Although the study included multiple centres, it was conducted within one large hospital network in Australia. It is possible that some challenges reported by the participants may not be generalisable to other areas. Furthermore, the study was not designed to directly evaluate competence, and is confined to participants self-reported confidence and procedural experience.

CONCLUSION

This study identifies heterogeneous, but generally low levels of pleural procedural experience and confidence in ICU junior doctors across multiple Australian centres. It has identified barriers and opportunities for enhancing training in this area. Ongoing research is needed into optimal models of training and assessment in pleural procedures for ICU trainees.

Declarations

Ethics approval and consent to participate

This research been performed in accordance with the Declaration of Helksinki. Ethics approval was provided by the Hunter New England Human Research Ethics Committee (REF: 2021/ETH12329). All participants provided informed consent prior to participation. Review of the Participant Information Sheet and a question affirming consent was required prior to completing the survey. An interview-specific Participant Information Sheet was provided to all prospective interview participants. The study

was explained and opportunities to ask questions were provided both during the booking of the interview and prior to providing consent at the time of the interview. A written consent form was completed before each interview.

Consent for publication

Not applicable

Competing interests

The authors declare that they have no competing interests.

Funding

This research was supported by a grant from the John Hunter Hospital Charitable Trust. The funder had no role in the conceptualization, design, data collection, analysis, decision to publish, or preparation of the manuscript.

Author Contribution

LF contributed to the conception and design of the work as well as acquisition, analysis and interpretation of the data, she has substantively contributed to the writing of the work. **CP** contributed to the conception and design of the work as well as acquisition, analysis and interpretation of the data, she has substantively contributed to the writing and revision the work. **KK** contributed to the conception and design of the work as well as acquisition, analysis and interpretation of the data, she has substantively contributed to the writing of the work. **VT** contributed to the acquisition of the data and the writing and revision of the work. **AR** contributed to the acquisition and interpretation of the data and writing and revision of the work. **MG** contributed to the design of the work, as well as the acquisition, analysis, and interpretation of the data and writing and revision of the work. **JB** contributed to the conception of the trial and writing and revision of the work. **CG** contributed to the conception of the trial and revision of the work. **NR** contributed to the conception of the trial and the writing and revision of the work. **VG** contributed to the conception and design of the work as well as acquisition, analysis, and interpretation of the data, he has substantively contributed to the writing and revision the work.

Acknowledgements

Not applicable

Data Availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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Figures



Figure 1

Seniority of Respondents

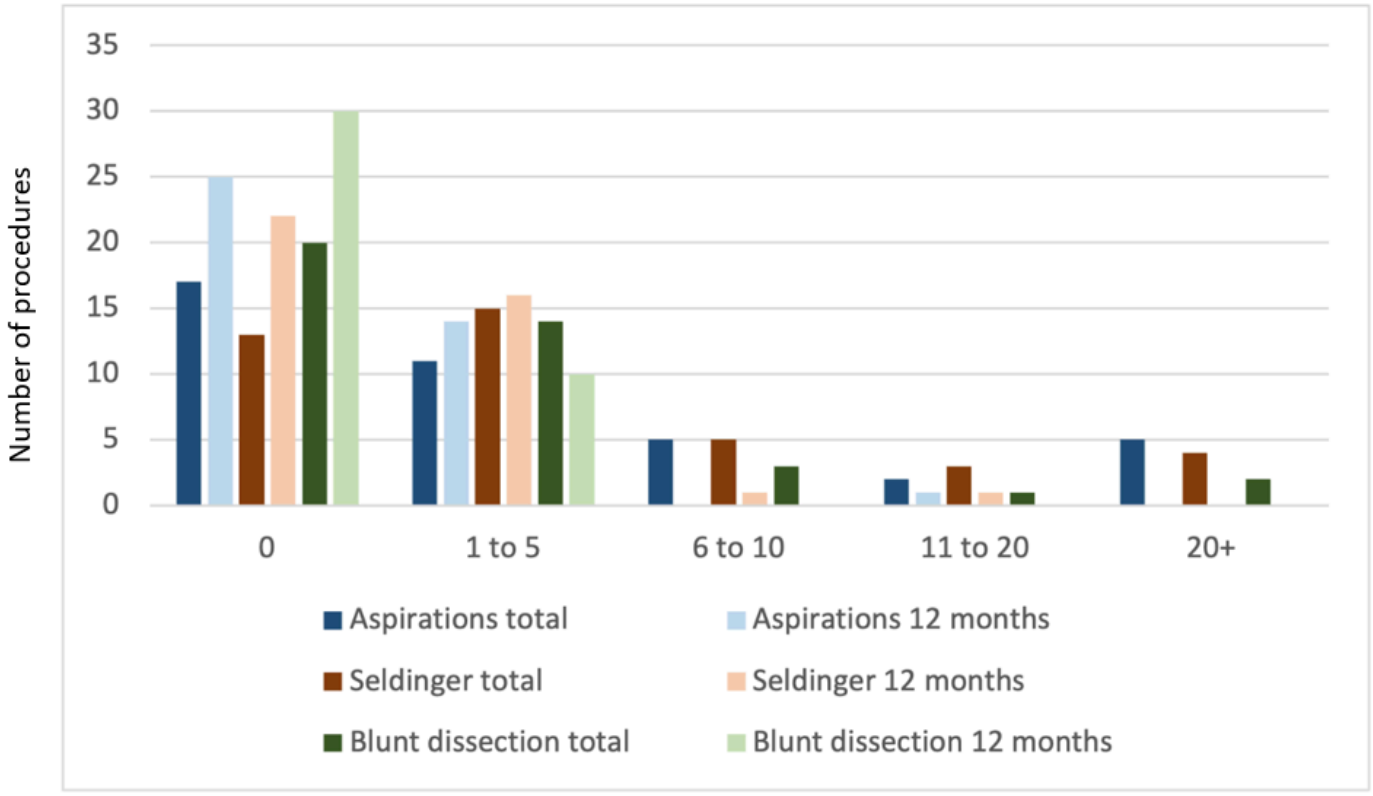


Figure 2

Procedural experience – all respondents

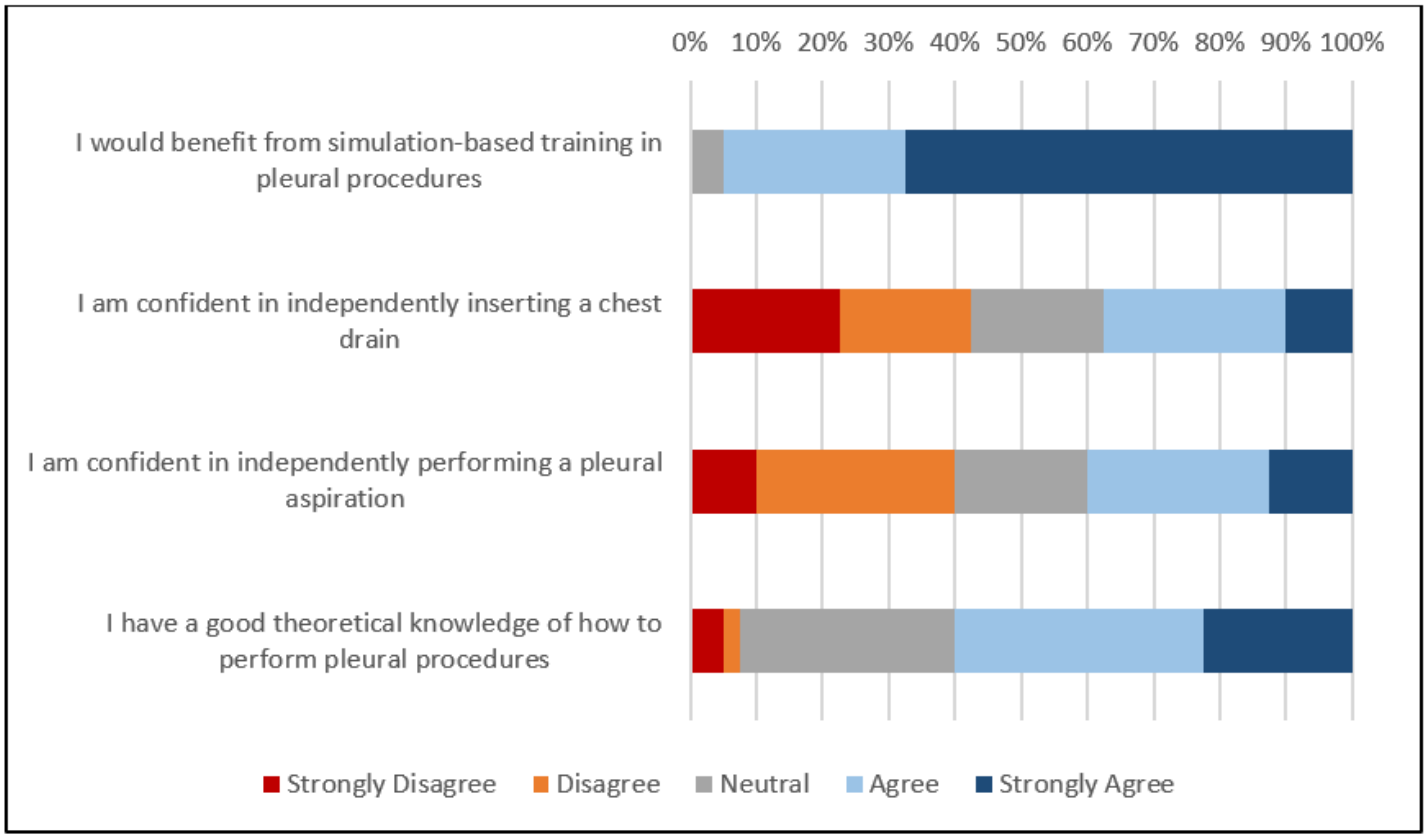


Figure 3

Pleural proceduralists' confidence and knowledge

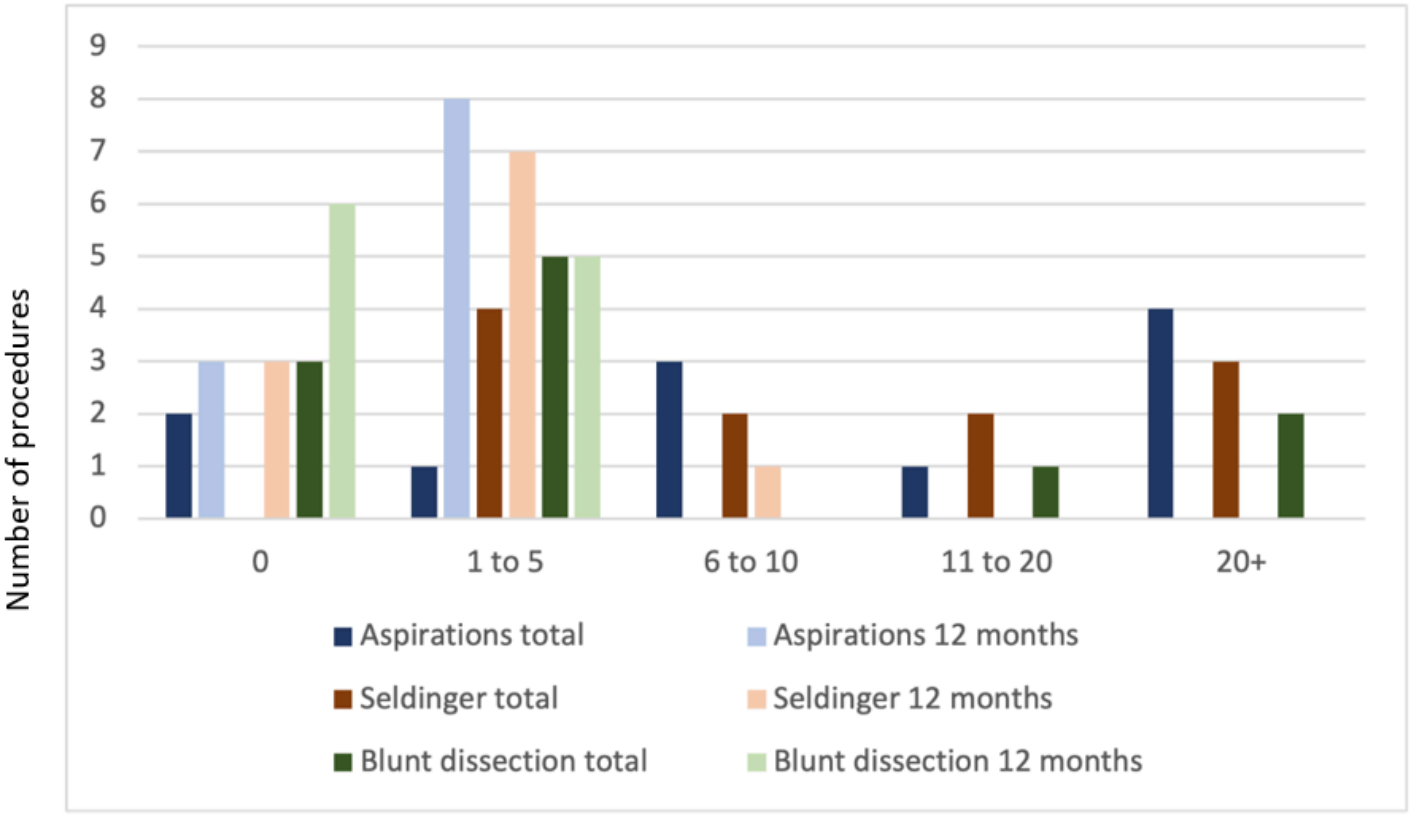


Figure 4

Senior Trainees' procedural experience

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- AMixedMethodsEvaluationofPleuralProceduralExperienceandTraininginIntensiveCareTraineesSupplementarymaterial.docx