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ORIGINAL RESEARCH

Perioperative ultrasound among South African anaesthetists: a survey of current practice and availability

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Background: Point-of-care ultrasound (POCUS) is becoming part of the standard skill set of the modern-day anaesthetist. There is limited knowledge regarding the availability of ultrasound (US) and POCUS skills in South Africa. There may be barriers to adopting US in many institutions.

Methods: An observational cohort questionnaire was distributed via an online REDCap survey. All doctors practising anaesthesia in South Africa were eligible. Recruitment was done via an email link that was sent to South African Society of Anaesthesiologists (SASA) members. Non-SASA members were recruited via departmental mailing lists or social media.

Results: Of the 580 respondents, 478 were SASA members (response rate 22.9%, confidence interval 3.94) and 102 were non-SASA members. In total, 571 surveys were suitable for analysis, 397 (69.5%) respondents had more than five years anaesthesia experience, 558 (97.7%) of respondents worked in hospitals that have US machines available, and 76.7% had US readily available after hours. Respondents used US mostly for central venous catheter (CVC) insertions (77.9%), regional anaesthesia (82.3%), and cardiac and lung assessments (26.4% and 17.7%, respectively). It is used much less frequently for neuraxial anaesthesia (1.4%). Of the respondents, 382 (66.9%) had received US training, only 198 (34.7%) felt confident in their US skills, and 482 (84.4%) wish to have further US training. The two most significant barriers to US were lack of equipment and lack of training at postgraduate level.

Conclusion: South African anaesthetists work at institutions where US equipment is generally available, and most practitioners want to incorporate US in their practice. However, anaesthetists feel insecure with respect to their skills and indicated that they wish to receive further training. Efforts should be made to formalise POCUS training in the Fellowship of the College of Anaesthetists (FCA) curriculum and make US training more accessible.

Keywords: anaesthetists, point-of-care ultrasound, POCUS, FATE, ultrasound guidance, South Africa, training

Introduction

Point-of-care ultrasound (POCUS) plays an important role in vascular access placement, regional nerve blocks, and heart and lung assessments in the perioperative period. Its use has been shown to reduce failure and complication rates, thereby improving patient safety and procedural efficiency.[1] Ultrasound (US) use among anaesthesiologists has gained greater importance in postgraduate training. Specialist training milestones, such as those developed by the Accreditation Council for Graduate Medical Education (ACGME) and the American Board of Anesthesiology (ABA), have incorporated US for nerve blocks, vascular access and certain pain procedures.[2]

Many international guidelines, including those issued by the National Institute for Health and Care Excellence (NICE) in the United Kingdom (UK) and the Canadian Anesthesiologists' Society (CAS), have recommended the routine use of US guidance when performing invasive procedures such as central venous cannulations.[1,4] As per the 2018 guidelines of the South African Society of Anaesthesiologists (SASA), US is now considered as part of the basic skill set of an anaesthesiologist.[3] The introduction of US technology has revolutionised the field of regional anaesthesia.[3] Focused assessment using transthoracic echocardiography (FATE) is an invaluable perioperative extension to the clinical examination.[3] Also, the use of US imaging aids with rapid diagnosis of severe and life-threatening pathological conditions, and may change clinical management and impact on patient outcome.[5,6] In many international centres, US is included in the training of anaesthesiologists from the outset.[3]

In South Africa, however, there is limited knowledge as to the availability of ultrasound for POCUS and the skills necessary for training among anaesthetists. It is not clear what factors affect the uptake of POCUS in a resource-limited setting such as South Africa. The primary objective of this study was to determine how US is used perioperatively for vascular access placement, nerve blocks, and heart and lung assessments. The study also sought to identify training experiences, desire for further US training and preferences in modes of training from participants. Secondary objectives were to identify the barriers and limitations preventing US use among South African anaesthetists.

Methods

This study was conducted using a questionnaire that was made available in an online digital format. Approval was obtained from the Human Research Ethics Committee of the University of Cape Town (HREC 397/2020) prior to distribution of the questionnaire.

This questionnaire that was used was adapted (with permission) from a similar survey conducted by Chui et al.[1] in 2018 in Southwestern Ontario. The questionnaire was modified to suit the South African context and validated by doing a pilot survey with a small sample of twelve anaesthetists who use POCUS.

The questionnaire was run for a 6-week period from 19 August 2020 to 2 October 2020. Participants were recruited via a link which was either sent by email to all SASA members, or distributed through a web-based link on anaesthesia departmental mailing lists and on social media WhatsApp groups. Follow-up reminders were sent out during the 6-week period.

All anaesthesia practitioners from South Africa were eligible to participate. SASA members working in South Africa were especially approached for inclusion as they represent a feasible and reliable sample of all potential respondents that could be reached via the SASA membership database. Specialists, trainees and non-specialist anaesthetists were included. The survey was composed of 39 questions and was estimated to take approximately less than five minutes to complete. The questions were designed to address five main aspects: i) respondent characteristics, ii) institution characteristics, iii) individual practice, iv) training in US and US training preferences, and v) barriers and limitations to using US. Informed consent was obtained electronically prior to respondents participating in the survey.

Data were captured using REDCap, in collaboration with Safe Surgery SA and the Anaesthesia Network for South Africa (ANSA). The survey data were analysed using Microsoft Excel. Descriptive statistics, including mean, modes and percentages, were reported as appropriate to assess the data. From the SASA membership, based on a confidence level of 95% and confidence interval of 5, the minimum sample size required was 324 (response rate 15.6%).

Results

Participants

Eligible participants for this study include doctors who currently practise anaesthesia in South Africa. This included specialists, registrars (trainee specialists) and non-specialists (medical officers and GP anaesthetists). At the time of the survey, there were 2 082 doctors on the SASA membership database currently practicing anaesthesia in South Africa. The total number of respondents was 580, of which 472 were SASA members. Nine surveys were incomplete and therefore discarded (Figure 1).

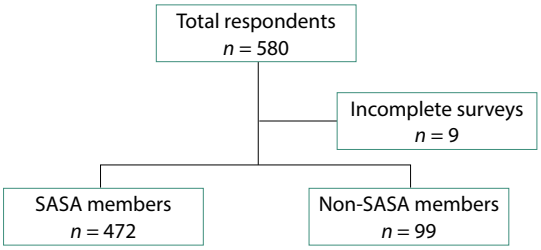

Figure 1: Analysed responses

With a sample size of 478 out of 2 082 SASA members (response rate 22.9%), the confidence interval is 3.94.

The demographics of the respondents and the institutions at which they practice are summarised in Table I and Table II, respectively. Respondents were mostly between 30 and 49 years of age (70.9%). Most of the respondents were consultant anaesthetists (55.7%), 25.7% were registrars and 14.7% were medical officers. Only a small minority were GP anaesthetists (3.9%) and 4.4% had no anaesthesia qualifications. Almost all of the respondents were full-time anaesthetists (93.0%). Of the respondents, 58.8% worked in state hospitals, 32.4% in private hospitals and 8.8% worked in both. The majority of respondents work in the four most populated South African provinces, namely Western Cape (34.9%), Gauteng (25.7%), KwaZulu-Natal (20.3%) and Eastern Cape (8.4%). Detailed data about the respondents regarding their designation and the institutions where they work is available in Supplementary File 1.

Table I: Respondent data (*n* = 571)

	n	%
Gender		
Male	303	53.1
Female	265	46.4
Prefer not to disclose	3	0.5
Age group		
20–29	41	7.2
30–39	266	46.6
40–49	139	24.3
50–59	77	13.5
60–69	43	7.5
> 69	5	0.9
Designation		
Medical officer	84	14.7
Registrar	147	25.7
Consultant	318	55.7
GP anaesthetist	22	3.9
Highest anaesthesia qualification		
None	25	4.4
DA	224	39.2
FCA (or equivalent)	305	53.4
Subspecialists	17	3.0
Full-time practice	531	93.0
Part-time practice	40	7.0
State practice	336	58.8
Private practice	185	32.4
Both	50	8.8
Province of practice		
Eastern Cape	48	8.4
Free State	30	5.3
Gauteng	147	25.7
KwaZulu-Natal	116	20.3
Limpopo	2	0.4
Mpumalanga	9	1.6
Northern Cape	14	2.5
North-West	6	1.1
Western Cape	199	34.9

DA – Diploma in Anaesthesia, FCA – Fellow of College of Anaesthetists

Institutional characteristics

Of the respondents, 77.7% worked mostly at tertiary level hospitals, 29.9% at regional and the remaining 9.8% at district hospitals. Respondents predominantly worked at either large

Table II: Institutional data (*n* = 571)

	n	%
Level of hospital		
District	56	9.8
Regional	171	29.9
Tertiary	442	77.7
No of operating rooms		
1–3	18	3.2
4–10	245	42.9
≥ 10	308	53.9
No of US machines for perioperative care		
0	13	2.8
1	176	30.8
2	134	23.5
3	64	11.2
4	58	10.2
≥ 5	126	22.1
US readily available during daytime (07h00–17h00)		
Yes	393	68.8
Sometimes	152	26.6
No (locked away/special authorisation)	26	4.6
US readily available after hours and weekends		
Yes	438	76.7
Sometimes	87	15.2
No (locked away/special authorisation)	46	8.1
US is common practice for cardiac assessments		
Yes	188	32.9
Sometimes	172	30.1
No	211	36.9
US is common practice for lung assessments		
Yes	78	13.7
Sometimes	220	38.5
No	273	47.8
US is common practice for regional anaesthesia		
Yes	475	83.2
Sometimes	72	12.6
No	24	4.2
US is common practice for neuraxial (spinals/epidurals)		
Yes	36	6.3
Sometimes	87	15.2
No	448	78.4
US is common practice for CVC insertions		
Yes	447	78.2
Sometimes	93	16.3
No	31	5.4
US is common practice for difficult A-line insertions		
Yes	283	49.5
Sometimes	205	35.9
No	83	14.5
US is common practice for difficult peripheral line insertions		
Yes	153	26.8
Sometimes	219	38.4
No	199	34.9

(≥ 10 operating rooms; 53.9%) or medium (4–10 operating rooms; 42.9%) facilities. Most of the institutions (97.2%) had at least one US machine available for perioperative care and US was available for 24-hour use at most facilities (76.7%). The data pertaining to the institutions at which respondents worked is presented in Table II.

Most respondents observed that the use of US is common practice for central venous catheter (CVC) insertions (78.2%) and regional anaesthesia (83.2%) at their institutions. US for difficult arterial insertions was a common practice at almost half (49.5%) of the respondents' institutions, whereas US for difficult peripheral line insertions was less common. US was used less commonly for cardiac assessments (32.9%) and lung assessments (13.7%) whenever indicated. US was not commonly practiced for neuraxial anaesthesia.

In terms of individual practices, as detailed in Table III, a vast majority of respondents reported that they "always" or "frequently" used US for CVC insertion (77.9%) and when performing regional anaesthesia (82.3%), but much less frequently for neuraxial anaesthesia (1.4%). The use of US for arterial cannulation and difficult peripheral line insertion, was also uncommon. Regarding POCUS for cardiac and lung assessment, 49.0% and 62.2% of respondents respectively "never" or "seldomly" used this modality.

Two-thirds of respondents reported that they had received some form of US training (as summarised in Table IV), but only one-third of respondents "strongly agreed" or "agreed" that they felt confident regarding their US skill set. Participation in workshops was the most common form of training (58.0%) and 27.3% of respondents had received US training during their registrar training. Of the respondents, 84.4% indicated that they would still like to receive US training, and 71.1% were planning to undertake some form of US training, with workshops and peer-to-peer training being the preferred choices. Almost all respondents (96.5%) "strongly agreed" or "agreed" that US is an important skill for anaesthetists.

Discussion

This is the first study of its kind evaluating the current practice pattern of perioperative US use among South African anaesthetists. A similar study of 66 anaesthetists conducted in a well-resourced Canadian context in 2018 identified the major barrier to the use of POCUS being limited US resources, with US in this context most commonly used for regional anaesthesia and CVC insertion.[1] These findings are similar to our findings in that 78.2% of South African respondents regularly use US for CVC insertion compared to 90% in the Canadian group.[1] The NICE guidelines state that "US guidance should be used in most clinical circumstances where CVC insertion is necessary and that all those involved in placing CVCs using US guidance should undertake appropriate training to achieve competence".[4]

The use of US in peripheral nerve block has been shown to reduce block performance time, increase block success, improve block quality, and allow adequate visualisation of surrounding structures, needle and catheter (American Society of Regional Anesthesia [ASRA] guideline: Level Ib evidence).[7] Our current practice of regional anaesthesia pattern appears to be in line with the current recommendation with US being used "always" or "frequently" by 82.3% respondents, which is higher than that of high-income countries (67%). Although US-guided arterial

Table III: Individual data (n = 571)

Individual practice	Always	Frequently	Sometimes	Seldom	Never
I use ultrasound guidance when inserting a central line	325 (56.9)	120 (21.0)	55 (9.6)	29 (5.1)	42 (7.4)
I use ultrasound guidance for arterial cannulation	23 (4.0)	73 (12.8)	194 (34.0)	169 (29.6)	112 (19.6)
I use ultrasound guidance for difficult peripheral line insertion	23 (4.0)	60 (10.5)	137 (24.0)	143 (25.0)	208 (36.4)
I use ultrasound guidance when performing regional blocks	367 (64.3)	103 (18.0)	38 (6.7)	19 (3.3)	44 (7.7)
I use ultrasound guidance for spinal and epidural blocks	3 (0.5)	5 (0.9)	33 (5.8)	95 (16.6)	435 (76.2)
I use ultrasound for cardiac assessments whenever indicated	60 (10.5)	91 (15.9)	140 (24.5)	103 (18.0)	177 (31.0)
I use ultrasound for lung assessments whenever indicated	36 (6.3)	65 (11.4)	115 (20.1)	134 (23.5)	221 (38.7)

All results are presented as n % .

Table IV: Training data (n = 571)

	n	%
Have you received training in perioperative ultrasound use?		
Yes	382	66.9
No	189	33.1
I feel confident in my POCUS skills		
Strongly agree	44	7.7
Agree	154	27.0
Neutral	141	24.7
Disagree	145	25.4
Strongly disagree	87	15.2
I have received training in POCUS through		
Registrar training	156	27.3
Fellowship training	15	2.6
Peer-to-peer training	176	30.8
Workshops (e.g. FATE)	331	58.0
Self-trained	187	32.7
Is there a colleague with whom you can review your POCUS findings if needed?		
Always	56	9.8
Frequently	188	32.9
Sometimes	165	28.9
Seldom	103	18.0
Never	59	10.4
I would like to receive ultrasound training		
Yes	482	84.4
No	28	4.9
Maybe	61	10.7
I plan to undertake ultrasound training		
Yes	406	71.1
No	33	5.8
Maybe	132	23.1
If you PLAN to undertake training, in what format should the training be?		
Hands-on workshop(s) (e.g. FATE)	462	80.9
Online workshops/webinars	240	42.0
Formal fellowship training	105	18.4
Peer-to-peer training within your institution	261	45.7
Self-training	138	24.2
I am NOT planning to undertake ultrasound training because		
I have sufficient training	15	2.6
Training is not available easily in my institution	8	1.4
It is not needed in my practice	7	1.2
I have no interest in ultrasound training	5	0.9
I do not see the benefit in ultrasound training	3	0.5
Ultrasound guidance is an important skill for all anaesthetists		
Strongly agree	464	81.3
Agree	87	15.2
Neutral	13	2.3
Disagree	6	1.1
Strongly disagree	1	0.2

cannulation has been shown to improve first-pass success and reduce the number of attempts,[8] the adoption rates of US for arterial lines insertion is low with only 16.8% of respondents using US guidance "always" or "frequently".

The uptake of US for neuraxial anaesthesia among South African anaesthetists was very low, with only 1.4% of respondents using US "always" or "frequently". The majority (92.8%) "never" or "seldom" used US. The practice of central neuraxial block (CNB) has traditionally relied on the palpation of bony anatomical landmarks, namely the iliac crests and spinous processes, together with tactile feedback during needle insertion.[9] There is consistent evidence to suggest that neuraxial ultrasound can be used to identify vertebral levels more accurately than palpation of surface anatomical landmarks. A 2015 systematic review highlighted the poor correlation between vertebral levels determined by ultrasound and palpation, with rates of agreement varying from 14% to 64%.[10] As per the ASRA guidelines, the use of US in neuraxial blockade shortens the procedural time, improves block success and allows better prediction of epidural depth.[7] Further training in US guidance for neuraxial anaesthesia may be valuable.

FATE is an invaluable perioperative extension to the clinical examination.[11] The bedside use of ultrasound imaging aids with rapid diagnosis of severe and life-threatening pathological conditions that may change clinical management and impact on patient outcome.[11] This study showed that only 49.0% and 62.2% of respondents "never" or "seldom" used US whenever indicated for cardiac and lung assessments, respectively. These findings suggest that most South African anaesthetists may not have integrated POCUS for cardiac and lung assessment into daily clinical practice. Given that POCUS is becoming the standard of care in anaesthesia internationally, this suggests that further training and formalisation of POCUS standards is essential in South Africa. As Neethling et al.[11] suggest, "by incorporating POCUS as part of our armamentarium, we might see it reach its full clinical potential, optimising patient care and improving patient outcomes".

An important barrier to US as identified by our respondents was lack of US training at the postgraduate level. It is important to note that only 27.3% of respondents received US training as a registrar and 32.7% of respondents were self-trained. The latest published FCA curriculum (2014) does not mention US skills nor

competence required from a specialist trainee nor is there any formal logbook of US procedures required for qualification.[12] However, questions on POCUS do form a significant part of the final FCA exams. In this regard, there seems to be a gap in the current curriculum, suggesting that an updated curriculum incorporating POCUS skills is necessary. This is in contrast to The College of Emergency Medicine of South Africa (CEMSA) which has a credentialing procedure for emergency physicians or other clinicians who wish to perform emergency ultrasound in the emergency department for diagnostic purposes, or even as an adjunct in the placement of CVCs.[13] Fellows of the CEMSA are expected to have both appropriate training and practical experience to perform and interpret basic emergency US examinations.

Mahmood et al.,[14] representing a group of international experts in the fields of cardiothoracic, general and regional anaesthesiology, critical care and pain medicine, recommended that perioperative US training should be continuous and structured. They advocate that residency programmes should create their own teaching tools and evaluation metrics to demonstrate the progression of learners.

The findings of this study suggest that there is a need to incorporate US in the undergraduate curriculum. In a study evaluating training medical students, with no previous US experience to perform basic US-guided vascular access and basic FATE, Heiberg et al.[15] showed that medical students were able to rapidly improve their skills from baseline with the use of an e-learning package and a four-hour hands-on session. It is believed that clinicians are more likely to incorporate US into their daily practice if it is introduced at an early stage of their careers.[15]

There are currently multiple different courses available for training in POCUS: FATE as previously mentioned, extended focused assessment with sonography for trauma (e-FAST), bedside lung ultrasound in emergency (BLUE), focused echocardiographic evaluation in life support (FEEL), focused intensive care echocardiography (FICE) and haemodynamic echocardiography examination in real time (HART), among many others.[11] All these have a similar goal, that is to provide a structure to non-cardiologist practitioners to diagnose or confirm a specific clinical cardiorespiratory emergency that is responsible for patient haemodynamic instability. POCUS is easily taught, non-invasive and readily available.[11] This study showed that 58.0% of the study respondents had US training through courses and workshops. Some respondents felt that there is a lack of awareness of POCUS benefits and courses available. By promoting access to these courses nationally and advocating the benefits, there may be more interest in completing these courses. This study did not evaluate which courses the survey respondents attended, but establishing which courses would be most useful for our context would be of value.

The assumption that a lack of availability of US equipment would be a major barrier to the use of POCUS in South Africa was refuted as 68.8% of respondents had US readily available during daytime, and even more reported availability after hours (76.7%). Factors limiting use, such as limited numbers of machines being shared by multiple theatres during daytime hours, were not elucidated. The findings, however, suggest that using POCUS when indicated within a resource-limited setting is achievable and should be encouraged. South African anaesthetists, however, still perceived that one of the most important barriers to US was lack of equipment. There may be institutional logistical factors that could contribute to this perception. For example, US equipment being stored or locked away outside operation theatres and thus not readily accessible in an emergency setting. In solo private practice, surgical slate pressure and lack of peer support may also limit the use of POCUS.

Barriers that could be addressed in the promotion of more widespread US use include appropriate provision of equipment and increased formal training in order to improve competence and confidence.[16] With improved skills and confidence in POCUS use, time spent performing exams becomes less of a factor. The importance of continued training and supervision should be emphasised for skill maintenance.

Although respondents indicated that they would like to use US, had the requisite training and generally had access to US equipment, respondents also indicated that the two most important barriers to POCUS use in South Africa were lack of equipment and lack of training at the postgraduate level. Other perceived barriers to POCUS use in South Africa were lack of training at undergraduate level, lack of POCUS courses nationally and lack of awareness of its benefits. Specific feedback from some respondents indicated that there are certain circumstances, such as pressure from surgical colleagues, that discourage an anaesthetist from gaining self-confidence in using US.

Study limitations

The response rate for this study was 22.9% among SASA members. Although the confidence interval of 3.9 is acceptable, the sample was self-selected, and given the fact that this was an online survey, there may have been selection bias by POCUS practitioners. Therefore, the results may underestimate the practice and availability of US among less enthusiastic users, or those with less access to US machines. Not all South African doctors who provide anaesthesia are registered with SASA, and some may not have received the invitation to participate in the survey. The results of this study may therefore not necessarily be generalisable to the entire country as smaller provinces were less represented. This study could also have been biased towards obtaining information from physicians with access to the internet, smart phone applications, WhatsApp accounts and an active email address. However, this was not expected to be a significant limitation, considering the general easy accessibility and widespread use of email and social media. Response rates to emailed or web-based surveys are comparable to a mailed hard copy survey.[17]

The researchers also did not survey the hospitals independently or cross-checked equipment availability with hospital and anaesthetic department management. Further, this study did not interrogate the availability of the different types of US equipment; for example, the different types of US probes available, portability of US machines, or the availability of special needles for regional anaesthesia. Importantly, one must not disregard the costs of US equipment and related disposables, which may be extremely relevant in a resource-limited setting like South Africa. Given the rapidly diminishing cost of small, handheld ultrasound machines, economics may be less of a factor in the acquisition of ultrasound devices in future.

Recommendations

A national audit of POCUS equipment for anaesthesia at hospitals would provide more insight into US equipment available for perioperative care. Comparing such information with clinical practice may truly reflect the uptake of POCUS among South African anaesthetists. We strongly recommend formalising POCUS in the FCA curriculum and the use of procedural logbooks for US procedures and skills as part of the FCA portfolio of learning. The use of ultrasound should be included from the outset of specialist training of anaesthetists and tested in the FCA OSCE exam, similar to the American Board of Anesthesiology (ABA) Applied exam.[2,3] Making POCUS workshops or online modules more accessible will also increase training opportunities for anaesthetists, especially for those who do not work in major cities or centres. In addition, there must be ongoing emphasis and awareness about the benefits of POCUS in perioperative care, and opportunities must be afforded to anaesthetists to practice skills learnt under supervision.

Conclusion

US in the South African perioperative setting is common for CVC insertion and regional anaesthesia, but less frequent in relatively new applications such as cardiac and lung assessments, as well as peripheral vascular access and neuraxial anaesthesia. Ultrasound machine availability should not be a barrier to the widespread use of POCUS by local practitioners. South African anaesthetists are enthusiastic about upskilling themselves and introducing US more regularly into their practice. However, there may be some shortcomings in the current training standards and curricula that can potentially hinder further US adoption. A matched administrative effort at formalising US training, incorporating procedural logbooks in the FCA curriculum, and making US training or workshops more accessible with the input from The College of Anaesthetists of South Africa may assist in improving the fate of POCUS in our daily practice.

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Conflict of interest

The authors declare no conflict of interest.

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Ethical approval

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Supplementary File 1

Institutional characteristics	Total (*n* = 571)		Medical officers (*n* = 84)		Registrars (*n* = 147)		Consultants (*n* = 318)		GP anaesthetists (*n* = 22)	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Level of hospital										
District	56	9.8	12	14.3	18	12.2	22	6.9	4	18.2
Regional	171	29.9	39	46.4	32	38.1	87	27.4	13	59.1
Tertiary	442	77.7	44	52.4	144	98.0	244	76.7	10	45.5
No of operating rooms										
1–3	18	3.2	3	3.6	0	0	13	40.9	2	9.1
4–10	245	42.9	68	81.0	25	17.0	139	43.7	13	59.1
≥ 10	308	53.9	13	15.5	122	83.0	166	52.2	7	31.8
No of US machines for perioperative care										
0	13	2.8	1	1.2	0	0	10	3.14	2	9.1
1	176	30.8	40	47.6	7	4.8	113	35.5	16	72.7
2	134	23.5	29	34.5	27	18.3	75	23.6	3	13.6
3	64	11.2	10	11.9	17	11.6	37	11.6	0	0
4	58	10.2	1	1.2	28	19.0	29	9.1	0	0
≥ 5	126	22.1	3	3.6	68	46.3	54	17.0	1	4.5
US readily available during daytime (07h00–17h00)										
Yes	393	68.8	64	76.2	91	61.9	229	72.0	9	40.9
Sometimes	152	26.6	18	21.4	47	31.9	79	24.8	8	36.4
No (locked away/special authorisation)	26	4.6	2	23.8	9	6.1	10	31.4	5	22.7
US readily available after hours and weekends										
Yes	438	76.7	66	78.6	122	83.0	240	74.5	10	45.5
Sometimes	87	15.2	10	11.9	15	10.2	56	17.6	6	27.2
No (locked away/special authorisation)	46	8.1	8	9.5	10	6.8	22	6.9	6	27.2
US is common practice for cardiac assessments										
Yes	188	32.9	11	13.1	79	53.7	92	28.9	6	27.2
Sometimes	172	30.1	40	47.6	47	32.0	119	37.4	5	22.7
No	211	36.9	33	39.2	21	14.3	107	33.6	11	50.0
US is common practice for lung assessments										
Yes	78	13.7	8	9.5	42	28.6	27	8.5	1	4.5
Sometimes	220	38.5	25	29.8	73	49.7	119	37.4	3	13.6
No	273	47.8	51	60.7	32	21.8	172	54.1	18	81.8
US is common practice for regional anaesthesia										
Yes	475	83.2	71	84.5	139	94.6	253	79.6	12	54.5
Sometimes	72	12.6	9	10.7	5	3.4	53	16.7	5	22.7
No	24	4.2	4	4.8	3	2.0	12	37.7	5	22.7
US is common practice for neuraxial (spinals/epidurals)										
Yes	36	6.3	7	8.3	10	6.8	19	6.0	0	0
Sometimes	87	15.2	8	9.5	21	14.3	54	17.0	4	18.2
No	448	78.4	69	82.1	116	78.9	245	77.0	18	81.8
US is common practice for CVC insertions										
Yes	447	78.2	67	79.8	131	89.1	240	75.5	9	40.9
Sometimes	93	16.3	11	13.1	16	10.9	59	18.6	7	31.8
No	31	5.4	6	7.1	0	0	19	59.7	6	27.2
US is common practice for difficult A-line insertions										
Yes	283	49.5	37	44.0	85	57.8	154	48.4	7	31.8
Sometimes	205	35.9	31	36.9	45	30.6	121	38.1	8	36.3
No	83	14.5	16	19.0	17	11.6	43	13.5	7	31.8
US is common practice for difficult peripheral line insertions										
Yes	153	26.8	14	16.7	59	40.3	80	25.2	0	0
Sometimes	219	38.4	35	41.7	59	40.3	115	36.2	10	45.5
No	199	34.9	35	41.7	29	19.7	123	38.7	12	54.5