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1 **Nutrition-related symptoms in adult survivors of critical illness when eating orally: a scoping review**
2 **protocol.**

3 **Abstract**

4 Objective: To explore and map the current literature on the nutrition impact of symptoms reported by adult
5 survivors of critical illness who are eating orally after intensive care unit (ICU) discharge.

6 Introduction: Survivors of critical care often experience CU-acquired weakness and poor functional
7 recovery. It is plausible that nutrition interventions throughout their recovery could improve outcomes for
8 these patients. While a growing number of studies aim to explore the effect of nutrition delivered in the early
9 phases of critical illness, this is also important post ICU, particularly in already nutritionally compromised
10 patients presenting with muscle loss and fatigue. Therefore, a comprehensive insight into the physiological,
11 physical or psychological difficulties that critically ill patients experience after ICU discharge which may
12 impede oral intake will inform the development of targeted nutrition interventions.

13 Inclusion criteria: Original research studies in adult patients 18 years and older, who are in the recovery
14 phase after being critically ill, and eating orally. Studies must report on any symptoms related to the ability
15 to eat, or represent nutrition inadequacy or utilization.

16 Methods: A scoping review will be conducted in accordance with the JBI methodology using a three-step
17 search strategy of MEDLINE, EMBASE, CINAHL, AMED, Web of Science, Cochrane and Joanna Briggs
18 Institute Database of Systematic Reviews to obtain original research studies that meet the inclusion criteria.
19 Duplicates will be removed and study selection and data extraction will be conducted in duplicate. Data
20 synthesis will involve quantitative and qualitative methods.

21 **Introduction**

22 The definition of critical illness varies internationally, but is commonly described as the provision of
23 specialized, multidisciplinary care for patients in a life-threatening, but treatable, condition.¹ With increased
24 critical care survival comes acquired and enduring difficulties for recovering patients.² These effects are
25 largely due to Intensive Care Unit (ICU) acquired weakness (ICU-AW) which, alongside other physical,
26 psychological and cognitive impairments, represents 'post intensive care syndrome' (PICS).³ The emphasis
27 of clinical care and research has therefore now shifted towards addressing the long-term effects of critical
28 illness in survivors, including identifying factors which increase the risk of PICS such as prolonged
29 ventilation, degree of muscle wasting and extended ICU length of stay (LOS).⁴

30 The inflammatory state caused by critical illness leads to catabolism, where energy stores are mobilized to
31 fuel hyper-metabolism with consequential muscle wasting.⁵ This further compounds the risk of malnutrition,

32 estimated at 43% in patients admitted to the ICU.⁶ Malnutrition has been independently associated with
33 increased hospital LOS, infectious complications and mortality.⁷ Nutrition therapy is proposed as one aspect
34 of medical care that may help attenuate muscle wasting and reduce ICU-acquired weakness, so nutrition
35 support is therefore normally initiated early after ICU admission, either enterally (through a gastrointestinal
36 tube) or parenterally (into the veins).^{8,9}

37 Nutrition research to date has focused predominantly on the acute phase of illness with varying results.¹⁰
38 This phase of illness however represents just a small fraction of a patients' inpatient journey of recovery.¹¹
39 The importance of specialist nutrition intervention as part of aftercare (post-ICU) due to altered physiology,
40 was highlighted as an important care aspect over two decades ago.¹² There is however a renewed interest
41 on whether nutrition interventions in the recovery phase may be more effective in improving outcomes.¹³
42 While oral intake is reduced, the influence that has on patient outcome has not been reported but is likely
43 to exacerbate malnutrition.¹¹

44 When patients are awake and liberated from their breathing support (called extubation), oral nutrition
45 support can be re-established if their swallow is deemed safe.^{8,9} Several studies have however reported
46 inadequate nutrition support immediately following extubation, with patients meeting just ~50% their
47 prescribed energy and ~25% of their protein targets orally; this is substantially lower than in patients that
48 continue to receive nutrition artificially.¹⁴⁻¹⁶ While a number of strategies, such as the provision of oral
49 nutritional supplementation (ONS) and fortified diets, have been implemented in recovery, patients'
50 requirements are often not met for multifactorial reasons.¹⁷ It is plausible that many physiological, physical,
51 or psychological symptoms that form part of PICS are associated with malnutrition.^{12,18}

52 Critical illness or its treatment can alter homeostatic control through inflammatory or neutral processes.¹⁹
53 Physiological effects may include reduced appetite, early satiety, changes in sensory perception, and
54 gastro-intestinal upset.^{18,19} These could potentially impede oral dietary intake and increase patients' risk for
55 critical care related morbidities.²⁰⁻²³ Physical effects include weakness and fatigue, alongside an altered
56 eating pattern, or swallow dysfunction, and these also could further reduce opportunities for
57 nourishment.^{22,23} In addition, psychological effects such as, alertness, anxiety, pain, poor sleep quality, low
58 mood and reduced motivation may also play a significant role.²⁴

59 Current research lacks comprehensive insight into the difficulties or symptoms that post critical care patients
60 experience when commencing oral intake. A preliminary search conducted on 18 March 2019 performed
61 in PubMed, the Joanna Briggs Institute Database of Systematic Reviews and Implementation Reports,
62 Cochrane Database of Systematic Reviews (CDSR), international database of prospectively registered
63 systematic reviews (PROSPERO), Campbell Systematic Reviews, and Database of Abstracts of Reviews
64 and Effects (DARE) indicated that no existing systematic or scoping reviews on this topic is available or
65 under development.

66 We therefore propose a scoping review to enable a broad review of the nutrition related symptoms which
67 adult survivors of critical care patients experience when eating orally after ICU discharge, using Joanna
68 Briggs Institute (JBI) methodology.²⁵ A scoping review allows for searching, selecting and synthesizing
69 current knowledge on a research question by mapping essential concepts, categories evidence and source
70 any gaps in the research.^{26,27}

71 This review will complement the increasing evidence base on the multifactorial interventions required for
72 post-ICU recovery, through providing insight into the required considerations for patient-centered and
73 effective nutritional plans.¹¹ It will add to growing evidence on nutritional rehabilitation and reveal gaps for
74 further exploratory research.

75 **Review question**

76 The objective of this scoping review is explore and map the current literature on the nutrition impact of
77 symptoms, reported by adult survivors of critical illness who are eating orally after ICU discharge.

78 The specific research questions are:

- 79 - What nutrition-related physiological, physical or psychological symptoms are reported in the literature in
80 adult survivors of critical illness who consume oral intake that may impact intake after ICU discharge?
- 81 - What nutritional factors or aspects of eating are reported alongside these symptoms?
- 82 - What tools are used to assess or measure, and report these symptoms?
- 83 - Are there differences between nutrition symptoms reported prior to and after hospital discharge?

84 **Keywords (5 max)**

85 critical care; nutrition; oral intake; recovery; symptoms

86 **Inclusion criteria**

87 **Participants**

88 This scoping review will consider studies in adult patients 18 years and older, who are in the recovery phase
89 after an admission to an intensive care or high-dependency unit, and eating orally.¹ The recovery phase is
90 defined as any point after discharge from ICU until a year later.¹⁸ Study population will either have no
91 respiratory support, non-invasive or invasive ventilation. Symptoms reported up until hospital discharge on

92 the ward outside the ICU setting and then after hospital discharge will be recorded. Eating orally is defined
93 as any oral food or drink intake including patients supported, but not fed exclusively, by artificial feeding.

94 **Concept**

95 This scoping review will consider data sources that report the presence of nutrition-related symptoms in
96 recovering critically ill patients who are eating. This review will map these symptoms in relation to oral
97 dietary intake, with particular attention to physiological symptoms (such as changes in sensory perception,
98 appetite, gastrointestinal symptoms, or swallowing problems), physical symptoms (such as muscle loss,
99 weakness, pain, hair loss, or nail changes) and psychological symptoms (such as low mood, anxiety,
100 insomnia). Nutrition-related symptoms are any reported symptom that may be the consequence of
101 inadequate nutrition, may influence the ability to eat and drink, or indicate difficulties in the digestion and/or
102 absorption of food. Data will be collated on how symptoms are assessed, or measured, and reported.

103 **Context**

104 This scoping review will consider data from care settings including post-ICU acute care (ward-based),
105 community care facilities, and patients at home. Studies that explore oral intake for patients in the ICU
106 setting alone will be excluded, as this represents an acute phase of illness as opposed to recovery. All
107 geographic areas, both national and international will be included.

108 **Types of Sources**

109 Evidence from all original research methodologies will be considered for inclusion in this scoping review
110 providing the article meets the inclusion criteria and they have a study population of more than one patient.
111 Systematic reviews will be used to source original papers that are either included or excluded based on the
112 inclusion and exclusion criteria. Other review and protocol papers will not be included as this is not original
113 work.

114 Text and opinion papers, letters, short communications, and conference abstracts will be considered for
115 inclusion in this scoping review. In addition, grey literature including guidelines or protocols produced by
116 hospital institutions or critical care associations as published on websites or retrieved from experts in the
117 field will be searched to seek the original work referenced.^{25,26}

118 **Methods**

119 The proposed systematic review will be conducted in accordance with the JBI methodology for scoping
120 reviews.²⁵

121 **Search strategy**

122 The search strategy aims to find both published and unpublished studies. A three-step search strategy will
 123 be utilized in this scoping review.²⁶ A stage one search has been completed as part of preparing this
 124 protocol. This involved an initial limited search of MEDLINE undertaken to identify core articles on this topic,
 125 followed by analysis of the text words and index terms contained in the titles and abstracts.²⁶ This informed
 126 the development of a stage two search strategy for databases using identified keywords and index term on
 127 18 March 2019, which will be tailored for each information source (Appendix I).²⁶ This search strategy was
 128 developed in consultation with information specialists with expertise in the field of critical care reviews, and
 129 with consideration of the principles of the Peer Review of Electronic Search strategies (PRESS) Checklist.²⁸
 130 Stage three of searching will involve screening the reference list of all the relevant studies to identify further
 131 citations.²⁶

132 **Information sources**

133 A wide range of databases and information sources will be searched to minimize publication bias.²⁹ The
 134 databases to be searched will include: MEDLINE (using Ovid host), EMBASE - Excerpta Medica (using
 135 Ovid host), CINAHL Plus with Full Text (using EBSCO host), and The Allied and Complementary Medicine
 136 Database (AMED) (using EBSCO host), as well as Web of Science, Cochrane Database of Systematic
 137 Reviews (CDSR) and Joanna Briggs Institute Database of Systematic Reviews (JBI). Searches will be
 138 limited to the year 2000 or later as this is when nutrition and physiological symptoms as part of ICU aftercare
 139 was first mentioned.¹² Although not applied as limits within the search, abstract screening will exclude
 140 studies with a population of adults under 18 years of age, and full text screening will exclude studies not
 141 available in English as this is not thought to significantly bias findings.²⁹ Trial registers will not be searched
 142 in this review. The search for unpublished studies and grey literature will include: Opengrey, Scopus and
 143 ProQuest using search terms similar to those used in database searches.²⁶

144 **Study selection**

145 Following the search, all identified citations will be collated and uploaded to the reference manager Endnote
 146 X9 (Clarivate Analytics, PA, USA) and duplicates removed.²⁵ Due to scoping reviews having broader
 147 eligibility criteria and the inclusion of not just the best evidence, a degree of subjectivity is unavoidable.^{26,29}
 148 Therefore, to minimize inter and intra reviewer variation, the Institute of Medicine Standard's guidance on
 149 screening and selecting studies will be observed, which includes a dual review process, a two stage study
 150 selection, as well as training and pilot testing.²⁹ Firstly, titles and abstracts will be screened against the
 151 inclusion criteria by two independent reviewers, followed by a full text retrieval and review of selected
 152 studies.²⁶

153 The first stage of screening, no reasoning of exclusion shall be included, however the number of articles
154 included and excluded will be recorded on the PRISMA diagram.³⁰ The second stage of screening will
155 have decisions and reasons for inclusion and exclusion documented, with the full text review being
156 performed using a coding system (Appendix II).²⁹ Prior to commencing study selection, reviewers will be
157 trained and the selection process will be piloted on 10% of the search results, including recording the K-
158 statistics on the level of agreement.²⁵ Once study selection is completed, citations of eligible studies will be
159 retrieved in full and will then be imported and managed by Covidence software.²⁹ Critical review of included
160 studies will not be performed, as this is not a requirement of a scoping review.²⁶ The final scoping review
161 report will include an appendix with details of all the full text studies excluded together with the reasons.²⁶
162 Results from grey literature searching and guidelines or protocols will be reviewed for its relevance by one
163 reviewer using a checklist duplicated from the reference manager coding framework (Appendix II), and
164 cross-checked by the second.²⁹ The results of the search will be reported in full in the final report and
165 presented in a PRISMA flow diagram.²⁶ Any disagreements that arise between the reviewers will be
166 resolved through discussion, or with a third reviewer.²⁶

167 **Data extraction**

168 Data will be extracted by two independent reviewers who will undergo training and trial the draft data
169 extraction tool prior to commencing the scoping review.^{26,29} Data extracted will include specific details about
170 the population, concept, context, study methods and key findings relevant to the scoping review objectives
171 using the data extraction tool (Appendix III).^{26,29} However, the tool will continue to be modified as necessary
172 during extraction in the spirit of the iterative nature of a scoping review.²⁷ Modifications will be detailed in
173 the full scoping review report. Results will be cross checked between the two reviewers and any
174 disagreements will be resolved through discussion, or with a third reviewer.²⁶

175 **Data presentation**

176 Extracted data will be presented in diagrammatic form, mapping the results in a manner that aligns with the
177 objective of this scoping review.²⁹ The tables and charts will reflect the data extraction tool (Appendix II)
178 and report on: authors, year of publication, country of origin, research methods or data type, aim of the
179 study, population, critical care details, time point in recovery, physiological symptoms reported, physical
180 symptoms reported, psychological symptoms reported, measurement tools used, and nutritional or oral
181 dietary intake details. A narrative summary will accompany the results and will describe how the results
182 relate to the review's objectives.²⁷

183 **Funding**

184 No funding has been obtained to perform this scoping review.

185 **Conflicts of Interest**

186 The authors declare no conflict of interest. They aim to maintain intellectual neutrality on this topic, no
 187 professional affiliations bias their position, and there is no intended financial gain through conducting this
 188 scoping review.²⁹ Reviewers will complete a conflict of interest disclosure form before commencing the
 189 review.

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262 **Appendix I. Search strategy**

263 **Medline Ovid (11/03/2019)**

264 S1 “intensive or critical*” adj3 “care or unit* or ill*” or ICU or ITU or artificial* adj2 “respirat* or ventilat*”
265 or mechanical* adj4 ventilat* or “care respiration” (Results = 409,959)

266 **SH: Intensive care units/ critical illness / critical care outcomes / critical care/ respiratory,**
267 **artificial (Results = 168,698)**

268 S2 surviv* or discharge* or recover* or transfer* or rehabilit* or follow up or post icu (Results =
269 3,501,605)

270 **SH: patient discharge/ rehabilitation / aftercare/ (Results = 52,568)**

271 S3 nutrition* diet* or food adj2 intake or oral intake or eat* or appetite or dysphagia (Results =
272 968,494)

273 **SH: feeding behaviour / diet/ eating/ food/ nutritional assessment/ appetite/ (Results =**
274 **328,180)**

275 S4 S1 AND S2 AND S3 (Results = 2930)

276 S5 with applying the limit of year 2000 or after (Results = 2320)

277

Appendix II. Screening tool and coding framework

Stages	Population	Concept	Context
Stage 1	<p>Is the article about adults (18+) who have been in ICU, now post ICU, and eating orally?</p> <p>If unclear include.</p> <p>Specifically looking for information regarding patients who are over 18 years, have been critically ill in an intensive care unit, and are now eating post ICU. Patients in ICU may be mentioned in papers and will need to clarify status.</p>	<p>Has the article reported any symptoms when eating orally and how these are measured, assessed or reported?</p> <p>If unclear include.</p> <p>Specifically looking for studies that mention symptoms when eating orally again, how this affects their ability to eat and how these are measured, assessed or reported. Patients may have artificial feeding as well as eating orally, but not exclusively.</p>	<p>Has the article mentioned the patient having survived critical care, been extubated, discharged from ICU, in recovery?</p> <p>If unclear include.</p> <p>Patients need to be liberated from invasive respiratory support, and in recovery from critical illness as an inpatient or in the community until 1 year post-ICU.</p>
Stage 2 – Abstract Code	<p>R = Retrieve as possibly meets eligibility criteria</p> <p>E = Exclude as does not meet inclusion criteria</p> <ul style="list-style-type: none"> · Not 18+ years 	<p>R = Retrieve as possibly meets eligibility criteria</p> <p>E = Exclude as does not meet inclusion criteria</p> <ul style="list-style-type: none"> · Not 18+ years 	<p>R = Retrieve as possibly meets eligibility criteria</p> <p>E = Exclude as does not meet inclusion criteria</p> <ul style="list-style-type: none"> · Not 18+ years
Stage 3 – Full text inclusion/exclusion criteria code	<p>I = Include as meets inclusion criteria</p> <p>E = Exclude because:</p> <ul style="list-style-type: none"> · Wrong population · No symptoms reported · Not eating orally · Not English · Outside limits 	<p>I = Include as meets inclusion criteria</p> <p>E = Exclude because:</p> <ul style="list-style-type: none"> · Wrong population · No symptoms reported · Not eating orally · Not English · Outside limits 	<p>I = Include as meets inclusion criteria</p> <p>E = Exclude because:</p> <ul style="list-style-type: none"> · Wrong population · No symptoms reported · Not eating orally · Not English · Outside limits
What year was it published?	Exclude if published before 2000	Exclude if published before 2000	Exclude if published before 2000

Appendix III. Data extraction tool

Publication Data	Response
Author(s)	
Year of Publication	
Country of Origin	
Brief aim of study	
The research objective this paper addresses	
Study design (i.e. RCT, observational) If interventional, include summary of intervention and control arms	
Patient population (number of patients, age, sex percentage, severity of critical illness, critical illness diagnoses, nutritional status, length of stay in ICU, length of stay in hospital, duration of artificial feeding, percentage of patients receiving mechanical ventilation, duration of mechanical ventilation)	
Time point of study conduct (e.g. time after ICU admission, time since extubation, time since ICU discharge, time since hospital discharge)	
Nutrition: (route: oral/ tube / parenteral)	
Nutritional status	
Physiological symptoms: (e.g. appetite, satiety, dysphagia, taste changes, nausea, bloating, etc.)	
Physical symptoms: (e.g. weakness, sleepy, pain, short of breath, weight loss, etc.)	
Psychological symptoms: (e.g. low mood/depression, anxiety, sleeping, etc.)	
Measurement tools used for physiological symptoms (type, scale, validation, subjective/ objective, self-reported/other)	
Measurement tools used for physical symptoms (type, scale, validation, subjective or objective, self-reported/other)	
Measurement tools used for psychological symptoms (type, scale, validation, subjective or objective, self-reported/other)	