

SPECIAL ARTICLE

Multidisciplinary, evidence-based, patient-centred perioperative patient safety recommendations: a European consensus study[☆]

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[†]The investigator groups are listed in [Appendix 1](#).

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Abstract

Background: Surgery-related adverse events are among the most common adverse events in-hospital. However, no comprehensive, multidisciplinary perioperative guidelines exist at the European level. The aim of this study is to describe the process and results in achieving European multidisciplinary consensus on perioperative patient safety recommendations. **Methods:** This multimethod study included: (1) a systematic review of guidelines; (2) selection and synthesis of recommendations; and (3) a two-round modified Delphi technique including a 2-day face-to-face consensus conference. We recruited a panel of two expert groups balanced in terms of gender, geographical origin, and professional background, with meaningful participation from patient representatives. Consensus was defined as at least 70% of the panel rating a recommendation 7–9 on a 9-point Likert scale for importance to patient safety and feasibility of implementation.

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Results: The systematic review included 267 guidelines, from which 4666 patient safety recommendations were identified and extracted. After four synthesis rounds, 99 recommendations were presented for the Delphi survey, detailing their strength of recommendation, level of evidence, and methodological quality of the cited guidelines. An expert group, composed of 66 multidisciplinary experts from 19 European countries, participated with a response rate of 80.3%. After the two Delphi rounds and the consensus conference, the panel agreed on a final set of 101 recommended perioperative patient safety practices.

Conclusions: A set of 101 comprehensive, evidence-based, patient-centred perioperative patient safety practices was developed through a European consensus process to improve the quality of care in healthcare facilities across Europe and beyond.

Keywords: evidence-based practice; medical errors patient safety; perioperative care; practice guidelines; quality; risk management; safety

Editor's key points

- Surgery-related incidents are the most common in-hospital adverse events. Although adoption of evidence-based practices can significantly improve surgical care safety outcomes, no comprehensive European consensus guidelines are available.
- An international multidisciplinary consortium conducted a multimethod study of perioperative patient safety recommendations as part of the SAFEST project that included a systematic review of perioperative guidelines, selection and synthesis of available evidence-based recommendations, a modified Delphi consensus building approach, and a face-to-face consensus conference.
- This resulted in a European multidisciplinary consensus of evidence-based, patient-focused recommendations for patient safety for the perioperative care of adults.
- The outcome is a set of 101 comprehensive, evidence-based, patient-centred consensus perioperative patient safety recommendations.

The rate of preventable harm from healthcare is estimated to be 6.0% globally.¹ In-hospital mortality after surgery in Europe is ~4%, with a range of 0.4–6.9%.² Surgery-related incidents are the most common in-hospital adverse events.^{1,3} These incidents affect both high-income and low- and middle-income countries alike, regardless of differences in their healthcare systems, and exhibit similar rates of adverse outcomes after inpatient surgery.⁴

Evidence-based recommendations are essential for policy and guideline development, as they enable standardisation of high-quality care. These recommendations help reduce avoidable disparities in care both across different providers^{5,6} and within individual providers over time.^{6,7} Adoption of evidence-based practices can significantly improve surgical care safety outcomes.^{8–10}

The World Health Organization (WHO) has initiated the *Global Patient Safety Action Plan 2021–2030*,¹¹ and several national agencies and scientific societies have issued policies and guidance for implementing up-to-date evidence-based practices.^{12–14} However, these recommendations are often dispersed across multiple guidelines, at national or regional levels, or targeted narrowly within specific areas of

perioperative care. A comprehensive, European, multidisciplinary consensus on perioperative patient safety practices is still lacking. Decision makers and frontline providers need guidance that not only synthesises available recommendations but also helps prioritise those most relevant for patient safety, easiest to implement, and most significant for patients. The objective of this study was to describe the process and results of achieving a European multidisciplinary consensus on evidence-based, patient-focused recommendations for patient safety across the perioperative continuum of care for adults.

Methods

We conducted a multimethod study focusing on perioperative patient safety recommendations (PPSRs), which comprised the following sequential steps: (1) a systematic review of perioperative guidelines; (2) selection and synthesis of available evidence-based recommendations; (3) a Europe-wide modified Delphi technique; and (4) a face-to-face consensus conference. This study was embedded within the framework of the SAFEST project.¹⁵ Ethical approval for the research and methods used in the SAFEST project was granted on July 26, 2022, by the local Clinical Research Ethics Committee from IDIAP Jordi Gol (22/146-P) in Catalonia, Spain.

Systematic review of guidelines

We performed a systematic review of clinical practice guidelines to compile and describe available patient safety recommendations across the perioperative care continuum for the adult population. In accordance with the PRISMA 2020 statement, we searched MEDLINE, Embase, Cochrane, Virtual Health Library Regional Portal, and Trip Database using a Population, Intervention, Comparison, Attributes of eligible guidelines, and characteristics of the Recommendations (PICAR) question.¹⁶ An extensive search of grey literature was also conducted, with international experts providing regional or national perioperative safety-related guidelines. A detailed description of the methodology and PRISMA flow diagram for guideline selection has been published.¹⁷

Initial selection and synthesis of perioperative patient safety recommendations

A selection and synthesis of the extracted recommendations was conducted through an iterative process.

Firstly, we prioritised those with the highest strength of recommendation as reported in the respective guidelines. Recommendations with low or unreported strength of recommendation were excluded from the initial selection.

Secondly, we identified duplicates and overlaps through a manual search of the selected recommendations within 12 predefined perioperative patient safety areas. Similar recommendations were linked, distinguishing primary recommendations from secondary supporting recommendations. In four synthesis rounds, four pairs of researchers with clinical experience in surgery, anaesthesiology, or quality of care tracked and merged verbatim texts into single recommendation proposals. Disagreements were resolved by an additional senior researcher.

Thirdly, we compiled the initial list of PPSRs, detailing their strength of recommendation and level of evidence, and the methodological quality of the clinical practice guidelines assessed using the rigour of development module of the AGREE II tool.¹⁸ The recommendations were categorised into 12 perioperative patient safety areas and three predefined phases of the perioperative care continuum: preoperative, intraoperative, and postoperative phases. Recommendations applicable to more than one phase were categorised as combined perioperative (preoperative, intraoperative, and postoperative) phases.

Europe-wide online modified Delphi survey

Recruitment of experts

We performed an online two-round modified Delphi technique^{19,20} compliant with the CREDES reporting recommendations.²¹ Two expert groups were recruited sequentially (Supplementary material 1): (1) the Scientific Executive group (SEG) and (2) the Scientific Advisory group (SAG). The SEG included 11 multidisciplinary members of the SAFEST consortium, including a patient representative. The SEG oversaw the Delphi survey regarding its content, timing, recruitment, and data interpretation throughout the study. The SAG was recruited over a 3-month period (September–November 2022) from European Union and associated countries (Switzerland, Turkey, Ukraine, UK). We aimed for at least a 60-member panel, selecting multidisciplinary stakeholders via institutional websites and personal contacts using a ‘stakeholder mapping’ analysis (available upon request). Priority was given to representatives from scientific societies (primarily nursing, anaesthesiology, and surgery) and patient organisations. Efforts were made to balance gender, geography, setting, and professional background to ensure diversity of perspectives while maintaining organisational representativeness, clinical experience, and patient safety expertise.^{22,23}

All participants in the SEG and SAG signed informed consent forms and declared any conflicts of interest.

Delphi survey questionnaire

The candidate list of PPSRs was presented in an *ad hoc* online questionnaire, including both technical and lay language versions. The lay version was developed by an English-speaking researcher with the assistance of ChatGPT-4 (OpenAI),²⁴ using the prompt ‘provide a lay language wording of the following sentence’. Then, it was reviewed by at least two researchers, and the SEG patient representative.

Panellists rated each PPSR for importance and feasibility using a 9-point Likert scale.²⁵ Importance was defined as ‘the

potential impact for improving the safety of the surgical patient’. Feasibility was defined as ‘the ease of implementation given its costs in terms of human, material, and economic resources’.²⁶

Consensus was defined as 70% agreement in the three highest categories (from ‘agree’ to ‘very strongly agree’) on the Likert scale. PPSRs were excluded only after discussion with the panel when consensus was not reached. Free-text fields allowed panellists to provide additional comments, questions, and suggestions.

Modified Delphi rounds procedures and analyses

The SAG members had 3 weeks to respond to each of the two rounds (round 1: December 30, 2022 to January 22, 2023; round 2: February 10, 2023 to March 5, 2023). Weekly reminders were sent by e-mail during these periods.

After each round: (1) quantitative results were compiled, and each participant received an individual report detailing their responses alongside group medians and interquartile ranges to encourage reflection and consensus-building²⁷; (2) qualitative feedback from free-text responses was systematically tabulated and peer reviewed before implementing any rewording, merging, addition, or removal of PPSRs; and (3) any changes in PPSR wording, number, or content were reviewed by the SEG for feedback and subsequently presented to the SAG in online meetings, incorporating both quantitative and qualitative results.

Face-to-face consensus conference

The final stage was a 2-day in-person meeting held on March 28 and 29, 2023, in Brussels. Eight SEG members and a selection of 20 SAG members were invited to participate. Invitations were sent sequentially by stratified groups to maintain balance between specialties and professional and non-professional backgrounds, particularly ensuring the presence of patient representatives.

Besides the feedback provided after each round, additional qualitative feedback was prepared for the consensus conference owing to the relevance of these rating differences. This included the ranked position of the highest PPSR rated on importance by patient representatives and a dedicated session on patient perspective. The consensus conference was organised into several thematic sessions: PPSR finetuning; patient perspective; equity; feasibility; and implementation considerations. Each session began with an introductory lecture on the topic, followed by a participatory collaborative activity, group discussion, or plenary Q&A session if needed. Researchers moderated the group discussions and took notes on both plenary and group debates.

Final SAFEST perioperative patient safety recommendations

After the consensus conference, a refined SAFEST PPSR list was shared with the SEG and the SAFEST research group for final approval. We used the nomenclature of the GRADE working group guidelines²⁸ to classify any SAFEST PPSR as ‘recommended’ when the level of evidence for at least one supporting recommendation from the systematic review was high; otherwise, they were classified as ‘suggested’. To provide additional relevant information for guiding future quality improvement initiatives, we used the 90th percentile cut-off^{29,30} to highlight the highest rated SAFEST PPSRs in terms of

importance and feasibility. Additionally, those rated highest in importance by patient representatives were also highlighted as a proxy for the most critical safety topics for patients.

Statistical analysis

Descriptive analyses were performed and stratified by subgroups of interest, including anaesthetists, nurses, patient representatives, primary care physicians, quality and safety experts, surgeons, and others. Responses from patient representatives were compared against those from professionals (i.e. the rest of the panel). Any significant differences across groups were reviewed with the research team and feedback was provided to panellists during the consensus conference. Kolmogorov–Smirnov normality test and bivariate analysis using Mann–Whitney *U*-test were performed. For subgroup analyses, multiple pairwise comparisons were adjusted using Tukey's correction.³¹ Data analysis and graphical presentations were performed using Stata 14 (StataCorp. 2015. Stata Statistical Software: Release 14. StataCorp LP, College Station, TX, USA) and spreadsheets.

Results

Systematic review and synthesis of recommendations

A total of 267 guidelines were included in the systematic review, from which 4666 recommendations were identified and extracted. Among these, 2095 recommendations were identified as strongly recommended by the cited guidelines and were selected for synthesis. A more detailed description of the results is available.¹⁷ After removing duplicated content and merging similar recommendations, 99 PPSRs were derived from the synthesis rounds and utilised for the consensus Delphi technique. The entire selection process and subsequent phases are presented in [Figure 1](#).

Online modified Delphi technique

A total of 115 invitations were sent to potential SAG panellists, with 66 (57.4%) representatives accepting it. Further details on participant characteristics and declared conflicts of interest are described in [Supplementary material 1](#). The SAG panellists were equally distributed in terms of gender during the Delphi rounds (female prevalence ~50%). Anaesthesiology was the most represented professional category, and patient representatives accounted for ~10%. The panel comprised representatives from 25 countries, 24 of which were European. Descriptive statistics from the respondents are presented in [Supplementary material, Table S3](#). The completion rate was 86.4% in round 1 and 80.3% in round 2.

Of the initial 99 PPSRs, 69 were rephrased during the first Delphi survey round, three were merged with other recommendations, and eight new practices were added, resulting in 104 PPSRs for the second round ([Fig. 1](#)). The second Delphi survey round resulted in minor rewordings for 89 PPSRs, with 12 requiring further discussion at the face-to-face consensus conference. Qualitative responses from the panel in both rounds are available in [Supplementary material 2](#). No additional changes were proposed after the second round.

The first round of the Delphi survey resulted in agreement on 96 out of 99 PPSRs concerning their importance for patient safety, and 33 PPSRs concerning their feasibility. After the second round, agreement increased to 102 PPSRs on importance for patient safety and 85 PPSRs on feasibility of the 104

evaluated. Of these, 84 PPSRs were agreed upon as both important and feasible after the second round, whereas 18 important PPSRs lacked consensus on feasibility. Detailed quantitative analysis and panel results by individual PPSRs for both rounds of the Delphi questionnaire are shown in [Supplementary material 3](#).

Subgroup quantitative analyses revealed an unequal distribution in the number of PPSRs that reached consensus among professional backgrounds. However, only the pooled feasibility ratings of patient representatives against the rest of the panel showed a statistically significant difference in round 1 (Mann–Whitney *U*-test, $P=0.03$). Differences in feasibility ratings by PPSR between these two groups were substantial ([Supplementary material 4](#)); in round 2, there was a statistically significant difference between patient representative ratings and those of professionals for 16 PPSRs.

Regarding importance results in round 2, differences in ratings for the PPSRs between patients and professionals were statistically significant for 'Surgical risk scales for morbidity and mortality' (mean of 8.8 vs 8.0, $P=0.05$) and 'Rehabilitation adjusted to the patient's characteristics' (8.8 vs 7.7, $P=0.02$) ([Supplementary material 4, Table S13](#)).

Face-to-face consensus conference

The consensus conference was held with the participation of 20 SAG members and eight SEG members ([Supplementary material 1](#)). The panellists agreed on a final list of 101 PPSRs, confirming the exclusion of two PPSRs that could not reach agreement during the second round of the Delphi survey, and an additional PPSR that was considered of no added value to be included (reducing surgery time to the maximum allowable in high-risk patients), as it is a usual aim in every surgical procedure. Final rewordings were suggested for 12 PPSRs ([Supplementary material 2](#)).

The PPSRs rated highest in importance by patient representatives were presented during the patient perspective session, leading to emergence of three main themes from the patient perspective: (1) patient engagement; (2) appropriate and accessible patient information; and (3) continuity of care.

Final SAFEST perioperative patient safety recommendations

Descriptive statistics of the 101 SAFEST PPSRs are presented in [Table 1](#), with the complete list provided in [Table 2](#).

Based on high level of evidence in at least one of the supporting recommendations, 21 PPSRs were graded as 'Recommended' ([Table 3](#)). The majority of PPSRs (53, 52.5%) were categorised as being applicable to more than one perioperative phase. 'Patient support and complication prevention' and 'Standard surgical and anaesthetic procedures' were the most represented areas, accounting for 19.8% and 16.8% of PPSRs, respectively. The quality of guidelines from which the evidence was extracted was moderate or high for 85.1% of the PPSRs.

A complete description of the SAFEST PPSRs is available in [Supplementary material 5](#), including technical and lay language descriptions, verbatim recommendations extracted from the systematic review and their references, level of evidence, strength of recommendation, and methodological quality of the cited guidelines. A graphical representation of the recommendations, emulating a Patient Safety Compass, is provided in [Supplementary material 6](#).

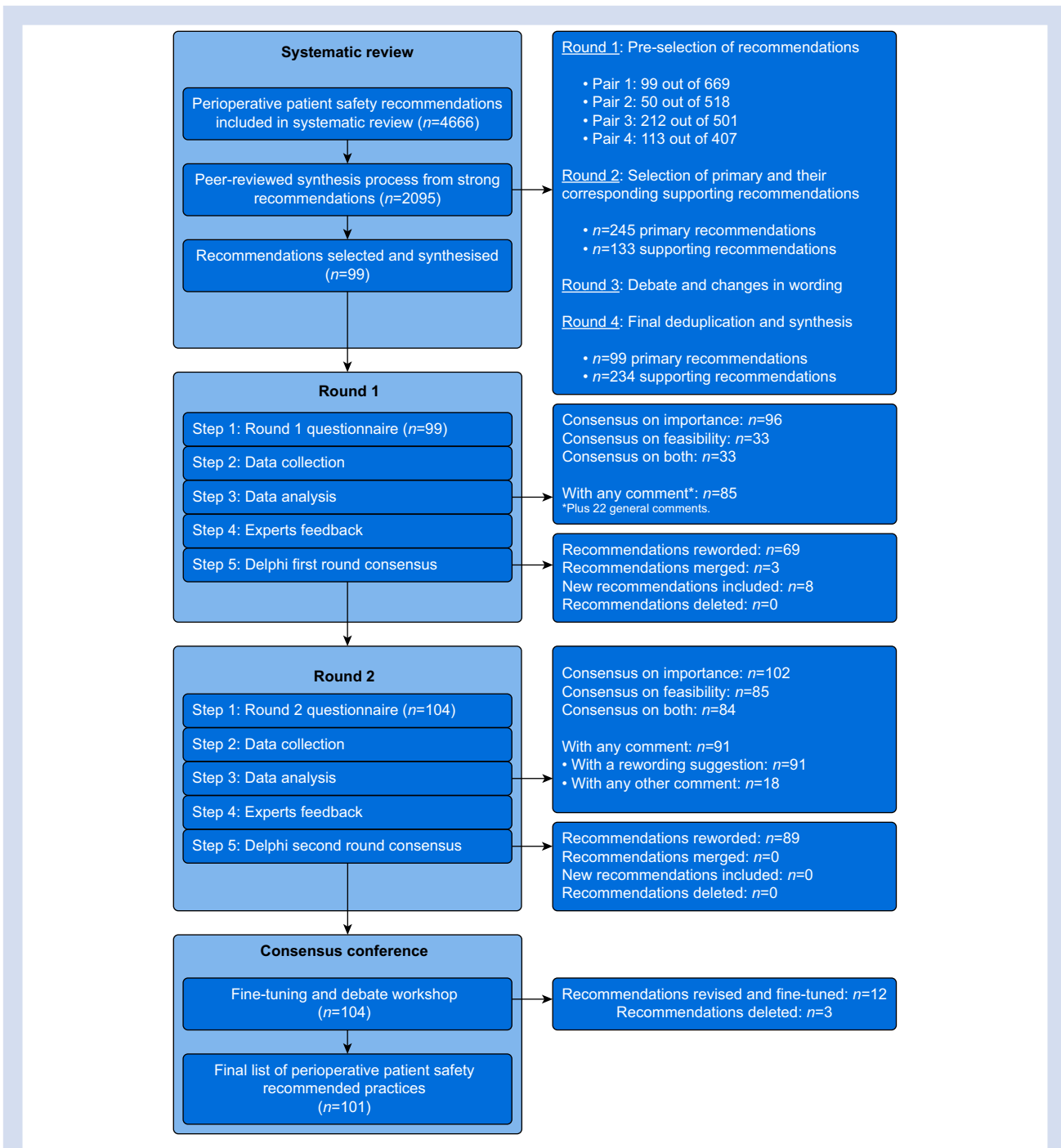


Fig 1. Delphi synthesis, selection, and consensus steps of the perioperative patient safety recommendations. Left-side boxes depict the phases of the consensus process. Right-side boxes provide details of the results gathered in each phase. The initial 4666 recommendations included in the peer-reviewed synthesis were selected from the extracted raw data from Martinez-Nicolas and colleagues.¹⁷

Discussion

We developed a European multidisciplinary consensus on 101 evidence-based, patient-oriented PPSRs in adults, with a high agreement on their relevance to reducing preventable surgical

patient harm. Previous initiatives have primarily focused on the field of anaesthesia.^{12,13} Additionally, a recent publication of national safety standards has been published in the UK for adoption at any health system level by any surgical provider.¹⁴ However, to the extent of our knowledge, this is the first list of

Table 1 Descriptive statistics of the 101 perioperative patient safety recommendations (PPSRs).

PPSR characteristics	Statistics
Number of original recommendations per PPSR, mean (sd)	3.2 (2.9)
Strength of recommendation, n (%)	
Recommended	21 (20.8)
Suggested	80 (79.2)
Highest level of evidence in each PPSR, n (%)	
High	21 (20.8)
Moderate	19 (18.8)
Low	13 (12.9)
Very low	39 (38.6)
Not reported	9 (8.9)
Highest guideline quality in each PPSR, n (%)	
High	36 (35.6)
Moderate	50 (49.5)
Low	6 (5.9)
Not determined	9 (8.9)
Perioperative phases, n (%)	
Preoperative phase	14 (13.9)
Intraoperative phase	20 (19.8)
Postoperative phase	15 (14.9)
Combined perioperative (preoperative, intraoperative, and postoperative) phases	52 (51.5)
Patient safety area, n (%)	
01. Safety and quality management	10 (9.9)
02. Human resources	4 (4.0)
03. Equipment	5 (5.0)
04. Communication	7 (6.9)
05. Patient information	4 (4.0)
06. Preoperative evaluation	8 (7.9)
07. Continuity of care	9 (8.9)
08. Medication safety	8 (7.9)
09. Blood management	3 (3.0)
10. Infection prevention	12 (11.9)
11. Intraoperative complications prevention	9 (8.9)
12. Common complications prevention	22 (21.8)

best practices covering the entire perioperative care continuum, with an international scope and not limited to a single surgical discipline or patient population.

The main strengths of our study include its use of the raw extracted data from a previous systematic review of guidelines on perioperative patient safety as a starting point,¹⁷ followed by consensus through a multidisciplinary, gender, and geographically balanced panel. This panel comprised a variety of experts from clinical, quality and safety, managerial, and industry fields, and patient representatives.

Our PPSRs include tangible care-related interventions (e.g. use of noninvasive positive pressure ventilation after tracheal extubation, asepsis for central venous catheter placement, generalised use of minimally invasive surgery), multidisciplinary practices for patient safety (e.g. preoperative team discussion for optimal surgical planning for complex patients, frail patient perioperative management, deteriorating patient detection, and rescue strategies), and facility-level approaches (e.g. quality of care audits, a second victim support programme, fostering a strong safety culture). Cross-cutting issues conceptually embedded in the PPSRs include protocolisation of care through guideline implementation (e.g. protocols and training for postoperative care, Enhanced Recovery After Surgery programmes), communication and human factors (e.g. standardised verbal communication, reduction of communication barriers, safety pauses), and

structural aspects of care such as medication or equipment (e.g. dantrolene for malignant hyperthermia, bleeding-related point-of-care diagnostics, NRFit connections to reduce medication errors), or appropriate staffing levels and training.

Characteristics attributed to the PPSRs, such as their highest rated importance (both overall and for the patient subgroup), level of evidence, strength of recommendation, feasibility, and the supporting guidelines' methodological quality, help support the necessary prioritisation for their effective and progressive implementation in a clinical setting. The SAFEST Patient Safety Compass (Supplementary material 6) can be used as a graphical tool to facilitate this process. Level of evidence information was provided to panellists and is used to highlight the PPSRs as 'recommended' to underscore their relevance. We avoided selectively choosing high level of evidence recommendations as we acknowledge the difficulty of achieving high level of evidence in patient safety research. System-wide interventions (i.e. multicomponent interventions targeting healthcare service impacts and outcomes) might have more subtle or indirect effects given the complexity of any health system.^{6,32}

We have expanded the focus on perioperative patient safety to preadmission and postdischarge care, involving primary care, which is often missing from previous work.^{12–14} By doing so, the concepts of continuity and integrated care^{33,34} are better incorporated into the surgical patient pathway. This approach is not limited to handovers and communication within secondary or tertiary care facilities but also involves out-of-hospital providers and patient caregivers, significantly impacting patient safety and improving surgical outcomes, both before^{35,36} and after a hospital episode of care.^{37–39}

Patient involvement strategies are of utmost importance in the current healthcare landscape, particularly in patient safety.⁴⁰ Some of these strategies (e.g. promoting a culture of openness and transparency, shared decision-making, patient reporting systems, disclosure of patient safety incidents) are included in the 28 highest rated PPSRs on importance by patient representatives and should be given special consideration. Once prioritised, they can be complemented with local patient journey mappings⁴¹ or other qualitative approaches,⁴² to identify patient-centred priorities and levers for micro-level improvement.

The PPSRs can also serve as useful resources for situational assessment if used as performance measures. They could be used for both national and local evaluation and monitoring activities, and potentially for accreditation purposes. Future research should focus on defining proper measures through a thorough review of existing indicators,^{43,44} defining a core outcome set,⁴⁵ and developing standards for healthcare assessment and identifying priority areas for action.

Our study has several limitations. Firstly, some patient safety strategies might have been omitted as we based the initial set of recommendations on a 10-yr systematic review. To mitigate this, we designed an inclusive criterion for the PICAR question and included both databases and grey literature searches. The large number of extracted recommendations indicates that our exploration likely covered the most relevant and common patient safety interventions. We considered relevance to patient safety as the only criterion for including PPSRs to obtain the most comprehensive consensus. Two expert groups were given the opportunity to propose additional recommendations during the consensus process.

Secondly, variability in SAG recruitment response could have led to differences in feasibility and importance ratings across subgroups. We aimed to provide the broadest perspective during

Table 2 List of 101 SAFEST perioperative patient safety recommendations (PPSRs). SR, strength of recommendation. *Priority defined as: I, rated over 90th percentile on importance; F, rated over 90th percentile on feasibility; P, rated over 90th percentile on importance by patient representatives. Full description of all PPSRs is described in [Supplementary material 5](#).

Recommendation (ID, title)	SR	Priority*
01. Safety and quality management		
PPSR-001. Safety culture enhancement	Suggested	
PPSR-002. Proactive risk identification tools	Suggested	
PPSR-003. Multidisciplinary training for safety and teamwork	Suggested	
PPSR-004. Patient identification verification	Suggested	I, F, P
PPSR-005. Quality indicator monitoring	Suggested	
PPSR-006. Continuous audits of care	Recommended	P
PPSR-007. Complaints and incident analysis	Suggested	P
PPSR-008. Crisis management aid availability	Suggested	
PPSR-009. Post-incident support for healthcare teams	Suggested	P
PPSR-010. Morbidity and mortality meetings	Suggested	
02. Human resources		
PPSR-011. Staffing levels protocols	Suggested	
PPSR-012. Full surgical teams for high-risk surgeries	Suggested	
PPSR-013. Availability of anaesthesia assistants	Suggested	
PPSR-014. Pain management training	Suggested	
03. Equipment		
PPSR-015. Minimum anaesthesia equipment availability	Suggested	
PPSR-016. Point-of-care diagnostic facilities	Suggested	
PPSR-017. Daily anaesthesia equipment verification	Suggested	I, F, P
PPSR-018. Minimum equipment in post-anaesthesia care unit	Suggested	I, F, P
PPSR-019. Medical equipment maintenance protocols	Suggested	I, F
04. Communication		
PPSR-020. Multidisciplinary preoperative discussions for complex cases	Suggested	
PPSR-021. Verbal communication standardisation	Suggested	
PPSR-022. Effective communication enhancements	Suggested	
PPSR-023. Standardised handover process	Recommended	P
PPSR-024. Surgical safety checklist implementation	Recommended	I, P
PPSR-025. Safety pause initiative	Suggested	
PPSR-026. Continuous patient data documentation	Suggested	
05. Patient information		
PPSR-027. Comprehensive discharge information	Recommended	P
PPSR-028. Patient engagement in their own safety	Suggested	
PPSR-029. Shared decision-making	Suggested	P
PPSR-030. Postoperative helpline availability	Suggested	
PPSR-031. High-risk patient identification protocols	Suggested	
06. Preoperative evaluation		
PPSR-032. Surgical risk scales use	Suggested	P
PPSR-033. High-risk patients prioritisation	Suggested	
PPSR-034. Reassessment if prolonged preoperative period	Suggested	I, P
PPSR-035. Written preoperative policies	Suggested	
PPSR-036. Further Preoperative optimisation for high-risk situations	Recommended	
PPSR-037. Primary care participation in the preoperative optimisation	Suggested	
PPSR-038. Preoperative accompaniment needs assessment	Suggested	
07. Continuity of care		
PPSR-039. ERAS guidelines adaptation	Suggested	P
PPSR-040. Uniform ambulatory surgical care standards	Suggested	
PPSR-041. Safe postoperative transportation protocols	Suggested	
PPSR-042. Postoperative care protocols	Suggested	
PPSR-043. Postoperative respiratory risk assessment	Suggested	
PPSR-044. Comprehensive post-day surgery assessment	Suggested	
PPSR-045. Critical care outreach services	Suggested	P
PPSR-046. Continuity of care protocols	Suggested	
PPSR-047. Tailored rehabilitation programmes	Recommended	P
08. Medication safety		
PPSR-048. Medicines management protocols implementation	Recommended	
PPSR-049. Medication handling training	Suggested	I, P
PPSR-050. Medication administration safety protocols	Suggested	I, P
PPSR-051. Pre-prepared emergency medication use	Suggested	
PPSR-052. Medication labelling and colour-coding standards	Suggested	I, P
PPSR-053. Sound-alike and look-alike medications precautions	Suggested	F
PPSR-054. Single-use vials protocol	Suggested	F
PPSR-055. Specific connection standards for neuraxial infusions	Suggested	
09. Blood management		
PPSR-056. Patient blood management strategy	Recommended	
PPSR-057. Blood transfusion protocols	Suggested	I, F, P

Continued

Table 2 Continued

Recommendation (ID, title)	SR	Priority*
PPSR-058. Massive transfusion protocols	Suggested	
10. Infection prevention		
PPSR-059. Operating room floor mapping for sterility	Suggested	
PPSR-060. Infrastructure works surgical area contamination prevention	Suggested	P
PPSR-061. Surgical site infection prevention bundle	Recommended	
PPSR-062. Perioperative hand hygiene	Suggested	I, F, P
PPSR-063. Perioperative blood glucose monitoring	Recommended	
PPSR-064. Glove change protocol to reduce infection risk	Suggested	
PPSR-065. Sterile closure trays use	Suggested	
PPSR-066. Cleaning protocol following contaminated surgery	Suggested	I, F, P
PPSR-067. Aseptic techniques for central vascular catheter placement	Suggested	F,
PPSR-068. Peripheral catheter infection prevention	Suggested	
PPSR-069. Urinary catheter infection prevention	Suggested	
PPSR-070. Invasive devices early removal	Recommended	
11. Intraoperative complications prevention		
PPSR-071. Minimally invasive surgical techniques	Recommended	
PPSR-072. Patient-tailored alarm settings	Suggested	
PPSR-073. Anaesthesia depth monitoring	Suggested	
PPSR-074. Protective ventilation strategies	Suggested	
PPSR-075. Laparoscopy insufflation pressure monitoring	Recommended	
PPSR-076. Dantrolene accessibility for malignant hyperthermia	Suggested	
PPSR-077. Bone cement implantation syndrome prevention	Suggested	
PPSR-078. Retained Surgical items prevention procedures	Suggested	P
PPSR-079. Verification of neuromuscular block reversal	Recommended	
12. Common complications prevention		
PPSR-080. Perioperative high-risk patient management protocols	Suggested	
PPSR-081. Timely hip fracture surgical treatment	Suggested	
PPSR-082. Deterioration alert systems for patients awaiting surgery	Suggested	
PPSR-083. Screening for depression in vulnerable populations	Suggested	
PPSR-084. Coordinated care for frail patients	Suggested	P
PPSR-085. Perioperative antiplatelet therapy management	Suggested	
PPSR-086. Perioperative fasting guidelines	Suggested	
PPSR-087. Fire safety precautions in surgical procedures	Recommended	P
PPSR-088. Difficult airway management protocol	Suggested	
PPSR-089. Local anaesthetic systemic toxicity protocol	Suggested	F
PPSR-090. Postoperative nausea and vomiting prevention	Recommended	
PPSR-091. Unintentional hypothermia prevention	Recommended	
PPSR-092. Venous thromboembolism prevention	Recommended	P
PPSR-093. Goal-directed haemodynamic therapy for high-risk patients	Recommended	
PPSR-094. Continuous monitoring in recovery areas	Suggested	
PPSR-095. Noninvasive ventilation for high-risk postoperative patients	Suggested	
PPSR-096. Pain control protocols	Suggested	
PPSR-097. Postoperative monitoring for sleep breathing disorders	Suggested	
PPSR-098. Early postoperative oral intake	Recommended	F
PPSR-099. Postoperative delirium risk reduction strategies	Recommended	P
PPSR-100. Fall precautions for at-risk patients	Suggested	P
PPSR-101. Pressure injury prevention	Suggested	

the consensus process, including frontline professionals and not exclusively experts in patient safety. We conducted dedicated analyses across subgroups to investigate this potential source of variation. No bias was detected, and although a relatively low number of patient representatives provided responses, we believe our results offer useful evidence-based practices from both professional and patient perspectives.

Thirdly, some PPSRs result in broad or unspecific recommendations. Further adaptation to local contextual factors and circumstances might be needed to translate them into implementable activities (e.g. using driver diagrams to articulate narrower improvement actions).⁴⁶ Thus, we recommend an in-depth review of barriers and facilitators for each standard, and a local analysis using rigorous approaches such as the Consolidated Framework for Implementation Research⁴⁷ during implementation.

Our focus on a European-wide consensus might limit applicability of these practices in other regions. However, despite disparities in anaesthesia⁴⁸ and surgery across high-income and low- and middle-income countries,^{49,50} the standards promoted are likely to be useful for enhancing health systems and strengthening patient safety globally for several reasons. They are based on a systematic review of clinical practice guidelines¹⁷ that included a comprehensive search of the bibliography without geographical and language limits, incorporating guidelines from other than high-income countries as well. The SAG included representatives from 24 European countries with heterogeneous income levels and healthcare systems. The recommendations include a feasibility evaluation, facilitating prioritisation of the most easily implementable strategies in cases of resource constraints. Finally, patient safety issues during the perioperative period

Table 3 SAFEST perioperative patient safety recommendations (PPSRs) selection based on high level of evidence of the supporting recommendations in the systematic review.

Recommendation (ID, title, and description)	Area
PPSR-006. Continuous audits of care The hospital performs continuous audits of care processes, guideline compliance, and outcomes, which are shared with the entire multidisciplinary team.	Safety and quality management
PPSR-023. Standardised handover process A standardised handover process for patient information transfer between individuals and teams is implemented.	Communication
PPSR-024. Surgical safety checklist implementation A locally adapted WHO Surgical Safety Checklist, or equivalent (e.g. SURPASS), is adopted and used by the surgical team applying memory aid tools.	Communication
PPSR-027. Comprehensive discharge information Patients and caregivers receive verbal and written understandable and complete personalised information upon discharge. This information is also provided to primary healthcare and community social providers to ensure continuity of care with special emphasis on medication changes and prescription.	Patient information
PPSR-036. Further preoperative optimisation for high-risk situations Deeper preoperative evaluation and treatment is provided if elective surgeries can be delayed, in certain clinical situations, including: acute coronary syndrome in patients undergoing noncardiac surgery, large or multiple strokes and severe neurological symptoms, current infections unrelated to the planned surgery, current venous thromboembolisms (VTEs), anaemia in major surgical patients, and decompensation of chronic pathologies.	Preoperative evaluation
PPSR-047. Tailored rehabilitation programmes The rehabilitation programme is tailored to each patient's individual needs and characteristics, with specific focus given to respiratory physiotherapy, as necessary.	Continuity of care
PPSR-048. Medicines management protocols implementation Protocols are implemented to ensure reliable medicines management, including accurate medication history documentation on admission, patients' medicines used during hospitalisation, technological resources (e.g. bar-coding, computerised prescriber orders, pharmacy automation), stock review and management, supply, expiry checks, and access to appropriately trained pharmacy staff to manage any medicine shortages. Medication storage is organised following safety considerations: separating medications by generic name and packaging; separating high-alert medications, with systematic segregation of medication for general anaesthesia and neuraxial anaesthesia/peripheral blocks; providing separate bins or proper dividers for all medications; label storage compartments; use tall man lettering; use both, generic and brand names; position containers so that the labels are visible; and avoid mere alphabetical storage.	Medication safety
PPSR-056. Patient blood management strategy A patient blood management (PBM) strategy is in place in the hospital, and involves identifying moderate-to-high-risk bleeding procedures before surgery, using multidisciplinary preoperative and perioperative measures to conserve as much patient blood as possible, and implementing a restrictive transfusion policy based on the patient's clinical condition rather than a fixed haemoglobin threshold.	Blood management
PPSR-061. Surgical site infection prevention bundle To prevent surgical site infections (SSIs), the perioperative team implements a protocolised bundle of aseptic and antibiotic procedures. This includes administering a systemic antibiotic within 120 min before incision in high-SSI risk surgeries and using alcohol-based chlorhexidine solution for skin preparation. During surgery, the team considers the half-life of the antibiotic and may administer a second dose, but they avoid prolonging its use after the operation is complete.	Infection prevention
PPSR-063. Perioperative blood glucose monitoring Blood sugar is monitored in the perioperative period in patients at risk of hyperglycaemia, diabetic patients and nondiabetic patients undergoing major surgery, to reduce the risk of surgical infection. If necessary, hyperglycaemia is treated with the objective of achieving concentrations below 150–180 mg dl ⁻¹ (8.33–10 mM).	Infection prevention
PPSR-070. Invasive devices early removal On a daily basis, the clinical indications for invasive devices, such as venous central lines, peripheral lines, catheters, nasogastric tubes, and drains, are evaluated to ensure they are promptly removed when no longer necessary.	Infection prevention
PPSR-071. Minimally invasive surgical techniques Whenever possible, surgery is performed using minimally invasive techniques to minimise the size of the incision and reduce the risk of complications.	Intraoperative complications prevention
PPSR-075. Laparoscopy insufflation pressure monitoring Monitor and maintain the insufflation pressure during laparoscopy at the lowest necessary level for pneumoperitoneum, following the direction of the leading surgeon. The standard laparoscopy pressure limits usually recommended are 1.6–2.0	Intraoperative complications prevention

Continued

Table 3 Continued

Recommendation (ID, title, and description)	Area
kPa (12–15 mm Hg) for the pneumoperitoneum pressure, and 1.1–1.6 kPa (8–12 mm Hg) for the intra-abdominal pressure during surgery. However, these pressure limits may vary depending on the patient's condition and the type of surgery being performed, and may need to be adjusted by the surgeon or anaesthesiologist.	
PPSR-079. Verification of neuromuscular block reversal To prevent residual weakness and reduce respiratory complications, the reversal of neuromuscular block should be verified by obtaining a train-of-four ratio greater than or equal to 0.9 in the adductor pollicis muscle before extubation during the anaesthetic discharge.	Intraoperative complications prevention
PPSR-087. Fire safety precautions in surgical procedures The hospital takes precautions to prevent fires by identifying potential hazards, including electrical equipment. They establish safe communication practices, prevention measures, evacuation plans, and strategies for suppressing fires. During surgical procedures that involve the patient's airway and have a gas delivery system, such as those above the xiphoid, special steps are taken to prevent fires: the surgeon notifies the anaesthesia professional before using any ignition sources near the face, head, or neck; the anaesthesia professional reduces the delivery of oxygen to the minimum required to avoid hypoxia, confirms it is safe to activate the ignition source after waiting a few minutes, and evacuates any accumulated anaesthetic gas mixture before using an ignition source in or near an oxygen-enriched environment.	Common complications prevention
PPSR-090. Postoperative nausea and vomiting prevention A multimodal prophylaxis for postoperative nausea and vomiting is routinely used based on a risk assessment, and timely rescue treatments with different classes of anti-emetics are implemented.	Common complications prevention
PPSR-091. Unintentional hypothermia prevention Perioperative accidental hypothermia is prevented through continuous body temperature monitoring and active warming following updated guidelines.	Common complications prevention
PPSR-092. Venous thromboembolism prevention To reduce the risk of VTE, all patients are assessed for VTE risk and provided for appropriate thromboprophylaxis based on updated guidelines. Thromboprophylaxis measures include: pharmacological thromboprophylaxis, mechanical thromboprophylaxis, or both for patients and procedures with VTE risk; continuation of pharmacological thromboprophylaxis in the postoperative period for high-VTE risk patients; general thromboprophylaxis measures such as early ambulation and optimal hydration for low-VTE risk patients; delayed initiation of low-molecular-weight heparin according to guidelines following regional anaesthetic procedures or high-bleeding risk procedures, if necessary.	Common complications prevention
PPSR-093. Goal-directed haemodynamic therapy for high-risk patients To reduce the incidence of postoperative complications and shorten hospital stays, goal-directed haemodynamic therapy is used to avoid large perioperative fluctuations in blood pressure. In high-risk patients, this approach may involve the use of cardiac output monitors to guide the administration of volume and inotropic therapy.	Common complications prevention
PPSR-098. Early postoperative oral intake If there are no concerns about the integrity or function of the gastrointestinal tract after abdominal surgery, patients are assessed for safe swallowing and considered for oral intake as soon as possible within the first 24 h after surgery.	Common complications prevention
PPSR-099. Postoperative delirium risk reduction strategies To prevent postoperative delirium in surgeries and patients associated to high risk of developing cognitive disorders, a bundle of strategies is implemented that includes: screening with diagnostic tools; targeted education for healthcare professionals about delirium; multicomponent, multidisciplinary nonpharmacological interventions such as daily physical activity, cognitive reorientation, and the presence of a family member at the bedside whenever possible; sleep enhancement through nonpharmacological sleep protocols and sleep hygiene; early mobility and physical rehabilitation; adaptations for sensorial impairment (e.g. visual and hearing); nutrition and fluid repletion; pain management; appropriate medication usage; adequate oxygenation; prevention of constipation and urinary retention; minimisation of patient tethers whenever possible.	Common complications prevention

are common to all countries regardless of geographical or income classification.¹¹

Conclusions

These 101 PPSRs constitute a comprehensive, evidence-based set of recommendations aimed at improving the quality of care and patient safety across hospitals in Europe and beyond.

This set was developed through a rigorous methodological participatory process, involving a balanced expert panel with broad stakeholder representation, with a special emphasis on the patient perspective. By implementing actions and initiatives that promote adherence to these recommendations, healthcare facilities can achieve significant improvements in clinical outcomes, economic efficiency, and social well-being, ultimately fostering a safer and more effective healthcare environment.

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Declarations of interest

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Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used ChatGPT-4 (OpenAI, 2024) to check spelling and grammar of this manuscript. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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Appendix A. Supplementary data

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References

- Panagioti M, Khan K, Keers RN, et al. Prevalence, severity, and nature of preventable patient harm across medical care settings: systematic review and meta-analysis. *BMJ* 2019; **366**:l4185
- Pearse RM, Moreno RP, Bauer P, et al. Mortality after surgery in Europe: a 7-day cohort study. *Lancet* 2012; **380**: 1059–65
- Schwendimann R, Blatter C, Dhaini S, Simon M, Ausserhofer D. The occurrence, types, consequences and preventability of in-hospital adverse events – a scoping review. *BMC Health Serv Res* 2018; **18**: 521
- International Surgical Outcomes Study group. Global patient outcomes after elective surgery: prospective cohort study in 27 low-, middle- and high-income countries. *Br J Anaesth* 2016; **117**: 601–9
- Atsma F, Elwyn G, Westert G. Understanding unwarranted variation in clinical practice: a focus on network effects, reflective medicine and learning health systems. *Int J Qual Health Care* 2020; **32**: 271–4
- Braithwaite J, Ellis LA, Churruarua K, Long JC, Hibbert P, Clay-Williams R. Complexity science as a frame for understanding the management and delivery of high quality and safer care. In: Donaldson L, Ricciardi W, Sheridan S, Tartaglia R, editors. *Textbook of patient safety and clinical risk management* vol. 27. Cham: Springer International Publishing; 2021. p. 375–91
- Bowen ME, Neuhauser D. Understanding and managing variation: three different perspectives. *Implement Sci* 2013; **8**: S1
- Russ S, Rout S, Sevdalis N, et al. Do safety checklists improve teamwork and communication in the operating room? A systematic review. *Ann Surg* 2013; **258**: 856–71
- Nagpal K, Vats A, Lamb B, et al. Information transfer and communication in surgery: a systematic review. *Ann Surg* 2010; **252**: 225–39
- Greco M, Capretti G, Beretta L, Gemma M, Pecorelli N, Braga M. Enhanced recovery program in colorectal surgery: a meta-analysis of randomized controlled trials. *World J Surg* 2014; **38**: 1531–41
- World Health Organization. *Global patient safety action plan 2021–2030: towards eliminating avoidable harm in health care*. Geneva: WHO; 2021
- Gelb AW, Morriss WW, Johnson W, et al. World health organization-world federation of societies of anaesthesiologists (WHO-wfsa) international standards for a safe practice of anesthesia. *Anesth Analg* 2018; **126**: 2047–55
- McCreedy A, Wacker J, Ffrench-O'Carroll R, Berthelsen KG, Kremeňova Tatičová Z, Smith AF. Patient safety practices in European anaesthesiology: expert evaluation and ranking. *Eur J Anaesthesiol* 2023; **40**: 113–20
- Centre for Perioperative Care. *National safety standards for invasive procedures 2 (NatSSIPs 2)*. London: Centre for Perioperative Care (CPOC); 2023
- Valli C, Schäfer WLA, Bañeres J, et al. Improving quality and patient safety in surgical care through standardisation and harmonisation of perioperative care (SAFEST project): a research protocol for a mixed methods study. *PLoS One* 2024; **19**, e0304159
- Johnston A, Kelly SE, Hsieh SC, Skidmore B, Wells GA. Systematic reviews of clinical practice guidelines: a methodological guide. *J Clin Epidemiol* 2019; **108**: 64–76
- Martínez-Nicolas I, Arnal Velasco D, Romero-García E, et al. Perioperative patient safety recommendations: systematic review of clinical practice guidelines. *BJS Open* 2024; **8**: zrae143
- Brouwers MC, Kho ME, Browman GP, et al. AGREE Next Steps Consortium. AGREE II: advancing guideline development, reporting and evaluation in health care. *CMAJ* 2010; **182**: E839–42
- McMillan SS, King M, Tully MP. How to use the nominal group and Delphi techniques. *Int J Clin Pharm* 2016; **38**: 655–62
- Hasson F, Keeney S, McKenna H. Research guidelines for the Delphi survey technique. *J Adv Nurs* 2000; **32**: 1008–15
- Jünger S, Payne SA, Brine J, et al. Guidance on Conducting and Reporting Delphi Studies (CREDES) in palliative care: recommendations based on a methodological systematic review. *Palliat Med* 2017; **31**: 684–706
- Pill J. The Delphi method: substance, context, a critique and an annotated bibliography. *Socioecon Plann Sci* 1971; **5**: 57–71
- Akins RB, Tolson H, Cole BR. Stability of response characteristics of a Delphi panel: application of bootstrap data expansion. *BMC Med Res Methodol* 2005; **5**: 37
- Ayre J, Mac O, McCaffery K, et al. New frontiers in health literacy: using ChatGPT to simplify health information for people in the community. *J Gen Intern Med* 2024; **39**: 573–7
- Lange T, Kopkow C, Lütznier J, et al. Comparison of different rating scales for the use in Delphi studies: different scales lead to different consensus and show different test-retest reliability. *BMC Med Res Methodol* 2020; **20**: 28

26. Day J, Bobeva M. A generic toolkit for the successful management of delphi studies. *Electron J Bus Res Methods* 2005; 3: 103–16
27. Murphy MK, Black NA, Lamping DL, et al. Consensus development methods, and their use in clinical guideline development. *Health Technol Assess* 1998; 2: 1–88
28. The GRADE Working Group. *GRADE handbook for grading quality of evidence and strength of recommendations* 2013. Available from, <https://gdt.gradepro.org/app/handbook/handbook.html>. [Accessed 22 February 2025]
29. World Health Organization. *WHO research agenda for hand hygiene in health care 2023–2030: summary*. Geneva: WHO; 2023
30. Francis N, Kazaryan AM, Pietrabissa A, et al. A research agenda for the European association for Endoscopic surgeons (EAES). *Surg Endosc* 2017; 31: 2042–9
31. Kramer CY. Extension of multiple range tests to group means with unequal numbers of replications. *Biometrics* 1956; 12: 307–10
32. Sugihara G, May R, Ye H, et al. Detecting causality in complex ecosystems. *Science* 2012; 338: 496–500
33. Goodwin N. Understanding integrated care. *Int J Integr Care* 2016; 16: 6
34. Gröne O, Garcia-Barbero M, WHO European Office for Integrated Health Care Services. Integrated care: a position paper of the WHO European Office for integrated health care services. *Int J Integr Care* 2001; 1: e21
35. Perry R, Herbert G, Atkinson C, et al. Pre-admission interventions (prehabilitation) to improve outcome after major elective surgery: a systematic review and meta-analysis. *BMJ Open* 2021; 11, e050806
36. Iqbal U, Green J, Patel S, et al. Preoperative patient preparation in enhanced recovery pathways. *J Anaesthesiol Clin Pharmacol* 2019; 35: S14–23
37. Forster AJ, Murff HJ, Peterson JF, Gandhi TK, Bates DW. The incidence and severity of adverse events affecting patients after discharge from the hospital. *Ann Intern Med* 2003; 138: 161–7
38. Tsilimingras D, Schnipper J, Duke A, et al. Post-discharge adverse events among urban and rural patients of an urban community hospital: a prospective cohort study. *J Gen Intern Med* 2015; 30: 1164–71
39. Jain U. Inadequately treated post-discharge adverse events after ambulatory surgery: nausea, pain, and pruritus. *ASA Monitor* 2022; 86: 31–2
40. World Health Organization. *Engaging patients for patient safety: advocacy brief*. Geneva: WHO; 2023
41. Davies EL, Bulto LN, Walsh A, et al. Reporting and conducting patient journey mapping research in healthcare: a scoping review. *J Adv Nurs* 2023; 79: 83–100
42. Powell RA, Single HM. Focus groups. *Int J Qual Health Care* 1996; 8: 499–504
43. Chazapis M, Gilhooly D, Smith AF, et al. Perioperative structure and process quality and safety indicators: a systematic review. *Br J Anaesth* 2018; 120: 51–66
44. Juran S, Gruendl M, Marks IH, et al. The need to collect, aggregate, and analyze global anesthesia and surgery data. *Can J Anaesth* 2019; 66: 218–29
45. Kirkham JJ, Williamson P. Core outcome sets in medical research. *BMJ Med* 2022; 1, e000284
46. Reed JE, McNicholas C, Woodcock T, Issen L, Bell D. Designing quality improvement initiatives: the action effect method, a structured approach to identifying and articulating programme theory. *BMJ Qual Saf* 2014; 23: 1040–8
47. Damschroder LJ, Reardon CM, Widerquist MAO, Lowery J. The updated Consolidated Framework for Implementation Research based on user feedback. *Implement Sci* 2022; 17: 75
48. Braz LG, Braz DG, Cruz DS da, Fernandes LA, Módolo NS, Braz JR. Mortality in anesthesia: a systematic review. *Clinics (Sao Paulo)* 2009; 64: 999–1006
49. Nepogodiev D, Martin J, Biccadd B, Makupe A, Bhangu A, National Institute for Health Research Global Health Research Unit on Global Surgery. Global burden of post-operative death. *Lancet* 2019; 393: 401
50. Rose J, Weiser TG, Hider P, Wilson L, Gruen RL, Bickler SW. Estimated need for surgery worldwide based on prevalence of diseases: a modelling strategy for the WHO Global Health Estimate. *Lancet Glob Health* 2015; 3: S13–20

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