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Consensus statements for the establishment of medical intensive care in low-resource settings: international study using modified Delphi methodology

Pedja Kovacevic^{1,2*}, Jadranka Vidovic¹, Boris Tomic¹, Jihad Mallat³, Ali Ait Hssain⁴, Muiyiwa Rotimi⁵, Owoniya Temitope Akindede⁶, Kent Doi⁷, Rajesh Mishra⁸, F. Joachim Meyer⁹, Ivan Palibrk¹⁰, Ranko Skrbic², Enrique Boloña¹¹, Oguz Kilickaya¹² and Ognjen Gajic¹²

Abstract

Background The inadequacy of intensive care medicine in low-resource settings (LRS) has become significantly more visible after the COVID-19 pandemic. Recommendations for establishing medical critical care are scarce and rarely include expert clinicians from LRS.

Methods In December 2023, the National Association of Intensivists from Bosnia and Herzegovina organized a hybrid international conference on the topic of organizational structure of medical critical care in LRS. The conference proceedings and literature review informed expert statements across several domains. Following the conference, the statements were distributed via an online survey to conference participants and their wider professional network using a modified Delphi methodology. An agreement of $\geq 80\%$ was required to reach a consensus on a statement.

Results Out of the 48 invited clinicians, 43 agreed to participate. The study participants came from 20 countries and included clinician representatives from different base specialties and health authorities. After the two rounds, consensus was reached for 13 out of 16 statements across 3 domains: organizational structure, staffing, and education. The participants favored multispecialty medical intensive care units run by a medical team with formal intensive care training. Recognition and support by health care authorities was deemed critical and the panel underscored the important roles of professional organizations, clinician educators trained in high-income countries, and novel technologies such as tele-medicine and tele-education.

Conclusion Delphi process identified a set of consensus-based statements on how to create a sustainable patient-centered medical intensive care in LRS.

Keywords Intensive care medicine, Development, MICU, Consensus

*Correspondence:

Pedja Kovacevic

pedja.kovacevic@med.unibl.org

Full list of author information is available at the end of the article



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Introduction

Over two-thirds of the world population lives in low-resource settings (LRS), most of whom lack access to modern critical care medicine. The absence of sufficient numbers of intensive care unit beds and trained staff directly impacts survival rates [1–3]. In LRS perioperative intensive care medicine, and consequently, established surgical ICUs, are much more common, while medical critical care is significantly underdeveloped compared to those in high-income countries (HICs) [2, 6, 7]. It is estimated that in LRS close to 9 million people die annually from preventable causes due to the lack of access to critical care [1]. The public health importance of this problem was further revealed by the COVID-19 pandemic [4–6].

There are very few publications that describe the challenges, obstacles, and uncertainties of establishing medical critical care in LRS from an insider's perspective. Furthermore, there are no guidelines, recommendations, and suggestions on how to establish a modern, patient-centered medical intensive care unit (MICU) in these countries. Defining the necessary components for establishing a modern MICU in LRS is a clear priority [3, 8–10]. With this goal in mind, in December 2023, the National Association of Intensivists from Bosnia and Herzegovina organized an ad hoc hybrid international conference entitled, "How to Create Multidisciplinary Medical Intensive Care Units in Low-Resource Settings: Challenges, Obstacles, and Opportunities." Immediately after the conference, an international modified Delphi study was conducted with an aim to reach a consensus on the key statements for establishing modern patient-centered MICUs in LRS. The post-COVID era is the ideal time to address this topic.

Material and methods

Task force

On December 15, 2023, the National Association of Intensivists in Bosnia and Herzegovina organized an ad hoc hybrid international conference (Taskforce) entitled: "How to Create Multidisciplinary Medical Intensive Care Units in Low-Resource Settings: Challenges, Obstacles, and Opportunities." This conference was supported by the World Federation of Intensive and Critical Care (WFICC). Approximately 30 doctors participated in the conference, primarily experts in intensive care medicine from various basic specialties (e.g. anesthesiology, pulmonary medicine, internal medicine, neurology) mostly from low-resource settings, dominantly from the region of former Yugoslavia (Southeast Europe region). Alongside participants from LRS, there were also representatives from countries with highly developed health

systems. In addition to intensivists doctors, representatives from health care authorities such as ministers of health, deans of medical schools, and general directors of hospitals also took part. Nurses who treat medically critically ill patients also participated in the conference.

The identification and selection of experts for the task force were based on participation in CERTAIN network [11], personal acquaintance, and recommendations from other regional experts.

During the conference, three topics were discussed:

- (a) The role of anesthesiologists and other specialists in establishing intensive care units for non-surgical branches and training the first critical care physicians in low-resource settings, multispecialty vs. single specialty ICU. A multispecialty MICU refers to a unit with multiple physician specialties, while a single specialty MICU refers to a specialized ICUs (pulmonary, infectious disease, neurology, cardiology, etc.)
- (b) The role of expert educators, as well as local and international societies, from countries with highly developed intensive care medicine in the establishment of the MICUs in low-resource settings.
- (c) The impact of local and global healthcare and political authorities in acknowledging the necessity for modern intensive care medicine in low-resource settings.

Based on a literature search and discussion during the conference, 16 statements across 3 areas were identified as crucial for establishing a modern, patient-centered MICU in LRS. At the end of the task force, it was concluded that conducting a modified Delphi study with new participants from around the world was necessary to achieve consensus on these sixteen statements.

Delphi Study

The modified Delphi consensus methodology is well-described, widely used, and leverages expert opinion to address questions when empirical data either cannot be answered or do not exist in an appropriate form. The Delphi process is an interactive survey method that sends relevant stakeholders (experts) a series of questionnaires, known as rounds, and asks them to rate the importance of each offered and identified outcome that will be included in the consensus. This involves at least two rounds of participants voting on statements related to a study question (Fig. 1). Voting is informed by the results of the preceding rounds and conducted anonymously to prevent external influence [12, 13]. During the December conference, 16 statements across 3 areas were defined that should be tested using the modified Delphi

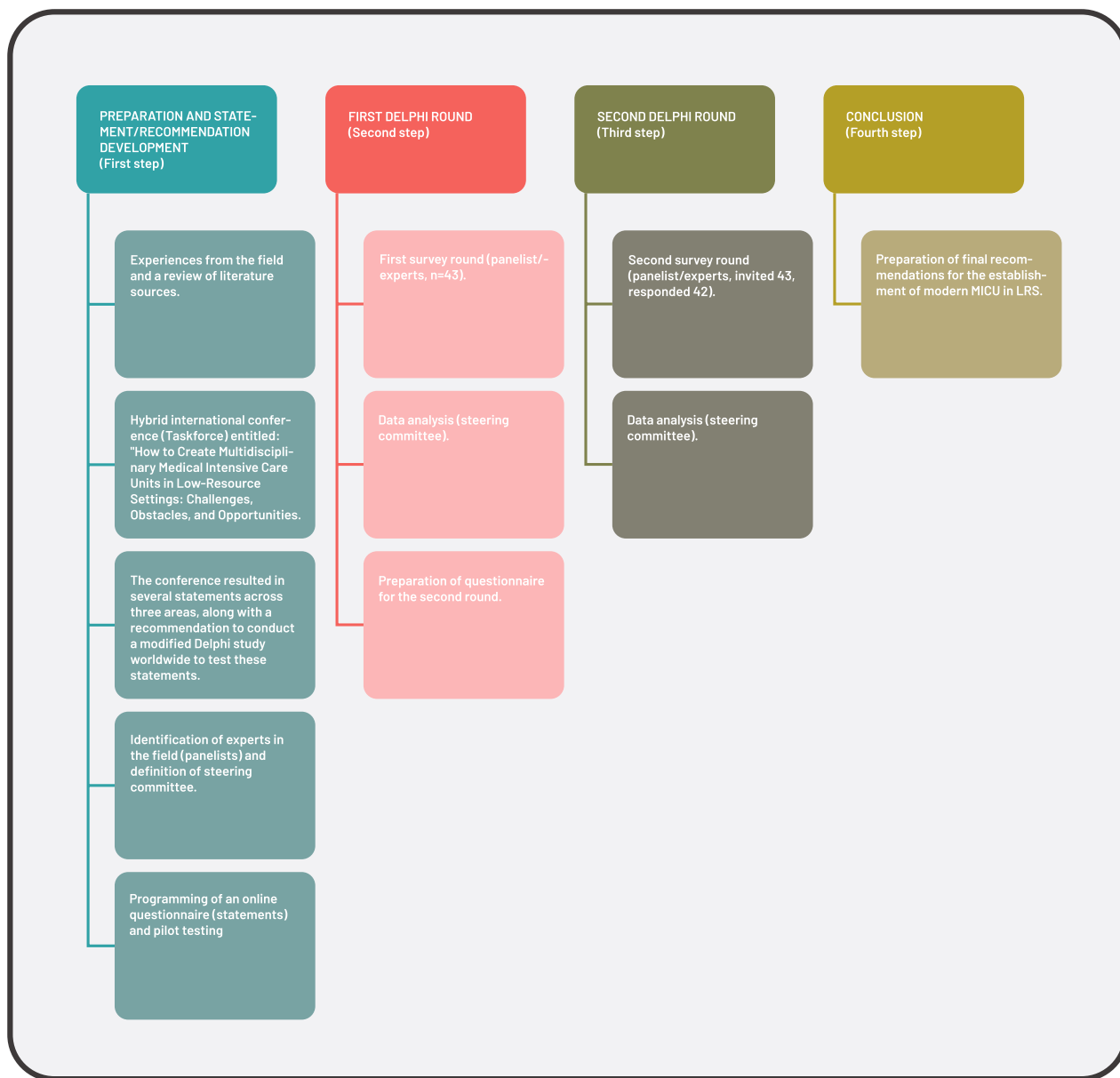


Fig. 1 Flowchart documenting modified Delphi process

methodology. The next step was to find the most commercially suitable Delphi survey system. By searching the literature, Surveylet (Calibrum Inc., Utah) was selected [14, 15].

Literature review

A complementary literature review was conducted in PubMed and Google Scholar using search terms: “critical care” OR “intensive care” AND “low resource” OR “low income” OR “low and middle income.”

Study participants (panelists)

Experts from the fields of intensive care medicine and hospital administration were identified. The participants in the Delphi study were partly those who attended the conference held in December 2023, while the remaining participants were selected through their wider professional network from LRS. The selection was made based on personal acquaintance and with the help of national coordinators from the European Society of Intensive Care Medicine (ESICM), who proposed experts according to the questions to be answered. The majority of

selected participants were from or have worked in or with low-resource settings. The first contact with the experts was made via email, providing a brief overview of the study. Study participants (experts) were asked to rate the importance of each question using a 9-point Likert scale (1, extremely unimportant to 9, extremely important). Additionally, they had the opportunity to provide any additional comments they might have. All study participants could asynchronously re-login to the website to modify their answers during the period from May 27 to July 29, 2024. Panel members could only see their own answers and could not see the answers of other participants.

Consensus process

The participants of the Delphi study had 16 statements defined across three areas to vote on during the first round. Each panelist was asked to rate the importance of the items using a 9-point Likert scale. Evaluation of this scale that is commonly divided into three categories for core outcome set projects: Not Important (1–3), Important but Not Critical (4–6), and Critical (7–9). After seeing the summary of the first round, consensus was defined as $\geq 80\%$ of the panel giving a score between 7 and 9. When $\geq 90\%$ of the panel gave these scores, it was defined as a strong consensus. Statements that had a consensus of $< 50\%$ were considered as dissent. Statements that were ranked between 50 and 80% entered the second round. The second round of the Delphi study had five redefined statements across the same three areas.

Ethical consideration

The ethics committee deemed the study exempt from regulatory approval and informed consent.

Data analysis

Quantitative data collected through the Delphi process were analyzed using descriptive statistics. Consensus among experts was defined a priori as agreement reaching a predetermined threshold (e.g., $\geq 80\%$ agreement). The median and interquartile range (IQR) were used to describe the central tendency and dispersion of responses. Qualitative data, including expert comments and suggestions, were analyzed thematically to identify recurring themes and patterns. Data from the last stable questionnaire round of the Delphi process for each statement were included for preparing the final statements.

Results

Out of the 48 invited respondents, 43—(89.6% response rate) participated in the first round and 42 agreed (87.5% response rate) to participate in the second round. The study participants were from 20 countries (Asia, Africa,

North America, South America, and Europe); 26 were male, (60.5%) and 17 (39.5%) were female (Table 1, Fig. 2). The sample represented diverse environments, and different base specialties, with or without official training in intensive care medicine, and included health care authorities (see Table 1).

After the two rounds, consensus was reached for 13 (81.3%) out of 16 statements (see Fig. 3 and electronic supplement 2 (eTable 1 and eTable 2).

Discussion

In this mixed-method study, ICU clinicians from LRS identified 13 consensus statements for establishing sustainable models of medical critical care. The participants favored multispecialty medical intensive care units run by a multispecialty medical team with formal intensive care training. Recognition and support by health care authorities was deemed critical and the panel underscored the important roles of professional organizations, clinician educators trained in high-income countries, and novel technologies such as tele-medicine and tele-education.

In the first domain defined as the “*Organizational structure of medical critical care in low-resource settings*”

Table 1 Characteristics of the experts who participated in the modified delphi study during the first round

	Number of experts (%)
<i>Gender</i>	
Male	26 (60,5)
Female	17 (39,5)
<i>Age</i>	
30–39 years	5 (11,6)
40–49 years	17 (39,5)
years	14 (32,6)
> 60 years	7 (16,3)
<i>Resource setting</i>	
Lower and middle-income countries	25 (58,2)
High-income countries	18 (41,8)
<i>Primary specialty</i>	
Anesthesiology	18 (41,8)
Internal medicine	11 (25,5)
Pulmonology	6 (14,0)
Neurology	3 (7,0)
Cardiology	2 (4,7)
Critical care	2 (4,7)
Other (Health care authority)	1 (2,3)
<i>Official training in intensive care medicine (subspecialty)</i>	
Yes	32 (74,4)

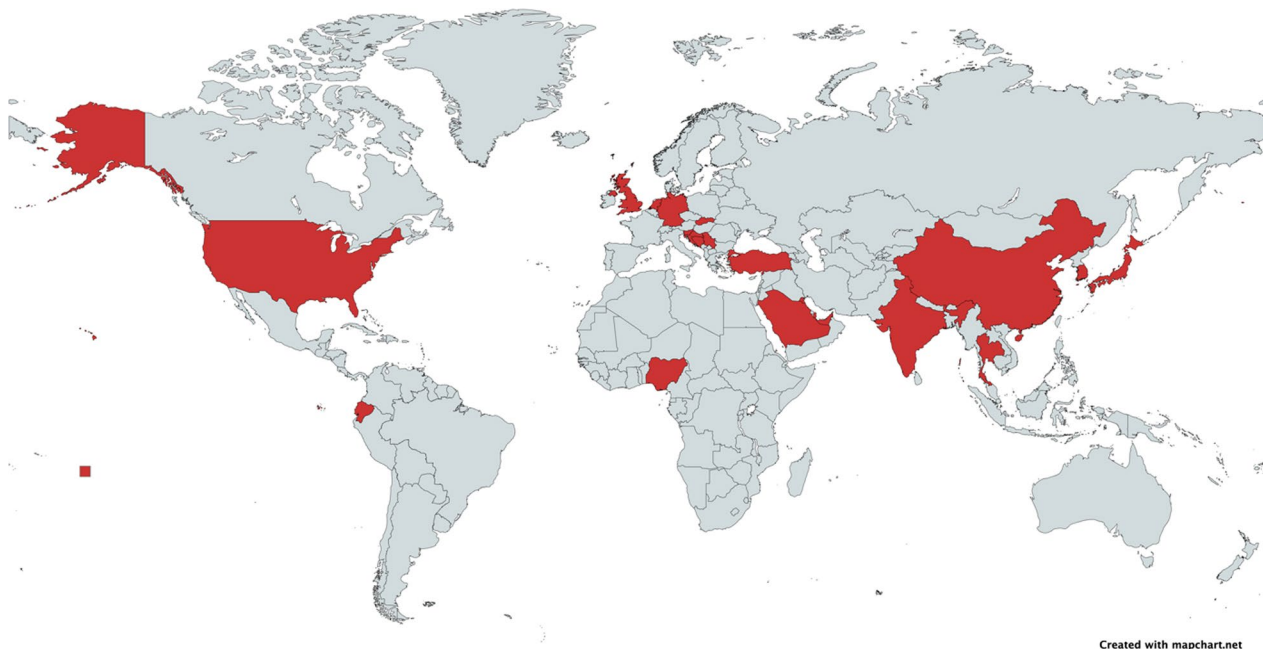


Fig. 2 Location of participants in the modified Delphi study. Created with mapchart.net. Disclaimer: the depictions of boundaries are not warranted to be error-free

(LRS)”, the consensus was reached on three out of five statements.

Regarding the first statement, in the process of establishing modern MICUs, it is impossible to completely replicate the system from developed countries, primarily due to the socioeconomic and cultural burdens, as well as other legal considerations in the organization of health systems in LRS [2, 3, 9, 10]. The participants favored multispecialty medical ICUs over more traditional specialty units such as pulmonary, cardiology, neurology, infectious disease, etc. Specialty MICUs consistently face shortages of trained personnel and challenges in organizing 24/7 coverage, leading to poorer treatment outcomes. Specialty ICUs do not provide better outcomes for specific problems and are associated with harm for general critical care patients [16, 17]. A consensus was not reached for the fourth statement either since the limited available literature shows that organizing the treatment of critically ill patients in mixed ICUs in this manner offers no clear benefit [18]. A consensus for the fifth statement was reached during the first round which implies that genuine, complete, and sufficient support from political and healthcare authorities at both local and state levels is necessary to create a suitable and stimulating environment, as shown by numerous studies [2, 8, 19–22].

In the second area of the Delphi study, titled “*People/Health Care Professionals*”, consensus was reached on four out of five statements.

There is little controversy that the newly established team should be led by intensivists trained in developed systems abroad [2, 23–25]. A multiprofessional team must include adequately trained nursing staff. The easiest way to train nurses from the newly established MICU is through the already existing SICU. Meanwhile, doctors should have a dual training in critical care and their primary specializations. This dual training will enable them to stay connected to the ICU during their primary specializations, such as pulmonology, cardiology, or neurology. Consensus on the fifth statement was reached during the first round of voting, making it the only statement to surpass the 90% threshold in the first round, indicating a high degree of agreement. This suggests that the staff should receive support from hospital leadership, including adequate compensation—both material and non-material—for their high-skill, high-stress work. Without this kind of support, achieving self-sustainability for the newly established team is nearly impossible. What should be strictly adopted from well-established systems is the ratio of healthcare workers to critically ill patients, without any compromise [24]. While there was no consensus on the role of anesthesiologists in establishing MICUs, many participants of the conference highlighted important role of anesthesiology colleagues during the first several years.

In the third area of the Delphi study, titled “*Education*”, the consensus was reached on all six statements. Local

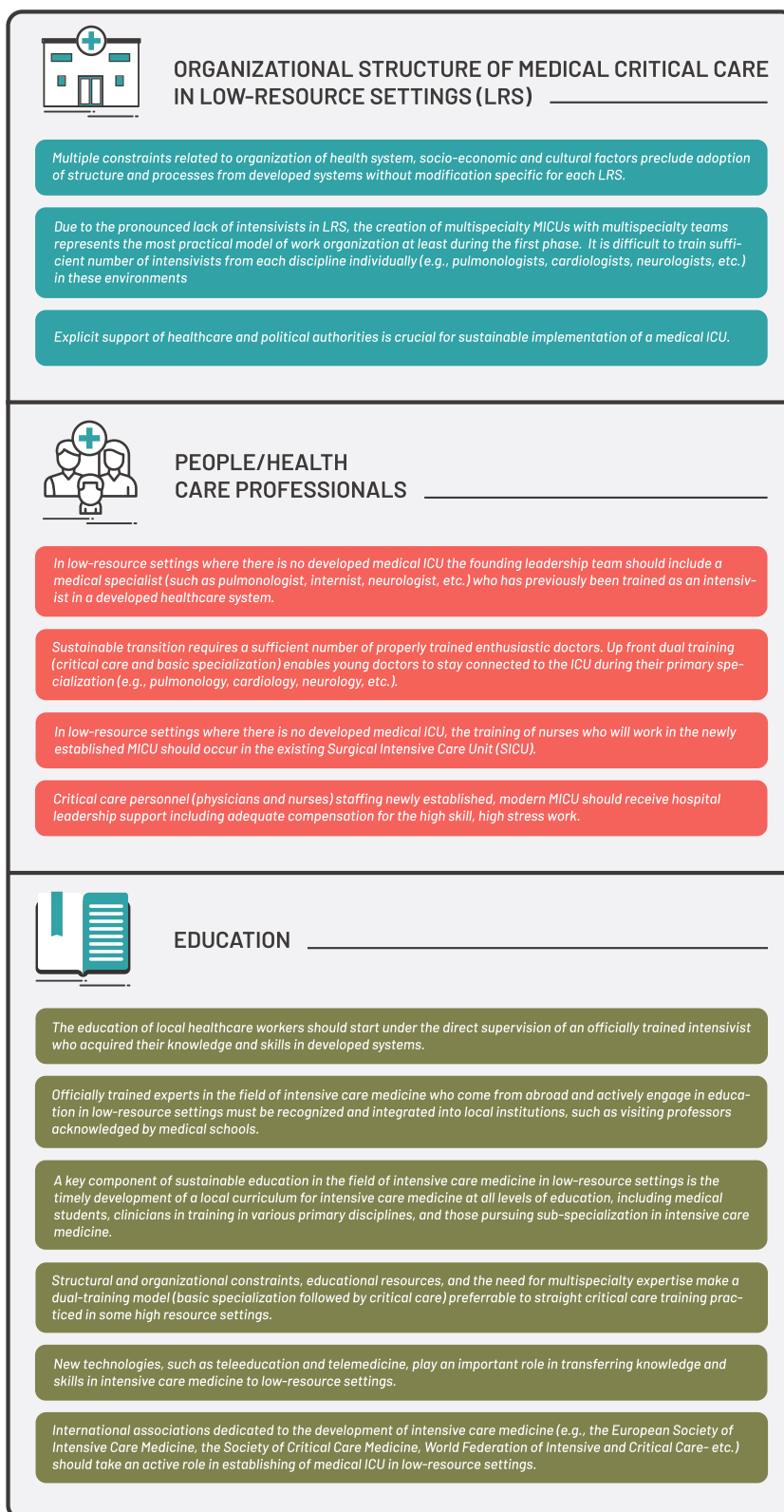


Fig. 3 Expert consensus statements for the establishment of medical intensive care in low-resource settings using a modified Delphi method

education should be supervised by intensivists who have been educated abroad. Additionally, experts from abroad should be well-integrated into local systems of education and healthcare. Furthermore, intensive care medicine should be incorporated at all levels of education—from undergraduate (medical students) to postgraduate, including specialization and a two-year sub-specialization in intensive care medicine. This goal can be achieved by developing a dedicated curriculum in intensive care medicine, which will make the process self-sustaining. The role of developed systems in the education process for intensive care medicine in LRS is crucial [2, 26]. The development of research projects logically follows the advancement of education. A two-year sub-specialization in intensive care medicine was preferred as the simplest to implement in LRS. The participants emphasized the role of novel technologies such as telemedicine and tele-education [27], along with more significant involvement of international and local organizations (e.g., the European Society of Intensive Care Medicine, the Society of Critical Care Medicine, the World Federation of Intensive and Critical Care, etc.). A win-win situation in the education process occurs when both the mentor and mentee share a primary language, ensuring effective communication. Many experts from high-income countries (HICs) are interested in connecting with and giving back to their home countries. These mentors understand the political and socioeconomic situation, are familiar with local customs, rules, and laws, and have a strong interest in assisting their country of origin [2, 3, 8, 11, 28]. Another approach involves experts from developed systems staying in LRS to train several healthcare workers in the newly established MICU [29]. The pandemic period has clearly demonstrated that distance learning and other types of remotely assisted education have a place in continuous education in intensive care medicine. Structured learning programs, such as CERTAIN (Checklist for Early Recognition and Treatment of Acute Illness and Injury), provide virtual intensive care medicine training and quality improvement across LRS [11, 27, 30].

Strengths and limitations

Our study has several strengths, including a mixed-methods approach using a modified online Delphi methodology. This methodology enables maximum participation of geographically distant panel members, shortens the time required for experts, ensures an equal flow of information to and from all members, provides real-time results so that experts can review and adjust their opinions, and allows panel members a greater degree of expression [31, 32]. Maintaining anonymity throughout the process is fundamental to avoid biases such as individual dominance, group pressure, and conformity of opinion (group

thinking) observed in face-to-face meetings. The study also has limitations, such as a relatively small number of participants and the use of a purposeful and convenient sample. However, the characteristics of the participants suggest an adequate representation of the LRS critical care community. The statements provided are based on consensus only and therefore qualify for weak recommendations. Some statements lack specificity and simply highlight the issues. Probably this is an important first step to raise awareness and encourage engagement of critical care clinicians from LRS. The inclusion of only doctors and not nurses, and the fact that only two rounds were conducted, are additional limitations. Multiple rounds could have provided an opportunity to discuss outstanding issues. However, this approach resulted in complete survey completion by all panelists, which would have become less likely as the number of rounds increased [33].

Conclusion

The expert consensus statement provided a set of recommendations for establishing a modern, patient-centered MICU in LRS. The participants favored a multispecialty medical ICUs run by a multispecialty team educated in the field of intensive care medicine. The accelerated creation of a curriculum in intensive care medicine and the implementation of different types of remote education systems with the help of experts from developed systems, integrated into all levels of the local educational system, is of great importance. Medical critical care is of global public health importance and must be consistently supported by regional and national health authorities.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s13054-024-05113-9>.

Additional file1

Additional file2

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Author contributions

The steering committee included PK, OG, RS and BT. PK and OG served as moderator of the task force. KP, OG, JM, FJM, RM and AIH contributed to conception and design of the work, data acquisition, data interpretation and drafting of the manuscript. JV, MR, OTA and KD contributed to design of the work, data acquisition, data interpretation and drafting of the manuscript. IP, OK and OG did the literature search and data analysis, BT and PK prepared the figures. Members of International Intensive Care Medicine Experts Group (Collaborative coauthors) completed the survey questionnaire in the various rounds of the Delphi process and participated at the task force (hybrid international conference). All authors read and approved the final manuscript.

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Availability of data and materials

No datasets were generated or analysed during the current study.

Declarations**Ethical approval and consent to participate**

The ethics committee deemed the study exempt from regulatory approval and informed consent.

Consent for publication

Consent for publication was taken from all co-authors.

Competing interests

None.

Author details

¹Medical Intensive Care Unit, University Clinical Centre of the Republic of Srpska, 78000 Banja Luka, The Republic of Srpska, Bosnia and Herzegovina. ²Faculty of Medicine, University of Banja Luka, Dvanaest Beba Bb, Banja Luka, The Republic of Srpska, Bosnia and Herzegovina. ³Department of Critical Care Medicine, Critical Care Institute, Cleveland Clinic Abu Dhabi, Al Maryah Island, Abu Dhabi, United Arab Emirates. ⁴Medical Intensive Care Unit, Department of Medicine, Hamad General Hospital, Weill Cornell Medical College, ESICM International Representative for Middle East, Doha, Qatar. ⁵Department of Anaesthesia, Lagos University Teaching Hospital, Idi-Araba, Lagos State, Nigeria. ⁶Department of Anaesthesia and Intensive Care Unit, Obafemi Awolowo University Teaching Hospital Complex (OAUTHC), Ile-Ife, Nigeria. ⁷Department of Emergency and Critical Care Medicine, University of Tokyo, ESICM International Representative for Asia-Pacific, Tokyo 113-8655, Japan. ⁸Critical Care, Shaibya Comprehensive Care Clinic, ESICM National Representative of India, Ahmedabad, Gujarat, India. ⁹München Klinik gGmbH and Medical Faculty, Lung Center Munich, University of Heidelberg, Heidelberg, Germany. ¹⁰Department of Anesthesiology, Reanimatology and Intensive Care, Clinic for Abdominal Surgery, University Clinical Centre of Serbia, 11000 Belgrade, Serbia. ¹¹Clínica Guayaquil, Guayaquil, Ecuador. ¹²Department of Medicine, Division of Pulmonary and Critical Care Medicine Mayo Clinic, Rochester, MN, USA.

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