Development and psychometric testing of the OCEAN-ICU instrument to optimise sedation use in intensive care

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Conflicts of interests:

Leanne M Aitken: has been in receipt of funding from National Institute of Health and Care Technology Assessment Programme, UK (HTA 16/93/01) (2018 – 2024) comparing Dexmedetomidine, Clonidine and usual sedation; Elsevier Australia – royalties related to Critical Care Nursing (multiple editions).

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Cathrine McKenzie: Dr McKenzie declares an honorarium for her role as Editor in Chief of Critical Illness (www.medicinescomplete.com) and has an NIHR Senior Clinical Practitioner Award (NIHR 304615). She has also been in receipt of funding from National Institute of Health and Care Technology Assessment Programme, UK (HTA 16/93/01) (2018 – 2024) comparing Dexmedetomidine, Clonidine and usual sedation.

Timothy S Walsh: has been in receipt of funding from National Institute of Health and Care Technology Assessment Programme, UK (HTA 16/93/01) (2018 – 2024) comparing Dexmedetomidine, Clonidine and usual sedation

280 character summary: OCEAN-ICU instrument can inform strategy development to optimise management of patients' discomfort, anxiety and pain in intensive care.

Abstract

Objective: Sedation and pain management are core strategies used to manage discomfort, anxiety and pain in intensive care, however strategies to improve this practice are inconsistently implemented with differential effect. We describe the development and psychometric testing of the Optimising ContExt in Assessing sedatioN in ICU (OCEAN-ICU) instrument intended for use in intensive care to guide development of change strategies to optimise sedation. We also provide descriptive results.

Design: A prospective instrument development study.

Setting: United Kingdom.

Participants: Clinical staff who self-identified as responsible for prescribing, administering and/or advising on sedation to invasively mechanically ventilated intensive care patients participated.

Interventions: Not applicable

Measurements & Main Results: Developed from previous interviews and refined during pilot testing, the draft instrument incorporated 68 statements aligned with the Theoretical Domains Framework. Interested clinicians completed an online survey. Item responses were summed descriptively. Congruence between rankings of agreement and importance were assessed descriptively. Construct validity was assessed using confirmatory factor analysis. 252 usable responses were received from UK based critical care clinicians (53 medical doctors, 149 nurses, 25 pharmacists, 16 physiotherapists and 9 other healthcare professionals). After refining, 39 items were retained with an overall internal consistency of 0.81 and construct validity of $\chi 2/df=1.86$; Comparative Fit Index=0.73; Root Mean Square Error of Approximation=0.058. Areas of practice with high levels of agreement and perceived importance focused on the value of light sedation and lack of progress in sedation minimisation. Conflict between importance and agreement was reported in the effective assessment and management of pain, delirium, and agitation.

Conclusion: The OCEAN-ICU instrument has been developed to determine barriers and facilitators to improving sedation practice in local intensive care contexts. Further validation is required prior to testing whether development of change strategies based on identified barriers and facilitators are effective in optimising sedation practice.

Key Points:

Question: What is the factor structure and construct validity of the OCEAN-ICU instrument and what is the level of agreement and perceived importance of the barriers and facilitators to sedation optimisation.

Findings: 39 items with an overall internal consistency of 0.81 and construct validity of $\chi 2/df=1.86$; Comparative Fit Index=0.73; Root Mean Square Error of Approximation=0.058. Areas of practice with high levels of agreement and perceived importance focused on the value of light sedation and lack of progress in sedation minimisation.

Meanings: Although further validation is required, OCEAN-ICU may be useful in informing change strategies to optimise sedation practice.

This section should be no more than 100 words.

For details, please visit the author instructions

Background

Mechanically ventilated patients in intensive care receive sedatives and analgesics to manage discomfort, pain and anxiety. Patients rate comfort and avoidance of delirium as a priority in their care and for research (1). Most practice guidelines include recommendations for optimising sedation and analgesic use. However, inconsistent definitions of optimal sedation make interpreting this literature challenging.

Guidelines generally suggest that lighter sedation is optimal for most patients and is likely to improve outcomes (2, 3). Lighter sedation during the first 48 hours of mechanical ventilation in the Emergency Department and Intensive Care Unit (ICU) is associated with reduced mortality, mechanical ventilation and ICU days (4). The Pain, Agitation, Delirium, Immobility and Sleep (PADIS) guidelines included meta-analysis of studies where sedation depth was defined *a priori*, and also found associations between lighter sedation and improved outcomes (3). In contrast, a systematic review of wider literature reported inconsistent evidence regarding the benefits of lighter sedation, but reported no harm and suggested potential advantages across a range of outcomes including mortality, mechanical ventilation duration, and length of ICU and hospital stays (5).

Despite evidence suggesting benefits of lighter sedation, recent reports indicate that many ICU patients worldwide continue to be deeply sedated (6-9). Reasons for continuing deep sedation are multi-dimensional and include issues of uncertainty in decision making, lack of support between colleagues, and tensions between evidence-based targets and perceived optimal care (10, 11). Furthermore, implementing practice change in clinical settings is notoriously challenging, especially when those responsible for implementation are not involved in its development.

Understanding the multiple factors influencing sedation practice within individual ICUs and clinician and other barriers and facilitators to changing practice is essential to inform development of interventions designed to optimise sedation for ICU patients. There are currently no validated tools that ICUs can use to comprehensively measure and describe their sedation culture and practice. Our

aim was to develop and psychometrically test a tool to support sedation practice improvement within ICUs, the Optimising ContExt in Assessing sedatioN in ICU (OCEAN-ICU) instrument. Our specific objectives were to determine the factor structure and construct validity of the OCEAN-ICU instrument and to describe the level of agreement and perceived importance of the barriers and facilitators to sedation optimisation.

Methods

Study Design

A prospective instrument development study was conducted in three stages: a qualitative interview study to identify the barriers and facilitators for sedation optimisation, a development stage where items were developed and refined for inclusion in the instrument and a pilot study to ensure the instrument was understandable. These were followed by the instrument testing phase.

Ethics approval was granted by City, University of London (Minimising Sedation in Intensive Care patients (MisSion-ICu) overall project 30/03/2020; this phase 28/11/2022). The study was conducted in accordance with the ethical standards of the responsible ethics committee and with the Helsinki Declaration of 1975. Participants confirmed their willingness to participate in the study prior to progressing from the online participant information to the survey. Participants were able to discontinue involvement at any stage up until they submitted their survey responses. Data were collected and managed using Qualtrics XM (USA).

Phase 1: Qualitative interview study

Forty-four ICU clinicians participated in semi-structured interviews between July 27th and December 15th, 2021. Registered nurses, medical doctors, pharmacists, physiotherapists, and other clinicians responsible for prescribing, administering and/or advising on sedation to invasively mechanically ventilated ICU patients in the United Kingdom (UK) were invited to participate via advertising through relevant professional organisations and social media (Twitter, LinkedIn).

Semi-structured interviews with participants followed a topic guide incorporating 39 questions informed by the Theoretical Domains Framework (TDF)(12) with at least 1 question addressing each domain. Interviews explored factors perceived by clinicians to be barriers or facilitators to achieving optimal sedation practice, and also explored strategies considered potentially effective in achieving optimal sedation practice. The topic guide was developed by a group of researchers, behavioural psychologist and ICU clinicians based on initial work undertaken in Scotland (10, 11) as well as the TDF domains. Interviews were conducted by a researcher trained in interview techniques and we held remotely, using tele/video conferencing facilities as preferred by the interviewee.

Phase 2: Development of the instrument

Barriers and facilitators for sedation optimisation identified from the interviews were transformed into beliefs statements and coded using the TDF (12). The TDF is an 11-domain framework used to assess barriers and facilitators to behaviour change and guides design of change interventions. Seven critical care and psychology experts assessed how well each statement fitted the domain they were initially coded to.

Phase 3: Pilot study - content and face validity

A convenience sample of 10 ICU clinicians completed the instrument and commented on clarity of statements, flow of the instrument, and any important aspects of sedation optimisation that were missing.

Phase 4: Instrument Testing

The instrument consisted of belief statements aligned with each of the 11 TDF domains (Table S1). Items were both positively and negatively phrased to mitigate response bias; participants rated their level of agreement and importance with each statement on a five-point Likert scale. Demographic questions related to role, experience and gender were also included. Instrument testing took place

between January 13 and March 24, 2023. Internal consistency within domains and construct validity was initially tested followed by test-retest assessment.

Participants & recruitment

Any registered nurses, medical doctors, pharmacists, physiotherapists, and other clinicians responsible for prescribing, administering and/or advising on sedation to invasively mechanically ventilated ICU patients in the United Kingdom (UK) were invited to participate. Participants self-determined if they met the criteria for inclusion prior to completing the survey.

A link to an online survey was provided to interested clinicians via emails, advertising and social media (Twitter, LinkedIn) via known contacts and critical care professional groups (UK Critical Care Research Forum, British Association of Critical Care Nurses, Intensive Care Society, UK Clinical Pharmacy Association).

When accessing the survey site, clinicians were provided with participant information; agreement was required for survey progression. On completion participants were asked if they would complete the OCEAN-ICU survey again in 2 weeks for test-retest reliability assessment.

Patient and Public Involvement

Three former ICU patients met with the study team at multiple points throughout the study to provide guidance in relation to topic importance and focus areas to be covered in the interviews that led to the development of the initial version of OCEAN-ICU.

Sample size and data analysis

Target sample size for this instrument testing study was 200 – 300 respondents (13). Responses were included if the participant answered 90% or more of items to minimise the risk of bias. Descriptive statistics were used to describe participants' demographic data (e.g., age, gender), information about their role (e.g., profession, years working in critical care) and the clinical centre where they worked (e.g., UK region, hospital type).

Frequency of responses to each OCEAN-ICU item was summed descriptively. Responses to barriers were reversed so that strongly agree/agree for facilitators and strongly disagree/disagree for barriers could be combined to enable item ranking. Median responses of scores for each item were calculated and examined for similarities and differences between professions. Analyses were conducted using SPSS v28 (IBM Corp., IBM SPSS Statistics (including AMOS) for Windows, Version 28.0., Armonk, NY, USA).

Construct validity analysis

Construct validity was assessed using confirmatory factor analysis in AMOS v28. Missing answers were imputed using the mean for each question and testing was conducted to determine whether items fitted in the TDF domains to which they were initially categorised. Items were deleted if they did not meet the model assumption of a skew<3 and a kurtosis index <10 (14). Items were also deleted if they had a weighted kappa<0.2 on test-retest assessment (15).

We used three indices to test for goodness of fit (16):

- Absolute fit: χ^2/df of <2 (17, 18)
- Parsimony of fit: Root Mean Square Error of Approximation of close to or less than 0.06 (16)
- Comparative fit of close to 0.95 (16).

The model was revised and the fit re-tested until the model was judged to fit well. Two values were examined in the factor loading matrix to identify areas of poor fit.

- Modification Indices (MI) of >3.84 indicates that a change will probably result in an improvement in model fit.
- Standardised Residuals (SR) greater than 2.58 indicates an area of strain.

Descriptive analysis

Responses were summarised according to the percentage of respondents who strongly agreed or agreed with facilitators and disagreed or strongly disagreed for barriers (referred to as 'agreement') and considered items as important or very important (referred to as 'importance').

These percentages of agreement and importance were ranked from 1 (highest level of agreement or importance) to 68 (lowest level of agreement or importance). Equal percentages were given the same rank. The rankings for agreement and importance were then compared to determine where the highest number of respondents both agreed and considered the item important, or in contrast, where there was lack of congruence between these rankings. For example, if an item was agreed with by a high number of participants, but not ranked as important by most participants, this was considered a lack of congruence.

Results

Phase 1 – Qualitative Interview Study results

Analysis of the interview data identified 250 barriers and facilitators that were used for development of the instrument. These barriers and facilitators focused on skills, beliefs about consequences, environmental context and resources, motivation and goals, social influences and social or professional role and identity.

Phase 2 Development of the instrument results and Phase 3 Pilot study results

Through review by the expert panel, agreement of ≥70% was achieved for 228 statements, with 22 items being relocated. Experts also judged whether items should be removed, kept or reworded for clarity to avoid duplication and lack of relevance to the topic. The pilot instrument comprised 74 remaining items. Following the pilot study, 68 items remained; these statements aligned with the 11 domains of the TDF, with at least 3 statements within each domain.

Phase 4 Instrument testing results

Characteristics of cohort

We recorded 522 responses; after removal of incomplete responses 252 respondents completed at least 90% of the survey (Figure 1). Those respondents who completed the survey differed in profession, qualifications and experience from those who did not complete the survey (Table S2).

Respondents included 53 medical doctors, 149 nurses, 25 pharmacists, 16 physiotherapists and 9 other healthcare professionals who were predominantly working in tertiary (academic) or district (urban or county hospital) publicly funded hospitals, were most commonly female (Table S3) and mainly practised in England (Table S4). Further details of the respondents, including characteristics of their practice settings, are outlined in Tables S2 – S4.

Confirmatory factor analysis of survey

Construct validity, using the 68-item instrument, was assessed using responses from 252 completers. All items were retained after testing for skew because they fell within defined parameters (maximum 2.8). Seven items were deleted because of low internal consistency with the rest of the scale. Weighted kappa, a measure of inter-rater agreement, ranged between -0.18 to 0.7. We deleted five items because of low test-retest reliability (weighted kappa<0.2) (Table S5).

The overall internal consistency of the instrument with 56-items was 0.83. We excluded items with an alpha <0.1, had overlapping content, were considered ambiguous or contributed to low internal consistency within each domain (aiming for as close to 0.7 as possible for each domain) (Table S5).

By the end of this process, an eight-factor 39-item instrument (Table S6) that measured barriers and facilitators for optimising sedation in the ICU context was created (Figure 2 and Figure S1). The instrument tested well for internal consistency (alpha=0.81) and construct validity ($\chi 2/df=1.86$; Comparative Fit Index=0.73; Root Mean Square Error of Approximation=0.058). The internal consistency for individual domains ranged from 0.37 for “environmental context” and 0.75 for “Skills”.

Descriptive summary

Descriptive analysis for each item is presented (Figure S2). Strongest areas of agreement included recognition that optimal sedation and pain management is not the same for all, confidence that staff are competent to discuss the sedation-analgesia needs with the team and the importance of teamwork, recognition that light sedation facilitates patients' orientation and engagement and that optimised sedation reduces ventilation time and improves recovery.

Differences between professional groups were identified for multiple statements (Tables S7, S8 & S9). Differences generally reflected the specific role of each profession and the subsequent perceived importance of the statement. Although most professions felt they had the skills and were confident to deliver several elements of sedation, analgesia and delirium practice, some professional groups considered that training was insufficient for their needs.

When considering the responses from the total cohort (Table S8), there was agreement that optimal sedation varied between patients and enabled reduced ventilatory time. Further, light sedation was considered to facilitate orientation and engagement, while teamwork was viewed as positively contributing to practice in this area. Additional areas that were rated as important (Table S9) included clinical staff having the necessary skills to deliver care in this area and feeling confident to distinguish between pain and delirium.

Congruence between rankings of agreement and importance for every item in OCEAN-ICU is displayed in Table S10 in the same order they appeared in the participant survey, with rankings provided for the total sample and for each professional sub-group. Items are shaded green where there were less than 10 positions of difference between agreement and importance rankings.

Areas of practice with high levels of both agreement and perceived importance in the total cohort and most professional sub-groups included the belief that light sedation facilitates orientation and engagement, and physical and cognitive recovery and reduces ventilation time. Survey respondents

considered they had the necessary skills including those required for delirium screening, have managed the sedation-analgesia-delirium needs of challenging patients and are competent to discuss the sedation-analgesia needs of patients with the multi-disciplinary team. Importantly, sedation optimisation was recognised as not being the same for all patients. Respondents strongly agreed on feeling frustration when sedation minimisation is not progressed for deeply sedated patients and felt unsupported when they were reducing sedation levels.

In contrast, areas of practice that were rated high for perceived importance, but low for agreement including being confident to distinguish between pain and delirium in patients, work out why a patient is agitated and to keep the agitated or delirious patients safe.

Discussion

In this instrument development study performed across the UK, we developed the 39-item OCEAN-ICU instrument to comprehensively describe elements considered to influence practice relevant to sedation optimisation in intensive care. We provide initial reliability and validity testing of the OCEAN-ICU instrument that is intended for use in any ICU setting. To our knowledge this is the first instrument to identify and enable measurement of practice and potentially inform practice change in local settings. It is intended that individual ICUs use this instrument to determine specific barriers and enablers that are important when designing a practice change initiative to optimise sedation and pain management practice in the local setting.

Based on the structure of the TDF the items related to staffing were initially within the Environmental context and resources domain, however given the poor fit these items were shifted to a separate staffing resources domain. This suggests respondents viewed staffing as distinct from other environmental elements such as sedative availability, patient characteristics and family involvement. Staffing has been linked to patient outcome in ICU, with nurse numbers having the greatest impact on patient survival (19). This may also link with perceptions of better patient safety with higher levels and qualifications of staffing in ICU (20).

316 The wording used in a small number of items meant that it was difficult to determine if they were a
317 barrier or facilitator. For example, 'Peer presence from the MDT [multi-disciplinary team] affects my
318 sedation practice' and 'Colleagues are willing to listen to my opinion about sedation holds' could
319 each be viewed as a positive or negative social influence. Although the influences are vital to
320 optimising practice in this area, further refinement of wording may be necessary. If these items are
321 scored highly in a specific context additional exploration of the meaning of high scores, and therefore
322 what strategies are required to change practice, is needed.

323 We also summarise both the agreement with, and perceived importance of, each of these elements
324 in a UK wide cohort. Practice related to sedation and pain management optimisation is recognised as
325 needing improvement (21) yet we continue to see reports of heavily, or poorly, sedated patients (6-
326 8). This is despite multiple different strategies being developed and tested to improve sedation
327 management for ICU patients (22). The importance of considering the role of context when
328 addressing barriers and facilitators to changing clinical practice has been recognised (23, 24), yet
329 there is rarely any recommendation for how to adapt sedation improvement strategies to address
330 these contextual considerations. A mechanism to enable consideration of local barriers and
331 facilitators to changing practice, and inform development of tailored strategies for change, is
332 therefore required. OCEAN-ICU is designed to provide this mechanism in relation to ICU sedation
333 practices.

334 The continued practice of heavily, or poorly, sedated patients appears in contrast to the high ratings
335 of the need to individualise sedation reported in this study. The difference between work-as-
336 imagined (practice outlined in practice guidelines etc) and work-as-done has been recognised in the
337 patient safety literature (25). Practice change strategies clearly need to be based on work-as-done
338 rather than work-as-imagined. For this reason, development of change strategies should include
339 measurement of current practice and identification of perceived barriers and facilitators to achieving
340 optimal practice (26).

Potential areas for future practice change include those areas that respondents considered important, but did not agree with, or alternatively, where agreement was inconsistent across professional groups. Our results suggest areas to improve sedation include building skills and confidence in a range of areas and building a common understanding of care across all professional groups within the ICU. Other potentially useful strategies include mechanisms to improve communication and planning with the entire healthcare team regarding the approach to sedation and related care during the coming shift period, as well as strategies to support each other if the patient becomes agitated, in pain or distressed. While multi-component nonpharmacologic interventions are recommended to improve practice in this area (3), no guidelines have addressed the important areas of teamwork, communication or having a plan in place for what interventions should be implemented should a patient becomes agitated.

Strengths and limitations

This instrument has been developed with responses from a range of healthcare professionals responsible for the clinical care of ICU patients across the UK. As such, it represents care in multiple different settings. Despite this, we recognise that this sample represents a very small proportion of the critical care clinicians who practice in UK critical care. Further, we did not collect a description of sedation and related aspects of care in the ICUs where participants were practicing; we acknowledge that those who volunteered to participate may have had a specific interest in this area of practice. In addition, the initial interviews that informed item development in OCEAN-ICU began in 2021 when the impact of the COVID-19 pandemic was significant; this may have impacted on the practice and perceptions of sedation and related aspects of care.

A further limitation is that OCEAN-ICU has not been validated in a second cohort, including outside the UK or in ICU settings where different practices are the norm; this includes ICUs in low resource settings. Validation in other cohorts, with revision as required, is essential as the next step in development of OCEAN-ICU. A further limitation is that, although 522 surveys were submitted, many

were incomplete and only 252 participants completed more than 90% of the survey. There may have been a systematic bias in those who did, or did not, complete the survey. Additionally, there has not been testing to determine if interventions based on areas identified as important using OCEAN-ICU are effective in improving sedation and related care – this is required to determine the merit of using an instrument such as OCEAN-ICU when planning practice change interventions.

Conclusion

Achieving optimal practice in sedation and pain management for ICU patients remains a challenge. Use of this 39-item instrument to identify relevant barriers and enablers may lead to development of context specific strategies that are more effective than generic guidance in improving this practice. Although OCEAN-ICU showed good levels of validity and reliability in the UK setting, testing in different settings is required. Additional testing is also required to determine if strategies developed based on OCEAN-ICU are effective in improving practice.

Declarations

Funding: This work was funded by Barts Charity, Grant No. G-001806

Ethics approval and consent to participate: Ethics approval was granted by City, University of London (overall project 30/03/2020; this phase 28/11/2022).

Availability of data and materials: The datasets used in this study are not available.

Competing interests:

Leanne M Aitken: has been in receipt of funding from National Institute of Health and Care Technology Assessment Programme, UK (HTA 16/93/01) (2018 – 2024) comparing Dexmedetomidine, Clonidine and usual sedation; Elsevier Australia – royalties related to Critical Care Nursing (multiple editions).

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Timothy S Walsh: has been in receipt of funding from National Institute of Health and Care Technology Assessment Programme, UK (HTA 16/93/01) (2018 – 2024) comparing Dexmedetomidine, Clonidine and usual sedation

Author contributions:

Leanne M Aitken: conception and design of study, analysis and interpretation of data, drafting of article, final approval of submitted version of publication

Ana Castro-Avila: acquisition of data, analysis and interpretation of data, critical review of article, final approval of submitted version of publication

Judith Dyson: conception and design of study, analysis and interpretation of data, critical review of article, final approval of submitted version of publication

Kalliopi (Claire) Kydonaki: conception and design of study, analysis and interpretation of data, critical review of article, final approval of submitted version of publication

Bronagh Blackwood: conception and design of study, analysis and interpretation of data, critical review of article, final approval of submitted version of publication

Katerina Iliopoulou: acquisition of data, analysis and interpretation of data, critical review of article, final approval of submitted version of publication

Cathrine McKenzie: conception and design of study, analysis and interpretation of data, critical review of article, final approval of submitted version of publication

Timothy S Walsh: conception and design of study, analysis and interpretation of data, critical review of article, final approval of submitted version of publication.

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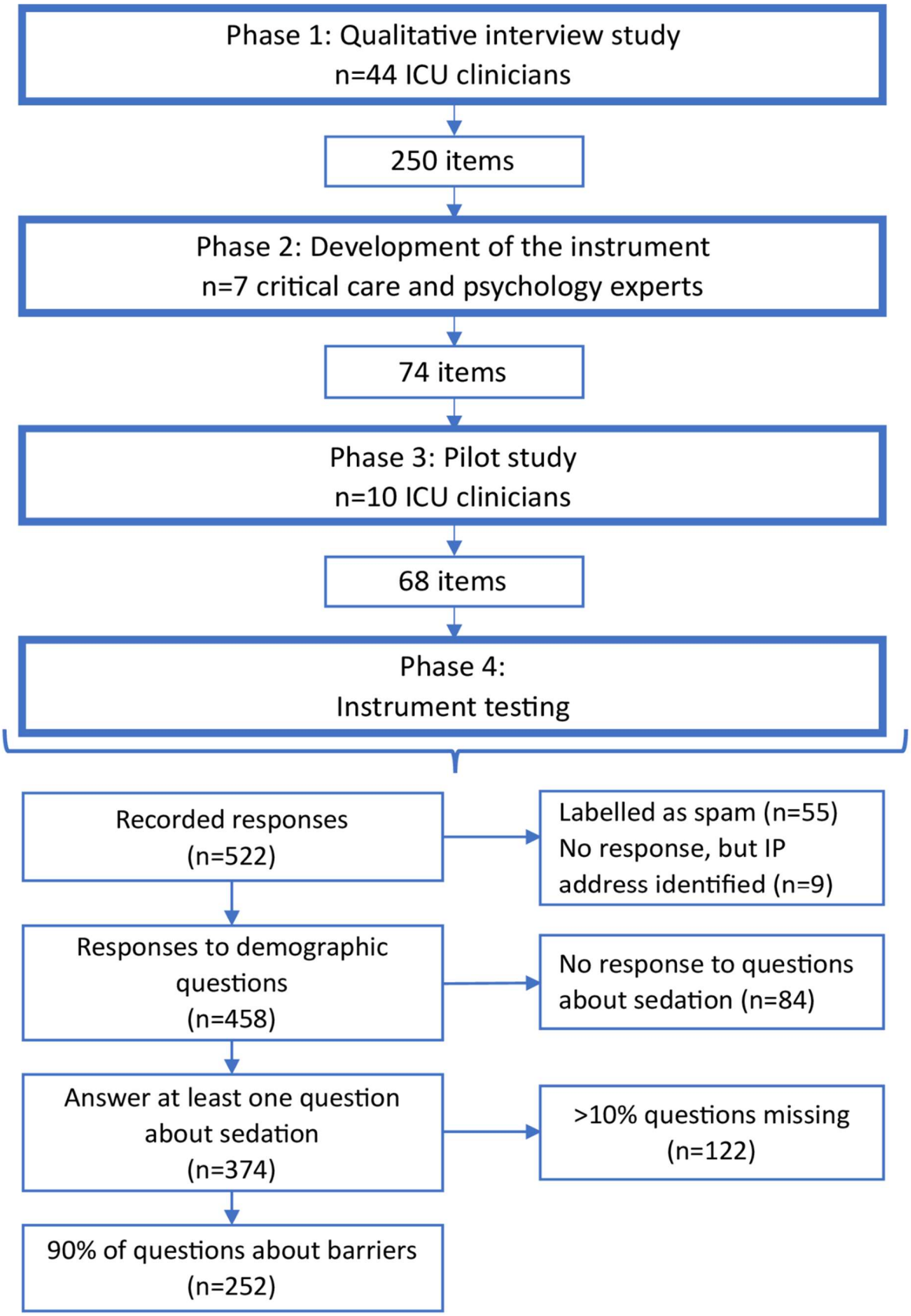
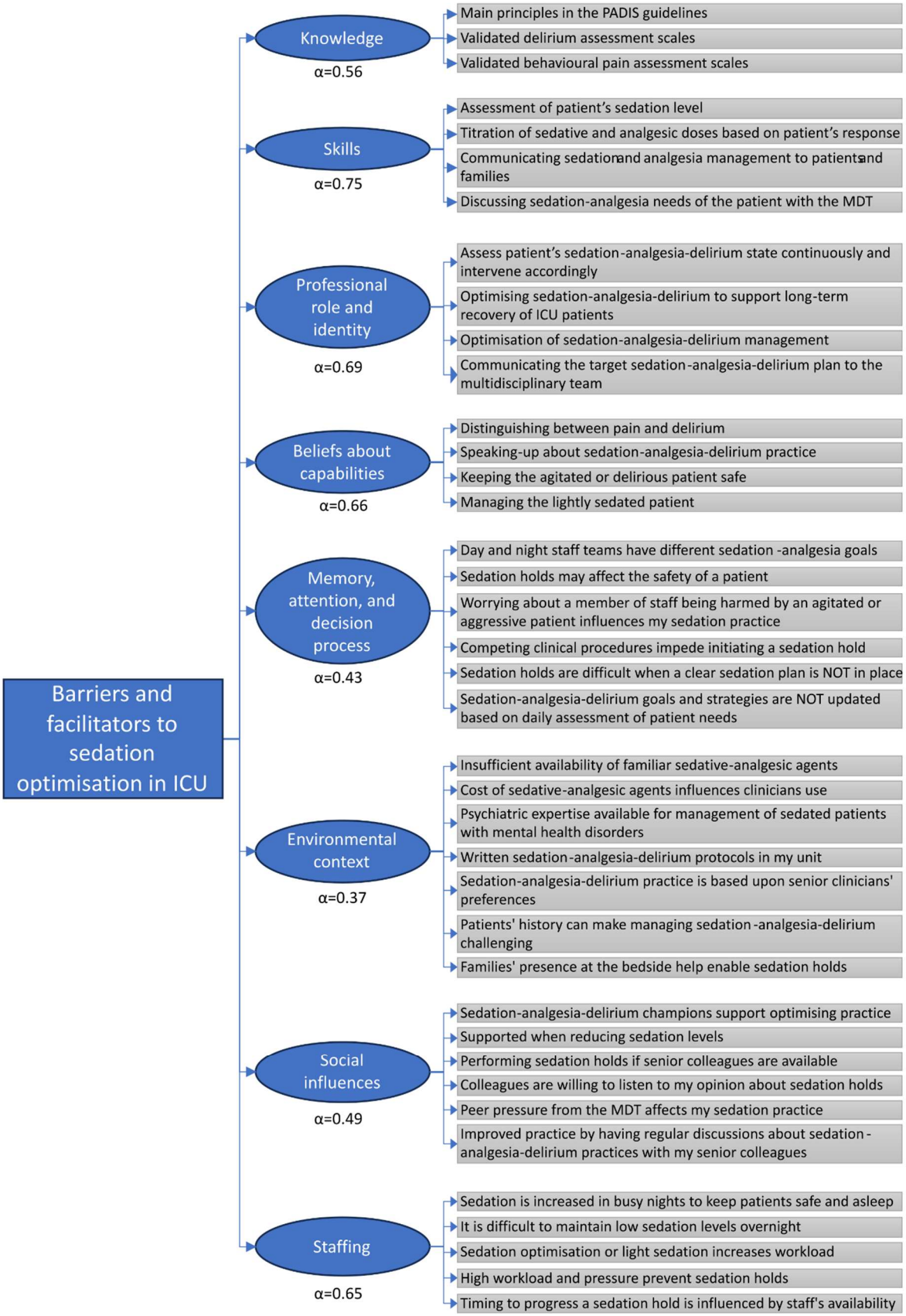
Figure Legends

Figure 1 Flow diagram of survey responses

Figure 2. 39-item scale obtained through confirmatory factor analysis with items mapped to relevant domains of the TDF


Phase 1: Qualitative interview study
n=44 ICU clinicians
250 items
Phase 2: Development of the instrument
n=7 critical care and psychology experts
74 items
Phase 3: Pilot study
n=10 ICU clinicians
68 items
Phase 4:
Instrument testing
Recorded responses
(n=522)
Labelled as spam (n=55)
No response, but IP
address identified (n=9)
Responses to demographic
questions
(n=458)
No response to questions
about sedation (n=84)
Answer at least one question
about sedation
(n=374)
>10% questions missing
(n=122)
90% of questions about barriers
(n=252)


Barriers and facilitators to sedation optimisation in ICU
Knowledge
α=0.56
Main principles in the PADIS guidelines
Validated delirium assessment scales
Validated behavioural pain assessment scales
Skills
α=0.75
Assessment of patient's sedation level
Titration of sedative and analgesic doses based on patient's response
Communicating sedation and analgesia management to patients and families
Discussing sedation-analgesia needs of the patient with the MDT
Professional role and identity
α=0.69
Assess patient's sedation-analgesia-delirium state continuously and intervene accordingly
Optimising sedation-analgesia-delirium to support long-term recovery of ICU patients
Optimisation of sedation-analgesia-delirium management
Communicating the target sedation-analgesia-delirium plan to the multidisciplinary team
Beliefs about capabilities
α=0.66
Distinguishing between pain and delirium
Speaking-up about sedation-analgesia-delirium practice
Keeping the agitated or delirious patient safe
Managing the lightly sedated patient
Memory, attention, and decision process
α=0.43
Day and night staff teams have different sedation -analgesia goals
Sedation holds may affect the safety of a patient
Worrying about a member of staff being harmed by an agitated or aggressive patient influences my sedation practice
Competing clinical procedures impede initiating a sedation hold
Sedation holds are difficult when a clear sedation plan is NOT in place
Sedation-analgesia-delirium goals and strategies are NOT updated based on daily assessment of patient needs
Environmental context
α=0.37
Insufficient availability of familiar sedative-analgesic agents
Cost of sedative-analgesic agents influences clinicians use
Psychiatric expertise available for management of sedated patients with mental health disorders
Written sedation-analgesia-delirium protocols in my unit
Sedation-analgesia-delirium practice is based upon senior clinicians' preferences
Patients' history can make managing sedation-analgesia-delirium challenging
Families' presence at the bedside help enable sedation holds
Social influences
α=0.49
Sedation-analgesia-delirium champions support optimising practice
Supported when reducing sedation levels
Performing sedation holds if senior colleagues are available
Colleagues are willing to listen to my opinion about sedation holds
Peer pressure from the MDT affects my sedation practice
Improved practice by having regular discussions about sedation-analgesia-delirium practices with my senior colleagues
Staffing
α=0.65
Sedation is increased in busy nights to keep patients safe and asleep
It is difficult to maintain low sedation levels overnight
Sedation optimisation or light sedation increases workload
High workload and pressure prevent sedation holds
Timing to progress a sedation hold is influenced by staff's availability

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Development and psychometric testing of the OCEAN-ICU instrument to optimise sedation use in intensive care

Supplementary files

Table S1 Distribution of statements according to TDF domains

Domain	Number of statements
Knowledge	7
Skills	8
Professional role and identify	5
Beliefs about capabilities	7
Beliefs about consequences	8
Motivation, goals, and intention	6
Memory, attention, and decision processes	3
Environment, context	10
Social influences	7
Emotions	4
Action planning	3

Table S2 Demographic and clinical characteristics of completers versus non-completers

	Non-completers n=206	Completers n=252	p-value
Profession			<0.001
Medical doctor	36 (17.5%)	53 (21.0%)	
Nurse	105 (51.0%)	149 (59.1%)	
Other	8 (3.9%)	9 (3.6%)	
Pharmacist	15 (7.3%)	25 (9.9%)	
Physiotherapist	42 (20.4%)	16 (6.3%)	
Highest degree			0.95
Bachelor or Diploma	133 (64.6%)	162 (64.3%)	
Postgraduate degree	73 (35.4%)	90 (35.7%)	
Post specialty certifications			0.047
No	100 (48.5%)	99 (39.3%)	
Yes	106 (51.5%)	153 (60.7%)	
Years working in critical care, median (IQR)	8 (4, 15)	10 (5, 19)	0.005
Years working in critical care			0.058
0-4 years	59 (28.8%)	59 (23.4%)	
5-9 years	53 (25.9%)	63 (25.0%)	
10-14 years	40 (19.5%)	36 (14.3%)	
15-19 years	25 (12.2%)	35 (13.9%)	
20-24 years	22 (10.7%)	37 (14.7%)	
25-29 years	2 (1.0%)	14 (5.6%)	
>30 years	4 (2.0%)	8 (3.2%)	
>10 years in critical care	93 (45.4%)	130 (51.6%)	0.19
Type of facility			0.13
Tertiary referral hospital	85 (41.3%)	118 (46.8%)	
District hospital	69 (33.5%)	92 (36.5%)	
Specialty hospital	44 (21.4%)	33 (13.1%)	
Other[¥]	8 (3.9%)	9 (3.6%)	
Location of hospital			0.85
Other	80 (38.8%)	100 (39.7%)	
Major city	126 (61.2%)	152 (60.3%)	
Country in the UK			0.55
England	147 (71.4%)	186 (73.8%)	
Northern Ireland	13 (6.3%)	13 (5.2%)	
Scotland	38 (18.4%)	38 (15.1%)	
Wales	8 (3.9%)	15 (6.0%)	
Number of ICU beds			0.96
<15 beds	65 (31.6%)	79 (31.3%)	
> 15 beds	141 (68.4%)	173 (68.7%)	
Type of ICU			0.012
Mixed ICU	151 (73.3%)	213 (84.5%)	
Cardiothoracic ICU	30 (14.6%)	22 (8.7%)	
Surgical	25 (12.1%)	17 (6.7%)	
Gender			0.76
Female	140 (68.0%)	163 (64.7%)	
Male	61 (29.6%)	82 (32.5%)	
LGTBQ+/prefer not to say	5 (2.4%)	7 (2.8%)	

Table S3 Sample characteristics by profession

	Medical doctor n=53	Nurse n=149	Pharmacist n=25	Physiotherapist n=16	Other n=9	p-value
Highest degree						<0.001
Bachelor or Diploma	27 (50.9%)	117 (78.5%)	1 (4.0%)	12 (75.0%)	5 (55.6%)	
Postgraduate degree	26 (49.1%)	32 (21.5%)	24 (96.0%)	4 (25.0%)	4 (44.4%)	
Post specialty certifications						<0.001
No	9 (17.0%)	62 (41.6%)	16 (64.0%)	10 (62.5%)	2 (22.2%)	
Yes	44 (83.0%)	87 (58.4%)	9 (36.0%)	6 (37.5%)	7 (77.8%)	
Years working in critical care, median (IQR)	15 (10, 20)	7 (4, 16)	12 (5, 20)	10 (6.25, 17.5)	10 (7, 20)	<0.001
Years working critical care						0.068
0-4 years	6 (11.3%)	44 (29.5%)	4 (16.0%)	3 (18.8%)	2 (22.2%)	
5-9 years	5 (9.4%)	44 (29.5%)	7 (28.0%)	5 (31.3%)	2 (22.2%)	
10-14 years	13 (24.5%)	17 (11.4%)	4 (16.0%)	1 (6.3%)	1 (11.1%)	
15-19 years	8 (15.1%)	20 (13.4%)	2 (8.0%)	4 (25.0%)	1 (11.1%)	
20-24 years	12 (22.6%)	16 (10.7%)	5 (20.0%)	2 (12.5%)	2 (22.2%)	
25-29 years	6 (11.3%)	5 (3.4%)	1 (4.0%)	1 (6.3%)	1 (11.1%)	
>30 years	3 (5.7%)	3 (2.0%)	2 (8.0%)	0 (0.0%)	0 (0.0%)	
>10 years working in critical care	42 (79.2%)	61 (40.9%)	14 (56.0%)	8 (50.0%)	5 (55.6%)	<0.001
Type of facility						0.012
Tertiary referral hospital	25 (47.2%)	71 (47.7%)	12 (48.0%)	4 (25.0%)	6 (66.7%)	
District hospital	27 (50.9%)	44 (29.5%)	11 (44.0%)	8 (50.0%)	2 (22.2%)	
Specialty hospital	1 (1.9%)	28 (18.8%)	0 (0.0%)	3 (18.8%)	1 (11.1%)	
Other	0 (0.0%)	6 (4.0%)	2 (8.0%)	1 (6.3%)	0 (0.0%)	
Location of hospital						0.89
Other	22 (41.5%)	57 (38.3%)	12 (48.0%)	6 (37.5%)	3 (33.3%)	
Major city	31 (58.5%)	92 (61.7%)	13 (52.0%)	10 (62.5%)	6 (66.7%)	
Country of the UK						0.026
England	33 (62.3%)	118 (79.2%)	18 (72.0%)	13 (81.3%)	4 (44.4%)	
Northern Ireland	2 (3.8%)	5 (3.4%)	4 (16.0%)	1 (6.3%)	1 (11.1%)	
Scotland	14 (26.4%)	17 (11.4%)	3 (12.0%)	2 (12.5%)	2 (22.2%)	
Wales	4 (7.5%)	9 (6.0%)	0 (0.0%)	0 (0.0%)	2 (22.2%)	
Number of ICU beds						0.69
<15 beds	17 (32.1%)	46 (30.9%)	9 (36.0%)	6 (37.5%)	1 (11.1%)	
more than 15 beds	36 (67.9%)	103 (69.1%)	16 (64.0%)	10 (62.5%)	8 (88.9%)	
Type of ICU						0.40
Mixed ICU	46 (86.8%)	124 (83.2%)	23 (92.0%)	13 (81.3%)	7 (77.8%)	
Cardiothoracic ICU	3 (5.7%)	16 (10.7%)	2 (8.0%)	1 (6.3%)	0 (0.0%)	
Surgical	4 (7.5%)	9 (6.0%)	0 (0.0%)	2 (12.5%)	2 (22.2%)	
Gender						<0.001
Female	11 (20.8%)	121 (81.2%)	13 (52.0%)	12 (75.0%)	6 (66.7%)	
Male	38 (71.7%)	25 (16.8%)	12 (48.0%)	4 (25.0%)	3 (33.3%)	
LGTBQ+/ prefer not to say	4 (7.5%)	3 (2.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	

Table S4 Demographic characteristics by country

	England n=186	Northern Ireland n=13	Scotland n=38	Wales n=15	p-value
Profession					0.026
Medical doctor	33 (17.7%)	2 (15.4%)	14 (36.8%)	4 (26.7%)	
Nurse	118 (63.4%)	5 (38.5%)	17 (44.7%)	9 (60.0%)	
Other	4 (2.2%)	1 (7.7%)	2 (5.3%)	2 (13.3%)	
Pharmacist	18 (9.7%)	4 (30.8%)	3 (7.9%)	0 (0.0%)	
Physiotherapist	13 (7.0%)	1 (7.7%)	2 (5.3%)	0 (0.0%)	
Highest degree					0.28
Bachelor or Diploma	118 (63.4%)	7 (53.8%)	29 (76.3%)	8 (53.3%)	
Postgraduate degree	68 (36.6%)	6 (46.2%)	9 (23.7%)	7 (46.7%)	
Post specialty certification					0.005
No	63 (33.9%)	9 (69.2%)	22 (57.9%)	5 (33.3%)	
Yes	123 (66.1%)	4 (30.8%)	16 (42.1%)	10 (66.7%)	
Years working in critical care, median (IQR)	8.75 (4, 17)	7 (4, 9)	15.5 (10, 22)	10 (6, 20)	0.003
Years working in critical care					0.024
0-4 years	47 (25.3%)	4 (30.8%)	5 (13.2%)	3 (20.0%)	
5-9 years	50 (26.9%)	6 (46.2%)	4 (10.5%)	3 (20.0%)	
10-14 years	25 (13.4%)	0 (0.0%)	8 (21.1%)	3 (20.0%)	
15-19 years	29 (15.6%)	2 (15.4%)	3 (7.9%)	1 (6.7%)	
20-24 years	22 (11.8%)	1 (7.7%)	11 (28.9%)	3 (20.0%)	
25-29 years	9 (4.8%)	0 (0.0%)	3 (7.9%)	2 (13.3%)	
>30 years	4 (2.2%)	0 (0.0%)	4 (10.5%)	0 (0.0%)	
>10 years working in critical care	89 (47.8%)	3 (23.1%)	29 (76.3%)	9 (60.0%)	0.002
Type of facility					0.020
Tertiary referral hospital	94 (50.5%)	6 (46.2%)	14 (36.8%)	4 (26.7%)	
District hospital	66 (35.5%)	2 (15.4%)	18 (47.4%)	6 (40.0%)	
Specialty hospital	19 (10.2%)	3 (23.1%)	6 (15.8%)	5 (33.3%)	
Other	7 (3.8%)	2 (15.4%)	0 (0.0%)	0 (0.0%)	
Location of hospital					0.19
Other	67 (36.0%)	6 (46.2%)	18 (47.4%)	9 (60.0%)	
Major city	119 (64.0%)	7 (53.8%)	20 (52.6%)	6 (40.0%)	
Number of ICU beds					<0.001
<15 beds	51 (27.4%)	6 (46.2%)	21 (55.3%)	1 (6.7%)	
More than 15 beds	135 (72.6%)	7 (53.8%)	17 (44.7%)	14 (93.3%)	
Type of ICU					0.44
Mixed ICU	155 (83.3%)	11 (84.6%)	32 (84.2%)	15 (100.0%)	
Cardiothoracic ICU	18 (9.7%)	0 (0.0%)	4 (10.5%)	0 (0.0%)	
Surgical	13 (7.0%)	2 (15.4%)	2 (5.3%)	0 (0.0%)	
Gender					0.083
Female	124 (66.7%)	9 (69.2%)	20 (52.6%)	10 (66.7%)	
Male	59 (31.7%)	4 (30.8%)	14 (36.8%)	5 (33.3%)	
LGTBQ+/ prefer not to say	3 (1.6%)	0 (0.0%)	4 (10.5%)	0 (0.0%)	

Table S5. Items eliminated from final survey

Q	Item	Initial Domain	Barrier / Facilitator	Weighted kappa
1	I have adequate knowledge to use validated sedation assessment scales, e.g. Richmond Agitation-Sedation Scale (RASS), Riker Sedation Agitation Scale (SAS)	**KNOWLEDGE**	F	0.19
9	Sedation-analgesia-delirium practice should be based on evidence and NOT on clinicians' personal beliefs	**KNOWLEDGE**	F	0.39
13	The patient's underlying condition influences my sedation-analgesia-delirium management decisions	**MEMORY, ATTENTION, DECISION PROCESS**	F	0.47
14	My sedation-analgesia-delirium management is influenced by whether the patient has cardiovascular instability	**BELIEFS ABOUT CONSEQUENCES**	F	0.49
15	I have experience of managing the sedation-analgesia-delirium needs of challenging patients	**BELIEFS ABOUT CAPABILITIES**	F	0.62
17	I find sedation-analgesia-delirium management challenging	**SKILLS**	B	0.48
19	I prioritise sedation-analgesia-delirium optimisation over other aspects of patient care	**MOTIVATION, GOALS, INTENTIONS**	B	0.19
26	Training to assess and manage sedation-analgesia-delirium is insufficient for my needs	**SKILLS**	B	0.33
29	I feel stressed by managing an agitated or combative patient	**EMOTIONS**	B	0.53
30	I am confident working out why a patient is agitated	**BELIEFS ABOUT CAPABILITIES**	F	0.49
33	I do NOT know when I should use a behavioural pain scale rather than non-behavioural pain scale such as the Visual Analogue Scale (VAS)	**KNOWLEDGE**	B	0.16
36	Light sedation facilitates patients' orientation and engagement	**BELIEFS ABOUT CONSEQUENCES**	F	0.26
37	I am anxious about reducing sedation if my workload is too high	**EMOTIONS**	B	0.34
38	It is easier to lighten sedation when the patient is pain free	**BELIEFS ABOUT CONSEQUENCES**	F	0.60
39	I feel frustrated when sedation minimisation is NOT progressed for deeply sedated patients	**EMOTIONS**	B	0.52
41	It is part of my role to support the patients who are awake to deal with their fears and anxiety	**PROFESSIONAL ROLE & IDENTITY**	F	0.62
42	There are conflicts between staff in my unit when clinicians wean off sedation either very quickly or stop abruptly	**ENVIROMENT, CONTEXT**	B	0.30

Q	Item	Initial Domain	Barrier / Facilitator	Weighted kappa
48	In my unit there are insufficient numbers of clinical staff to perform sedation holds	**STAFFING**	B	0.43
50	I have the necessary decision-making skills to initiate a sedation hold	**SKILLS**	F	0.26
52	A low proportion of experienced ICU staff creates a barrier to initiating or progressing sedation holds in my unit	**STAFFING**	B	0.43
54	Optimising sedation reduces the time a patient needs to stay on the ventilator	**BELIEFS ABOUT CONSEQUENCES**	F	0.26
56	Day and night staff teams have different sedation-analgesia goals	**MOTIVATION, GOALS, INTENTIONS**	B	0.49
57	Sedation optimisation facilitates patients' physical and cognitive recovery	**BELIEFS ABOUT CONSEQUENCES**	F	0.10
58	Optimal sedation and analgesia is NOT the same for every patient	**KNOWLEDGE**	B	-0.17
60	I work towards a target sedation score to achieve sedation-analgesia-delirium optimisation	**MOTIVATION, GOALS, INTENTIONS**	F	0.32
61	I am able to coordinate the clinical team to manage sedation-analgesia-delirium practices	**SKILLS**	F	0.57
63	Teamwork contributes positively to my sedation-analgesia-delirium practice	**SOCIAL INFLUENCES**	F	0.61
64	Agreeing the sedation-analgesia-delirium plan is a shared decision-making process within the multidisciplinary team	**MEMORY, ATTENTION, DECISION PROCESS**	F	0.01
67	I feel less concerned when implementing a sedation-analgesia-delirium plan that has been decided after a multi-disciplinary team discussion	**EMOTIONS**	F	0.58

B: barrier; F: facilitator.

Table S6 Remaining items in the scale, test-retest reliability, and internal consistency for each domain.

Q	Item	Current Domain	Barrier / Facilitator	Weighted Kappa	Domain's Cronbach
2	I have the necessary skills to assess patient's sedation, analgesia and delirium level	Skills	F	0.39	0.74
3	It is part of my role to assess patient's sedation-analgesia-delirium state continuously and intervene accordingly	Professional Role & Identity	F	0.53	0.69
4	I do NOT feel I have the necessary skills to titrate sedative and analgesic doses considering the patient's response	Skills	B	0.57	0.74
5	There are times in my unit when there is insufficient availability of sedative-analgesic agents that I am familiar with	Environment, Context	B	0.47	0.37
6	The cost of sedative-analgesic agents influences which agents clinicians use	Environment, Context	B	0.33	0.37
7	In my unit psychiatric expertise is NOT available to guide optimal medication management in sedated patients with mental health disorders	Environment, Context	B	0.69	0.37
8	I am aware of the main principles in the sedation, agitation, delirium (PADIS) guidelines	Knowledge	F	0.54	0.59
10	Written sedation-analgesia-delirium protocols are NOT in place in my unit	Environment, Context	B	0.46	0.37
11	Sedation is increased in my unit when the unit is busy at night to keep patients safe and asleep	Staffing	B	0.46	0.65
12	Day and night staff teams have different sedation-analgesia goals	Memory, Attention, Decision Process	B	0.58	0.43
16	Sedation-analgesia-delirium goals and strategies are NOT updated based on daily assessment of patient needs	Memory, Attention, Decision Process	B	0.36	0.43
18	I am confident to distinguish between pain and delirium	Beliefs about Capabilities	F	0.60	0.65
20	It is difficult to maintain low sedation levels overnight	Staffing	B	0.32	0.65

21	Sedation-analgesia-delirium champions support staff in optimising practice	Social Influences	F	0.39	0.49
22	Sedation-analgesia-delirium practice is based upon senior clinicians' preferences in my unit	Environment, Context	B	0.38	0.37
23	I am confident to speak-up about sedation-analgesia-delirium practice	Beliefs about Capabilities	F	0.41	0.65
24	Patients' history such as age, chronic pain, substance abuse and mental health disorders can be challenging factors for me when managing sedation-analgesia-delirium	Environment, Context	B	0.30	0.37
25	I am competent to communicate with patients and families about sedation and analgesia management	Skills	F	0.57	0.74
27	I have adequate knowledge to use validated delirium assessment scales, e.g. Confusion Assessment Method (CAM)-ICU, Intensive Care Delirium Screening Checklist (ICDSC)	Knowledge	F	0.45	0.59
28	I am confident to keep the agitated or delirious patient safe	Beliefs about Capabilities	F	0.55	0.65
31	Worrying about a member of staff being harmed by an agitated or aggressive patient influences my sedation practice	Memory, Attention, Decision Process	B	0.32	0.43
32	I have adequate knowledge to use validated behavioural pain assessment scales, e.g. Critical-care Pain Observation Tool (CPOT), Behavioural Pain Scale (BPS)	Knowledge	F	0.61	0.59
34	Sedation optimisation or light sedation increases workload	Staffing	B	0.56	0.65
35	I am confident to manage the lightly sedated patient	Beliefs about Capabilities	F	0.38	0.65
40	I do NOT feel adequately supported when I am reducing sedation levels	Social Influences	B	0.43	0.49
43	Sedation holds may affect the safety of a patient	Memory, Attention, Decision Process	B	0.65	0.43

44	High workload and pressure prevent ICU staff from performing sedation holds	Staffing	B	0.48	0.65
45	Competing clinical procedures (eg theatre, diagnostics etc) impede initiating a sedation hold	Memory, Attention, Decision Process	B	0.20	0.43
46	In my unit, timing to progress a sedation hold is influenced by staff's availability	Staffing	B	0.34	0.65
47	I am more likely to perform sedation holds if senior colleagues are available at the bedside	Social Influences	B	0.40	0.49
49	Sedation holds are difficult for me to accomplish when a clear sedation plan is NOT in place	Memory, Attention, Decision Process	B	0.35	0.43
51	My colleagues are willing to listen to my opinion about sedation holds	Social Influences	F	0.59	0.49
53	Families' presence at the bedside help enable sedation holds	Environment, Context	F	0.60	0.37
55	Optimising sedation-analgesia-delirium to support long-term recovery of ICU patients is NOT part of my role	Professional Role & Identity	B	0.62	0.69
59	Optimisation of sedation-analgesia-delirium management is NOT within the scope of my practice	Professional Role & Identity	B	0.60	0.69
62	I am competent to discuss with the multidisciplinary team the sedation-analgesia needs of the patient	Skills	F	0.64	0.74
65	Peer pressure from the multidisciplinary team affects my sedation-analgesia-delirium practice	Social Influences	B	0.51	0.49
66	I improve my practice by having regular discussions about sedation-analgesia-delirium practices with my senior colleagues	Social Influences	F	0.52	0.49
68	Communicating the target sedation-analgesia-delirium plan to the multidisciplinary team is part of my role	Professional Role & Identity	F	0.43	0.69

B: barrier; F: facilitator

Table S7 Barriers and facilitators – responses by profession

Responses have been recoded where necessary so "1" always represent a barrier.

Knowledge		MD n=53	Nurse n=149	Pharmacist n=25	Physiotherapist n=16	Other 9	p-value
Q1	I have adequate knowledge to use validated sedation assessment scales, e.g. Richmond Agitation-Sedation Scale (RASS), Riker Sedation Agitation Scale (SAS), median (IQR)	5 (4, 5)	5 (4, 5)	4 (4, 5)	4.5 (4, 5)	4 (2, 5)	0.25
	How important is the above issue to you achieving optimal sedation, analgesia and delirium, median (IQR)	4 (4, 5)	4 (4, 5)	4 (4, 5)	4 (4, 5)	4 (3, 5)	0.29
Q8	I am aware of the main principles in the sedation, agitation, delirium (PADIS) guidelines, median (IQR)	4 (2, 5)	4 (3, 5)	5 (4, 5)	4 (3, 4)	4 (4, 4)	0.062
	How important is the above issue to you achieving optimal sedation, analgesia and delirium, median (IQR)	3 (3, 4)	4 (4, 5)	4 (4, 5)	4 (4, 5)	4 (4, 4)	<0.001
Q9	Sedation-analgesia-delirium practice should be based on evidence and NOT on clinicians' personal beliefs, median (IQR)	4 (4, 5)	5 (4, 5)	4 (4, 5)	4 (4, 5)	5 (4, 5)	0.13
	How important is the above issue to you achieving optimal sedation, analgesia and delirium, median (IQR)	4 (3, 4)	4 (4, 5)	4 (4, 5)	4 (3.5, 5)	4 (4, 4)	<0.001
Q27	I have adequate knowledge to use validated delirium assessment scales, e.g. Confusion Assessment Method (CAM)-ICU, Intensive Care Delirium Screening Checklist (ICDSC), median (IQR)	5 (4, 5)	4 (4, 5)	4 (4, 4)	4 (4, 5)	5 (2, 5)	0.045
	How important is the above issue to you achieving optimal sedation, analgesia and delirium, median (IQR)	4 (3, 5)	5 (4, 5)	4 (4, 5)	4 (4, 5)	4 (4, 5)	0.003
Q32	I have adequate knowledge to use validated behavioural pain assessment scales, e.g. Critical-care Pain Observation Tool (CPOT), Behavioural Pain Scale (BPS), median (IQR)	3 (2, 4)	4 (3, 5)	3 (3, 4)	3 (2, 3.5)	4 (4, 4)	<0.001
	How important is the above issue to you achieving optimal sedation, analgesia and delirium, median (IQR)	3 (3, 4)	4 (4, 5)	4 (3, 4)	4 (3, 4)	4 (3, 4)	<0.001
Q33	I do NOT know when I should use a behavioural pain scale rather than non-behavioural pain scale such as the Visual Analogue Scale (VAS), median (IQR)	3 (2, 4)	3 (2, 5)	4 (3, 5)	2 (2, 4)	3 (2, 4)	0.21
	How important is the above issue to you achieving optimal sedation, analgesia and delirium, median (IQR)	3 (2, 4)	4 (3.5, 5)	3 (3, 4)	4 (3, 4.5)	4 (3, 4)	<0.001
Q58	Optimal sedation and analgesia is not the same for every patient, median (IQR)	5 (5, 5)	5 (5, 5)	5 (5, 5)	5 (5, 5)	5 (5, 5)	0.20
	How important is the above issue to you achieving optimal sedation, analgesia and delirium, median (IQR)	5 (4, 5)	5 (4, 5)	5 (4, 5)	5 (4.5, 5)	5 (5, 5)	0.012

Skills		MD n=53	Nurse n=149	Pharmacist n=25	Physiotherapist n=16	Other n=9	p-value
Q2	I have the necessary skills to assess patient's sedation, analgesia and delirium level, median (IQR)	5 (5, 5)	5 (4, 5)	4 (3, 5)	4 (4, 4)	4 (3, 5)	<0.001
	How important is the above issue to you achieving optimal sedation, analgesia and delirium, median (IQR)	5 (4, 5)	5 (4, 5)	4 (4, 5)	4.5 (4, 5)	5 (4, 5)	1.00
Q4	I do NOT feel I have the necessary skills to titrate sedative and analgesic doses considering the patient's response, median (IQR)	5 (5, 5)	5 (4, 5)	4 (3, 4)	1.5 (1, 3)	5 (5, 5)	<0.001
	How important is the above issue to you achieving optimal sedation, analgesia and delirium and delirium, median (IQR)	4 (3, 5)	4 (4, 5)	4 (3, 4)	4 (3, 5)	5 (4, 5)	0.004
Q17	I find sedation-analgesia-delirium management challenging, median (IQR)	2 (2, 3)	2 (2, 3)	2 (2, 3)	2 (2, 3)	3 (2, 4)	0.15
	How important is the above issue to you achieving optimal sedation, analgesia and delirium, median (IQR)	4 (3, 4)	4 (4, 5)	4 (3, 5)	4 (3, 4)	4 (4, 4)	<0.001
Q25	I am competent to communicate with patients and families about sedation and analgesia management, median (IQR)	5 (4, 5)	5 (4, 5)	4 (3, 4)	4 (3, 4)	4 (4, 5)	<0.001
	How important is the above issue to you achieving optimal sedation, analgesia and delirium, median (IQR)	4 (3, 4)	4 (4, 5)	3 (3, 4)	4 (4, 4)	4 (4, 5)	<0.001
Q26	Training to assess and manage sedation-analgesia-delirium is insufficient for my needs, median (IQR)	4 (3, 5)	3 (2, 4)	3 (2, 4)	2 (1.5, 3)	5 (3, 5)	<0.001
	How important is the above issue to you achieving optimal sedation, analgesia and delirium, median (IQR)	3 (2, 4)	4 (4, 5)	3 (3, 4)	4 (4, 5)	4 (4, 5)	<0.001
Q50	I have the necessary decision-making skills to initiate a sedation hold, median (IQR)	5 (5, 5)	4 (4, 5)	3 (2, 4)	3 (1, 3.5)	5 (4, 5)	<0.001
	How important is the above issue to you achieving optimal sedation, analgesia and delirium, median (IQR)	4 (3, 5)	4 (4, 5)	3 (3, 4)	4.5 (3, 5)	4 (4, 4)	0.005
Q61	I am able to coordinate the clinical team to manage sedation-analgesia-delirium practices, median (IQR)	4 (4, 5)	4 (3, 4)	3 (3, 4)	3 (3, 4)	4 (4, 4)	<0.001
	How important is the above issue to you achieving optimal sedation, analgesia and delirium, median (IQR)	4 (4, 5)	4 (4, 5)	4 (3, 5)	4 (4, 5)	4 (4, 4)	0.57
Q62	I am competent to discuss with the multidisciplinary team the sedation-analgesia needs of the patient, median (IQR)	5 (5, 5)	5 (4, 5)	5 (4, 5)	4.5 (4, 5)	4 (4, 5)	<0.001
	How important is the above issue to you achieving optimal sedation, analgesia and delirium, median (IQR)	4 (4, 5)	4 (4, 5)	4 (4, 5)	4 (4, 5)	5 (4, 5)	0.13

Social / professional role and identity		MD n=53	Nurse n=149	Pharmacist n=25	Physiotherapist n=16	Other n=9	p-value
Q3	It is part of my role to assess patient's sedation-analgesia-delirium state continuously and intervene accordingly, median (IQR)	4 (4, 5)	5 (5, 5)	4 (2, 5)	4 (4, 4)	5 (1, 5)	<0.001
	How important is the above issue to you achieving optimal sedation, analgesia and delirium, median (IQR)	4 (4, 5)	5 (4, 5)	4 (3, 5)	4 (4, 5)	5 (4, 5)	<0.001
Q41	It is part of my role to support the patients who are awake to deal with their fears and anxiety, median (IQR)	5 (4, 5)	5 (5, 5)	4 (2, 4)	5 (4, 5)	5 (4, 5)	<0.001
	How important is the above issue to you achieving optimal sedation, analgesia and delirium, median (IQR)	4 (4, 5)	5 (4, 5)	4 (3, 5)	5 (5, 5)	4 (4, 5)	<0.001
Q55	Optimising sedation-analgesia-delirium to support long-term recovery of ICU patients is NOT part of my role, median (IQR)	5 (5, 5)	5 (5, 5)	5 (4, 5)	5 (2.5, 5)	5 (5, 5)	0.035
	How important is the above issue to you achieving optimal sedation, analgesia and delirium, median (IQR)	4 (3, 5)	5 (4, 5)	4 (3, 5)	5 (4.5, 5)	5 (4, 5)	0.002
Q59	Optimisation of sedation-analgesia-delirium management is NOT within the scope of my practice, median (IQR)	5 (5, 5)	5 (4, 5)	5 (4, 5)	3.5 (2, 4)	5 (4, 5)	<0.001
	How important is the above issue to you achieving optimal sedation, analgesia and delirium, median (IQR)	4 (3, 5)	4 (4, 5)	4 (3, 5)	5 (4, 5)	4 (4, 5)	0.004
Q68	Communicating the target sedation-analgesia-delirium plan to the multidisciplinary team is part of my role, median (IQR)	5 (5, 5)	4 (4, 5)	4 (2, 5)	3.5 (3, 4)	5 (4, 5)	<0.001
	How important is the above issue to you achieving optimal sedation, analgesia and delirium, median (IQR)	4 (4, 5)	4 (4, 5)	4 (3, 5)	4 (3, 5)	5 (4, 5)	0.071

Table S8. Level of agreement by profession (green shading represents top 10 ranked items in each group)

Q	Statement	Total (n=252)		Medical (n=53)		Nurses (n=149)		Pharmacists (n=25)		Physiotherapists (n=16)		Other (n=9)	
		%agree	ranking	%agree	ranking	%agree	ranking	%agree	ranking	%agree	ranking	%agree	ranking
1	I have adequate knowledge to use validated sedation assessment scales, e.g. RASS, SAS	90%	14	92%	23	91%	17	88%	15	100%	1	55%	41
2	I have the necessary skills to assess patient's sedation, analgesia and delirium level	92%	8	98%	6	95%	6	72%	27	81%	16	66%	38
3	It is part of my role to assess patient's sedation-analgesia-delirium state continuously and intervene accordingly	87%	20	81%	30	97%	2	52%	40	81%	16	67%	33
4	I do NOT feel I have the necessary skills to titrate sedative and analgesic doses considering the patient's response (Reversed)	84%	24	98%	6	93%	12	52%	40	12%	53	78%	23
5	There are times in my unit when there is insufficient availability of sedative-analgesic agents that I am familiar with (Reversed)	89%	18	94%	20	88%	22	96%	6	69%	22	89%	10
6	The cost of sedative-analgesic agents influences which agents clinicians use (Reversed)	45%	47	53%	42	42%	47	64%	31	12%	53	44%	46
7	In my unit psychiatric expertise is NOT available to guide optimal medication management in sedated patients with mental health disorders (Reversed)	23%	57	29%	54	19%	57	20%	61	24%	50	55%	41
8	I am aware of the main principles in the sedation, agitation, delirium (PADIS) guidelines	70%	35	62%	37	69%	38	88%	15	69%	22	89%	10
9	Sedation-analgesia-delirium practice should be based on evidence and NOT on clinicians' personal beliefs	90%	14	83%	29	93%	12	92%	9	82%	12	89%	10
10	Written sedation-analgesia-delirium protocols are NOT in place in my unit (Reversed)	63%	39	68%	35	64%	39	56%	35	44%	40	67%	33
11	Sedation is increased in my unit when the unit is busy at night to keep patients safe and asleep (Reversed)	28%	53	14%	62	32%	52	36%	51	25%	45	33%	50
12	Day and night staff teams have different sedation-analgesia goals (Reversed)	29%	51	17%	58	34%	48	40%	49	6%	65	33%	50

Q	Statement	Total (n=252)		Medical (n=53)		Nurses (n=149)		Pharmacists (n=25)		Physiotherapists (n=16)		Other (n=9)	
		%agree	ranking	%agree	ranking	%agree	ranking	%agree	ranking	%agree	ranking	%agree	ranking
13	The patient's underlying condition influences my sedation-analgesia-delirium management decisions	91%	10	98%	6	90%	20	100%	1	69%	22	89%	10
14	My sedation-analgesia-delirium management is influenced by whether the patient has cardiovascular instability	84%	24	76%	32	89%	21	80%	24	75%	18	78%	23
15	I have experience of managing the sedation-analgesia-delirium needs of challenging patients	93%	7	100%	1	97%	2	84%	19	50%	33	89%	10
16	Sedation-analgesia-delirium goals and strategies are NOT updated based on daily assessment of patient needs (Reversed)	79%	30	89%	27	75%	34	88%	15	69%	22	89%	10
17	I find sedation-analgesia-delirium management challenging (Reversed)	18%	61	23%	55	17%	60	8%	63	18%	52	33%	50
18	I am confident to distinguish between pain and delirium	80%	29	70%	34	87%	24	56%	35	87%	11	88%	21
19	I prioritise sedation-analgesia-delirium optimisation over other aspects of patient care	27%	54	11%	63	33%	51	28%	55	25%	45	22%	59
20	It is difficult to maintain low sedation levels overnight (Reversed)	22%	58	17%	58	22%	56	28%	55	12%	53	44%	46
21	Sedation-analgesia-delirium champions support staff in optimising practice	37%	48	34%	52	34%	49	48%	43	69%	22	33%	50
22	Sedation-analgesia-delirium practice is based upon senior clinicians' preferences in my unit (Reversed)	24%	56	17%	58	26%	53	32%	53	12%	53	33%	50
23	I am confident to speak-up about sedation-analgesia-delirium practice	85%	22	96%	16	80%	30	92%	9	82%	12	89%	10
24	Patients' history such as age, chronic pain, substance abuse and mental health disorders can be challenging factors for me when managing sedation-analgesia-delirium (Reversed)	6%	68	4%	68	6%	68	8%	63	12%	53	11%	63
25	I am competent to communicate with patients and families about sedation and analgesia management	90%	14	98%	6	96%	5	56%	35	62%	32	88%	21

Q	Statement	Total (n=252)		Medical (n=53)		Nurses (n=149)		Pharmacists (n=25)		Physiotherapists (n=16)		Other (n=9)	
		%agree	ranking	%agree	ranking	%agree	ranking	%agree	ranking	%agree	ranking	%agree	ranking
26	Training to assess and manage sedation-analgesia-delirium is insufficient for my needs (Reversed)	46%	46	64%	36	44%	46	32%	53	12%	53	67%	33
27	I have adequate knowledge to use validated delirium assessment scales, e.g. Confusion Assessment Method (CAM)-ICU, Intensive Care Delirium Screening Checklist (ICDSC)	91%	10	97%	15	91%	17	80%	24	94%	5	67%	33
28	I am confident to keep the agitated or delirious patient safe	84%	24	96%	16	85%	25	56%	35	75%	18	100%	1
29	I feel stressed by managing an agitated or combative patient (Reversed)	17%	62	38%	49	10%	65	8%	63	12%	53	44%	46
30	I am confident working out why a patient is agitated	79%	30	75%	33	80%	30	72%	27	75%	18	100%	1
31	Worrying about a member of staff being harmed by an agitated or aggressive patient influences my sedation practice (Reversed)	7%	67	6%	67	8%	66	0%	68	6%	65	11%	63
32	I have adequate knowledge to use validated behavioural pain assessment scales, e.g. Critical-care Pain Observation Tool (CPOT), Behavioural Pain Scale (BPS)	62%	40	49%	45	73%	36	48%	43	25%	45	78%	23
33	I do NOT know when I should use a behavioural pain scale rather than non-behavioural pain scale such as the Visual Analogue Scale (VAS) (Reversed)	46%	45	46%	46	46%	45	60%	33	38%	42	33%	50
34	Sedation optimisation or light sedation increases workload (Reversed)	22%	59	17%	58	19%	57	28%	55	50%	33	11%	63
35	I am confident to manage the lightly sedated patient	89%	18	91%	24	93%	12	68%	30	82%	12	89%	10
36	Light sedation facilitates patients' orientation and engagement	96%	2	98%	6	95%	6	100%	1	94%	5	100%	1
37	I am anxious about reducing sedation if my workload is too high (Reversed)	32%	50	36%	51	25%	55	56%	35	25%	45	66%	38

Q	Statement	Total (n=252)		Medical (n=53)		Nurses (n=149)		Pharmacists (n=25)		Physiotherapists (n=16)		Other (n=9)	
		%agree	ranking	%agree	ranking	%agree	ranking	%agree	ranking	%agree	ranking	%agree	ranking
38	It is easier to lighten sedation when the patient is pain free	91%	10	96%	16	93%	12	92%	9	63%	30	89%	10
39	I feel frustrated when sedation minimisation is NOT progressed for deeply sedated patients	85%	22	98%	6	77%	33	92%	9	94%	5	100%	1
40	I do NOT feel adequately supported when I am reducing sedation levels (Reversed)	50%	43	57%	40	55%	41	40%	50	12%	53	33%	50
41	It is part of my role to support the patients who are awake to deal with their fears and anxiety	92%	8	89%	27	98%	1	52%	40	100%	1	100%	1
42	There are conflicts between staff in my unit when clinicians wean off sedation either very quickly or stop abruptly (Reversed)	15%	63	21%	56	13%	64	28%	55	6%	65	0%	68
43	Sedation holds may affect the safety of a patient (Reversed)	26%	55	31%	53	17%	60	48%	43	50%	33	44%	46
44	High workload and pressure prevent ICU staff from performing sedation holds (Reversed)	14%	64	8%	65	15%	63	28%	55	12%	53	11%	63
45	Competing clinical procedures (eg theatre, diagnostics etc) impede initiating a sedation hold (Reversed)	8%	66	8%	65	7%	67	4%	67	12%	53	22%	59
46	In my unit, timing to progress a sedation hold is influenced by staff's availibility (Reversed)	14%	64	9%	64	16%	62	16%	62	12%	53	22%	59
47	I am more likely to perform sedation holds if senior colleagues are available at the bedside	47%	44	44%	48	50%	43	48%	43	37%	43	22%	59
48	In my unit there are insufficient numbers of clinical staff to perform sedation holds (Reversed)	53%	42	52%	43	48%	44	64%	31	75%	18	66%	38
49	Sedation holds are difficult for me to accomplish when a clear sedation plan is NOT in place (Reversed)	29%	52	51%	44	26%	53	8%	63	25%	45	33%	50
50	I have the necessary decision-making skills to initiate a sedation hold	79%	30	100%	1	83%	27	44%	48	24%	51	78%	23
51	My colleagues are willing to listen to my opinion about sedation holds	82%	27	94%	20	80%	30	84%	19	69%	22	67%	33

Q	Statement	Total (n=252)		Medical (n=53)		Nurses (n=149)		Pharmacists (n=25)		Physiotherapists (n=16)		Other (n=9)	
		%agree	ranking	%agree	ranking	%agree	ranking	%agree	ranking	%agree	ranking	%agree	ranking
52	A low proportion of experienced ICU staff creates a barrier to initiating or progressing sedation holds in my unit (Reversed)	18%	60	19%	57	19%	57	24%	60	0%	68	11%	63
53	Families' presence at the bedside help enable sedation holds	58%	41	62%	37	54%	42	72%	27	63%	30	55%	41
54	Optimising sedation reduces the time a patient needs to stay on the ventilator	96%	2	98%	6	94%	9	100%	1	94%	5	100%	1
55	Optimising sedation-analgesia-delirium to support long-term recovery of ICU patients is NOT part of my role (Reversed)	90%	14	100%	1	91%	17	80%	24	68%	29	78%	23
56	It is easier for me to optimise sedation when a clear sedation-analgesia-delirium plan is in place	78%	33	60%	39	84%	26	88%	15	69%	22	77%	31
57	Sedation optimisation facilitates patients' physical and cognitive recovery	95%	5	94%	20	94%	9	100%	1	100%	1	100%	1
58	Optimal sedation and analgesia is NOT the same for every patient	97%	1	100%	1	95%	6	100%	1	100%	1	100%	1
59	Optimisation of sedation-analgesia-delirium management is NOT within the scope of my practice (Reversed)	87%	20	100%	1	88%	22	84%	19	50%	33	78%	23
60	I work towards a target sedation score to achieve sedation-analgesia-delirium optimisation	78%	33	81%	30	82%	28	84%	19	31%	44	55%	41
61	I am able to coordinate the clinical team to manage sedation-analgesia-delirium practices	67%	38	91%	24	64%	39	48%	43	44%	40	78%	23
62	I am competent to discuss with the multidisciplinary team the sedation-analgesia needs of the patient	94%	6	98%	6	94%	9	96%	6	88%	9	77%	31
63	Teamwork contributes positively to my sedation-analgesia-delirium practice	96%	2	98%	6	97%	2	92%	9	88%	9	100%	1
64	Agreeing the sedation-analgesia-delirium plan is a shared decision-making process within the multidisciplinary team	91%	10	91%	24	93%	12	92%	9	82%	12	89%	10

Q	Statement	Total (n=252)		Medical (n=53)		Nurses (n=149)		Pharmacists (n=25)		Physiotherapists (n=16)		Other (n=9)	
		%agree	ranking	%agree	ranking	%agree	ranking	%agree	ranking	%agree	ranking	%agree	ranking
65	Peer pressure from the multidisciplinary team affects my sedation-analgesia-delirium practice (Reversed)	33%	49	37%	50	34%	50	36%	52	18%	52	33%	50
66	I improve my practice by having regular discussions about sedation-analgesia-delirium practices with my senior colleagues	68%	36	55%	41	71%	37	84%	19	50%	33	78%	23
67	I feel less concerned when implementing a sedation-analgesia-delirium plan that has been decided after a multi-disciplinary team discussion	68%	36	45%	47	74%	35	96%	6	50%	33	55%	41
68	Communicating the target sedation-analgesia-delirium plan to the multidisciplinary team is part of my role	81%	28	96%	16	82%	28	60%	34	50%	33	89%	10

Table S9. Items deemed as most important by profession (green shading indicates top 10 ranked items in each group

Q	Statement	Total (n=252)		Medical (n=53)		Nurses (n=149)		Pharmacists (n=25)		Physiotherapists (n=16)		Other (n=9)	
		%Important	ranking	%Important	ranking	%Important	ranking	%Important	ranking	%Important	ranking	%Important	ranking
1	I have adequate knowledge to use validated sedation assessment scales, e.g.RASS, SAS	86%	16	83%	10	89%	21	88%	4	82%	20	66%	52
2	I have the necessary skills to assess patient's sedation, analgesia and delirium level	94%	1	95%	1	93%	9	96%	1	94%	1	89%	13
3	It is part of my role to assess patient's sedation-analgesia-delirium state continuously and intervene accordingly	89%	8	82%	13	97%	1	52%	41	88%	9	100%	1
4	I do NOT feel I have the necessary skills to titrate sedative and analgesic doses considering the patient's response	79%	25	72%	23	87%	25	52%	41	63%	63	100%	1
5	There are times in my unit when there is insufficient availability of sedative-analgesic agents that I am familiar with	69%	55	36%	60	83%	38	60%	30	69%	51	66%	52
6	The cost of sedative-analgesic agents influences which agents clinicians use	38%	68	12%	68	52%	68	8%	68	43%	67	33%	68
7	In my unit psychiatric expertise is NOT available to guide optimal medication management in sedated patients with mental health disorders	61%	60	24%	67	77%	55	32%	65	82%	20	55%	58
8	I am aware of the main principles in the sedation, agitation, delirium (PADIS) guidelines	72%	47	45%	53	79%	51	76%	16	87%	12	78%	32
9	Sedation-analgesia-delirium practice should be based on evidence and NOT on clinicians' personal beliefs	82%	20	61%	35	90%	18	80%	9	75%	40	89%	13
10	Written sedation-analgesia-delirium protocols are NOT in place in my unit	74%	39	49%	46	80%	48	76%	16	87%	12	88%	27
11	Sedation is increased in my unit when the unit is busy at night to keep patients safe and asleep	71%	49	64%	30	73%	60	64%	26	81%	27	89%	13

Q	Statement	Total (n=252)		Medical (n=53)		Nurses (n=149)		Pharmacists (n=25)		Physiotherapists (n=16)		Other (n=9)	
		%Important	ranking	%Important	ranking	%Important	ranking	%Important	ranking	%Important	ranking	%Important	ranking
12	Day and night staff teams have different sedation-analgesia goals	73%	42	59%	37	81%	44	56%	35	68%	62	89%	13
13	The patient's underlying condition influences my sedation-analgesia-delirium management decisions	81%	23	73%	21	84%	33	84%	6	69%	51	78%	32
14	My sedation-analgesia-delirium management is influenced by whether the patient has cardiovascular instability	73%	42	49%	46	84%	33	56%	35	75%	40	77%	44
15	I have experience of managing the sedation-analgesia-delirium needs of challenging patients	89%	8	87%	4	91%	13	84%	6	75%	40	100%	1
16	Sedation-analgesia-delirium goals and strategies are NOT updated based on daily assessment of patient needs	87%	15	81%	14	87%	25	96%	1	88%	9	100%	1
17	I find sedation-analgesia-delirium management challenging	77%	31	54%	42	85%	32	72%	20	75%	40	89%	13
18	I am confident to distinguish between pain and delirium	91%	3	85%	6	96%	4	72%	20	88%	9	89%	13
19	I prioritise sedation-analgesia-delirium optimisation over other aspects of patient care	59%	65	27%	65	73%	60	44%	53	69%	51	44%	65
20	It is difficult to maintain low sedation levels overnight	72%	47	59%	36	79%	51	44%	53	87%	12	89%	13
21	Sedation-analgesia-delirium champions support staff in optimising practice	51%	67	25%	66	58%	67	48%	48	69%	51	55%	58
22	Sedation-analgesia-delirium practice is based upon senior clinicians' preferences in my unit	52%	66	32%	63	59%	66	52%	41	56%	66	44%	65
23	I am confident to speak-up about sedation-analgesia-delirium practice	78%	30	59%	37	84%	33	76%	16	82%	20	89%	13

Q	Statement	Total (n=252)		Medical (n=53)		Nurses (n=149)		Pharmacists (n=25)		Physiotherapists (n=16)		Other (n=9)	
		%Important	ranking	%Important	ranking	%Important	ranking	%Important	ranking	%Important	ranking	%Important	ranking
24	Patients' history such as age, chronic pain, substance abuse and mental health disorders can be challenging factors for me when managing sedation-analgesia-delirium	83%	19	64%	30	90%	18	84%	6	81%	27	77%	44
25	I am competent to communicate with patients and families about sedation and analgesia management	76%	35	59%	37	86%	29	44%	53	87%	12	89%	13
26	Training to assess and manage sedation-analgesia-delirium is insufficient for my needs	70%	52	42%	57	81%	44	48%	48	82%	20	77%	44
27	I have adequate knowledge to use validated delirium assessment scales, e.g. Confusion Assessment Method (CAM)-ICU, Intensive Care Delirium Screening Checklist (ICDSC)	88%	13	73%	21	93%	9	80%	9	94%	1	100%	1
28	I am confident to keep the agitated or delirious patient safe	90%	6	85%	7	96%	4	64%	26	81%	27	100%	1
29	I feel stressed by managing an agitated or combative patient	77%	31	54%	42	91%	13	32%	65	82%	20	88%	27
30	I am confident working out why a patient is agitated	89%	8	83%	10	95%	6	68%	24	94%	1	88%	27
31	Worrying about a member of staff being harmed by an agitated or aggressive patient influences my sedation practice	79%	25	59%	37	91%	13	52%	41	0%	68	77%	44
32	I have adequate knowledge to use validated behavioural pain assessment scales, e.g. Critical-care Pain Observation Tool (CPOT), Behavioural Pain Scale (BPS)	74%	39	44%	54	90%	18	52%	41	69%	51	66%	52
33	I do NOT know when I should use a behavioural pain scale rather than non-behavioural pain scale such as the Visual Analogue Scale (VAS)	62%	59	34%	62	75%	56	44%	53	63%	63	55%	58
34	Sedation optimisation or light sedation increases workload	71%	49	68%	26	75%	56	56%	35	69%	51	78%	32

Q	Statement	Total (n=252)		Medical (n=53)		Nurses (n=149)		Pharmacists (n=25)		Physiotherapists (n=16)		Other (n=9)	
		%Important	ranking	%Important	ranking	%Important	ranking	%Important	ranking	%Important	ranking	%Important	ranking
35	I am confident to manage the lightly sedated patient	79%	25	66%	29	89%	21	56%	35	75%	40	78%	32
36	Light sedation facilitates patients' orientation and engagement	91%	3	85%	7	95%	6	80%	9	94%	1	88%	27
37	I am anxious about reducing sedation if my workload is too high	71%	49	49%	46	83%	38	36%	64	81%	27	78%	32
38	It is easier to lighten sedation when the patient is pain free	82%	20	71%	24	91%	13	60%	30	62%	65	100%	1
39	I feel frustrated when sedation minimisation is NOT progressed for deeply sedated patients	85%	17	87%	4	84%	33	80%	9	93%	7	100%	1
40	I do NOT feel adequately supported when I am reducing sedation levels	73%	42	49%	46	86%	29	48%	48	69%	51	89%	13
41	It is part of my role to support the patients who are awake to deal with their fears and anxiety	89%	8	79%	16	97%	1	60%	30	87%	12	100%	1
42	There are conflicts between staff in my unit when clinicians wean off sedation either very quickly or stop abruptly	67%	56	43%	55	79%	51	40%	59	75%	40	67%	51
43	Sedation holds may affect the safety of a patient	73%	42	53%	45	87%	25	40%	59	75%	40	55%	58
44	High workload and pressure prevent ICU staff from performing sedation holds	82%	20	74%	20	87%	25	64%	26	81%	27	100%	1
45	Competing clinical procedures (eg theatre, diagnostics etc) impede initiating a sedation hold	70%	52	57%	41	79%	51	40%	59	76%	38	77%	44
46	In my unit, timing to progress a sedation hold is influenced by staff's availibility	76%	35	68%	26	83%	38	44%	53	94%	1	55%	58
47	I am more likely to perform sedation holds if senior colleagues are available at the bedside	61%	60	46%	52	72%	62	28%	67	69%	51	44%	65
48	In my unit there are insufficient numbers of clinical staff to perform sedation holds	70%	52	48%	50	80%	48	44%	53	81%	27	78%	32

Q	Statement	Total (n=252)		Medical (n=53)		Nurses (n=149)		Pharmacists (n=25)		Physiotherapists (n=16)		Other (n=9)	
		%Important	ranking	%Important	ranking	%Important	ranking	%Important	ranking	%Important	ranking	%Important	ranking
49	Sedation holds are difficult for me to accomplish when a clear sedation plan is NOT in place	61%	60	28%	64	72%	62	52%	41	75%	40	78%	32
50	I have the necessary decision-making skills to initiate a sedation hold	77%	31	68%	26	86%	29	48%	48	69%	51	78%	32
51	My colleagues are willing to listen to my opinion about sedation holds	77%	31	70%	25	82%	42	56%	35	82%	20	78%	32
52	A low proportion of experienced ICU staff creates a barrier to initiating or progressing sedation holds in my unit	75%	37	64%	30	84%	33	48%	48	82%	20	66%	52
53	Families' presence at the bedside help enable sedation holds	60%	64	42%	57	68%	65	40%	59	69%	51	55%	58
54	Optimising sedation reduces the time a patient needs to stay on the ventilator	91%	3	92%	2	93%	9	80%	9	87%	12	89%	13
55	Optimising sedation-analgesia-delirium to support long-term recovery of ICU patients is NOT part of my role	80%	24	62%	33	88%	24	68%	24	81%	27	89%	13
56	It is easier for me to optimise sedation when a clear sedation-analgesia-delirium plan is in place	73%	42	47%	51	81%	44	76%	16	87%	12	66%	52
57	Sedation optimisation facilitates patients' physical and cognitive recovery	90%	6	78%	18	93%	9	88%	4	93%	7	100%	1
58	Optimal sedation and analgesia is NOT the same for every patient	93%	2	79%	16	97%	1	92%	3	94%	1	100%	1
59	Optimisation of sedation-analgesia-delirium management is NOT within the scope of my practice	74%	39	54%	42	82%	42	60%	30	81%	27	77%	44
60	I work towards a target sedation score to achieve sedation-analgesia-delirium optimisation	75%	37	62%	33	81%	44	72%	20	75%	40	66%	52
61	I am able to coordinate the clinical team to manage sedation-analgesia-delirium practices	79%	25	83%	10	80%	48	64%	26	81%	27	78%	32

Q	Statement	Total (n=252)		Medical (n=53)		Nurses (n=149)		Pharmacists (n=25)		Physiotherapists (n=16)		Other (n=9)	
		%Important	ranking	%Important	ranking	%Important	ranking	%Important	ranking	%Important	ranking	%Important	ranking
62	I am competent to discuss with the multidisciplinary team the sedation-analgesia needs of the patient	89%	8	80%	15	94%	8	80%	9	87%	12	89%	13
63	Teamwork contributes positively to my sedation-analgesia-delirium practice	88%	13	89%	3	91%	13	72%	20	75%	40	89%	13
64	Agreeing the sedation-analgesia-delirium plan is a shared decision-making process within the multidisciplinary team	85%	17	78%	18	89%	21	80%	9	81%	27	88%	27
65	Peer pressure from the multidisciplinary team affects my sedation-analgesia-delirium practice	61%	60	41%	59	70%	64	40%	59	75%	40	55%	58
66	I improve my practice by having regular discussions about sedation-analgesia-delirium practices with my senior colleagues	66%	58	39%	60	75%	56	56%	35	76%	38	77%	44
67	I feel less concerned when implementing a sedation-analgesia-delirium plan that has been decided after a multi-disciplinary team discussion	67%	56	43%	55	75%	56	60%	30	81%	27	78%	32
68	Communicating the target sedation-analgesia-delirium plan to the multidisciplinary team is part of my role	79%	25	85%	7	83%	38	52%	41	69%	51	78%	32

Table S10 Congruence in ranking of strength of agreement and perceived importance (Numbers represent ranks of agreement and importance)

		Total		MD		Nurses		Pharmacists		Physiotherapists		Other	
Q	Statement	Agreement	Importance	Agreement	Importance	Agreement	Importance	Agreement	Importance	Agreement	Importance	Agreement	Importance
1	I have adequate knowledge to use validated sedation assessment scales, e.g. Richmond Agitation-Sedation Scale (RASS), Riker Sedation Agitation Scale (SAS)	14	16	23	10	17	21	15	4	1	20	41	52
2	I have the necessary skills to assess patient's sedation, analgesia and delirium level	8	1	6	1	6	9	27	1	16	1	38	13
3	It is part of my role to assess patient's sedation-analgesia-delirium state continuously and intervene accordingly	20	8	30	13	2	1	40	41	16	9	33	1
4	I do NOT feel I have the necessary skills to titrate sedative and analgesic doses considering the patient's response (Reversed)	24	25	6	23	12	25	40	41	53	63	23	1
5	There are times in my unit when there is insufficient availability of sedative-analgesic agents that I am familiar with (Reversed)	18	55	20	60	22	38	6	30	22	51	10	52
6	The cost of sedative-analgesic agents influences which agents clinicians use (Reversed)	47	68	42	68	47	68	31	68	53	67	46	68
7	In my unit psychiatric expertise is NOT available to guide optimal medication management in sedated patients with mental health disorders (Reversed)	57	60	54	67	57	55	61	65	50	20	41	58
8	I am aware of the main principles in the sedation, agitation, delirium (PADIS) guidelines	35	47	37	53	38	51	15	16	22	12	10	32
9	Sedation-analgesia-delirium practice should be based on evidence and NOT on clinicians' personal beliefs	14	20	29	35	12	18	9	9	12	40	10	13
10	Written sedation-analgesia-delirium protocols are NOT in place in my unit (Reversed)	39	39	35	46	39	48	35	16	40	12	33	27
11	Sedation is increased in my unit when the unit is busy at night to keep patients safe and asleep (Reversed)	53	49	62	30	52	60	51	26	45	27	50	13
12	Day and night staff teams have different sedation-analgesia goals (Reversed)	51	42	58	37	48	44	49	35	65	62	50	13
13	The patient's underlying condition influences my sedation-analgesia-delirium management decisions	10	23	6	21	20	33	1	6	22	51	10	32

		Total		MD		Nurses		Pharmacists		Physiotherapists		Other	
Q	Statement	Agreement	Importance	Agreement	Importance	Agreement	Importance	Agreement	Importance	Agreement	Importance	Agreement	Importance
14	My sedation-analgesia-delirium management is influenced by whether the patient has cardiovascular instability	24	42	32	46	21	33	24	35	18	40	23	44
15	I have experience of managing the sedation-analgesia-delirium needs of challenging patients	7	8	1	4	2	13	19	6	33	40	10	1
16	Sedation-analgesia-delirium goals and strategies are NOT updated based on daily assessment of patient needs (Reversed)	30	15	27	14	34	25	15	1	22	9	10	1
17	I find sedation-analgesia-delirium management challenging (Reversed)	61	31	55	42	60	32	63	20	52	40	50	13
18	I am confident to distinguish between pain and delirium	29	3	34	6	24	4	35	20	11	9	21	13
19	I prioritise sedation-analgesia-delirium optimisation over other aspects of patient care	54	65	63	65	51	60	55	53	45	61	59	65
20	It is difficult to maintain low sedation levels overnight (Reversed)	58	47	58	36	56	51	55	53	53	12	46	13
21	Sedation-analgesia-delirium champions support staff in optimising practice	48	67	52	66	49	67	43	48	22	51	50	58
22	Sedation-analgesia-delirium practice is based upon senior clinicians' preferences in my unit (Reversed)	56	66	58	63	53	66	53	41	53	66	50	65
23	I am confident to speak-up about sedation-analgesia-delirium practice	22	30	16	37	30	33	9	16	12	20	10	13
24	Patients' history such as age, chronic pain, substance abuse and mental health disorders can be challenging factors for me when managing sedation-analgesia-delirium (Reversed)	68	19	68	30	68	18	63	6	53	27	63	44
25	I am competent to communicate with patients and families about sedation and analgesia management	14	35	6	37	5	29	35	53	32	12	21	13
26	Training to assess and manage sedation-analgesia-delirium is insufficient for my needs (Reversed)	46	52	36	57	46	44	53	48	53	20	33	44
27	I have adequate knowledge to use validated delirium assessment scales, e.g. Confusion Assessment Method (CAM)-ICU, Intensive Care Delirium Screening Checklist (ICDSC)	10	13	15	21	17	9	24	9	5	1	33	1

		Total		MD		Nurses		Pharmacists		Physiotherapists		Other	
Q	Statement	Agreement	Importance	Agreement	Importance	Agreement	Importance	Agreement	Importance	Agreement	Importance	Agreement	Importance
28	I am confident to keep the agitated or delirious patient safe	24	6	16	7	25	4	35	26	18	27	1	1
29	I feel stressed by managing an agitated or combative patient (Reversed)	62	31	49	42	65	13	63	65	53	20	46	27
30	I am confident working out why a patient is agitated	30	8	33	10	30	6	27	24	18	1	1	27
31	Worrying about a member of staff being harmed by an agitated or aggressive patient influences my sedation practice (Reversed)	67	25	67	37	66	13	68	41	65	68	63	44
32	I have adequate knowledge to use validated behavioural pain assessment scales, e.g. Critical-care Pain Observation Tool (CPOT), Behavioural Pain Scale (BPS)	40	39	45	54	36	18	43	41	45	51	23	52
33	I do NOT know when I should use a behavioural pain scale rather than non-behavioural pain scale such as the Visual Analogue Scale (VAS) (Reversed)	45	59	46	62	45	56	33	53	42	63	50	58
34	Sedation optimisation or light sedation increases workload (Reversed)	59	49	58	26	57	56	55	35	33	51	63	32
35	I am confident to manage the lightly sedated patient	18	25	24	29	12	21	30	35	12	40	10	32
36	Light sedation facilitates patients' orientation and engagement	2	3	6	7	6	6	1	9	5	1	1	27
37	I am anxious about reducing sedation if my workload is too high (Reversed)	50	49	51	46	55	38	35	64	45	27	38	32
38	It is easier to lighten sedation when the patient is pain free	10	20	16	24	12	13	9	30	30	65	10	1
39	I feel frustrated when sedation minimisation is NOT progressed for deeply sedated patients	22	17	6	4	33	33	9	9	5	7	1	1
40	I do NOT feel adequately supported when I am reducing sedation levels (Reversed)	43	42	40	46	41	29	50	48	53	51	50	13
41	It is part of my role to support the patients who are awake to deal with their fears and anxiety	8	8	27	16	1	1	40	30	1	12	1	1
42	There are conflicts between staff in my unit when clinicians wean off sedation either very quickly or stop abruptly (Reversed)	63	56	56	55	64	51	55	59	65	40	68	51

		Total		MD		Nurses		Pharmacists		Physiotherapists		Other	
Q	Statement	Agreement	Importance	Agreement	Importance	Agreement	Importance	Agreement	Importance	Agreement	Importance	Agreement	Importance
43	Sedation holds may affect the safety of a patient (Reversed)	55	42	53	45	60	25	43	59	33	40	46	58
44	High workload and pressure prevent ICU staff from performing sedation holds (Reversed)	64	20	65	20	63	25	55	26	53	27	63	1
45	Competing clinical procedures (eg theatre, diagnostics etc) impede initiating a sedation hold (Reversed)	66	52	65	41	67	51	67	59	53	38	59	44
46	In my unit, timing to progress a sedation hold is influenced by staff's availibility (Reversed)	64	35	64	26	62	38	62	53	53	1	59	58
47	I am more likely to perform sedation holds if senior colleagues are available at the bedside	44	60	48	52	43	62	43	67	43	51	59	65
48	In my unit there are insufficient numbers of clinical staff to perform sedation holds (Reversed)	42	52	43	50	44	48	31	53	18	27	38	32
49	Sedation holds are difficult for me to accomplish when a clear sedation plan is NOT in place (Reversed)	52	60	44	64	53	62	63	41	45	40	50	32
50	I have the necessary decision-making skills to initiate a sedation hold	30	31	1	26	27	29	48	48	51	51	23	32
51	My colleagues are willing to listen to my opinion about sedation holds	27	31	20	25	30	42	19	35	22	20	33	32
52	A low proportion of experienced ICU staff creates a barrier to initiating or progressing sedation holds in my unit (Reversed)	60	37	57	30	57	33	60	48	68	20	63	52
53	Families' presence at the bedside help enable sedation holds	41	64	37	57	42	65	27	59	30	51	41	58
54	Optimising sedation reduces the time a patient needs to stay on the ventilator	2	3	6	2	9	9	1	9	5	12	1	13
55	Optimising sedation-analgesia-delirium to support long-term recovery of ICU patients is NOT part of my role (Reversed)	14	24	1	33	17	24	24	24	29	27	23	13
56	It is easier for me to optimise sedation when a clear sedation-analgesia-delirium plan is in place	33	42	39	51	26	44	15	16	22	12	31	52
57	Sedation optimisation facilitates patients' physical and cognitive recovery	5	6	20	18	9	9	1	4	1	7	1	1

		Total		MD		Nurses		Pharmacists		Physiotherapists		Other	
Q	Statement	Agreement	Importance	Agreement	Importance	Agreement	Importance	Agreement	Importance	Agreement	Importance	Agreement	Importance
58	Optimal sedation and analgesia is NOT the same for every patient	1	2	1	16	6	1	1	3	1	1	1	1
59	Optimisation of sedation-analgesia-delirium management is NOT within the scope of my practice (Reversed)	20	39	1	42	22	42	19	30	33	27	23	44
60	I work towards a target sedation score to achieve sedation-analgesia-delirium optimisation	33	37	30	33	28	44	19	20	44	40	41	52
61	I am able to coordinate the clinical team to manage sedation-analgesia-delirium practices	38	25	24	10	39	48	43	26	40	27	23	32
62	I am competent to discuss with the multidisciplinary team the sedation-analgesia needs of the patient	6	8	6	15	9	8	6	9	9	12	31	13
63	Teamwork contributes positively to my sedation-analgesia-delirium practice	2	13	6	3	2	13	9	20	9	40	1	13
64	Agreeing the sedation-analgesia-delirium plan is a shared decision-making process within the multidisciplinary team	10	17	24	18	12	21	9	9	12	27	10	27
65	Peer pressure from the multidisciplinary team affects my sedation-analgesia-delirium practice (Reversed)	49	60	50	59	50	64	52	59	52	40	50	58
66	I improve my practice by having regular discussions about sedation-analgesia-delirium practices with my senior colleagues	36	58	41	60	37	56	19	35	33	38	23	44
67	I feel less concerned when implementing a sedation-analgesia-delirium plan that has been decided after a multi-disciplinary team discussion	36	56	47	55	35	56	6	30	33	27	41	32
68	Communicating the target sedation-analgesia-delirium plan to the multidisciplinary team is part of my role	28	25	16	7	28	38	34	41	33	51	10	32

'Other' category included advanced clinical practitioners, psychologists,
Numbers represent ranked sums of each of agreement and importance

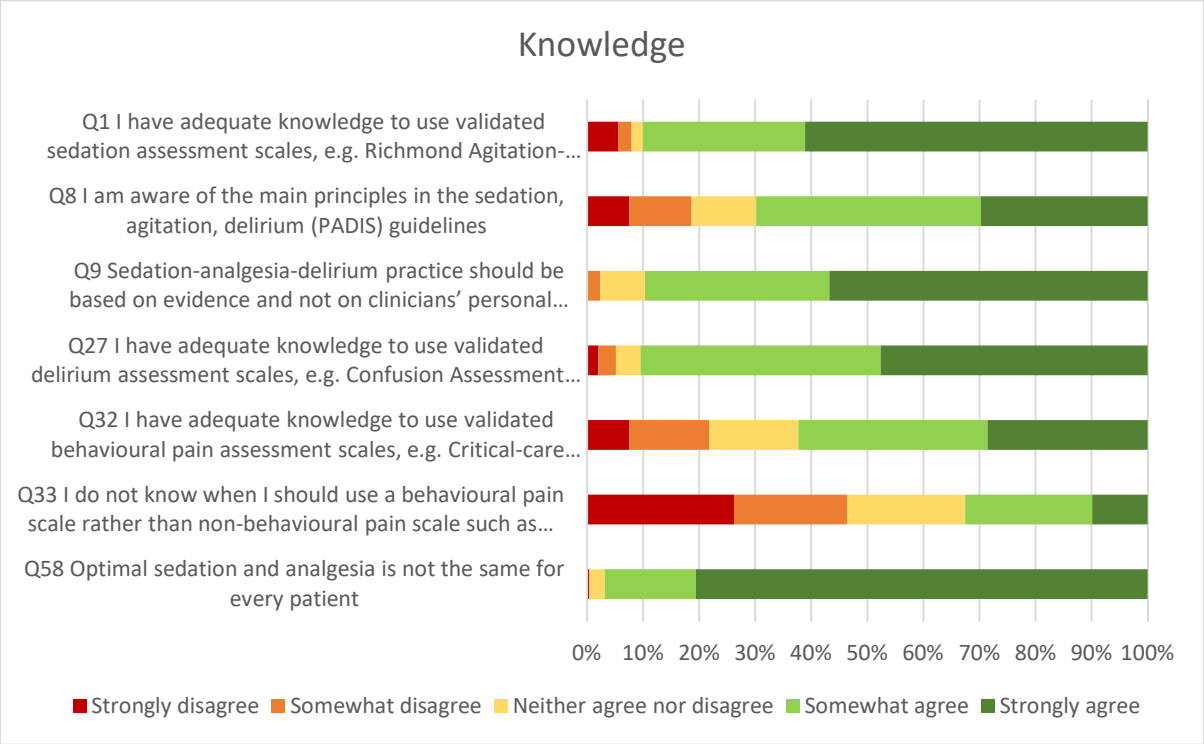
Difference between agreeing this issue affected sedation, analgesia and delirium practice compared to how important they considered the issue

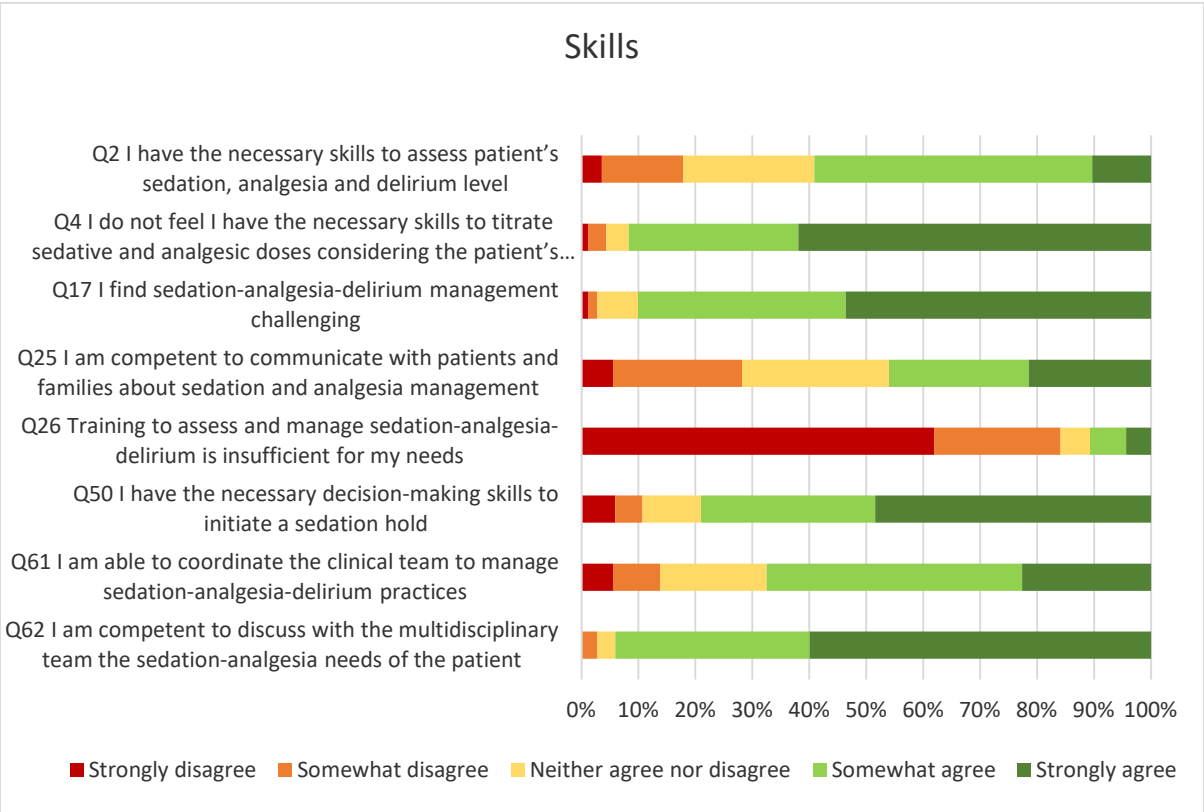
Agreement: <10 positions in ranking

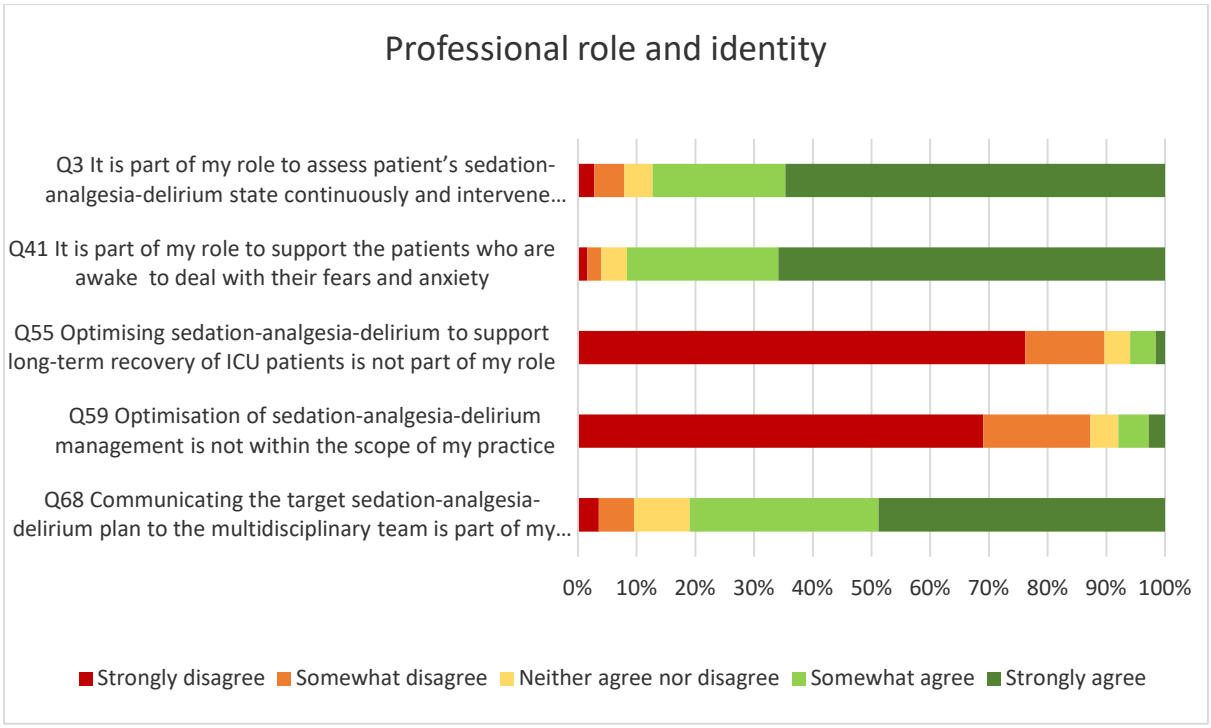
Partial agreement: 10 - 19 difference positions in ranking

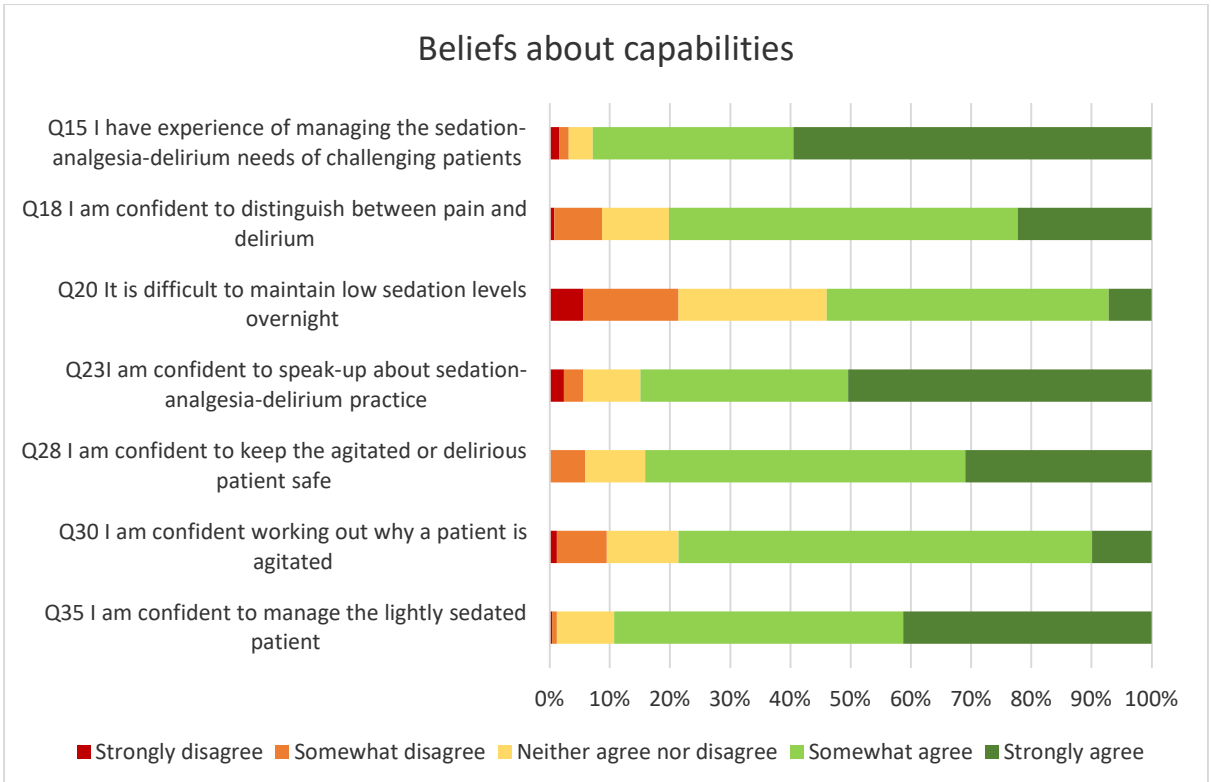
Disagreement: ≥20 difference positions in ranking

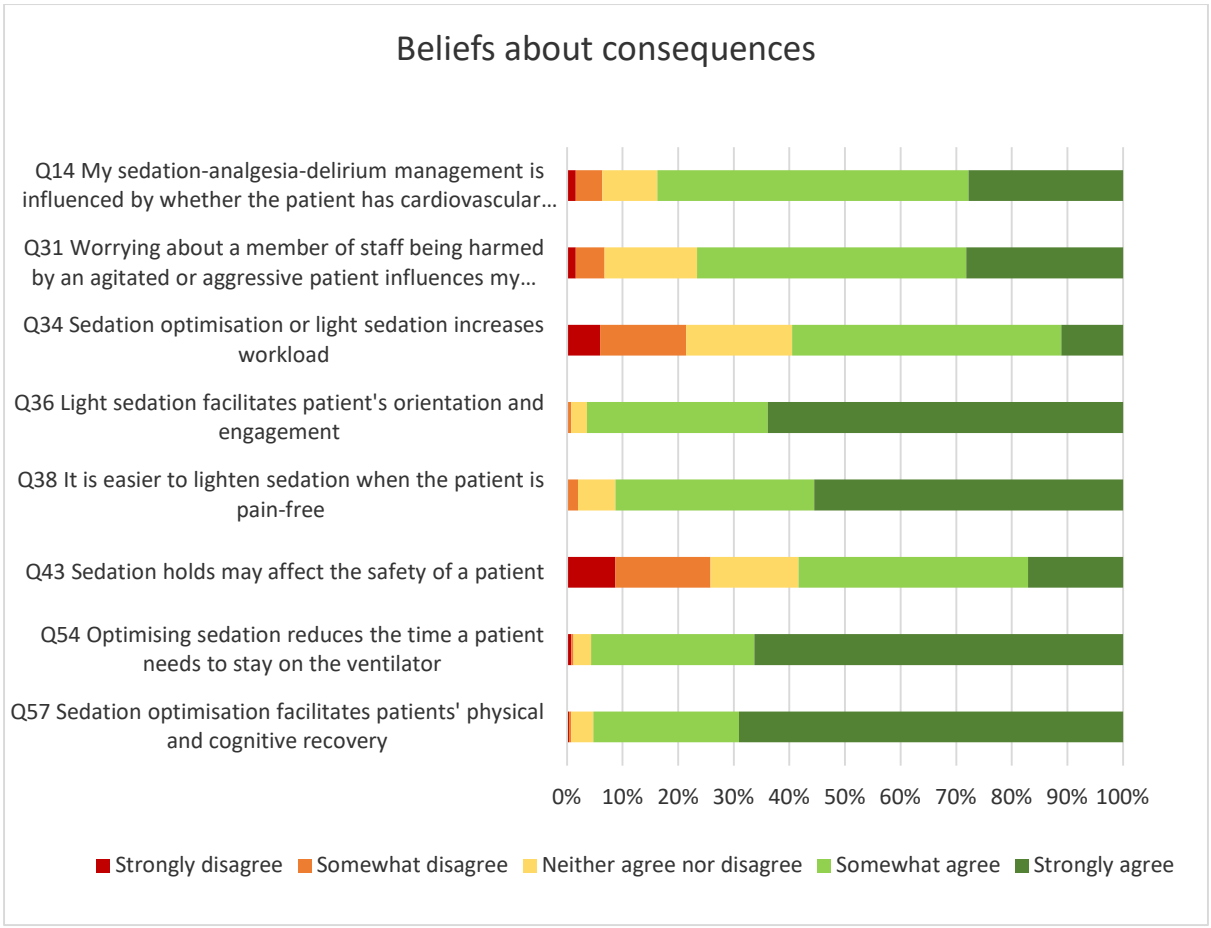
Figure S1

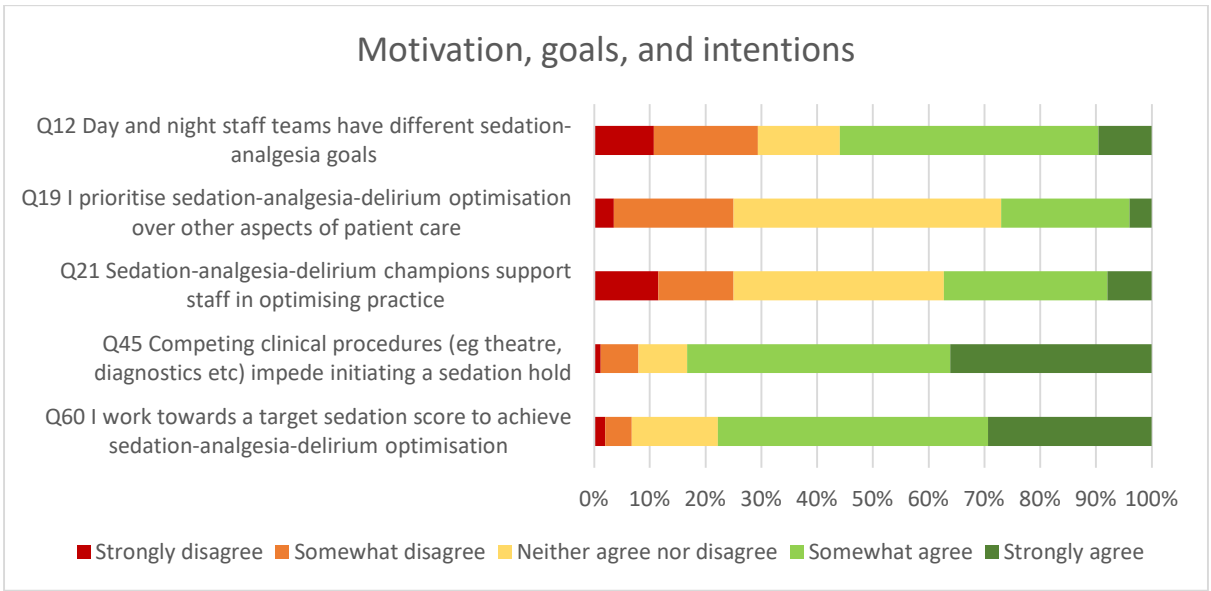

Knowledge
Q1 I have adequate knowledge to use validated sedation assessment scales, e.g. Richmond Agitation-...
Q8 I am aware of the main principles in the sedation, agitation, delirium (PADIS) guidelines
Q9 Sedation-analgesia-delirium practice should be based on evidence and not on clinicians' personal...
Q27 I have adequate knowledge to use validated delirium assessment scales, e.g. Confusion Assessment...
Q32 I have adequate knowledge to use validated behavioural pain assessment scales, e.g. Critical-care...
Q33 I do not know when I should use a behavioural pain scale rather than non-behavioural pain scale such as...
Q58 Optimal sedation and analgesia is not the same for every patient
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
Strongly disagree
Somewhat disagree
Neither agree nor disagree
Somewhat agree
Strongly agree

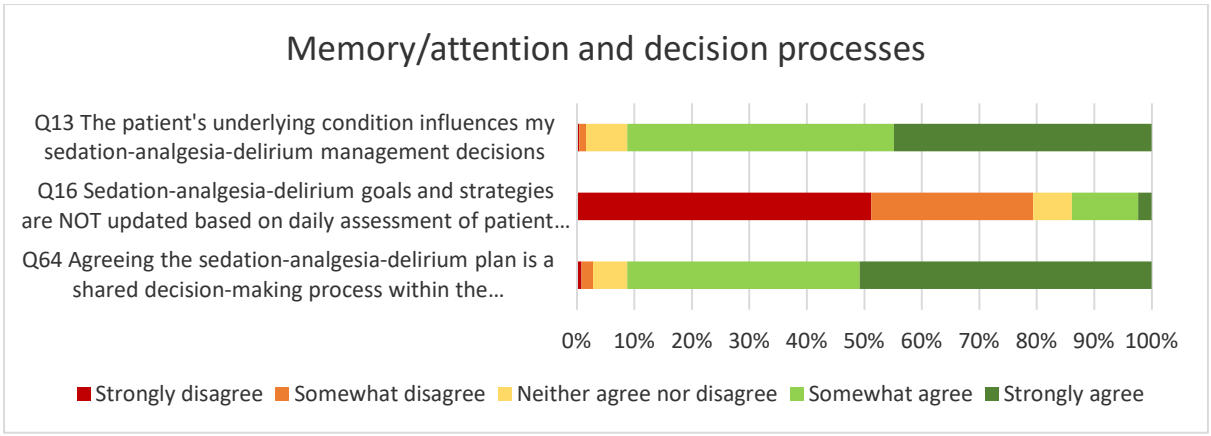

Skills
Q2 I have the necessary skills to assess patient's sedation, analgesia and delirium level
Q4 I do not feel I have the necessary skills to titrate sedative and analgesic doses considering the patient's...
Q17 I find sedation-analgesia-delirium management challenging
Q25 I am competent to communicate with patients and families about sedation and analgesia management
Q26 Training to assess and manage sedation-analgesia-delirium is insufficient for my needs
Q50 I have the necessary decision-making skills to initiate a sedation hold
Q61 I am able to coordinate the clinical team to manage sedation-analgesia-delirium practices
Q62 I am competent to discuss with the multidisciplinary team the sedation-analgesia needs of the patient
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
Strongly disagree
Somewhat disagree
Neither agree nor disagree
Somewhat agree
Strongly agree

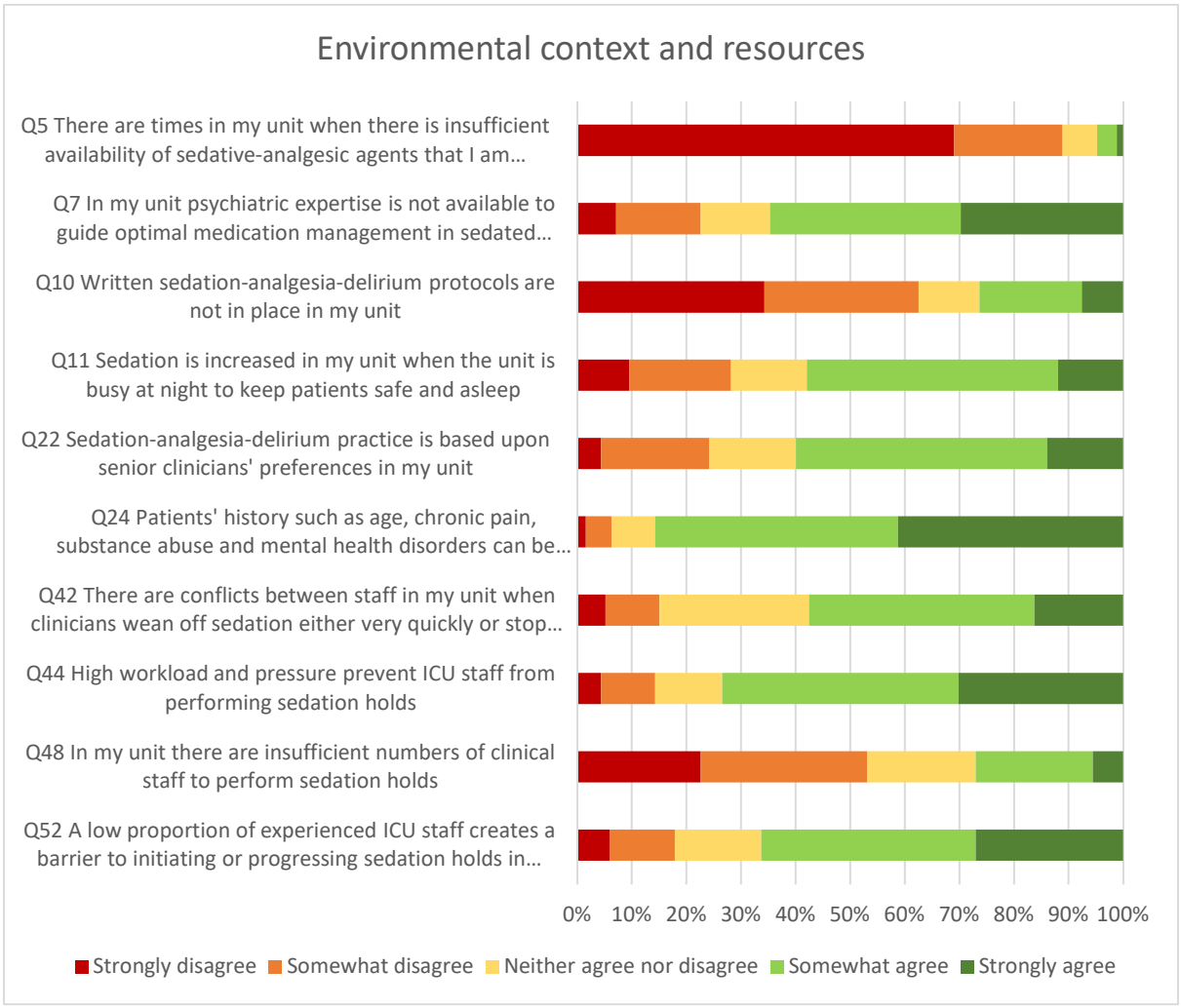

Professional role and identity
Q3 It is part of my role to assess patient's sedation-analgesia-delirium state continuously and intervene...
Q41 It is part of my role to support the patients who are awake to deal with their fears and anxiety
Q55 Optimising sedation-analgesia-delirium to support long-term recovery of ICU patients is not part of my role
Q59 Optimisation of sedation-analgesia-delirium management is not within the scope of my practice
Q68 Communicating the target sedation-analgesia-delirium plan to the multidisciplinary team is part of my...
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
Strongly disagree
Somewhat disagree
Neither agree nor disagree
Somewhat agree
Strongly agree

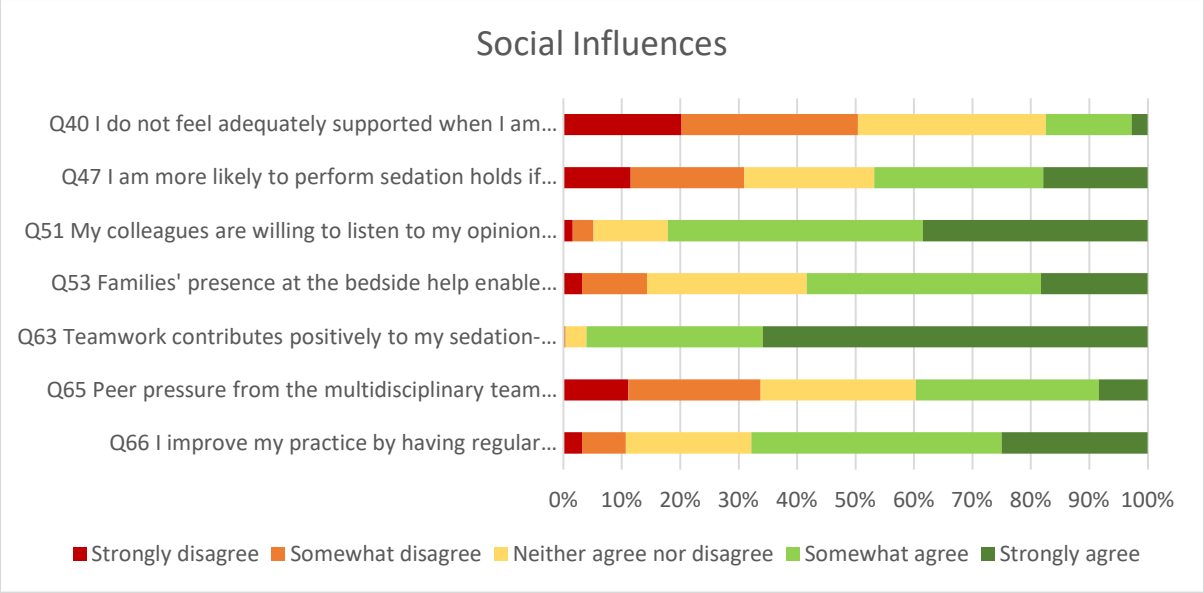

Beliefs about capabilities
Q15 I have experience of managing the sedation-analgesia-delirium needs of challenging patients
Q18 I am confident to distinguish between pain and delirium
Q20 It is difficult to maintain low sedation levels overnight
Q23I am confident to speak-up about sedation-analgesia-delirium practice
Q28 I am confident to keep the agitated or delirious patient safe
Q30 I am confident working out why a patient is agitated
Q35 I am confident to manage the lightly sedated patient
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
Strongly disagree
Somewhat disagree
Neither agree nor disagree
Somewhat agree
Strongly agree

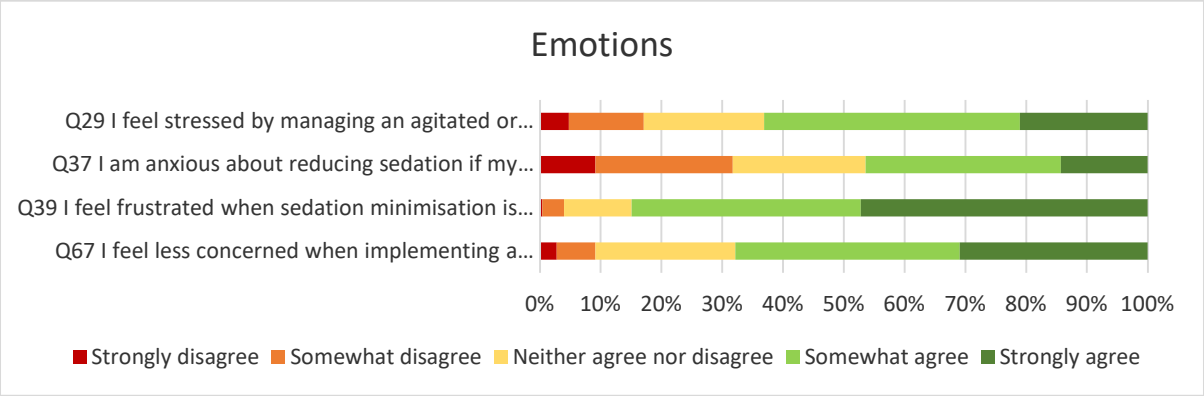

Beliefs about consequences
Q14 My sedation-analgesia-delirium management is influenced by whether the patient has cardiovascular...
Q31 Worrying about a member of staff being harmed by an agitated or aggressive patient influences my...
Q34 Sedation optimisation or light sedation increases workload
Q36 Light sedation facilitates patient's orientation and engagement
Q38 It is easier to lighten sedation when the patient is pain-free
Q43 Sedation holds may affect the safety of a patient
Q54 Optimising sedation reduces the time a patient needs to stay on the ventilator
Q57 Sedation optimisation facilitates patients' physical and cognitive recovery
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
Strongly disagree
Somewhat disagree
Neither agree nor disagree
Somewhat agree
Strongly agree


Motivation, goals, and intentions
Q12 Day and night staff teams have different sedation-analgesia goals
Q19 I prioritise sedation-analgesia-delirium optimisation over other aspects of patient care
Q21 Sedation-analgesia-delirium champions support staff in optimising practice
Q45 Competing clinical procedures (eg theatre, diagnostics etc) impede initiating a sedation hold
Q60 I work towards a target sedation score to achieve sedation-analgesia-delirium optimisation
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
Strongly disagree
Somewhat disagree
Neither agree nor disagree
Somewhat agree
Strongly agree


Memory/attention and decision processes
Q13 The patient's underlying condition influences my sedation-analgesia-delirium management decisions
Q16 Sedation-analgesia-delirium goals and strategies are NOT updated based on daily assessment of patient…
Q64 Agreeing the sedation-analgesia-delirium plan is a shared decision-making process within the…
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
Strongly disagree
Somewhat disagree
Neither agree nor disagree
Somewhat agree
Strongly agree


Environmental context and resources
Q5 There are times in my unit when there is insufficient availability of sedative-analgesic agents that I am…
Q7 In my unit psychiatric expertise is not available to guide optimal medication management in sedated…
Q10 Written sedation-analgesia-delirium protocols are not in place in my unit
Q11 Sedation is increased in my unit when the unit is busy at night to keep patients safe and asleep
Q22 Sedation-analgesia-delirium practice is based upon senior clinicians' preferences in my unit
Q24 Patients' history such as age, chronic pain, substance abuse and mental health disorders can be…
Q42 There are conflicts between staff in my unit when clinicians wean off sedation either very quickly or stop…
Q44 High workload and pressure prevent ICU staff from performing sedation holds
Q48 In my unit there are insufficient numbers of clinical staff to perform sedation holds
Q52 A low proportion of experienced ICU staff creates a barrier to initiating or progressing sedation holds in…
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
Strongly disagree
Somewhat disagree
Neither agree nor disagree
Somewhat agree
Strongly agree





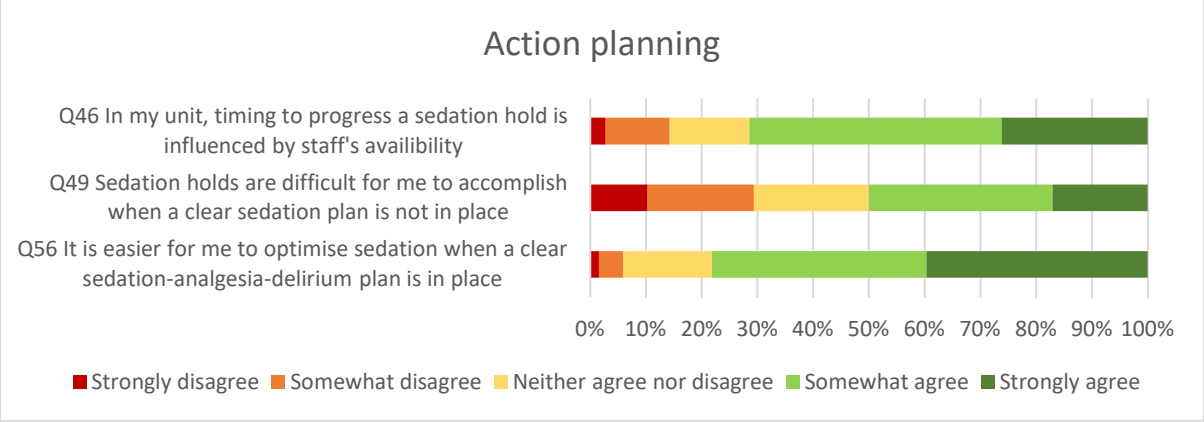


Figure S1. Responses to each OCEAN-ICU item (n = 252)

Questions are phrased in the same format as the instrument, i.e. with the desirable response sometimes being 'agree' and sometimes being 'disagree'. The questions have been grouped following the Theoretical Domains Framework.