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Narrative Review

Nutrition guidelines for critically ill adults admitted with COVID-19: Is there consensus?

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Aims: To identify key guidelines or practice recommendations for nutrition support practices in critically ill adults admitted with COVID-19, to describe similarities and differences between recommendations, and to discuss implications for clinical practice.

Methods: A literature review was conducted to identify guidelines affiliated with or endorsed by international nutrition societies or dietetic associations which included recommendations for the nutritional management of critically ill adult patients with COVID-19. Data were extracted on predefined key aspects of nutritional care including nutrition prescription, delivery, monitoring and workforce recommendations, and key similarities and discrepancies, as well as implications for clinical practice were summarized.

Results: Ten clinical practice guidelines were identified. Similar recommendations included: the use of high protein, volume restricted enteral formula delivered gastrically and commenced early in ICU and introduced gradually, while taking into consideration non-nutritional calories to avoid overfeeding. Specific advice for patients in the prone position was common, and non-intubated patients were highlighted as a population at high nutritional risk. Major discrepancies included the use of indirect calorimetry to guide energy targets and advice around using gastric residual volumes (GRVs) to monitor feeding tolerance.

Conclusion: Overall, common recommendations around formula type and route of feeding exist, with major discrepancies being around the use of indirect calorimetry and GRVs, which reflect international ICU nutrition guidelines.

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1. Introduction

Globally the Coronavirus Disease 2019 (COVID-19) pandemic has impacted more than 100 million people, with hospitalization reported to occur at a rate of 4.6 per 100,000 population. Approximately 90% of hospitalized patients have more than one co-morbidity, with the most frequent being obesity, hypertension, chronic lung disease, diabetes and cardiovascular disease, complicating nutritional...
management [1]. Five to ten percent of hospitalized patients with COVID-19 develop severe acute respiratory distress coronavirus 2 (SARS-CoV-2) and require an intensive care unit (ICU) admission [1,2]. Commonly, patients present with progressive symptoms, several days after contracting the illness. In severe cases, this may cause respiratory distress syndrome, heart failure, and septic shock, which can lead to multi-organ failure and uncontrolled acute inflammation causing pulmonary tissue damage [3]. Critically ill patients with COVID-19 are at high nutritional risk due to critical illness itself, its medical management (e.g. organ support, sedation, ventilation) and significant metabolic changes such as persistent fever and hypermetabolism [4]. Patients may stay in the ICU for anywhere between a few days to months and the majority require mechanical ventilation with high doses of sedation [2,5]. Furthermore, patients often present with several unique physiological symptoms which are likely to impact nutritional intake including a loss of taste and smell, poor appetite and gastrointestinal (GI) symptoms in around 10% of cases, such as diarrhoea, nausea, and vomiting [6,7]. It has been reported that up to 65% of patients admitted to the ICU with COVID-19 are malnourished [8–10].

Due to the nature of this pandemic, the number of admissions has overwhelmed many ICUs and healthcare workers have been considerably impacted. As a result, less experienced staff have been required to work in the ICU. Due to both the complexity of the patients and the environment, guidelines detailing the nutritional management of these patients are vital to ensure safe patient care [11]. To date there is no international consensus on the optimal nutrition care of critically ill patients with COVID-19. The objective of this review was to identify key guidelines or practice recommendations which have been published for nutrition support practices in critically ill adults admitted with COVID-19. The secondary objectives were to describe similarities and differences between the recommendations, and to discuss implications for clinical practice.

2. Materials and methods

Guidelines, practice recommendations, or consensus recommendations affiliated with or produced by a professional nutrition society or dietetic association known to authors at commencement of the review were assessed against eligibility criteria. In addition, a literature search of Medical Literature Analysis and Retrieval System Online (MEDLINE) on Ovid was conducted from January 2020 to 22 January 2021 to identify further relevant guidelines that were published in scientific journals. Search strings included terms related to 1) intensive care; 2) nutrition support; and 3) guidelines/practice recommendations. The search strategy was based on two previously published search strategies from an affiliated institution [12,13] and is shown in the Supplemental Table S1. The websites of the International Confederation of Dietetic Associations (40 member countries) (https://www.internationaldietetics.org/NDAs.aspx) and reference lists of review articles identified via MEDLINE were also searched for relevant guidelines.

Guidelines and practice recommendations were included if they met all of the below inclusion criteria and none of the exclusion criteria:

2.1. Inclusion

1. Included recommendations for the nutritional management of patients with COVID-19.
2. Contained recommendations for critically ill adults.
3. Related to care provided directly within the ICU setting.

4. Were affiliated with an international nutrition or dietetic society.

2.2. Exclusion

1. Were an opinion piece, narrative or systematic review.
2. Were not published in English.
3. Related solely for patients following an intensive care stay (e.g. standalone post-ICU recommendations were excluded).

Data were extracted on pre-defined key aspects of nutrition care identified as important by the authors during a pandemic and for patients with COVID-19, including: nutrition risk screening; nutrition prescription; timing, route, and mode of feeding; formula type; monitoring of nutrition intervention; recommendations for specific patient populations or conditions and; recommendations on service provision such as equipment considerations and workforce. Key similarities and discrepancies, as well as implications for clinical practice are discussed.

3. Results

3.1. Summary of published guidelines

Seven guidelines were known to authors at commencement of the review and were included. To identify further guidelines unknown to authors, a database search was conducted which identified 229 non-duplicate articles of which two met all inclusion criteria and none of the exclusion criteria, and a final guideline was identified through searching the websites of the International Confederation of Dietetic Associations (CONSORT diagram in Fig. 1). Overall, 10 guidelines were included in this review from the following associations: American Society For Parenteral and Enteral Nutrition (ASPEN) [14]; Australian Society For Parenteral and Enteral Nutrition (AuSPEN) [15]; Brazilian Society of Parenteral and Enteral Nutrition (BRASPEN) [16]; British Dietetic Association (BDA) [17]; European Society for Clinical Nutrition and Metabolism (ESPEN) [18]; Indian Dietetic Association (IDA) [19]; Irish Nutrition and Dietetic Institute (INDI) [20]; Israeli Dietetic Association (ATID) [21]; ANSISA: National Association of Specialists in Food Science (ANSISA; Italy) [22]; Turkish Dietetic Association (TDA) [23] (Supplemental Table S2; Fig. 2).

The guideline development process was reported for five guidelines (ASPEN, AuSPEN, BDA, ESPEN and ATID) [14,15,17,18,21]. Recommendations were developed using clinician experiences with COVID-19 (BDA, ATID) [17,21], extrapolated from previous international guidelines for nutrition provision in critically ill patients without COVID-19 (ESPEN, ATID, ASPEN) [14,15,18,21], expert consensus (ESPEN, AuSPEN) [15,18], infection control practices (ATID) [21], and based on physiological processes reported in patients with COVID-19 (AuSPEN) [15]. No guideline provided levels of evidence for their recommendations.

3.2. Common recommendations and major discrepancies

3.2.1. Nutrition risk screening

Seven guidelines state the importance of nutrition risk screening in critically ill patients with COVID-19 (Table 1) [14–16,18,20–22]. Three guidelines recommend a specific validated tool: NRS-2002 (ESPEN) [18]; MST or MUST (INDI) [20] and; NUTRIC (ATID) [21]. A further two state specific patient populations that should be considered at higher nutritional risk: ASPEN recommend identifying pre-
Fig. 1. CONSORT diagram of included guidelines. ANSISA: National Association of Specialists in Food Science (Italy); ASPEN: American Society for Parenteral and Enteral Nutrition; AuSPEN: Australasian Society for Parenteral and Enteral Nutrition; BRASPEN: Brazilian Society of Parenteral and Enteral Nutrition; ESPEN: European Society for Clinical Nutrition and Metabolism; INDI: Irish Nutrition and Dietetic Institute; IDA: Indian Dietetic Association; ATID: Israeli Dietetic Association; TDA: Turkish Dietetic Association.

Fig. 2. Geographical location of guideline development. ASPEN: American Society for Parenteral and Enteral Nutrition; AuSPEN: Australasian Society for Parenteral and Enteral Nutrition; BRASPEN: Brazilian Society of Parenteral and Enteral Nutrition; BDA: British Dietetic Association; ESPEN: European Society for Clinical Nutrition and Metabolism; IDA: Indian Dietetic Association; INDI: Irish Nutrition and Dietetic Institute; ATID: Israeli Dietetic Association; ANSISA: National Association of Specialists in Food Science (Italy); TDA: Turkish Dietetic Association.
3.2.2. Nutrition requirements and prescriptions

Five guidelines discuss the use of indirect calorimetry for measuring energy expenditure and one (ESPEN) recommends that indirect calorimetry is used where safely available [18]. Three (ASPEN, AuSPEN, BRASPEN) recommend against the use of indirect calorimetry due to risk of staff exposure to the virus, potential spread of disease, and/or workforce related demands [14–16]. The ATID guideline did not provide an explicit recommendation on the use of indirect calorimetry but mentioned the use of indirect calorimetry when considering energy prescription [21].

The majority of guidelines (eight of the 10) provide recommendations on the prescription of energy and protein in patients with COVID-19 using a predictive equation. All eight guidelines support the slow and progressive delivery of energy and protein during the first 5–7 days of critical illness, although approaches to this vary (Table 2) [14–16,18,19,21–23]. Two guidelines (ANSISA and AuSPEN) provide algorithms for commencement and management of nutrition therapy; AuSPEN provides an algorithm with set rates for the first five days of nutrition therapy [15], while ANSISA provides guidance for continuous infusion rates [22]. Two guidelines (BDA and INDI) do not provide recommendations for energy and protein prescriptions; BDA encourages use of local practices and guideline recommendations [17] and INDI provides algorithms for out-of-hours EN and PN initiation [20].

3.2.3. Timing of initiation

Seven guidelines recommend the initiation of EN within 48 h of admission, in line with broader critical illness nutrition practice guidelines [24,25]. Two guidelines (ASPEN and IDA) discuss timing of initiation in patients with sepsis or circulatory shock, recommending early EN at a trophic rate be considered [14,19]. The ASPEN guideline states COVID-19 should not be considered a contraindication to early trophic EN, unless combined with escalating vasopressor use and EN intolerance [14]. The remaining three guidelines do not provide specific recommendations for the timing of initiation of EN [17,22,23], with the TDA referring to “early intestinal nutrition” but providing no further guidance [23].

3.2.4. Route of feeding

All of the included guidelines recommend the enteral route (oral or EN) in preference for PN for nutrition therapy [14–23]. Four (ASPEN, AuSPEN, BDA, ESPEN) guidelines recommend the commencement of EN via the nasogastric (NG) route [14,15,17,18]. One guideline (TDA) recommends post-pyloric EN as the first line feeding route, stating that critically ill patients often experience GI intolerance [23]. In the four guidelines where NG feeding is recommended, progression to post-pyloric EN is not recommended unless adequate management of GI intolerance is first attempted (such as the use of prokinetics) due to the risk to staff with tube insertions [14,15,17,18]. The remaining five guidelines recommend nutrition via the EN route but do specify whether delivery should be via a NG or post-pyloric tube [16,19–22]. In the case of uncontrolled shock and hemodynamic instability, four (ASPEN, ESPEN, IDA and ATID) guidelines recommend that EN is withheld and gradually recommenced upon patient stabilization [14,18,19,21].

Six (ANSISA, ASPEN, BRASPEN, ESPEN, IDA, INDI) guidelines provide recommendations for the commencement of PN where EN is contraindicated (Table 2) [14,16,18–20,22]; with three (ASPEN, IDA, INDI) recommending that PN is initiated as soon as possible in high nutrition risk and/or malnourished patients [14,19,20]. The commencement of supplemental PN is mentioned in five (ANSISA, AuSPEN, BRASPEN, ESPEN, ATID) guidelines (Table 2), but the recommended timing varies; four (AuSPEN, BRASPEN, ESPEN, ATID) guidelines recommending consideration of commencement within the first week of ICU where intake is suboptimal and one (ANSISA) not providing a specific recommendation regarding the timing of supplemental PN initiation [22]. Two (BDA and TDA) guidelines do not explicitly discuss the use of PN; one guideline (BDA) stating that it may be required where post-pyloric EN is not available and the remaining guideline (TDA) mentioning the use of PN in elderly patients at high aspiration risk or GI intolerance [17,23].
3.2.5. Mode of feeding

Six guidelines (ANSISA, ASPEN, AuSPEN, BDA, IDA, INDI) include recommendations on the mode of feeding, with all guidelines recommending continuous EN [14,15,17,19,20,22]. ASPEN were the only society to provide evidence to justify this recommendation, stating a reduction in diarrhea and less frequent patient interaction for staff with continuous EN, decreasing exposure of healthcare professionals to COVID-19 [14].

3.2.6. Enteral formula prescription

All but one guideline provided a recommendation on the type of EN formula to prescribe for critically ill patients admitted with COVID-19 [14–17,19–23]. Four guidelines provide a specific recommendation on caloric density of EN (ANSISA, AuSPEN, BDA, ATID) with disparate recommendations, ranging from 1.25 to 2 kcal/ml [15,17,21,22]. Six guidelines (ANSISA, ASPEN, AuSPEN, IDA, INDI, ATID) recommend using a high protein formula [14,15,19–22] with three guidelines encouraging the use of protein supplementation delivered through a bolus [20], modular protein [21], or as a single bolus to cluster care [14].

ANSISA, ASPEN, and the IDA recommend using fiber-free formula early in the ICU admission [14,19,22]. Conflicting advice on the use of omega-3 enriched formula are present, with ANSISA and the IDA recommending omega-3 [19,22] while the BRASPEN guideline states the use of EN with omega-3 is not indicated [16]. Similarly, conflicting advice on carbohydrate load to manage dysglycemia is present: ANSISA recommend a low carbohydrate formula [22] and the TDA recommends the use of nutritional preparations which are beneficial to glycemic control in hyperglycaemic patients [23], while the ATID states there is no widespread recommendation for the use of EN low in carbohydrates compared to standard EN to achieve glycemic control [21].

3.2.7. Monitoring

3.2.7.1. Gastric residual volumes. Seven guidelines make recommendations about using gastric residual volumes (GRVs) to monitor EN tolerance [15,17–21]. Five of these guidelines (AuSPEN, BDA, ESPEN, INDI, ATID) recommended monitoring GRVs at various timepoints using different cut-offs, as shown in Table 2 [15,17,18,20,21]. Both ASPEN and the IDA do not recommend routinely monitoring GRVs, citing that GRV monitoring is not reliable for detection of delayed gastric emptying, can impact nutrition delivery, and is a risk of viral transmission to the healthcare provider [14,19].

Table 1

| Guideline or practice recommendation society | Nutrition risk screening | Nutrition requirements prescription | Timing of initiation | Route of feeding | Mode of feeding | Formula prescription | Monitoring | Specific patient populations/conditions | Equipment considerations | Workforce recommendations |
|---------------------------------------------|--------------------------|-----------------------------------|---------------------|-----------------|-----------------|---------------------|------------|------------------------------------------|--------------------------|--------------------------|
| ANSISA                                      | √                        | √                                 | X                   | ✓               | ✓               | X                   | X          | X                                       | X                        | X                        |
| ASPEN                                       | √                        | √                                 | ✓                   | ✓               | ✓               | ✓                   | ✓          | X                                       | X                        | X                        |
| AuSPEN                                      | √                        | √                                 | ✓                   | ✓               | ✓               | ✓                   | ✓          | X                                       | X                        | X                        |
| BDA                                         | X                        | X                                 | X                   | ✓               | ✓               | ✓                   | ✓          | X                                       | X                        | X                        |
| BRASPEN                                     | ✓                        | √                                 | ✓                   | ✓               | ✓               | ✓                   | ✓          | X                                       | X                        | X                        |
| ESPEN                                       | ✓                        | ✓                                 | ✓                   | ✓               | ✓               | ✓                   | ✓          | X                                       | X                        | X                        |
| IDA                                         | X                        | ✓                                 | ✓                   | ✓               | ✓               | ✓                   | ✓          | X                                       | X                        | X                        |
| INDI                                        | ✓                        | X                                 | ✓                   | ✓               | ✓               | ✓                   | ✓          | X                                       | X                        | X                        |
| ATID                                        | ✓                        | ✓                                 | ✓                   | ✓               | ✓               | ✓                   | ✓          | X                                       | X                        | X                        |
| TDA                                         | ✓                        | ✓                                 | ✓                   | ✓               | ✓               | ✓                   | ✓          | X                                       | X                        | X                        |
Table 2
Guidelines and key recommendations.

| Guidelines          | Energy requirements | Protein requirements | Route of feeding | Formula prescription | Initiation and considerations | Monitoring (GRVs) |
|---------------------|---------------------|----------------------|------------------|----------------------|-----------------------------|------------------|
| ANSISA (Italian)    | 20–25 kcal/kg/day   | 1.2–2 g/kg/day       | No recommendation for commencement of EN | High-protein energy EN, low carbohydrates, omega-3 enriched, no fiber as first preference | Start with <70% of requirements and increase progressively | N/A              |
| ASPEN               | First week: 15–20 kcal/kg/day | 1.2–2.0 g/kg/day | EN is preferred to PN | Standard high protein (≥20% protein) polymeric isonotic EN in acute phase | 24–36 h of ICU admission (or within 12 h of intubation) | Do not routinely monitor GRVs |
| AuSPEN              | Day 1–5: Standard feed rate 50 ml/h: 1.25 kcal/ml Day 6+: 25 kcal/kg/day (up to 30 kcal/kg/day for severely unwell patients + prolonged admission) | ≥1.2 g/kg/day | No recommendation for commencement of EN | Use energy-dense EN formula (1.25–1.5 kcal/ml) | Low nutrition risk: within 7 days | 300 ml cut-off (8 hourly). Stop monitoring in non-prone patients if GRVs are <300 ml for >48 h |
| BDA                 | N/A                 | N/A                  | Consider an NGT on admission, post-pyloric tube if persistently high GRVs | CN: consider if post-pyloric feeding is not available | Avoid large volumes/high rates of EN. Consider 1.3/1.5 kcal/ml EN | N/A              |
| BRASPMEN            | Day 1–4: 15–20 kcal/kg/day Day 5+: 25 kcal/kg/day | 1.3 g/kg/day delivered progressively | EN preferred route in critical illness | Use of EN with omega 3, borage oils, and antioxidants is not indicated | 24–48 h of admission | N/A              |
| ESPEN               | Use IC where safe, if so: | Day 1–3: <70% of measured REE Day 3–7: progression to 80–100% measured REE | Oral → ONS preferred, followed by EN | N/A | 24-48 during hospitalization | 500 ml cut-off |
| IDA                 | First week: 15–20 kcal/kg/day | 1.3–1.5 g/kg/day (up to 2 g/kg/day with high metabolic demands) | EN preferred to PN EN contraindication: PN is recommended within 3–7 days | Standard high protein (>20% protein) polymeric and isonotic EN | 24–36 h of ICU admission (or within 12 h of intubation) | Do not routinely monitor GRVs |
| INDI                | N/A                 | N/A                  | EN preferred to PN EN contraindication: Commence PN as early as possible | Consider double-strength EN Higher protein EN with lower energy content, if on high dose propofol (>15 ml/h) | 24–48 h once hemodynamically stable | Only check GRVs for surgical, prone positioned, intestinal failure, and multi-organ failure patients and those who had vomited in the previous 24 h |
| ATID                | Day 1–2: up to 70% of 25 kcal/kg/day Day 3–7: 25 kcal/kg/day Day 7+: 25–30 kcal/kg/day | 1.3–1.5 g/kg/day | No recommendation for commencement of EN | High protein EN Concentrated formulas (1.5–2 kcal/ml) recommended for patients who require fluid restriction | Within 48 h | 500 ml cut-off (6 hourly) |
3.2.7.2. Electrolytes. Four guidelines mention that re-feeding syndrome risk should be considered in critically ill patients admitted with COVID-19 (ASPEN, BRASPEN, ESPEN, ATID), as poor appetite and intake and gastrointestinal symptoms are common before hospital admission. These guidelines recommend close monitoring and replacement of potassium, phosphate, and magnesium when commencing nutrition support [14,16,18,21].

3.2.7.3. Triglycerides. Four guidelines (ASPEN, ESPEN, INDI, ATID) recommend monitoring serum triglycerides when patients are receiving propofol and/or PN [14,18,20,21]. The ASPEN guideline also recommended that when interpreting elevated triglyceride levels, clinicians should be aware that a subset of COVID-19 patients develop a cytokine storm that resembles hemophagocytic histiocytosis (secondary HLH) [14], and this may be the cause of hypertriglyceridemia (rather than propofol-induced) [24].

3.2.7.4. Nutrition adequacy. To prevent under- or over-feeding, the majority of guidelines recommend close monitoring of nutrition adequacy (energy and protein delivery compared to estimated or measured requirements) [14]. Five guidelines (ASPEN, AuSPEN, BDA, INDI, ATID) highlight the importance of monitoring the delivery of non-nutritional calories (e.g. glucose, propofol) [14,15,17,20,21].

3.2.8. Specific patient populations

3.2.8.1. Prone positioning. Seven guidelines recommend early EN, given continuously, while patients are in the prone position [14–20,21]. Five of the seven guidelines (ASPEN, AuSPEN, BDA, INDI, ATID) highlight that patients in the prone position may have increased GI intolerance, and prokinetics and insertion of post-pyloric tubes should be considered as necessary [14–17,21].

3.2.8.2. Patients receiving extracorporeal membrane oxygenation. Three guidelines (AuSPEN, ASPEN, ATID) make specific recommendations for patients receiving extracorporeal membrane oxygenation (ECMO) [15,17,23]. Two (ASPEN, ATID) specifically recommend early EN in this patient group [14,21]. The AuSPEN and ATID guidelines highlight that patients on ECMO are likely to have high metabolic needs (e.g. after ICU day 5 up to 30 kcal/kg and 1.5–2 g protein/kg day in normal-weight individuals) [15,21]. The ASPEN guideline highlights that in the past there was concern about lipid infiltration into the oxygenator when patients were receiving PN; however, with newer ECMO circuits it is stated that this is no longer a concern [14].

3.2.8.3. Non-intubated critically ill patient. Seven guidelines make recommendations for non-intubated patients [15,17,18,20–23]. The overarching theme is that these patients are at high nutrition risk.
(e.g. due to poor appetite, fatigue, difficulty breathing, dysphagia) and that a high energy and high protein diet and oral nutrition supplements should be provided. Escalation to enteral nutrition should occur if energy and protein intakes are inadequate (e.g. meeting <50–65% targets after 5 days). Three guidelines (AuSPEN, BDA, ATID) specifically recommend avoiding early removal of nasogastric tubes post extubation [15,17,21].

### Key points

- Seven guidelines recommend early EN in patients in the prone position, while monitoring GI tolerance closely
- Two guidelines recommend early EN for patients receiving ECMO
- Guidelines report that patients who are not intubated are considered at high nutrition risk and should receive a high energy high protein diet and oral nutritional supplements ± EN

#### 3.2.9. Workforce and equipment recommendations

**3.2.9.1. Equipment.** Two guidelines (AuSPEN and BDA) recommend assessment of equipment needs early and development of plans in the event of equipment and nutrition formula shortage [15,17].

3.2.9.2. Workforce. Two guidelines (BDA and AuSPEN) make specific recommendations regarding dietetic workforce capacity during the COVID-19 pandemic [15,17]. This includes rapidly identifying additional staff who could be used in the case of significant admission numbers (such as the use of appropriately trained allied health assistance staff, or training of dietetic staff who have transferable skills in specific ICU nutrition processes). It is also recommended that training be commenced early with an appropriate education package that has been developed by an experienced critical care dietitian, and that the most experienced critical care dietitians see the sickest patients. Five guidelines (BDA, AuSPEN, ESPEN, INDI and ATID) mention use of remote working processes to protect staff from infection risk of COVID-19 [15,17,18,20,21]. Two guidelines (AuSPEN and ESPEN) specifically mention appropriate personal protective equipment (PPE) training for nutrition staff [15,18].

### Key points

- Consideration to equipment, nutrition formula requirements and workforce capacity issues was infrequently discussed
- Five guidelines discussed remote working and revision of processes to facilitate this
- Specific mention of PPE training for nutrition staff was infrequent

#### 3.2.10. Post-ICU

While not the primary focus of this article, four guidelines provided a section on nutritional management in the post-ICU or recovery phase within the ICU focussed guideline [15,17,18,21].

### 4. Discussion

#### 4.1. Implementation into clinical practice

The application of recommendations within included guidelines is likely to be dependent on the clinical setting, the resources and available workforce, the individual patient presentations, and the stage of the pandemic. Due to the limited data available to inform optimal patient care, clinicians should utilize the available recommendations as a guide. However, where possible, focus should still be on the individual assessment and monitoring of nutrition support within the limitations of the available workforce [26]. When considering how to implement these recommendations, ICUs should consider the range of guidelines available and develop local procedures that take into consideration their patient cohort and workforce capabilities. ICUs may need to consider the standard operating procedures within their unit and what they are willing to change in the setting of a pandemic to minimize PPE use and reduce staff exposure [27].

Across most guidelines the maintenance of nutrition screening has been highlighted as important to continue to identify patients who are at the greatest nutritional risk. Malnourished patients and those with complex co-morbidities should be priorities for more specialized nutrition care [26]. However, all critically ill patients with COVID-19 are likely to be at nutritional risk and, therefore, early nutritional interventions should be integrated into the overall medical therapy [26]. The majority of the guidelines support the initiation of early EN in mechanically ventilated patients via the gastric route. Nutritional targets for protein tend to align with standard critical care nutrition guidelines, with a focus on high protein provision. Clinicians should therefore consider which nutrition formula they have available to try to reach these targets. Where the guidelines conflict, including in relation to the measurement of GRVs and the use of indirect calorimetry, clinicians should deliberate the risks and consider what is acceptable within their unit. All guideline recommendations need to be considered in the context of a lack of specific data and are predominately based on expert opinion rather than high level evidence, and it is hence reasonable to adapt them to the local context.

It should be recognized that the included guidelines were developed early in the pandemic (March–September 2020) and, therefore, may not reflect the most recently available evidence for managing patients with COVID-19 in ICU. New data is rapidly emerging to guide nutrition clinical care and should be considered [28,29]. In addition, as hospital systems become more coordinated, and patient numbers more manageable, the ability to safely implement higher-level practices to provide optimal nutrition care will improve, and these practices may be able to be reintroduced.

For example, while the use of indirect calorimetry was not recommended early in the pandemic, primarily due to the increased risk of staff exposure to the virus. However, studies using indirect calorimetry have since been conducted safely as the pandemic and management strategies have progressed [28]. Reintroduction of these higher risk procedures should be considered based on site capacities, levels of expertise, and follow best practice recommendations [30].

#### 4.2. Limitations

Limitations of the review include that only guidelines available in the English language were included, as it is likely that a number of country-specific associations would have guidelines in their native language only. Similarly, only websites of nutrition or dietetic...
societies that are members of the International Confederation of Dietetics were searched; however, it should be recognized that medical or intensive care specific societies may also have practice guidelines that incorporate a section on nutrition management.

5. Conclusions

Clinical recommendations for patients with COVID-19 were similar across guidelines and to those in the general ICU population including the use high protein, volume restricted enteral formula delivered gastrically and commenced early in ICU, while taking into consideration non-nutritional calories to avoid overheating. A number of discrepancies exist, including the use of IC to determine energy prescriptions, and monitoring of GI intolerance using GRVs, delivered gastrically and commenced early in ICU, while taking into account energy expenditure in critically ill and acute care hospitalised inpatients: a scoping review protocol. 2020. doi:10.1101/4sp7e.

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Declaration of competing interest

There are no conflicts of interest to declare.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.clnesp.2021.05.003.

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