



# Global guidelines for emergency general surgery: systematic review and Delphi prioritization process

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## Abstract

**Background:** Existing emergency general surgery (EGS) guidelines rarely include evidence from low- and middle-income countries (LMICs) and may lack relevance to low-resource settings. The aim of this study was to develop global guidelines for EGS that are applicable across all hospitals and health systems.

**Methods:** A systematic review and thematic analysis were performed to identify recommendations relating to undifferentiated EGS. Those deemed relevant across all resource settings by an international guideline development panel were included in a four-round Delphi prioritization process and are reported according to International Standards for Clinical Practice Guidelines. The final recommendations were included as essential (baseline measures that should be implemented as a priority) or desirable (some hospitals may lack relevant resources at present but should plan for future implementation).

**Results:** After thematic analysis of 38 guidelines with 1396 unique recommendations, 68 recommendations were included in round 1 voting (410 respondents (219 from LMICs)). The final guidelines included eight essential, one desirable, and three critically unwell patient-specific recommendations. Preoperative recommendations included guidance on timely transfers, CT scan pathways, handovers, and discussion with senior surgeons. Perioperative recommendations included surgical safety checklists and recovery room monitoring. Postoperative recommendations included early-warning scores, discharge plans, and morbidity meetings. Recommendations for critically unwell patients included prioritization for theatre, senior team supervision, and high-level postoperative care.

**Conclusion:** This pragmatic and representative process created evidence-based global guidelines for EGS that are suitable for resource limited environments around the world.

## Introduction

The implementation of clinical guidelines into routine healthcare pathways can improve patient outcomes and reduce overall costs<sup>1-4</sup>. Despite a year-by-year increase in the number of clinical guidelines produced, few of these include evidence generated in low- and middle-income countries (LMICs)<sup>4-7</sup>. At best, the application of guidelines from high-income countries (HICs) to lower-resourced settings may be inefficient or unachievable. At worst, they may directly or indirectly cause harm to patients or misdirect healthcare spending in an already resource-constrained environment. Developing context-specific guidelines for surgical topics by involving key stakeholders from low-resource settings has the potential to increase adoption<sup>8</sup>. The first of the NIHR Global Surgery Unit's streamlined global guidelines addressed measures to reduce surgical-site infection and was published in 2019<sup>9</sup>.

Emergency general surgery (EGS) is performed in most hospitals providing acute care worldwide and is a core component of a functional healthcare system. Patients undergoing emergency surgery are at a higher risk of death than those undergoing elective surgery<sup>10-13</sup>, and these differences are amplified across LMICs<sup>13-16</sup>. EGS involves a heterogeneous group of patients, surgeons, multidisciplinary healthcare professionals, and pathways,

but has been identified as a critical area for whole system improvement<sup>9</sup>. The aim of this process was to develop rationalized, pragmatic, globally relevant guidelines for EGS that are applicable across resource limited systems.

## Methods

### Overall design and scope

This manuscript reports a systematic review of guidelines and Delphi prioritization process for derivation of rationalized global guidelines for EGS. The scope of the guidelines was predefined as pre-, intra-, and postoperative recommendations for undifferentiated patients admitted under the care of an EGS team with the objective of reducing risk of perioperative mortality. This pragmatic definition allowed variation in case mix and specialty definitions between countries.

### Reporting

The protocol for the systematic review was registered on the Open Science Framework (doi:10.1706/OSF.IO/3T92A). This study was designed and reported according to the PRISMA recommendations for systematic reviews<sup>17</sup>, COMET recommendations for Delphi consensus<sup>18</sup>, and SAMPL guidelines for statistical

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reporting<sup>19</sup>. Development of the guidelines was conducted according to International Standards for Clinical Practice Guidelines<sup>20</sup>. No ethical issues were identified.

## International guideline development group

An international guideline development group (IGDG) was formed with clinicians with an active practice in EGS, and representatives from the Royal College of Surgeons of England, African Surgical Outcomes Study collaborative, and the World Health Organization Collaborating Centre in Perioperative Mortality. Members were recruited from national lead investigators within the NIHR Global Health Research Unit on Global Surgery (NIHR GSU). This group held overall responsibility for study steering, synthesis of the included recommendations, and final sign-off of the rationalized global guidelines.

## Topic selection

A Delphi prioritization exercise has been previously conducted by the NIHR-GSU to identify and prioritize topics for development of global guidelines<sup>9</sup>. EGS was highlighted as the second-highest priority area for development of guidelines; in that study, 73.5 per cent of 736 LMIC participants rated both the importance and impact of guidelines for EGS as being high. EGS was consistently ranked within the top three priority areas across upper-middle, lower-middle, and low-income strata, and from respondents working in both rural and urban hospitals.

## Systematic review

A systematic review of published and non-indexed grey literature was undertaken to identify clinical practice guidelines for EGS. Guidelines applicable to an undifferentiated group of patients presenting to EGS services from any settings were eligible for inclusion. There were no exclusions due to country of origin or language. Guidelines relating specifically to subgroups of patients (e.g. children, older adults, and obese patients), or specific disease types (e.g. ischaemic bowel and small bowel obstruction) were excluded. To ensure that contemporaneous evidence informed the development of the EGS global guidelines, only guidelines published in the previous 15 years (1 January 2005 to 1 January 2020) were eligible. Additional national, regional, and local guidelines were identified in partnership with the IGDG ([Appendix S1](#)). Detailed description of the search strategy and screening processes is available in [Appendix S2](#). The quality of included guidelines was described using the AGREE-II tool by two independent reviewers<sup>21</sup>.

## Longlisting of recommendations

Longlisting of recommendations was performed using eligible existing guidelines. Specific recommendations relating to the care of the undifferentiated EGS patients were included. Recommendations relating to specific patient groups or disease types were excluded. Individual recommendations underwent three-stage thematic content analysis. As the various guidelines often had recommendations with only small differences between them, recommendations similar in both content and theme were combined into a single point.

**Table 1 Adherence to components of International Standards for Clinical Practice Guidelines**

Component	Adherence
<b>Composition of guideline development group</b>	The international guideline development group (IGDG) was involved throughout the development process, from identifying relevant recommendations for voting round 1 to steering and agreeing the final guideline. The IGDG consisted of 17 individuals, including representation from 10 LMICs. The IGDG was multidisciplinary, including clinical staff across surgery, anaesthesia and critical care, and expert methodologists. A wider pool of both global collaborators, including 219 from LMICs contributed to guideline development during the voting rounds (rounds 1 and 3).
<b>Decision-making progress</b>	The processes for ensuring transparent decision-making are reported in the study methods. Discussions and decision-making of the IGDG in each round are reported in the supplementary material.
<b>Conflicts of interest</b>	No conflicts of interest are declared by members of the IGDG.
<b>Methods</b>	The manuscript reports all relevant methods, and was designed and reported in accordance with several best practice frameworks (systematic review, statistical reporting, Delphi prioritization).
<b>Scope of guideline</b>	The guideline's scope was defined at the start of the development process and is reported in the study methods.
<b>Evidence reviews</b>	A full systematic review of existing guidelines was undertaken in order to longlist recommendations. This guideline was not designed to include new primary research, rather to rationalize existing guidelines into an Essential Surgical Guideline that could be implemented around the world. Reflecting the immature evidence base for recommendations included in existing guidelines, none of these was supported with randomized evidence. Only recommendations that were deemed applicable to LMIC settings were included in the prioritization process for consideration of inclusion in this guideline.
<b>Guideline recommendations</b>	Twelve key recommendations have been identified. Each is summarized in a single sentence. Statements have been extensively discussed and revised with the IGDG to ensure clarity and consistency. These will be translated across several languages to support widespread adoption using forwards and backwards translation to ensure cross-cultural and cross-language relevance.
<b>Rating of evidence and recommendations</b>	Guidelines identified by the systematic review underwent quality assessment by two reviewers according to the AGREE-II framework. The strength of recommendation has been considered for each included statement and stratified as <i>Essential</i> (baseline measures that should be implemented as a priority) or <i>Desirable</i> (some hospitals may lack these resources at present, but should plan for future implementation). As no new primary literature was included, and no meta-analysis was undertaken, rating of evidence according to its quality or reliability was not undertaken.
<b>Peer review</b>	The manuscript describing the development of the guideline has been submitted for consideration by a peer-reviewed journal.
<b>Guideline expiration and updating</b>	The manuscript includes the expiration date for the guideline (2026).
<b>Financial support and sponsoring organization</b>	Financial support for the development of this guideline from charitable organizations has been reported transparently in this manuscript.

IGDG, international guideline development group; LMIC, low- or middle-income country.

The full methodology of analysis and processing of recommendations is reported in [Appendix S3](#).

## Shortlisting of recommendations

The longlist of recommendations was circulated within the IGDG for assessment using a standardized feedback form. Development group members were asked to identify recommendations with low relevance to care delivery in LMICs and to consider whether the recommendation was likely to have a direct impact on risk of mortality. A recommendation was removed when at least two members identified it as having low relevance and/or low importance.

## Delphi prioritization process

A four-round Delphi prioritization process was preplanned to consist of two consensus voting rounds and two rounds of face-to-face discussion with the IGDG. The full methodology for the prioritization process is presented in [Appendix S4](#). While respondents from any country were allowed to complete the round 1 voting, only responses from LMICs were included in pre-defined stopping rules. Responses from HICs were collected as an

exploratory comparator only. Only complete responses were included in analysis.

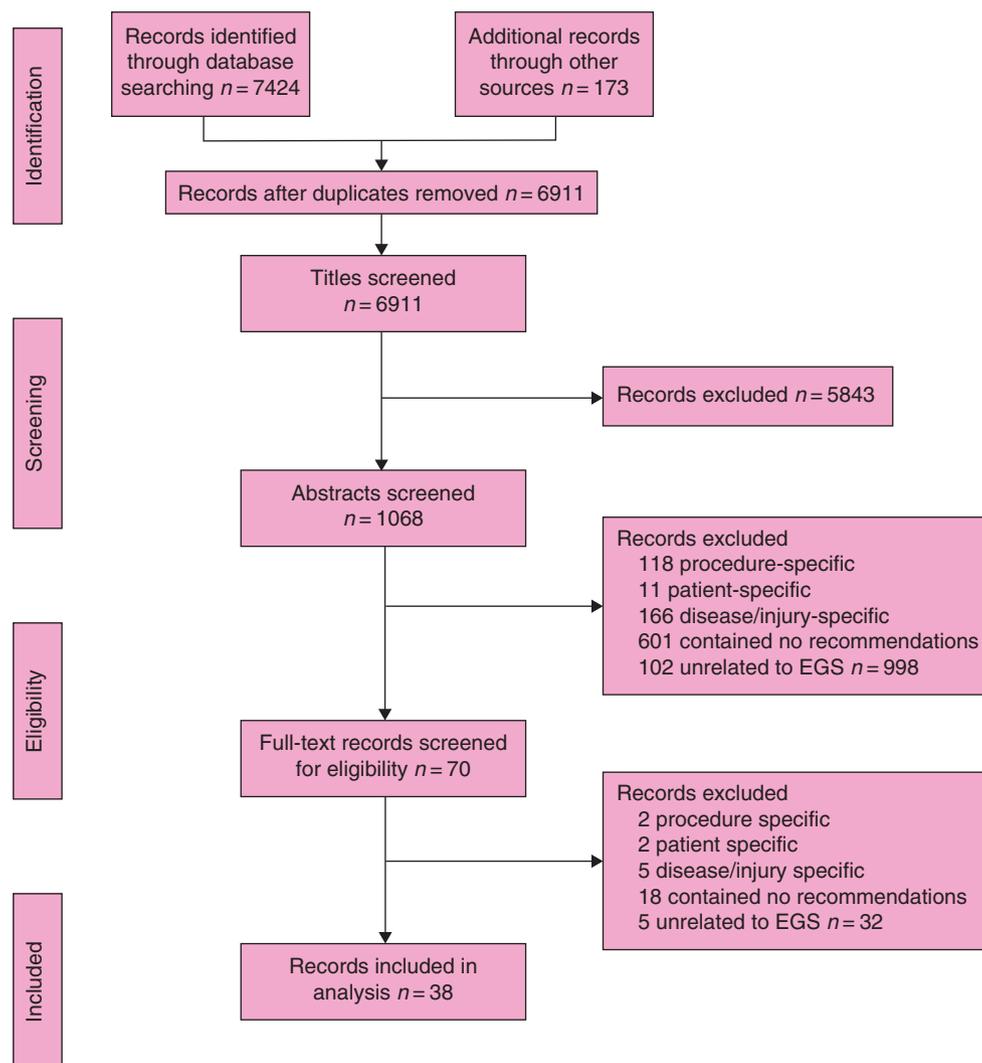
## Stratification of recommendations

Recommendations were designated as either:

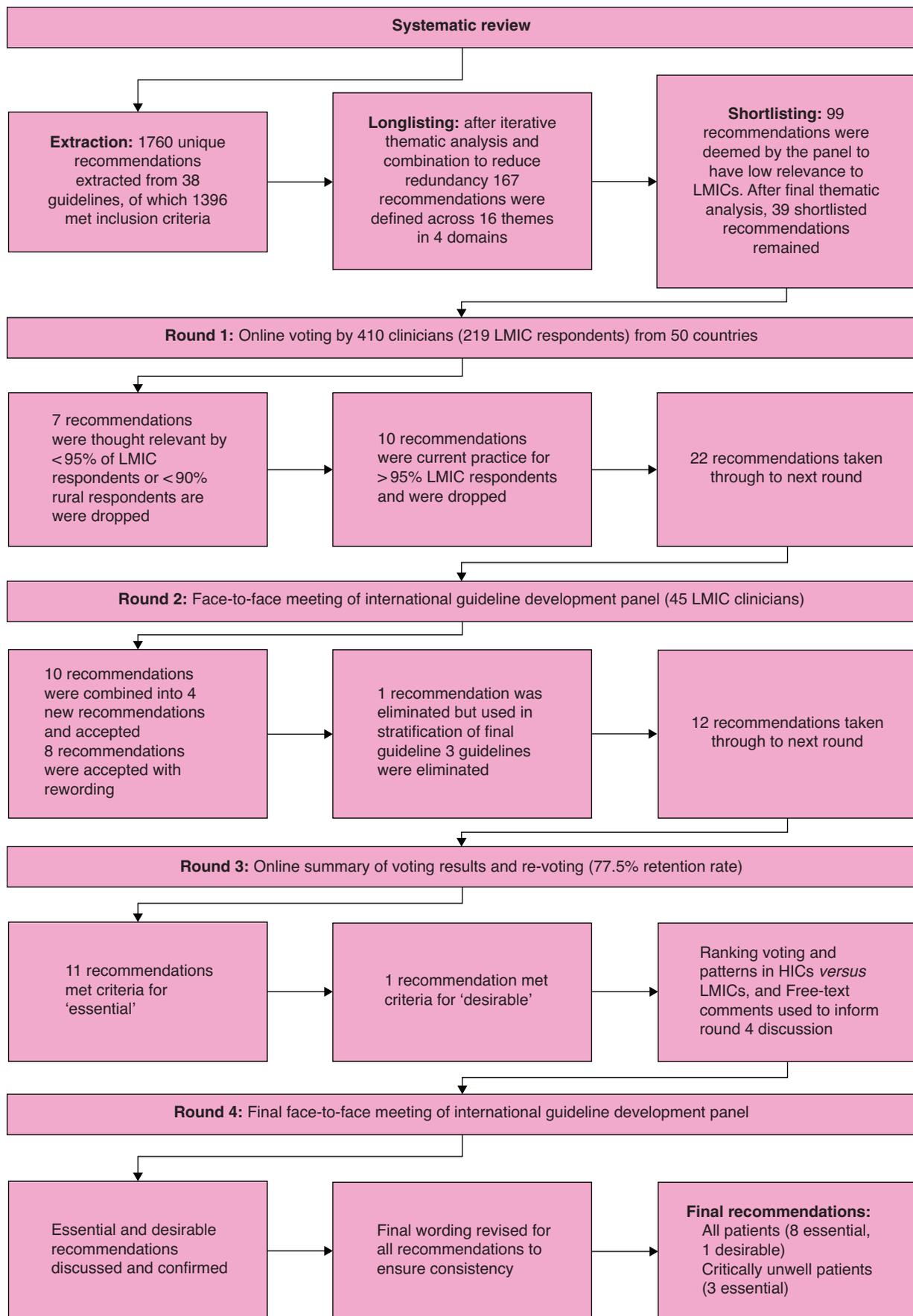
1. **Essential:** the IGDG agreed that these recommendations are baseline measures required for safe surgery and should be implemented as a priority across all hospitals performing EGS; or
2. **Desirable:** the IGDG recognized that at present some hospitals lack resources needed to implement these recommendations but agreed that all hospitals performing surgery should work towards implementation in the future.

## Results

Fifty-six surgeons and four anaesthetists from 12 LMICs were represented in the IGDG ([Appendix S1](#)). A summary of adherence to International Standards for Clinical Practice Guidelines is provided in [Table 1](#).



**Fig. 1** PRISMA flowchart for guidelines identified in systematic review  
EGS, emergency general surgery.



**Fig. 2** Overview of global guidelines development process  
LMIC, low- or middle-income country; HIC, high-income country.

## Systematic review

Of 6911 titles screened, 38 full-text guidelines were included (Fig. 1). A summary of features of included guidelines is presented in Table S1. Only two guidelines originated from and/or had authors from LMICs<sup>22,23</sup>. Only nine (23.6 per cent) scored 5 or more out of 7 on the quality rating from the AGREE-II instrument.

## Longlisting of recommendations

In total, 1760 unique recommendations were extracted, of which 1396 met the eligibility criteria. A total of 16 themes across four thematic domains were identified (Table S2). After iterative thematic analysis, 167 recommendations were defined within four thematic domains (Table S3):

1. Triage and transfer (12 recommendations).
2. Workforce (48 recommendations).
3. Clinical care (101 recommendations).
4. Clinical governance (6 recommendations).

## Shortlisting of recommendations

Ninety-nine recommendations were deemed to be of very low relevance and/or importance to LMICs by two or more reviewers, and were thus excluded. A final round of thematic analysis was undertaken of the remaining 68 recommendations (Table S4), from which 39 (Table S5) entered the first round of Delphi prioritization: triage and transfer (one recommendation); workforce (seven recommendations); clinical care (29 recommendations); and clinical governance (two recommendations).

## Delphi prioritization process

The results and flow through each Delphi voting round are shown in Fig. 2. Figure 3 shows the geographical spread of respondents, including 219 (53.4 per cent) respondents working in 50 LMICs. The majority of respondents were consultant surgeons

(276 (67.3 per cent)) or trainee surgeons (109 (26.6 per cent)), and 25 responses were also received from a mix of other surgical providers, nursing staff, anaesthetists, patients, hospital managers, and Ministry of Health officials. Prioritization was performed by respondents from both urban (343 (83.7 per cent)) and rural (67 (16.3 per cent)) areas, public (329 (80.2 per cent)) and private or mixed providers (81 (19.8 per cent)), and from both large (more than 500 beds; 231 (56.3 per cent)) and smaller (fewer than 500 beds; 179 (43.7 per cent)) hospitals.

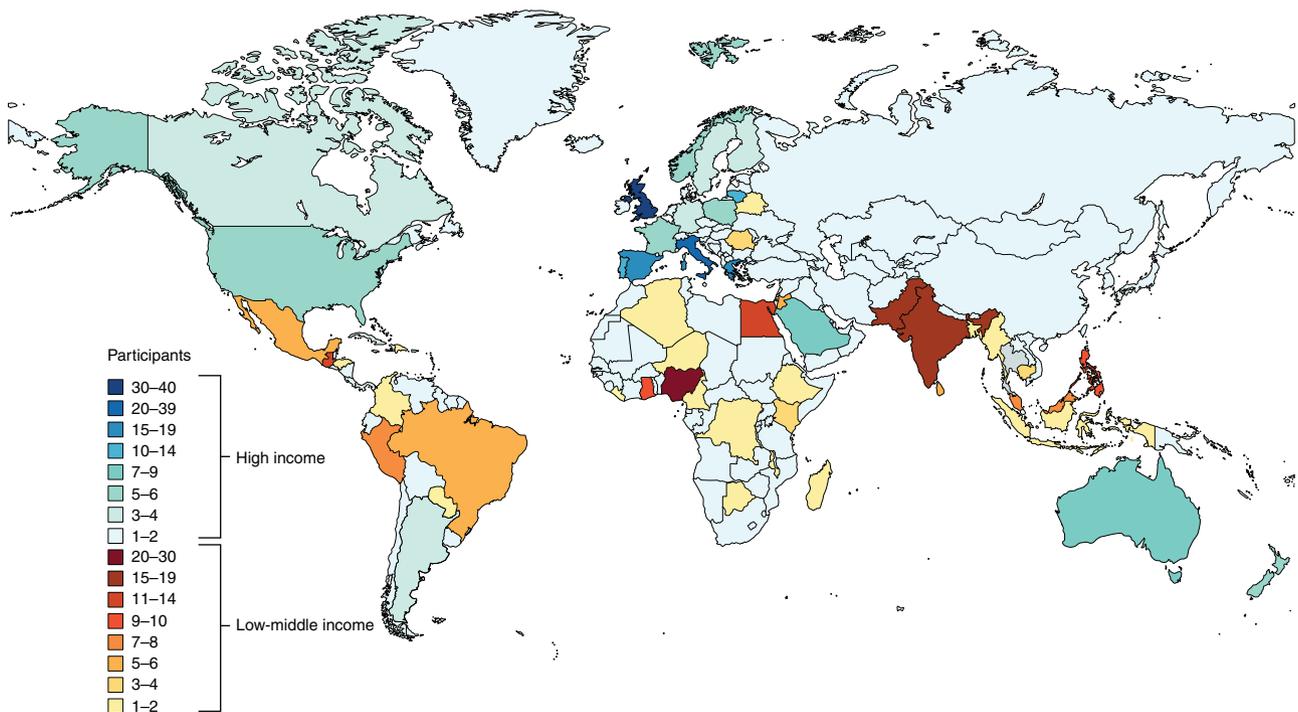
The results of round 1 voting can be found in Table S6. Seventeen recommendations did not meet the required level of relevance ( $n=7$ ) or represented current practice ( $n=10$ ) and were dropped. Discussion and modifications from round 2 are summarized in Table S7. Following discussion, recommendations were stratified into two groups:

1. Relevant to the care of all emergency general surgical patients.
2. Relevant to the care of the critically unwell EGS patient (according to physiological criteria or a risk-scoring system).

Twelve modified recommendations were therefore put forward for round 3 consensus voting, the results of which are provided in Table S8. All 12 recommendations from round 3 consensus voting were accepted (following refinement of wording, Table S9) by the IGDG for inclusion in the final global guidelines.

## Stratification of recommendations

The IGDG agreed upon a final list of 11 *essential* and one *desirable* clinical recommendation (Table 2). The final guidelines included two triage and transfer, four workforce, five clinical care, and one clinical governance recommendation. A majority of IGDG members (35 of 45 (77.8 per cent)) agreed that the inclusion of 10–12 recommendations would be acceptable across hospitals with variable resourcing. The IGDG agreed that the guidelines



**Fig. 3** Countries represented in round 1 voting

Participating low- and middle-income countries (LMICs) are marked in red/orange, and high-income countries in blue/green.

Table 2 Global guidelines for Emergency General Surgery

Recommendations for all patients admitted under Emergency General Surgery	
1. Local hospital networks should have systems in place for timely transfer of patients needing higher levels of care	Essential
2. Pathways should be established for patients who require a CT scan	Desirable
3. A structured handover should take place between surgical teams to facilitate prioritization of theatre cases and review of critically unwell patients	Essential
4. Patients who may require emergency surgery should be discussed with a senior surgeon	Essential
5. The WHO Surgical Safety Checklist should be used for all procedures in theatre	Essential
6. Patients should undergo close observation for 2–4 h after anaesthesia	Essential
7. Emergency patients should have early warning scores performed routinely and should be escalated in case of deterioration	Essential
8. Emergency patients should be discharged with a medical plan that includes advice on how to seek help in case of deterioration	Essential
9. Major morbidity and mortality should be discussed in a formal meeting	Essential
Recommendations for critically unwell patients with a high predicted risk of death*	
10. Critically unwell patients should be high priority for operating theatre time	Essential
11. Surgery for critically unwell patients should be supervised by the most experienced surgeon and anaesthetist available	Essential
12. Following surgery, critically unwell patients should receive the highest level of care available	Essential

\*According to physiological criteria, or a risk scoring system

would be reviewed in 5 years (i.e. 2026) to allow new evidence to be incorporated.

## Discussion

This international guideline development process has prioritized 12 recommendations to support emergency surgical care across all hospitals and setting. The process was developed and delivered in collaboration with surgeons and anaesthetists around the world according to a validated methodology. It used International Standards for Clinical Practice guidelines to inform its development and is reported according to best practice frameworks. Recommendations were made for all EGS patients, and a subset for patients identified as critically unwell according to established risk-scoring systems. This provides a practical framework to strengthen surgical systems around the world and can complement other policy efforts such as national surgical, obstetric, and anaesthesia planning.

The perioperative death of surgical patients is a major global public health issue, with a disproportionate incidence in LMICs<sup>13,24</sup>. This includes young patients, which has significant economic, social, and political consequences<sup>25–28</sup>. The patients in the highest risk group are those undergoing emergency surgery<sup>10,11,16</sup>, and thus practical methods aimed at reducing perioperative death are urgently required. While the guidelines do not aim to cover all aspects of delivering an emergency surgical service, they target areas that can be applied across all settings and that are likely to have the greatest impact on perioperative mortality.

Several guidelines for care of EGS patients exist, as identified in our systematic review. However, only two included authors or organizations from low-resource settings<sup>22,23</sup>. Unlike many guidelines, which are based upon high-level evidence, existing recommendations for EGS were generally best-practice statements and few had undergone randomized evaluation. In addition, the AGREE-II quality assessment identified a relative paucity in the quality and transparency of reporting<sup>21</sup>. By excluding recommendations with very low relevance to LMICs, consulting broadly across 50 LMICs, and co-development with a representative IGDG, these guidelines have been designed for use by all surgical care providers<sup>8</sup>. This includes those working in resource-constrained, and rural or remote settings.

There are few examples where the clinical impact of guidelines for emergency surgery have been evaluated. The EPOCH trial (22 754 patients from the UK) tested the impact of implementing a bundle of perioperative interventions on risk of death following emergency laparotomy<sup>29</sup>. That no survival benefit was observed

may have been due to low overall uptake of recommendations within the care bundle. The authors suggested that practice change is not possible in emergency surgery without dedicated time, financial support, and human resourcing<sup>30</sup>. This is likely to be even more apparent in LMICs, where health systems are often already under severe pressure.

This study has several limitations. First, it is possible that some non-indexed, non-English language, or recent guidelines (i.e. after 1 January 2020) were missed in the systematic search strategy. The authors attempted to minimize this by working with international collaborators to identify additional relevant guidelines from their local settings and searching the grey literature. Second, there was a high level of redundancy between recommendations identified, with many combined according to theme during iterative analysis cycles. While we attempted to preserve meaning, this may have led to some changes in the depth and content of recommendations. Third, the loss of 22.5 per cent of respondents between rounds 1 and 3 of consensus voting may have introduced some attrition bias. This rate is comparable to examples from opinion leaders in this area such as Core Outcome Measures in Effectiveness Trials (COMET), and is unlikely to have had a substantial impact on the results of online voting rounds<sup>18,31–33</sup>. Several other measures were implemented to otherwise minimize bias; anonymity was ensured to minimize social desirability bias, and random ordering was used to avoid primacy bias. Fourth, none of the included recommendations has been formally tested within randomized trials. Finally, responses were received from 50 LMICs representing surgeons and countries that are likely to be research active within our network. While this might limit the generalizability to the very lowest resourced hospitals, special attention was paid by the IGDG to ensure wording the final recommendations could be adapted to local contexts (e.g. 'the most senior surgeon and anaesthetist available' does not stipulate consultant/attending input, which may be unachievable in some settings).

Despite these limitations, this robust, inclusive, and diverse process maximized the collective experience of frontline global surgeons to prioritize high-yield improvement measures in the setting of EGS. Future research is now required to test and implement the effectiveness of these new global guidelines at a cluster (hospital level), learning from implementation science and behavioural change theory.

## Collaborators

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## Supplementary material

[Supplementary material](#) is available at *BJS Open* online.

## Data availability

Data available upon request, following approval from the International Guideline Development Group, and satisfactory completion of a data sharing agreement.

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