Study Protocol

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REsource-limited Standards & Quality for NUTRItion in the ICU: Protocol for an International Modified Delphi Study (RES-Q Nutri ICU)

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REsource-limited Standards & Quality for NUTRItion in the ICU: Protocol for an International Modified Delphi Study (RES-Q Nutri ICU)

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Abstract

Background: Nutritional therapy is a crucial component of intensive care, yet international guidelines are based largely on evidence from settings with relatively greater access to infrastructure, trained personnel, and nutrition support systems. Intensive care units (ICUs) with limited staffing, equipment, monitoring, or nutrition products, whether in low- and middle-income countries or in high income countries during healthcare surges, lack an internationally agreed framework defining minimum achievable standards for nutrition care.

Methods: RES-Q Nutri ICU is an international, web-based modified Delphi study. A multidisciplinary Steering Committee will draft Round 1 statements from a systematic literature review across five domains: nutritional screening and assessment; timing, route, and delivery of nutritional therapy; monitoring, tolerance, and metabolic control; early mobilization, micronutrients, and special clinical situations; and team-based nutrition care, task-shifting, documentation, and quality improvement. Approximately 40–50 panellists, including intensivists, ICU dietitians, critical care nurses, clinical pharmacists, and nutrition researchers, will rate statements on a 9-point Likert scale. At least 60% of the panel will be from low- or middle-income countries or resource-limited ICUs, and at least one-third will be non-physicians. ICU survivors or patient-care representatives will contribute through qualitative interviews. The study will be reported according to the ACCORD guideline.

Results: Consensus to include and consensus to exclude will be defined as at least 80% of panellists rating a statement 7–9 and 1–3, respectively. Stability of responses will be assessed from Round 2 onwards using the Wilcoxon signed-rank or Kruskal–Wallis test. Statements achieving consensus and stability will form the final consensus statements.

Conclusion: This study aims to develop the first international consensus framework of pragmatic minimum standards for nutritional support in resource-limited ICUs, and to identify research priorities relevant to these settings.

Keywords: Critical care nutrition, Delphi, Enteral nutrition, Intensive care units, Low- and middle-income countries, Minimum standards, Resource-limited settings.

Highlights

- Current ICU nutrition guidelines are based largely on evidence from well-resourced settings, with little representation of low- and middle-income countries.
- This international modified Delphi study will define pragmatic minimum standards for nutritional therapy in resource-limited ICUs, using a multidisciplinary panel drawn predominantly from resource-limited settings.
- The resulting statements may inform local nutrition protocols and highlight research priorities for resource-limited ICUs.

Introduction and Need for the Study

Medical Nutritional Therapy (MNT) is an essential component of intensive care management and has important implications for clinical outcomes in critically ill patients. International guidelines from ESPEN, ASPEN, and ESICM provide evidence-based recommendations for nutritional assessment, initiation, delivery, and monitoring of nutrition support in intensive care units. These recommendations are based largely on evidence generated from settings with relatively greater access to infrastructure, trained personnel, and nutrition support systems. Using the current World Bank classification, no trial included in the main analyses of the ASPEN or ESPEN guidelines came from a low-income country, and trials from lower-middle-income countries made up less than 1% of patients[1-3]. However, the practical implementation of these recommendations may be difficult in resource-limited settings.

Resource limitations include, but are not limited to, lack of monitoring tools and specialized enteral or parenteral nutrition products, limited trained nursing workforce, inconsistent access to ICU dietitians and post-pyloric feeding, absence of indirect calorimetry, and restricted availability of feeding pumps. These limitations are particularly common in low- and middle-income countries but may also arise in high-income settings during periods of healthcare system surge, such as pandemics and mass-casualty events. Furthermore, internal disparities exist within the same country, creating gaps between urban university hospitals, and public or private facilities[4,5].

As a result, nutritional practices in many ICUs remain pragmatic, variable, and dependent on local resources. There is currently no internationally agreed framework defining minimum achievable standards for ICU nutrition in resource-limited settings based on the available evidence for clinical standardization and weighing cost-effectiveness against other healthcare needs and interventions. A consensus-based approach is therefore needed to identify essential practices, acceptable adaptations, and future research priorities relevant to such settings.

Recent Delphi consensus studies in critical care have demonstrated that structured expert consensus can help develop pragmatic recommendations where evidence is limited or implementation varies widely. Similar approaches have been used in critical care nutrition to establish core outcomes and monitoring standards[6-10].

Aim and Objectives

Aim

To develop international expert consensus statements on nutritional support for adult critically ill patients in resource-limited intensive care units.

Objectives

Primary Objective

1. To establish consensus-based minimum standards for assessment, initiation, delivery, and monitoring of nutritional therapy in resource-limited ICUs.

Secondary Objectives

1. To identify pragmatic adaptations of existing international ICU nutrition guidelines for resource-limited settings.
2. To identify essential (minimum) nutritional practices for critically ill patients in ICUs
3. To identify research priorities in ICU nutrition for resource-limited settings.

Materials and Methods

Study Design and Setting

The RES-Q Nutri ICU study will use an international modified Delphi methodology to develop expert consensus statements for nutritional practices in resource-limited ICUs. The study will focus on minimum standards that are realistic, clinically relevant, and adaptable across different resource-constrained environments.

The study will be conducted as an international web-based Delphi study under the RES-Q Nutri ICU Working Group. The study will be reported in accordance with the ACCORD (ACcurate COnsensus Reporting Document) guideline for consensus studies. Systematic review of available evidence will be used for drafting the Delphi Round 1 statements. Ethics approval for this study has been obtained from the Institutional Ethics Committee, Father Muller Medical College, Mangalore, India (Ref. no. FMIEC/CCM/495/2026, dated 22/10/2026).

Operational Definition of Resource-Limited Settings

For this Delphi study, the term ‘resource-limited settings’ is used to describe settings with lack or limited availability of one or more of the following: trained healthcare professionals, infrastructure, laboratory diagnostic facilities and equipment for the management of nutrition support. This definition will be independent of particular geographic region or World Bank income classification and will also include temporary resource constraints during healthcare surges[6].

Study Duration

The study will be conducted over approximately 18 months year from protocol finalization to completion of Delphi rounds and final consensus statement development.

Study Participants

The study will involve international experts and experienced clinicians involved in ICU nutrition practice, research, education, or guideline development. Eligible participants include intensivists, ICU dietitians, critical care nurses, clinical pharmacists, nutrition researchers, and clinicians involved in the nutritional care of critically ill patients.

Steering Committee

A multidisciplinary international Steering Committee comprising intensivists, dietitians, pharmacists, nurses, and a Delphi methodologist will guide the study. The Steering Committee will define the scope of the study, conduct the focused literature review, develop the initial statements, analyze Delphi responses, refine statements between rounds, and draft the final consensus manuscript. Steering Committee members will not participate as voting panellists. An independent Delphi methodologist will provide methodological oversight to ensure the integrity and transparency of the Delphi process

and to identify and minimize potential cognitive biases, including reflexivity, confirmation, cultural, and citation bias, particularly during the development and refinement of statements by the Steering Committee[11].

Expert Panel Size and Selection

Panelists will be invited using purposive sampling through professional networks, academic collaborations, and critical care or nutrition societies. The panel will aim for diversity across professional background, geography, sex/gender, and healthcare resource settings.

The study aims to include approximately 40 to 50 experts in Round 1 to ensure multidisciplinary and geographical representation as used in other Delphi studies with similar scope.[6] A minimum retention of 80% of panellists completing the first round will be considered acceptable for interpretation of the consensus results, provided that representation from relevant professional groups and resource-limited settings is maintained. If attrition exceeds 20%, sensitivity analyses will be performed to assess the robustness of the consensus results under assumptions of extreme ratings among participants who did not complete subsequent rounds.

Eligibility criteria

Panellists will be eligible if they meet all of the following criteria:

1. **Professional background:** Adult ICU clinicians or researchers involved in critical care nutrition practice, research, education, or guideline development, and belonging to one of the following professional groups: intensivists, ICU dietitians, critical care nurses, clinical pharmacists, nutrition researchers, or allied professionals involved in ICU nutrition.
2. **Relevant expertise:** At least one of the following:

    a) At least one peer-reviewed publication related to critical care nutrition.
    b) A minimum of 10 years of relevant ICU or nutrition experience, with at least 50% of clinical time spent managing critically ill patients.
    c) Involvement in nutrition guideline or protocol development.
    d) A leadership or advocacy role in a critical care or nutrition society; or
    e) At least 5 years of direct experience working in resource-limited ICU settings.

3. **Willingness to participate:** Willingness to participate in multiple Delphi rounds.
4. **Professional diversity:** At least one-third of the final panel will comprise non-physicians.

At least 60% of the final expert panel will be from low- or middle-income countries or have direct, current experience working in resource-limited ICUs, as defined in this protocol.

Exclusion Criteria

1. Failure to provide implied consent through survey participation.

2. Inability to comprehend or independently vote on statements written in English. (To support non-native English speakers, all Delphi statements will be written in clear, unambiguous English.)
3. Incomplete Round 1 response with no rating data.

Patient and Public Involvement and Engagement (PPIE)

Five to ten ICU survivors or patient-care representatives predominantly from resource-limited settings, will take part in a single 30–40-minute qualitative interview, rating the Round 1 statements on a 5-point Likert scale statement from least valuable to most valuable; any adult ICU survivor with an informed consent is eligible, and patient-care group representatives may take part where direct patient involvement raises ethical concerns. Interviews will be conducted in the participant's preferred language by bilingual interviewers, to avoid selection bias and preserve the validity of patient-reported perspectives. Responses will be analyzed descriptively and included in the controlled feedback during Round 2 or 3. Local and regional ethics committee approvals will be obtained for PPI involvement, and informed consent will be obtained from all participants before the interviews are conducted.

Methodology and Timeline

The Delphi process will be conducted electronically using a secure online survey platform such as REDCap, Qualtrics, or Google Forms. Participation in the Delphi rounds will be voluntary, and informed consent will be obtained electronically at the beginning of the Round 1 survey. Once panellists agree to take part, they will receive a concise overview of the study covering its aims, what is expected of them, the planned timeline of survey rounds and the approximate time each round will take. To keep panellists engaged and to reduce drop-out, at least three personalised email reminders will be sent during each round, and investigators will also try to contact non-responders directly. In recognition of their expertise, panellists who complete all the Delphi rounds will be invited to contribute as collaborative authors in the final publication. No financial incentives or honoraria will be provided to panellists or Steering Committee members for their participation.

The Steering Committee members will perform a systematic literature search on the available evidence, including existing international guidelines, surveys, and protocols on ICU nutrition, to draft the initial statements for the first survey. The following databases will be searched: PubMed, Scopus, Embase, Web of Science, and Google Scholar, together with relevant international guidelines from ESPEN, ASPEN, and ESICM. The searches will be based on a combination of keyword terms and controlled vocabulary related to "critical illness" or "intensive care," "nutrition therapy" (including enteral and parenteral nutrition), and "resource-limited settings" (including low- and middle-income countries). Search results will be limited to adult studies published in English from January 2015 to September 2026. No restrictions will be placed on geographic location or study design, to maximise sensitivity given the limited evidence from resource-limited settings. Duplicate articles between databases will be removed using Rayyan. Following removal of duplicate records, all citations will be screened at the title and abstract level independently by two study team members (Reviewers VS and ST). Citations meeting the inclusion criteria or requiring further clarification will undergo full-text review, and full manuscripts will be reviewed independently. Disagreements will be resolved by discussion or by a third

reviewer. The selection process will be summarised in a PRISMA flow diagram. A summary of the key evidence identified for each domain will be shared with panellists along with the Round 1 survey.

Initial Delphi statements will be developed under the following thematic domains:

1. Nutritional screening and assessment.
2. Timing, route, and delivery methods of nutritional therapy.
3. Monitoring, tolerance, and metabolic control.
4. Early mobilization, micronutrients, and special clinical situations.
5. Team-based nutrition care, task-shifting, documentation, and quality improvement.

Round 1

Participants will rate the importance of each statement using a 9-point Likert scale, where scores of 1-3 indicate “not important,” 4-6 indicate “important but not essential,” and 7-9 indicate “essential.” Participants will also be encouraged to suggest modifications, propose additional statements, and provide free-text comments. Demographic details including country, profession, years of experience, and type of practice setting will be collected in round 1. In addition, each panellist will be asked to provide information on resource limitations in their practice setting, where applicable.[9,10]. A summary of the systematic search findings will be shared with panellists along with the Round 1 survey to inform their ratings.

Round 2 and Subsequent Rounds

After each round, participants will receive controlled feedback including their previous score, group median score with interquartile range, percentage agreement, anonymised comments, and consensus status of each item. Statements reaching predefined consensus will be retained. Statements with no consensus may be revised, merged, clarified, or dropped by the Steering Committee based on quantitative scores and qualitative comments. Free-text comments will be coded independently by two Steering Committee members, with disagreements resolved by discussion or the methodologist. A statement will be revised for the next round when at least 10% of respondents (and no fewer than four) make comments raising the same substantive issue. Revisions that change the meaning of a statement will be treated as a new statement requiring re-rating; wording clarifications that do not change the meaning will not. The Steering Committee may revise a statement below this threshold only where a comment identifies a safety or factual concern, and the rationale will be recorded. All revisions will be reported in the final manuscript[9,10]. Delphi rounds will continue until response stability are achieved.

Consensus Definition

- Consensus to include: at least 80% of participants rate the statement as 7-9.
- Consensus to exclude: at least 80% of participants rate the statement as 1-3.
- Equivocal or no consensus: failure to meet either inclusion or exclusion threshold after repeated rating.

Response stability: assessed from Round 2 onwards using comparison of score distributions between consecutive rounds; absence of statistically significant variation will indicate stability.

The Delphi process will be concluded until the responses are stable for all the statements. Stable statements are circulated to the panel for approval before the manuscript is submitted.

Statistical Analysis

Data will be analysed using SPSS, R, or equivalent statistical software. Continuous variables will be summarised as median with interquartile range, and categorical variables as frequencies and percentages. For each Delphi statement, median score, interquartile range, percentage of ratings in the 1-3, 4-6, and 7-9 categories, and consensus status will be reported.

Stability of responses between consecutive rounds will be assessed from Round 2 onwards using appropriate non-parametric tests such as Wilcoxon signed-rank test, or Kruskal-Wallis test, depending on data structure. A p-value <0.05 will indicate significant variation and lack of stability. Qualitative free-text comments will be reviewed thematically by the Steering Committee to refine statements[10]. Subgroup analyses are planned to compare responses between professional groups (e.g., dietitians vs. intensivists) and between panellists from high-income versus low- and middle-income countries. These exploratory analyses will be descriptive in nature and will be interpreted with caution due to the small sample sizes within each subgroup.

Ethical Considerations

Participation will be voluntary and based on electronic consent through survey completion. All invited participants will be provided with an electronic Participant Information Sheet at the beginning of the online survey. The information sheet will explain the study objectives, procedures, voluntary nature of participation, confidentiality, and contact details of the investigators. Participants will be required to provide electronic informed consent by selecting "I agree to participate" before they can access the Delphi questionnaire. Only participants providing electronic consent will be able to proceed with the survey. No patient data will be collected. Individual responses will remain anonymous to other panellists and will be reported only in aggregate. Ethical approval will be obtained from the Institutional Ethics Committee of Father Muller Medical College prior to study initiation. The study protocol will be registered on an appropriate clinical study registry. The study will be conducted in accordance with the principles of the Declaration of Helsinki.

Discussion

This Delphi study aims to develop the first international consensus framework specifically regarding nutritional practices in resource-limited ICUs. The resulting statements from this study may help establish minimum standards of nutrition care, inform local nutrition protocols and quality improvement initiatives, and bridge the gap between international guidelines and bedside practice. They may also identify research priorities relevant to these settings.

The study's strengths include a multidisciplinary panel comprising intensivists, dietitians, critical care nurses, clinical pharmacists and nutrition researchers, with substantial representation from low- and middle-income countries and resource-limited ICUs. By focusing on pragmatic minimum standards rather than optimal care, the recommendations are intended to be applicable across diverse settings, including

those experiencing temporary resource constraints. The involvement of ICU survivors and patient-care representatives will also provide a patient perspective of nutrition practices in these settings.

Several limitations of this study should be acknowledged. The requirement for basic English proficiency and recruitment through professional networks may limit geographical representation and favour academically engaged clinicians. Given the diversity of resource-limited settings, not all statements may be applicable across institutions. Patient involvement is restricted to a small number of interviews, and their ratings will inform but not contribute to expert consensus. Finally, the recommendations will be based on expert consensus and will require further validation in clinical practice.

Authors' Contributions

Vijay Sundarsingh and Soumaya Touzani were involved in the conceptualization and design of the study. Prashant Nasa served as the methodologist for the Delphi process. Michael P. Casaer, Martin Sundström Rehal, Christian Stoppe, Nawfal Houari, Danielle Bear, Frank Carrera-Gil, and Liane Brescovici Nunes de Matos served as members of the Steering Committee, contributing to the development of the study protocol. All authors contributed to reviewing and editing the manuscript for intellectual content and are responsible for the content of this protocol.

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Source of Support

Nil

Conflict of Interest

Dr Prashant Nasa is associated as an Editorial Board Member of this journal, and this manuscript will be subjected to this journal's standard review procedures, with peer review handled independently of this Editorial Board Member and his research group. The other authors declare no conflict of interest.

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