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Original Article

Perceptions of UK clinicians towards postoperative critical care

S. Hashim,[1] **D. J. N. Wong,**[2,3] **L. Farmer,**[4] **S. K. Harris**[5,6] and **S. R. Moonesinghe**[7,8]

1 Foundation Doctor, University College London Medical School, London, UK
2 Specialty Registrar, Department of Anaesthesia, Guy's and St Thomas' NHS Foundation Trust, London, UK
3 Research Fellow, 4 Research Administrator, 8 Director, Health Services Research Centre, National Institute for Academic Anaesthesia, Royal College of Anaesthetists, London, UK
5 Consultant Intensivist, University College London Hospitals NHS Foundation Trust, London, UK
6 Honorary Senior Lecturer, Bloomsbury Institute of Intensive Care Medicine, Department of Internal Medicine, Division of Medicine, University College London, London, UK
7 Professor, Surgical Outcomes Research Centre, Centre for Peri-operative Medicine, Department for Targeted Intervention, Division of Surgery and Interventional Science, University College London, London, UK

Summary

Postoperative critical care is a finite resource that is recommended for high-risk patients. Despite national recommendations specifying that such patients should receive postoperative critical care, there is evidence that these recommendations are not universally followed. We performed a national survey aiming to better understand how patients are risk-stratified in practice; elucidate clinicians' opinions about how patients should be selected for critical care; and determine factors which affect the actual provision of postoperative critical care. As part of the second Sprint National Anaesthesia Project, epidemiology of critical care after surgery study, we distributed a paper survey to anaesthetists, surgeons and intensivists providing peri-operative care during a single week in March 2017. We collected data on respondent characteristics, and their opinions of postoperative critical care provision, potential benefits and real-world challenges. We undertook both quantitative and qualitative analyses to interpret the responses. We received 10,383 survey responses from 237 hospitals across the UK. Consultants used a lower threshold for critical care admission than other career grades, indicating potentially more risk-averse behaviour. The majority of respondents reported that critical care provision was inadequate, and cited the value of critical care as being predominantly due to higher nurse: patient ratios. Use of objective risk assessment tools was poor, and patients were commonly selected for critical care based on procedure-specific pathways rather than individualised risk assessment. Challenges were highlighted in the delivery of peri-operative critical care services, such as an overall lack of capacity, competition for beds with non-surgical cases and poor flow through the hospital leading to bed 'blockages'. Critical care is perceived to provide benefit to high-risk surgical patients, but there is variation in practice about the definition and determination of risk, how patients are referred and how to deal with the lack of critical care resources. Future work should focus on evaluating 'enhanced care' units for postoperative patients, how to better implement individualised risk assessment in practice, and how to improve patient flow through hospitals.

Correspondence to: S.R. Moonesinghe
Email: ramani.moonesinghe@nhs.net
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Twitter: @dannyjnwong; @rmoonesinghe

Introduction

Occupancy of England's 4060 adult critical care beds generally exceeds 80%, placing pressure on elective and emergency care. Over 300 urgent operations are cancelled each month [1], and at least 80,000 elective operations per year [2]. Previously published data from the second Sprint National Anaesthesia Project, epidemiology of critical care provision after surgery (SNAP-2 EPICCS) study indicated that requirement for a critical care bed was a significant risk factor for cancellation of inpatient surgery [3]. Demand for high-quality, individualised postoperative care for high-risk patients is likely to increase, due to an ageing population and increasing volume of complex surgery [4], putting existing services under further strain. In 2020, this risk has been further compounded by the additional burden on healthcare, and specifically critical care, posed by endemic COVID-19 and the need to restore elective services after a period of pause during the pandemic.

Guidelines recommending which surgical patients should be admitted to critical care postoperatively are predominantly based on expert opinion rather than empirical evidence, and recommend, for example, mandatory admission for patients with a predicted 30-day mortality risk of > 5% [5,6], or those patients where there is a high risk of complications [7]. However, there remains uncertainty over the most reliable way to determine which patients might benefit from critical care, and how patients should be risk stratified (e.g. risk scores vs. exercise testing vs. clinical judgement). There is also evidence that clinicians may be guided more by treatment pathways (e.g. routine admission for all patients after open cardiac surgery) than risk assessment of individual patients [8]. Understanding and addressing these uncertainties is all the more pressing when considering the competition for critical care beds between acutely unwell patients and those who might benefit from a period of close observation after planned surgery.

We report a sub-study of SNAP2 EPICCS, which aimed to investigate the factors which influenced clinician decision-making regarding critical care referral after surgery [9]. Our aim was to establish how clinicians determined the risk of postoperative mortality in clinical practice, and what influenced their decision-making around critical care referral and how to manage high-risk patients in a resource constrained setting.

Methods

We conducted a survey of clinicians involved in the care of, and decision-making with, surgical patients. The study was reviewed and approved by the South Central - Berkshire B Research Ethics Committee (on behalf of the Health Research Authority). All anaesthetists, surgeons and critical care doctors working in participating UK NHS hospitals during the week of SNAP-2: EPICCS patient recruitment (21 to 27 March 2017) were eligible to take part. The questionnaire design was reviewed by a study steering group comprising representatives from: the National Institute of Academic Anaesthesia Health Services Research Centre; the Royal College of Anaesthetists; the Royal College of Surgeons of England; the Faculty of Intensive Care Medicine; the Intensive Care Society; the Association of Anaesthetists; the UK Critical Care Nursing Alliance; and patient representatives and lay-people.

The questionnaire contained three sections. The first detailed respondent characteristics, including: specialty; grade; primary work-load; and years since qualification. The second sought opinions regarding delivery of postoperative critical care; while the third concerned the use of risk stratification tools.

The questionnaire predominantly required participants to select answer boxes, with opportunities to elaborate on responses in Section 2 (online Supporting Information Appendix S1). The questionnaire was piloted and refined by members of the steering group before the main study was undertaken. Questions about the use of risk stratification tools asked about tools which were considered to be well known by clinicians in the peri-operative medical, surgical, anaesthesia and intensive care fields for risk stratifying surgical patients. These were pre-selected on the basis of previous literature review, and the consensus decision of the study steering group [10].

Paper questionnaires were distributed to eligible participants in participating UK hospitals by local principal investigators for the SNAP2 EPICCS study. The questionnaire included an explanation of the study's aims, and reassurance that any responses would remain confidential. To that end, potentially identifiable data were limited to the number of years of practice, job title (grade and specialty), and the name of the hospital where the individual completed the questionnaire. Reassurance of no litigation or reprisal was necessary given existing national guidelines on this topic [11].

Descriptive statistics were used to report clinicians' views around decision-making, referral and admission to critical care following surgery, and how they used risk stratification tools. Participants with some missing data were also included in the data analysis. In order to calculate the denominator (the number of eligible clinicians who could have participated in the survey), we calculated the number of anaesthetists, surgeons and intensivists who should have

been working in the UK during the week of the study. We performed a Chi-squared test to compare consultants vs. non-consultants' minimum risk threshold for critical care admission. As a number of questions provided the opportunity for free-text comments to be submitted, we undertook a thematic analysis of free-text responses using both a priori and emergent themes. This was completed using the six-step approach recommended by Braun and Clarke [12], including familiarisation and text-search queries to code for common themes.

Results

A total of 10,383 clinicians answered the questionnaire from 237 of 263 hospitals across the UK which were invited to participate (hospital response rate 90.1%). In March 2017, there were approximately 12,000 anaesthetists, 1500 intensivists, and 23,000 surgeons of all grades in the UK [13,14]. However, allowing 28 days for annual leave and 10 days for study leave, 10.4% of the working year would be time off. If this is assumed for the week we distributed the surveys, then there would have been a total of 10,751 anaesthetists, 1344 intensivists and 20,605 surgeons at work at some point over that week, giving an estimated response rate of 57% for anaesthetists, 38% for intensivists and 19% for surgeons. Most clinicians reported 15–20 years of post-qualification experience, median (IQR [range]) 17.0 (9.5–24.5 [0–60]) years (Table 1). The majority of respondents (59.0%) were anaesthetists, followed by 36.6% surgeons and 4.4% intensivists. The most common grade was consultant (56.9%). Core trainees made up 11.6% of respondents, while 10.4% were staff and associate specialists and 21.0% specialist trainees.

There was variation in the risk threshold used for referring to critical care across different grades of healthcare professionals (Table 2). Consultants were significantly more likely to refer patients of lower-risk than recommended by national guidelines (≤ 5% 30-day mortality risk; 27.7% of consultants vs. 18.2% of non-consultants, chi-squared statistic = 44.4287, $p < 0.0001$).

Participants' use of risk stratification tools are described in online Supporting Information Figures S1 and S2. Of the generic risk tools, the Surgical Risk Scale and Charlson Comorbidity Index had the highest number of participants selecting they had 'never used' them. The ASA physical status had the highest number of participants select 'always used'.

Table 3 illustrates clinicians' responses to their perceptions of critical care delivery within their institutions; 61.2% stated there was an insufficient capacity for postoperative patients, despite 87.4% indicating high-risk patients would have better outcomes in critical care than being placed on the general surgical ward.

Table 1 Participants' baseline characteristics. Values are number (proportion).

Participants		**n = 10,383**
Specialty Grade	**Anaesthetist**	6126 (59.0%)
	Consultant	3571 (58.3%)
	Staff and Associate Specialists	674 (11.0%)
	Specialist trainee	1123 (18.3%)
	Core trainee	749 (12.2%)
	Missing	9 (<0.1%)
	Intensivist	454 (4.4)
	Consultant	274 (60.4%)
	Staff and Associate Specialists	13 (2.9%)
	Specialist trainee	73 (16.1%)
	Core trainee	93 (20.5%)
	Missing	1 (<0.1%)
	Surgeon	3802 (36.6)
	Consultant	2055 (54.1%)
	Staff and Associate Specialists	390 (10.3%)
	Specialist trainee	986 (25.9%)
	Core trainee	362 (9.5%)
	Missing	9 (0.2%)
Primary work-load *	Cardiothoracic	454 (4.4%)
	General	5371 (51.7%)
	Neurosurgery	533 (5.1%)
	Oral Maxillofacial	1231 (11.9%)
	Otolaryngology	1180 (11.4%)
	Plastic Reconstructive	852 (8.2%)
	Trauma and Orthopaedics	4030 (38.9%)
	Urology	1905 (18.3%)
	Vascular	779 (7.5%)
	Other	972 (9.4%)
Years since qualification	0–5	1167 (11.2%)
	5–10	1715 (16.5%)
	10–15	1626 (15.7%)
	15–20	1999 (19.3%)
	20–25	1395 (13.4%)
	25–30	1275 (12.3%)
	30–35	673 (6.5%)
	35–40	282 (2.7%)
	40–45	56 (0.5%)
	45–50	8 (<0.1%)
	50–55	0 (<0.1%)
	55–60	2 (<0.1%)
	Missing	172 (1.7%)

[a]Total will be > 100% as some clinicians responded with more than one primary work-load.

Five core themes were found in the qualitative analysis of free-text responses to the question of whether respondents felt there was enough critical care capacity at their institution: lack of capacity; variability; cancellations; hospital beds; and service-wide factors. Figure 1 illustrates respondents' comments on critical care capacity.

Within the 'lack of capacity' responses there was a sub-theme of resources being almost adequate, with

Table 2 Risk threshold for critical care admission subdivided by grade. Values are number (proportion).

	Total	≤ 5%	> 5%	Did not answer
Anaesthetist	6126 (59.0%)	2611 (25.1%)	3417 (32.9%)	98 (0.9%)
Consultant	3503 (33.7%)	1593 (15.3%)	1910 (18.4%)	
Non-consultant	2517 (24.2%)	1013 (9.8%)	1504 (14.5%)	
Missing grade	9 (0.1%)	6 (<0.1%)	3 (<0.1%)	
Intensivist	454 (4.4%)	209 (2.0%)	237 (2.3%)	8 (<0.1%)
Consultant	268 (2.6%)	135 (1.3%)	133 (1.3%)	
Non-consultant	178 (1.8%)	74 (0.7%)	104 (1.0%)	
Missing grade	0 (<0.1%)	0 (<0.1%)	0 (<0.1%)	
Surgeon	3802 (36.7%)	1956 (51.4%)	1770 (46.6%)	76 (0.7%)
Consultant	2009 (19.3%)	1143 (11.0%)	866 (8.3%)	
Non-consultant	1710 (16.5%)	808 (7.8%)	902 (8.7%)	
Missing grade	7 (<0.1%)	5 (<0.1%)	2 (<0.1%)	
Total	10,383	4777 (46.0%)	5424 (52.2%)	182 (1.8%)

some participants stating there were an appropriate number of Level 3 beds, but insufficient Level 2 beds. Additionally, participants stated there was a fine balance between the number of operations and critical care bed capacity. This linked into the theme of inappropriate occupancy of critical care beds by patients who were suitable for ward-based care. Some participants stated patients requiring postoperative critical care beds were transferred to linked hospitals that had beds available.

> *"Bed capacity adequate, only if patient flow out of critical care is unobstructed*." – Respondent 1, Consultant Anaesthetist with 26 years' experience.

> *"Critical beds usually blocked by 'wardable' patients. If we had enough beds to avoid critical beds blocking we might have adequate critical care capacity*" – Respondent 2, Consultant Anaesthetist with 32 years' experience.

> *"It's variable depending on bed being occupied by emergencies and blocked beds*" – Respondent 3, Anaesthetic Specialist Trainee with 8 years' experience.

A theme emerged on the impact of variation on how critical care after surgery was used; this included variation of the number of 'blocked beds', the number of emergency surgical procedures and seasonal variation of service pressures. Participants also noted that there were occasionally staff shortages, which contributed to a reduction in bed availability.

Respondents commented on the impact of critical care bed shortages on patient flow through the hospital.

> *"We quite often cancel elective patients on the day because there are no critical care beds available*" – Respondent 4, Consultant Anaesthetist with 27 years' experience.

> *"We still have some cancellations of major elective cancer surgery due to lack of Critical Care beds, so there are not enough critical care beds from a patient's perspective. . .2 patients (cancer) cancelled in last month due to no HDU beds*". – Respondent 5, Consultant Intensivist with 17 years' experience.

Cancellations were a common theme regarding intensive care and high-dependency beds. Elective surgery in particular was cancelled; however, participants also stated that urgent surgery could be delayed due to a lack of critical care capacity. The complexity of trying to achieve individualised decision-making was also reported, for example, in the context of competing external influences such as hospital pressures and other surgical patients:

> *"You can't individualise risk without context to the whole service i.e. I wish to reduce risk to my patient by taking up the last ICU bed but I must consider the risk to the rest of the hospital by taking that last bed*." – Respondent 6, Consultant Intensivist with 23 years' experience.

> *"Especially with increasing centralisation of. . .major services to single centres. . .[inadequate] critical care prioritisation resulting in daily service pressures*" – Respondent 7, Consultant Anaesthetist with 22 years' experience.

Table 3 Clinicians' responses to questions regarding current practice, divided by grade. Values are number (proportion).

"Do you think that there is sufficient critical care bed capacity at institution for postoperative patients that need it?"				
	No	**Yes**	**Not sure**	**Missing data**
Anaesthetist	4187 (40.3%)	1348 (13.0%)	560 (5.4%)	31 (0.3%)
Intensivist	268 (2.6%)	155 (1.5%)	29 (0.3%)	2 (< 0.1%)
Surgeon	1972 (19.0%)	1028 (9.9%)	783 (7.5%)	19 (0.2%)
Missing grade	-	-	-	1 (< 0.1%)
Total	6427 (61.2%)	2531 (24.4%)	1372 (13.2%)	53 (0.5%)
"Do you think that high-risk patients admitted for critical care postoperatively generally have better outcomes than if they were admitted onto a general surgical ward?"				
	No	**Yes**	**Not sure**	**Missing data**
Anaesthetist	145 (1.4%)	5426 (52.3%)	527 (5.1%)	28 (0.3%)
Intensivist	11 (0.1%)	395 (3.8%)	44 (0.4%)	4 (< 0.1%)
Surgeon	163 (1.6%)	3251 (31.3%)	369 (3.6%)	19 (0.2%)
Missing grade	-	-	-	1 (< 0.1%)
Total	319 (3.1%)	9072 (87.4%)	940 (9.1%)	52 (0.5%)
"Would you proceed with surgery for a high-risk patient if you knew there was no critical care capacity on the day of surgery?"				
	No	**Yes**	**Depends**	**Missing data**
Anaesthetist	1922 (18.5%)	234 (2.3%)	3938 (38.0%)	32 (0.3%)
Intensivist	150 (1.4%)	19 (0.2%)	279 (2.7%)	6 (< 0.1%)
Surgeon	2104 (20.3%)	138 (1.3%)	1542 (14.9%)	18 (0.2%)
Missing grade	-	-	-	1 (< 0.1%)
Total	4176 (40.2%)	391 (3.8%)	5759 (55.5%)	57 (0.5%)
"Do pathways exist within your institution for certain operations mandating that patients be admitted to critical care postoperatively?"				
	No	**Yes**	**Not sure**	**Missing data**
Anaesthetist	926 (8.9%)	3740 (36.0%)	1420 (13.7%)	40 (0.4%)
Intensivist	66 (0.6%)	299 (2.9%)	84 (0.8%)	5 (< 0.1%)
Surgeon	419 (4.0%)	1810 (17.4%)	1552 (14.7%)	21 (0.2%)
Missing Grade	-	-	-	1 (< 0.1%)
Total	1411	5849	3056	67

Service-wide factors, such as the centralisation of services, were viewed by participants as a negative change, commenting that although it may make economic sense, practically it is difficult to manage patients. Participants stated that often they would continue with surgery for patients with a postoperative risk of higher than 5% without critical care capacity.

Respondents generally thought critical care was beneficial due to higher levels of observation and quicker interventions (Fig. 2). Themes derived were advantages, staff, timings, patients, evidence and limitations.

> *"Better monitoring and management compared to ward"* –Respondent 8, Consultant Anaesthetist with 19 years' experience.

> *"Intensive nurse and medical care - able to respond quickly to deteriorating parameters compared with ward which is ill equipped, mainly staff-wise to deal with this"* – Respondent 9, Consultant Anaesthetist.

The perceived advantages of critical care over ward-based care illustrated that participants thought critical care could avoid poorer outcomes, with improved capacity for monitoring and management.

> *"These high-risk patients are better monitored and appropriate and timely actions are taken to maintain physiology"* – Respondent 11, Consultant Anaesthetist with 27 years' experience.

Participants noted timely management on critical care wards to be an advantage, and that the first 24–48 h postoperatively were particularly important.

> *"The wards are under-staffed at nursing level and there is a clinical doctor shortage."* – Respondent 12, Consultant Surgeon with 19 years' experience.

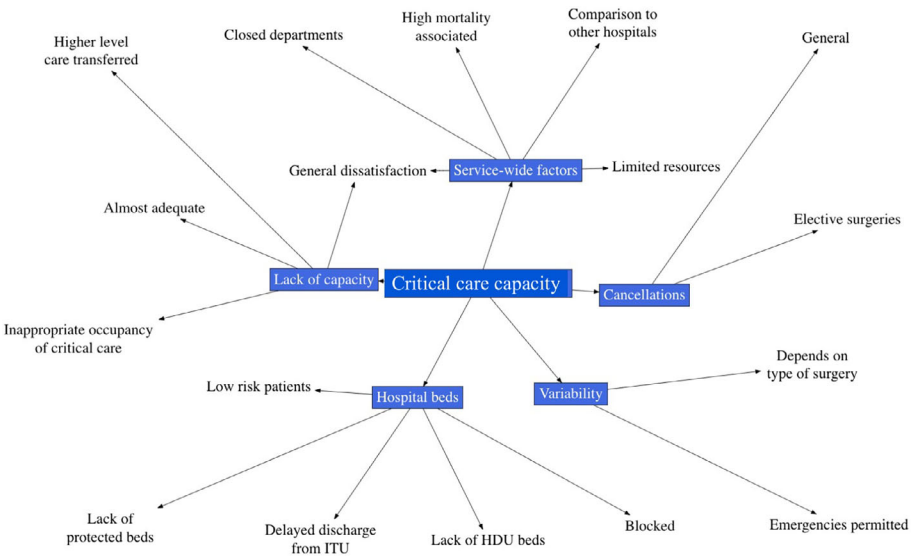

Figure 1 Thematic summary of respondents' comments on critical care capacity.

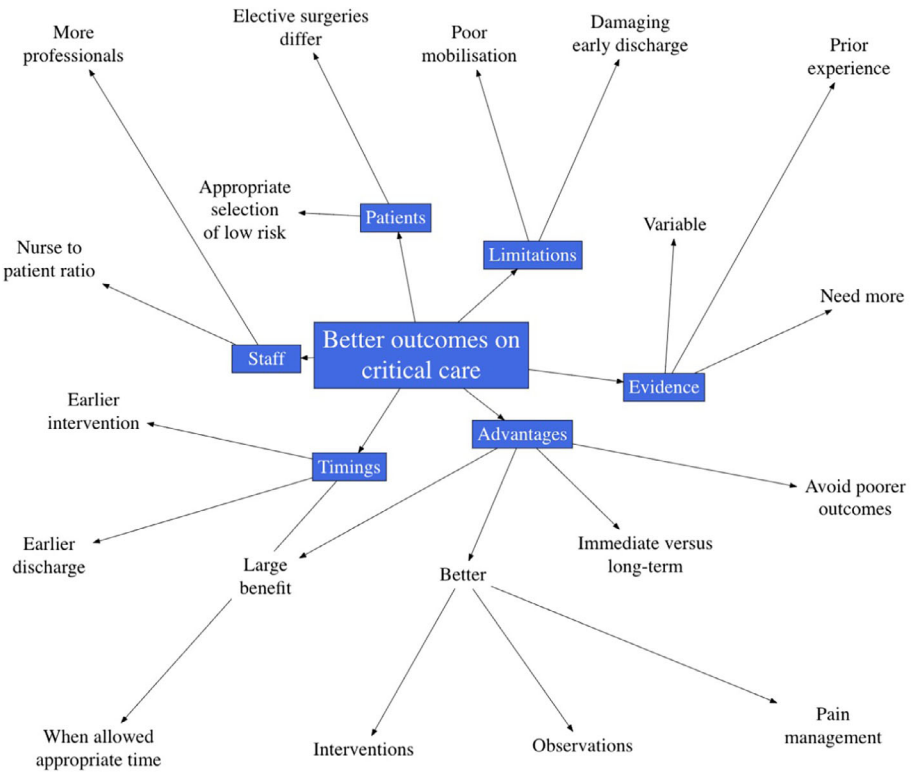

Figure 2 Thematic summary of respondents' comments on potential benefits of critical care admission after surgery.

"Twice daily consultant-led ward rounds with highly knowledgeable nursing staff" – Respondent 13, Consultant Surgeon with 15 years' experience.

"Better basic nursing care because of nurse to patient ratio" – Respondent 14, Consultant Anaesthetist with 29 years' experience.

Staffing was another key theme, with participants stating a higher nurse to patient ratio in critical care, leading to better outcomes. This was further supported by comments on ward-based care being frequently understaffed.

"Sometimes 'over-treated' in HDU but under monitored in general ward." – Respondent 15, Consultant Surgeon with 25 years' experience.

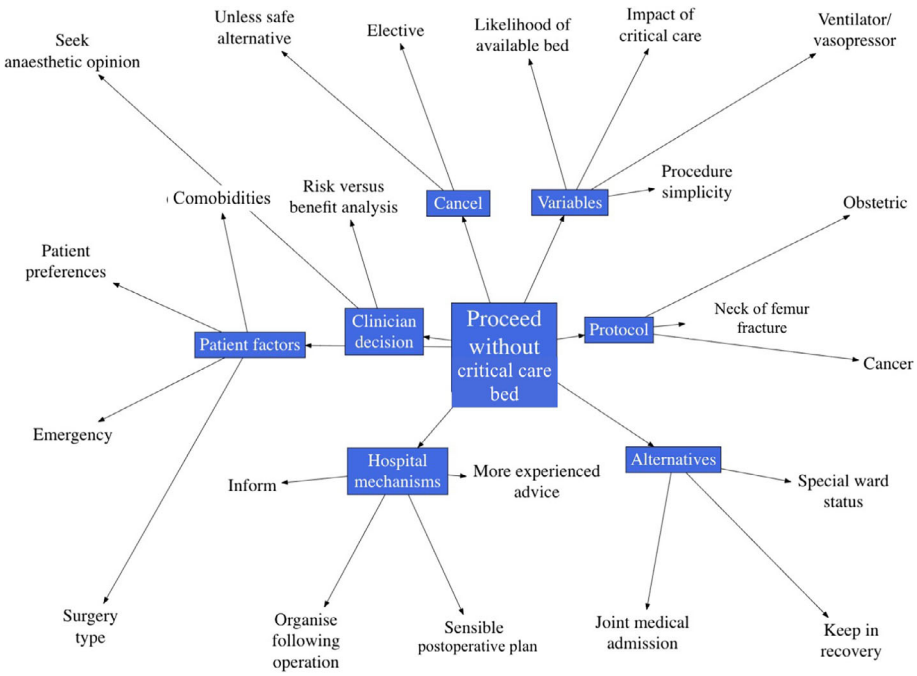

Figure 3 Thematic summary of respondents' comments on considerations regarding decisions to proceed on high-risk surgery without critical care beds available.

"Need not to discharge to ward too quickly post-surgery which is done for bed pressures… this may influence outcome" – Respondent 16, Consultant Anaesthetist with 17 years' experience.

There were some uncertainties expressed about the evidence underpinning critical care being of benefit to patients. Participants also noted difficulties in transferring patients who were fit for discharge out of critical care, and the requirement to sometimes have to discharge patients earlier than desired, due to pressure from new admissions.

Figure 3 summarises free-text responses on how respondents considered whether to proceed with surgery for a high-risk patient without appropriate critical care capacity. 'Not sure' or 'it depends' was the most common response to this question (55.4%).

"Cancer cases are not cancelled for this reason." – Respondent 17, Consultant Anaesthetist with 12 years' experience.

"In some cases especially in emergency. Risk [benefit] balance re delay must be considered." – Respondent 20, Consultant Intensivist with 20 years' experience.

Protocol adherence emerged as a theme. For example, urgent conditions such as hip fracture and cancer placed a time pressure on the surgery, which influenced behaviours regarding critical care admission, and which may mean that protocols were broken.

"I would pose the question to the patient; they are the ones taking the risk! If they prefer to postpone, so be it" – Respondent 21, Consultant Anaesthetist with 30 years' experience.

In the event of a bed being unavailable for a patient viewed as high risk, there was a suggestion that the decision about whether or not to proceed could be shared with the patient, following an informed discussion.

"Consultant opinion would be sought" –Respondent 22, Anaesthetic Specialist Trainee with 13 years' experience.

"[would depend] how urgent the surgery is, often a bed may become available eventually." – Respondent 24, Anaesthetic Specialist Trainee, with 6 years' experience.

Taking the decision to proceed without guaranteed critical care availability usually included a senior opinion and a risk vs. benefit evaluation.

"I do use overnight recovery with the blessing of ICU if appropriate." – Respondent 26, Consultant Anaesthetist with 28 years' experience.

"If follow up by outreach (24 h) staff, recovery can be a substitute for ICU admission" –Respondent 27, Consultant Intensivist with 20 years' experience.

Alternative options to critical care were proposed, such as joint medical admission and increased monitoring on a non-critical care ward. Clinicians proposed overnight recovery as an option, or a special ward status.

High nurse to patient ratio was most commonly identified as the most important likely benefit of critical care, a theme reinforced by the qualitative responses. Following this, the most important benefits were considered to be increased monitoring, consultant intensivist input and complex therapies offered. The least important benefit identified was the higher doctor:patient ratio.

Discussion

We have reported a large survey of surgeons, anaesthetists and critical care doctors, providing a perspective on how critical care resources for surgical patients are perceived and allocated in day-to-day practice in the UK. Consultants tended to have a lower threshold (based on 30-day mortality estimate) for critical care referral than early career or Specialty and Associate Specialist colleagues, and the majority stated they would recommend a patient for critical care at a lower threshold than national guidelines recommend. The reported use of objective risk assessment tools to estimate surgical risk was patchy, and critical care admission was commonly guided by procedure-specific pathways rather than individualised risk assessment. The potential value of critical care for improving patient outcomes and overcoming the limitations of normal ward care was widely appreciated, and the principal benefit was perceived to be better nurse to patient ratios.

Clinicians most frequently used the ASA physical status for risk stratification, despite this not providing an individualised assessment of risk. Individualised risk assessment necessitates consideration of all the key components of peri-operative risk, including operative urgency and magnitude, as well as patient health, which the ASA physical status may approximate. Discussions should be facilitated with patients about their individualised risk as has been recommended in the UK by the Montgomery ruling [15], which is a key criterion of consenting guidelines [16,17]. The fact that consultants felt that critical care should be used at a lower threshold than currently recommended may support the need for the "*High Risk General Surgical Patient*" [6] guidelines to be revised; this recommendation was based on expert opinion rather than high-level evidence, and revision might strengthen local business cases to increase critical care capacity.

Our qualitative analysis of free-text survey responses suggests widespread variation in critical care bed availability, influenced by both local and service-level factors. There was general consensus that critical care was superior to ward-based care through provision of regular monitoring, prompt treatment and a higher nurse to patient ratio. However, critical care capacity was commonly perceived to be inadequate for demand, and this may have led clinicians to have made the difficult decision whether to proceed with an operation. To do so, clinicians balanced the urgency of the operation and the likelihood of a bed becoming available, with the risk of proceeding without guaranteed critical care support. Another sub-study of SNAP-2 EPICCS has described the evolution of enhanced care wards and high-acuity beds, which are characterised predominantly by higher nurse to patient ratios, and which are used to provide postoperative support for patients who have a higher mortality risk, without many of the technical interventions (e.g. ventilation, vaso-active drug infusions) provided in critical care units [18]. What is unclear is the level of care (including nurse to patient ratios) or other support which would provide benefit to patients. Since this survey was conducted, a substantially increased demand for critical care has arisen as a result of COVID-19, and it is anticipated that this will be sustained for some months or years to come. This brings with it a risk that surgical patients will be even less able to access critical care after surgery, if no direct indication (e.g. requirement for mechanical ventilation) is present. In the short term, expansion of enhanced care facilities, which provide care somewhere in between the existing 'Level 0/1' and 'Level 2' criteria, might form part of a solution. They could be established to provide care for high-risk surgical patients, and additionally address the need to develop a rapidly expandable and agile workforce, which could support a significantly increased critical care population in the event of a further COVID surge or other epidemic of critically ill patients. Guidelines have recently been published in the UK which articulate the principles for patient selection, workforce, care and treatment within enhanced peri-operative care services. If widely implemented, there is the potential for these services to offer a higher standard of postoperative care to a larger proportion of high risk patients [13]. These new guidelines also provide a second reason for the existing "*Higher Risk General Surgical Patient*" [6] recommendations to be revised, taking into consideration all solutions which may support better postoperative care for high-risk surgical patients.

Our study has a number of strengths. This study investigated clinicians' views regarding who should be

referred for peri-operative critical care and factors which affect their decision-making on a day-to-day basis. The questionnaire was answered by over 10,000 anaesthetists, intensivists and surgeons providing care in over 90% of UK NHS hospitals providing major inpatient surgery, with low levels of missing data; therefore, the results are likely to be representative of clinical opinion amongst UK doctors involved in peri-operative care decision-making. There are also some limitations to our research. In particular, the response rate amongst clinicians is uncertain, and it is plausible that non-responders may have answered the questionnaire differently from respondents, leading to response bias. However, the number of surgeons and anaesthetists who routinely provide care for high-risk surgical patients would likely be lower – for example, hand surgeons or eye surgeons would rarely require their patients to have this type of support after surgery. We did not survey nurses, who might have provided an additional and very valuable perspective on some questions, particularly around critical care pressures, as we limited this survey to those clinicians who would usually be responsible for day-to-day peri-operative and critical care decision-making. There was a higher proportion of consultants as respondents, which may influence the outcome of chi-squared testing used to compare risk thresholds between consultants and non-consultants. Additionally, private sector hospitals did not participate in this study. The majority of clinicians who work in the private sector in the UK also work in the NHS; therefore, it may be interesting to contrast the attitudes and reported behaviours of individual clinicians depending on where they are working at that time, and understand the reasons for any differences. Future work in this area may benefit from more in-depth qualitative interview surveys of frontline clinical staff, including medical, nursing and allied health professionals, to elicit perceived problems and possible solutions to the issues described within this paper.

In conclusion, we have described variation in the thresholds used by different grades of doctor to determine whether patients should be admitted to critical care, with more senior doctors tending to be more risk-averse. We identified variable and overall poor use of risk stratification tools. Through qualitative analysis, we have highlighted some of the complexities governing the decision-making process, such as the challenges faced when making a decision on whether to proceed with surgery for a high-risk patient when critical care is not available. Service pressures frequently influence senior staff to make decisions which go against their better judgement and which may not be in individual patients' best interests – for example, cancelling surgery due to a lack of critical care bed, or taking the risk of proceeding with a high-risk operation without a bed. Taken together with other findings of the SNAP2 EPICCS study [3,18] we can make the following research recommendations: evaluation of the safety, clinical and cost effectiveness of enhanced care wards, which in particular, promote higher nurse to patient ratios over specific technological interventions; investigation of how to improve the implementation of formal individualised risk assessment and evaluation of the impact of this on patient care and outcomes; and operational research on patient flow through hospitals in order to address commonly reported problems related to pressures on critical care resources [19]. In addition, from a policy perspective, revision of national guidelines regarding thresholds for critical care admission after surgery may be warranted, both to reflect the existence and potential expansion of enhanced care, and our findings that senior clinical opinion indicated that lower thresholds for postoperative critical care admission should ideally be applied.

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Supporting Information

Additional supporting information may be found online via the journal website.

Figure S1. Risk stratification tool use, subdivided by specialty, illustrated as Likert summary.

Figure S2. Risk stratification tool use, subdivided by grade, illustrated as Likert summary.

Appendix S1. Participant questionnaire.

