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Towards definitions of critical illness and critical care using concept analysis

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1 Towards definitions of critical illness and critical care using concept analysis

2 Raphael Kazidule Kayambankadzanja^{1,2}, Carl Otto Schell^{3,4,5}, Martin Gerdin Wärnberg^{3,6},
3 Thomas Tamras⁷, Hedi Mollazadegan⁸, Mats Holmberg^{9,10,11}, Helle Mølsted Alvesson³, Tim
4 Baker^{3,12,13}

- 5 1. Department of Anaesthesia and Intensive Care, Queen Elizabeth Central Hospital, Blantyre Malawi
- 6 2. Department of Public Health, Kamuzu University of Health Sciences
- 7 3. Department of Global Public Health, Karolinska Institutet, Stockholm, Sweden
- 8 4. Centre for Clinical Research Sörmland, Uppsala University, Eskilstuna, Sweden
- 9 5. Department of Medicine, Nyköping Hospital, Nyköping, Sweden.
- 10 6. Function Perioperative Medicine and Intensive Care, Karolinska University Hospital, Solna, Sweden
- 11 7. Södertälje Hospital, Stockholm, Sweden
- 12 8. The Department of Addiction Medicine, Sankt Goran Hospital, Stockholm, Swede
- 13 9. Faculty of Health and Life Sciences, Linnaeus University, Växjö, Sweden
- 14 10. School of Health, Care and Social Welfare, Mälardalen University, Eskilstuna, Sweden
- 15 11. Centre for Clinical Research Sörmland, Uppsala University, Eskilstuna, Sweden
- 16 12. Department of Clinical Research, London School of Hygiene & Tropical Medicine, London, UK
- 17 13. Department of Emergency Medicine, Muhimbili University of Health and Allied Sciences, Dar es Salaam, Tanzania

18
19 Corresponding Author: Raphael Kazidule Kayambankadzanja Email: raphkazidule@gmail.com

20 Abstract

21 Objective

22 As “critical illness” and “critical care” lack consensus definitions, this study aims to explore how
23 the concepts’ are used, describe their defining attributes and propose potential definitions.

24 Design

25 We used the Walker and Avant stepwise approach to concept analysis. The uses and definitions of
26 the concepts were identified through a scoping review of the literature and an online survey of 114
27 global clinical experts. Through content analysis of the data we extracted codes, categories and
28 themes to determine the concepts’ defining attributes and we proposed potential definitions. To
29 assist understanding, we present model, related and contrary cases concerning the concepts, we
30 identified antecedents and consequences to the concepts, and defined empirical referents.

31 Results

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2
3 32 The defining attributes of critical illness were a high risk of imminent death; vital organ
4 33 dysfunction; requirement for care to avoid death; and potential reversibility. The defining attributes
5 34 of critical care were the identification, monitoring and treatment of critical illness; vital organ
6 35 support; initial and sustained care; any care of critical illness; and specialized human and physical
7 36 resources. Our proposed definition of critical illness is, “*a state of ill health with vital organ*
8 37 *dysfunction, a high risk of imminent death if care is not provided and the potential for*
9 38 *reversibility*”. Our proposed definition of critical care is, “*the identification, monitoring and*
10 39 *treatment of patients with critical illness through the initial and sustained support of vital organ*
11 40 *functions.*”

19 41 **Conclusion**

20 42 The concepts critical illness and critical care lack consensus definitions and have varied uses.
21 43 Through concept analysis of uses and definitions in the literature and among experts we have
22 44 identified the defining attributes of the concepts and propose definitions that could aid clinical
23 45 practice, research, and policy making.
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31 47 **Strengths and Limitations of the Study**

- 32
33 48 • This concept analysis is the first study to systematically describe the uses and definitions of the
34 49 concepts *critical illness* and *critical care*
35
36 50 • The study uses a scoping review of the literature and input from over one hundred clinical
37 51 experts from diverse settings globally to identify the defining attributes and provide
38 52 proposed definitions of the concepts
39
40 53 • Some uses and definitions of the concepts in languages other than English, in unpublished
41 54 grey literature and from clinical experts not included in the study may have been missed
42
43 55 • As current usage of the concepts is diverse, the proposed definitions may not be universally
44 56 accepted and are aimed to stimulate further discussion
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52 58 **Introduction**

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3 59 The concepts *critical illness* and *critical care* are commonly used in healthcare. In PubMed, both
4
5 60 are Medical Subject Headings (MeSH) terms, and searches for “critical illness” or “critical care”
6
7 61 return 40,000 and 220,000 articles respectively. While it may seem evident that the concepts
8
9 62 concern patients with very serious illness and their care, there is a lack of consensus around their
10
11 63 precise definitions.

12
13 64 This causes problems for clinical practice, research, and policy making. For the clinician,
14
15 65 discordant interpretations of when a patient is critically ill can lead to differing clinical assessments
16
17 66 and treatments despite similar states: when should a patient be regarded as critically ill so that an
18
19 67 alarm should be triggered and when is admission to an intensive care unit warranted? For the
20
21 68 researcher, it can be difficult to design a study or interpret findings: studying the effect of a
22
23 69 treatment for critical illness requires clear eligibility criteria and translating the findings to another
24
25 70 patient group requires that the groups have similar clinical conditions. For the policy maker,
26
27 71 prioritising programmes and investments designed to improve care for very sick patients relies on
28
29 72 comparisons between similar groups and clearly defined interventions.

30
31 73 Even quantifying the total global burden of critical illness has been challenging due to the lack of
32
33 74 an agreed definition. Proxies have been used instead, for example summing up syndromes
34
35 75 considered to comprise critical illness such as sepsis and acute lung injury– resulting in estimates
36
37 76 of up to 45 million critical illness cases each year.(1) Low- and middle-income countries are
38
39 77 suspected to have the highest burden (2), but the lack of a definition has hampered comparisons
40
41 78 across settings.

42
43 79 Studying the care for critically ill patients has also been problematic. Studies have focused on care
44
45 80 provided in hospital locations such as in intensive care or emergency units, which exclude care
46
47 81 provided in hospitals lacking such units, and to critically ill patients in general hospital wards. (3–
48
49 82 5) In the COVID-19 pandemic, there have been great efforts to describe, scale-up and improve
50
51 83 care for critically ill patients throughout the world (3,5) and a lack of agreement around critical
52
53 84 care has hampered these efforts.

54
55 85 These examples illustrate how important concepts are as the building blocks of theories and
56
57 86 communication. Ideally, concepts are clearly defined and their use well described for unambiguous
58
59 87 communication and an understanding about exactly what is being described or explained. (6)
60
61 88 *Concept analysis* is a method for investigating how concepts are used and understood. Concept

1
2
3 89 analyses have been conducted in diverse fields such as in teamwork (7), postoperative recovery(8)
4 90 and bioterrorism preparedness(9), all with the aim of providing basic conceptual understanding
5 91 and facilitating communication. In this paper, we have used concept analysis, following the
6 92 stepwise approach described by Walker and Avant(6). The first two steps in the approach are to
7 93 choose the concept and determine the aim of the analysis. Our chosen concepts are *critical illness*
8 94 and *critical care* and our aims are to explore the uses and definitions of the concepts in published
9 95 sources and by global clinical experts, leading to a description of the defining attributes of the
10 96 concepts and to proposed definitions.

17 97 **Methods**

18 98 The Walker & Avant approach to concept analysis uses the following steps: identifying the uses
19 99 of the concept; determining the concept's defining attributes; presenting a model case, identifying
20 100 related and contrary cases; identifying antecedents and consequences; and defining empirical
21 101 referents.(6)

27 102 **Identifying the uses of the concept**

28 103 We identified the uses of the concepts of critical illness and critical care through a scoping review
29 104 of the literature and a web-based survey of global experts.

33 105 ***Scoping Review***

34 106 We used the Arksey and O'Malley framework for scoping reviews(10). Relevant studies in English
35 107 were identified in the PubMed and Web of Science databases. To include publications that were
36 108 not found through the database searches, hand-searching of publication lists of intensive care
37 109 medicine, and emergency medicine societies was performed. Duplicates were removed using the
38 110 online software program Rayyan(11). The publications were examined through title, then abstract
39 111 review and lastly by full-text review.

45 112 ***Critical Illness***

46 113 The search terms used were terminolog*, etymolog*, nomenclatur*, definition*, plus emergency,
47 114 critical*, acute*, sever*, ill, illness. A total of 9323 articles were identified using these critical
48 115 illness terms in the databases and an additional two articles were identified through hand-
49 116 searching. Of these, 1126 articles were identified as duplicates and the remaining 8199 articles
50 117 were screened by title and abstract review by two of the authors (TT and HM). 8168 articles were

1
2
3 118 excluded as they did not concern critical illness, were not written in English or were not available
4
5 119 in full text online, leaving 31 articles for inclusion for full-text review. In the full-text review, 22
6
7 120 articles were excluded as they did not define critical illness, and so nine articles were included in
8
9 121 the analysis (Supplementary Table 1).

10 11 122 *Critical Care*

12
13 123 The search terms used were terminolog*, etymolog*, nomenclatur*, definition*, plus critical care,
14
15 124 intensive care, emergency care, acute care. A total of 7286 articles were identified using these
16
17 125 critical care terms in the databases and an additional six articles were identified through hand-
18
19 126 searching. Of these, 1964 were identified as duplicates and the remaining 5322 articles were
20
21 127 screened by title and abstract review by two of the authors (TT and HM). 5269 articles were
22
23 128 excluded as they were not concerning critical illness, not written in English or not available in full
24
25 129 text online, leaving 59 articles for inclusion for full-text review. In the full-text review, 46 articles
26
27 130 were excluded as they did not define critical care and so 13 articles were included in the analysis
28
29 131 (Supplementary Table 2).

30 31 132 *Expert survey*

32
33 133 The survey used open-ended questions to gather information about the experts' definitions of
34
35 134 critical illness and critical care, and how they see the relationship of the concepts to connected
36
37 135 concepts in order to provide context. The survey included the questions: i. *How would you define*
38
39 136 *critical illness?*, ii. *How would you define critical care?*, iii. *Do critical care and intensive care*
40
41 137 *differ? If yes, in what way?* iv. *Do critical care and emergency care differ and if yes, in what way?*
42
43 138 v. *Do critical care and acute care differ and if yes, in what way?*

44
45 139 The inclusion criterion for an expert to be invited to participate in the survey was experience in
46
47 140 any medical specialty that includes care of patients with acute, severe illness. Experts were
48
49 141 identified from a stakeholder mapping of global critical care done by one of the authors (TB,
50
51 142 unpublished), and those known to the researchers to be global experts in the field of critical care.
52
53 143 Purposive sampling was used to invite experts with the aim of including 100 experts with a balance
54
55 144 between specialties, geographical locations, health worker cadres and gender. In total 146 experts
56
57 145 were invited to take part, and 113 completed the survey (77% response rate) (Table 1).

58 59 146 **Table 1: Characteristics of the experts who participated in the survey**

Variable	Frequency (%)
All	114
Gender	
Male	80 (70.2)
Female	34 (29.8)
Continent	
Africa	42 (36.8)
Europe	29 (25.4)
North America	26 (22.8)
Asia	12 (10.5)
South America	3 (2.6)
Australia	2 (1.8)
Cadres*	
Physician	93 (53.1)
Researcher	62 (35.4)
Nurse	12 (6.9)
Policy Maker	5 (2.9)
Other	3 (1.7)
Specialty*	
Anaesthesia/Intensive Care	75 (59.1)
Emergency Care	20 (15.8)
Medicine	12 (9.5)
Paediatrics	7 (5.5)
Surgery	6 (4.7)
Obstetrics and Gynaecology	2 (1.6)
Other	5 (3.9)

147 * As the experts were asked to select all that apply, the sum may exceed 100%

148 **Analysis and determining the defining attributes**

149 The definitions of critical illness and critical care from the scoping reviews and the expert survey
 150 were charted and analysed using a content analysis based on methods developed by Erlingsson &
 151 Brysiewicz.(12) First, the data from any parts of the literature and from the expert survey that
 152 concerned the uses or definitions of the concepts were extracted. The data were coded and the
 153 codes analysed iteratively by the study team. Redundant codes were removed and similar codes
 154 were arranged into categories. The data were revisited when new categories arose or when diverse
 155 opinions with contrasting attributes were identified. Through the process, themes emerged that
 156 captured the defining attributes of the concepts. Using the defining attributes, definitions of the
 157 concepts were constructed by the research team to be coherent and useful.

159 **Presenting a model case, related and contrary cases, identifying antecedents and 160 consequences, and defining empirical referents**

1
2
3 161 The model cases, related, and contrary cases were developed by the researchers to provide
4 162 examples to illustrate the defining attributes of the concepts that emerged from the concept
5 163 analysis. Model cases were developed to be clinically realistic and to include all the defining
6 164 attributes. Related cases were developed that include some, but not all, of the defining attributes,
7 165 and contrary cases that are clearly “not the concept”, containing none of the defining attributes.
8 166 For simplicity in this study, we limited our cases to examples of patients with respiratory disease.
9 167 Antecedents and consequences were identified as events that occur prior to the occurrence of each
10 168 concept and as the outcomes of each concept respectively. Empirical referents were identified as
11 169 phenomena that demonstrate the occurrence of each concept “in real life”.

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19 170 **Ethical considerations:** Informed consent was provided by all of the experts. The Research Ethics
20 171 Committee of the London School of Hygiene and Tropical Medicine approved the study
21 172 (Reference number 22661).

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25 173

26 27 174 **Results**

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29
30 175 The results relate to steps 4-8 in the Walker and Avant approach, as steps 1-3 have been described
31 176 in the introduction and methods.

32 33 177 **Critical Illness**

34 35 178 **Defining attributes**

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37
38
39 179 A total of 48 codes were identified from the uses and definitions of critical illness from the scoping
40 180 review and expert survey. The codes were analysed into 14 categories and 4 themes. (Table 2).
41 181 The themes represent the defining attributes of critical illness: *high risk of imminent death*; *vital*
42 182 *organ dysfunction*; *requirement for care to avoid death*; and *potential reversibility*. (Figure 1)

43
44
45
46 183 **Table 2. Content analysis for the concept *critical illness***

Code	Category	Theme
Severe illness	Severe illness	High risk of imminent death
Process of increasing severity		
Imminent risk of death	High risk of imminent death	
Enough severity to lead to death rapidly		
Can kill within a short time		
Medical condition that results in short term mortality		
Sudden onset illness or acute deterioration		

Acute life-threatening illness	Acute onset or deterioration		
An episode of acute illness			
Increased risk of death	Life-threatening		
Continuous threat to life and well-being			
Life-threatening or potentially life-threatening disease			
High probability of life-threatening deterioration			
Acutely life-threatening injury or illness			
At least one and often multiple organ dysfunction	Organ dysfunction or failure		Vital organ dysfunction
Failure in one or more organ systems that needs support			
Hemodynamic instability, respiratory failure, seizure, disorders of consciousness			
Diseases with vital organ failures as complications	Threatened organ dysfunction		
Threatened organ failure			
Potential disturbances of vital organ functions			
Threatened end-organ damage	Vital signs derangements		
Deranged vital parameters			
Physiologic reserve is diminished, as manifested by abnormal vital signs			
NEWS2 ≥ 7	Treatment needed to avoid death	Requirement for care to avoid death	
Associated with significant morbidities if untreated			
Decline in a patient's ability to survive on their own			
Conditions requiring rapid intervention to avert death or disability			
An illness which without rapid treatment would result in death or disability.			
Needs prompt and sustained intervention to avert death or lifelong disability			
If no intervention is made, death is certain	Requirement for immediate treatment		
Requiring minute-by-minute nursing and/or medical care			
Requires a rapid diagnosis and response to ensure good outcomes			
Illnesses where timely care can reduce the chances of death and disability			
Requires immediate intervention			
The illness needs close monitoring and prompt management	Requirement for organ support		
Treatment delays of hours or less make interventions less effective			
Requiring organ support			
Requiring vital organ support	Requires critical care		
Requiring intensified patient monitoring and organ support			
Critical care services	Need for specific care		
ICU admission			
Illness that results in need for more than standard of care	Reversible with treatment	Potential reversibility	
Acute disease that needs specific treatment alongside the disease itself			
Some element of treatability	Potentially reversible		
Any treatable life-threatening reversible illness			
Reversible life-threatening organ failure			
Life-threatening situation, illness or disease that is potentially reversible			
Acute potentially reversible illness			

184

185 **Figure 1**

186

187 **Proposed operational definition**

188 The proposed definition for critical illness is “*Critical illness is a state of ill health with vital organ*
 189 *dysfunction, a high risk of imminent death if care is not provided and the potential for*
 190 *reversibility.*”

1
2
3 191 **Cases**
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6 192 **A model case of critical illness (a case including all the defining attributes)**
7

8 193 A woman has a viral pneumonia. She is breathless and hypoxic with a low oxygen level in her
9
10 194 blood (oxygen saturation) of 74%. Her lungs are dysfunctional, and she has a life-threatening
11
12 195 condition that is likely to lead to her death in the next few hours. She requires care to support her
13
14 196 lungs (oxygen therapy) and if she receives that care, she has a chance of recovery.

15
16 197 **A related case for critical illness (a case including some of the defining attributes but not the**
17
18 198 **attribute of “imminently life-threatening”)**

19 199 A man has a chest infection. He has a fever, is coughing up green sputum and feels short-of-breath
20
21 200 when walking. He has an oxygen saturation of 91%. He has a serious condition, but it is not
22
23 201 imminently life-threatening. He requires treatment, likely with antibiotics, but it is uncertain
24
25 202 whether he requires any organ support such as oxygen. His condition is potentially reversible, and
26
27 203 he can recover.

28
29 204 **A contrary case for critical illness (a clear example of “not the concept”)**

30 205 A woman has lung cancer. She is coughing up small amounts of blood but is able to walk to the
31
32 206 hospital. She has an oxygen saturation of 94%. She is sick and she requires treatment. However,
33
34 207 her illness is not imminently life-threatening, she has no dysfunctional vital organ and she does
35
36 208 not require immediate care. Her condition may or may not be reversible.

37
38 209 **Antecedents and consequences of Critical Illness**

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40 210 The antecedents of critical illness are the onset of illness, in mild or moderate form, with
41
42 211 progressing severity. The consequences of critical illness are either recovery or death.
43

44
45 212 **Empirical Referents**

46
47 213 There are an estimated 30-45 million cases of critical illness globally each year(1). Many patients
48
49 214 are cared for in hospitals with illnesses that are causing vital organ dysfunction and that are
50
51 215 imminently life-threatening. There is much work done to identify patients with critical illness such
52
53 216 as the use of single severely deranged vital signs(13), or compound scoring systems such as the
54
55 217 National Early Warning Score (NEWS) and The Sequential Organ Failure Assessment score
56
57 218 (SOFA) (14,15). In hospitals, the severity of patients' conditions can be assessed using tools such

219 as the Acute Physiology and Chronic Health Evaluation (APACHE) (16) and the Simplified Acute
220 Physiology Score (SAPS)(17).

221

222 ***Critical Care***

223 **Defining attributes**

224 A total of 60 codes were identified from the definitions of critical care from the scoping review
225 and expert survey. The codes were analysed into 13 categories and 5 themes. (Table 3) The themes
226 represent the concept's defining attributes: *identification, monitoring and treatment of critical*
227 *illness; vital organ support; initial and sustained care; any care of critical illness; and specialized*
228 *human and physical resources.* (Figure 2)

229 **Table 3: Content analysis for the concept *critical care***

Codes	Category	Theme
Identifying and addressing critical illness	Identification and monitoring of critical illness	Identification, monitoring and treatment of critical illness
Medical care with timely monitoring		
Appropriate monitoring of critical illness		
Management of critically ill patients	Treatment of critical illness	
Treat critical illness		
Care given to the critically ill		
Services required to stabilize critical illness		
Reduce the risk of death from a critical illness		
Care dedicated to patients with severe illness or potentially severe condition	Addressing life-threatening condition	
Managing life-threatening condition		
Preventing the occurrence of life-threatening conditions		
Treatment and management due to the threat of imminent deterioration		
Medical care required to reduce the risk to the patient's life	Supporting vital functions	
Care to sustain cardiopulmonary functions		
Support the patient's hemodynamic or cardiorespiratory status		
Supportive care in critical illness to enable body's systems to continue functioning before definitive treatment can work		
Care of vital organ failure		
Focus of care on supporting vital organs until improvement		
Providing organ support		
Main focus on organ-supporting treatment.	Organ support	
Support of vital organ function, or reverse specific organ dysfunctions		
Supportive care for organs that are failing		
Provision of support to dysfunctional body systems		
Early management for saving and maintaining life	Timely care	Initial and sustained care
Rapid and timely intervention that is administered in critical illness		
From admission until the course of illness ends, either in full recovery or death	From start of critical illness until the patient is no longer critically ill	
From home through to discharge from hospital		
From the time of first contact with healthcare services through to stabilization		
To the point where the illness or injury is no longer acutely life-threatening		

Critical care could be over days to weeks	Sustained care	
Constant monitoring		
Irrespective of the location of the patient within the health system	Any location	Any care of critical illness
Anywhere in the emergency or inpatient setting		
Any care provided to critically ill patients	Any care provided to critically ill patients	
Can be specialized care but depends on the level of resources		
Usually located in an area with infrastructure to support these activities	Specific area	Specialized human and physical resources
Inside a healthcare facility, outside the emergency department		
High dependency care		
Care in ICU or Critical care unit		
A place where equipment, staff and environment is ready to save patients with life-threatening disease	Multi-disciplinary and specialist staff	
Multidisciplinary care		
Specially trained staff		
Essentially a team-based and multi-professional care	High-intensity care	
Requires the grouping of special facilities and specially trained staff		
Higher level of care than is available on a general ward		
Minute-by-minute nursing and/or medical care		
Advanced respiratory support / mechanical ventilation		
Nursing 24/7		
High nurse: patient ratio no lower than 1:2		

230

231 **Figure 2:**

232

233 **Proposed operational definition of *Critical care***

234 The proposed definition for critical care is “*Critical care is the identification, monitoring and*
 235 *treatment of patients with critical illness through the initial and sustained support of vital organ*
 236 *functions.*”

237 ***Cases***

238 **A model case of critical care (a case including all the defining attributes)**

239 A woman with a viral pneumonia is rapidly identified as critically ill when she arrives at the
 240 hospital. She is immediately admitted to a unit with supplies for managing critically ill patients
 241 and treatment is started. Nurses and doctors who have been trained in the care of critical illness
 242 monitor her regularly, and provide continuous care, titrating the treatments as needed. Continuous
 243 oxygen therapy is provided for her life-threatening hypoxia, supporting her respiratory
 244 dysfunction, until she has recovered and is no longer critically ill.

245 **A related case of critical care (a case including some of the defining attributes but not the** 246 **attribute of “vital organ support”)**

247 Care in a hospital is provided to a man with a chest infection. A nurse assesses him at arrival to
248 hospital. A doctor admits him to the ward, prescribes antibiotics and decides he is not critically ill
249 and does not require support for any of his vital organs. After four days the doctor discharges him
250 from hospital.

251 **A contrary case of critical care (a clear example of “not the concept”)**

252 In the outpatient department, care is provided to a woman with lung cancer. A doctor and a nurse
253 do some investigations and prescribe some medications. She is sent home with a follow-up
254 appointment two weeks later.

255 **Antecedents and consequences of critical care**

256 The antecedents of critical care are the contact of the patient with the healthcare system and may
257 include other care of a patient who has not deteriorated to the point of becoming critically ill. The
258 consequences of critical care are either the patient’s recovery or death.

259 **Empirical Referents**

260 Many hospitals have wards or units for the provision of critical care, such as Emergency Units,
261 High Dependency Units or Intensive Care Units (ICUs) (18). Critical care can also be provided in
262 general wards, and a recent global consensus specified the care that should be included for all
263 patients with critical illness in any hospital location (19). Rapid Response Teams or Medical
264 Emergency Teams have been introduced into some hospitals, often consisting of staff from the
265 ICU responding to calls from the wards when a critically ill patient has been identified, and
266 providing either critical care on the ward, or transferring the patient to the ICU (20).

268 **Discussion**

269 We have described how the concepts *critical illness* and *critical care* are used and defined in the
270 literature and by global experts using a concept analysis approach.

271 Our proposed definition for critical illness of, “*a state of ill health with vital organ dysfunction, a*
272 *high risk of imminent death if care is not provided and the potential for reversibility*”, is similar to
273 those in some key publications. Chandrashekar et al state that, “*Critical illness is any condition*
274 *requiring support of failing vital organ systems without which survival would not be possible*”

1
2
3 275 (21) . Painter et al write that, “*A critically ill or injured patient is defined as one who has an*
4 276 *illness or injury impairing one or more vital organ systems such that there is a high probability of*
5 277 *imminent or life-threatening deterioration in the patient's condition*”(22) . Indeed, we found
6
7 278 widespread agreement in the literature and expert sources that critical illness concerns life-
8
9 279 threatening illness with organ dysfunction.

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11
12 280 However, we found diverse and varied usage of the concept concerning the attribute of reversibility
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14 281 and the interface between critical illness and the natural process of dying. Some uses included only
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16 282 illness that was potentially reversible – these sources regarded that for critical illness there should
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18 283 be a possible chance of recovery. Without this, critical illness would be a concept that encompasses
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20 284 the dying process – everyone would be critically ill immediately before death – which would
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22 285 conflict with many clinical uses and understandings of the term., Others had a wider interpretation
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24 286 including all life-threatening illness and did not include reversibility in the definition as it is
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26 287 difficult to identify in the clinical setting, and the concept risks becoming context dependent, (high-
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28 288 resource interventions may reverse some critical illness which would not be possible in low-
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30 289 resource healthcare). Our iterative content analysis method led to our interpretation that
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32 290 reversibility should be included as one of the defining attributes, and this conclusion should be
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34 291 seen as one possible interpretation that can stimulate further discussion.

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36 292 It is hoped that the proposed definition of critical illness assists communication in the field.
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38 293 Previously, studies about critical illness have focused on patients in certain hospital units, or with
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40 294 diseases or syndromes as proxies for critical illness that exclude some critically ill patients.(1)
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42 295 Our definition of critical illness is not diagnosis or syndrome specific and can be due to any
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44 296 underlying condition. The definition could facilitate the specification of clinical criteria for the
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46 297 identification of critical illness, estimates of the overall burden of critical illness, assessments of
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48 298 outcomes for patients with critical illness across centres and settings, and interventions to improve
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50 299 outcomes.

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52 300 For critical care, there was greater diversity around its use and definition. There was widespread
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54 301 agreement that critical care is the care of critically ill patients including the support of vital organs.
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56 302 However, there were differing uses around the location of the care and the need for specialized
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58 303 resources. Some sources considered critical care to be only the care provided in certain locations,
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60 304 (such as ICUs or critical care units), or to be care that is always highly specialized or resource-

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3 305 intensive. The World Federation of Societies of Intensive and Critical Care Medicine have
4 306 suggested that critical care is synonymous with intensive care and is, “*a multidisciplinary and*
5 307 *interprofessional specialty dedicated to the comprehensive management of patients having, or at*
6 308 *risk of developing, acute, life-threatening organ dysfunction. [Critical care] uses an array of*
7 309 *technologies that provide support of failing organ systems, particularly the lungs, cardiovascular*
8 310 *system, and kidneys.*”(18) In contrast, other sources used critical care to be inclusive of any
9 311 care for patients with critical illness, irrespective of location or resources. The Joint Faculty of
10 312 Intensive Care Medicine of Ireland state that critical care units are those that, “*provide life*
11 313 *sustaining treatment for critically ill patients with acute organ dysfunction due to potentially*
12 314 *reversible disease*”,(23) and in Belgium, critical care beds have been defined as any beds “*for*
13 315 *patients with one or more organ functions compromised*”(24) Hirshon et al strike a balance
14 316 between these two contrasting views, “[*Critical care is] the specialized care of patients whose*
15 317 *conditions are life-threatening and who require comprehensive care and constant monitoring,*
16 318 *usually in intensive care units.*” (25)

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19 319 Our proposed definition of, “*the identification, monitoring and treatment of patients with critical*
20 320 *illness through the initial and sustained support of vital organ functions*”, aims to be inclusive.
21 321 Critical care may include the use of specialized resources but it is not a requirement. We see this
22 322 as a strength in the definition, as it maintains a patient-centred rather than setting-dependent focus.
23 323 Critical care when defined in this way can be provided anywhere and does not have to be resource-
24 324 intensive – it includes both high-resource care in ICUs and lower resource care in other settings.
25 325 Indeed, critical care can even be provided in general wards, in small health facilities, in the
26 326 community or in ambulances. High-resource intensive care may not be possible in low-resource
27 327 settings, but such settings care for many critically ill patients who require critical care(4,26,27).
28 328 The definition focuses on supporting vital organ functions, emphasising that critical care’s primary
29 329 focus is treating the critical condition of the patient rather than definitive care for the underlying
30 330 condition(28,29). Critical care, as we have defined it, can be seen as a system of care of patients
31 331 with critical illness throughout the course of their illness, from the time of their first contact with
32 332 healthcare through to resolution of the critical illness or death. Critical care is part of the wider
33 333 concept of acute care which also includes prehospital care, emergency care, trauma and surgery
34 334 care, as well as in-patient care in medical, surgical, pediatric, obstetric and other wards(29).

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56 336 **Strengths and Limitations**
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9 337 To our knowledge, this is the first study attempting to describe the uses and definitions of the
10 338 concepts *critical illness* and *critical care*, and to identify the defining attributes leading to proposed
11 339 definitions of the concepts. A strength is the use of both a scoping review of the literature and the
12 340 inclusion of over one hundred clinical experts as sources. The findings of the analysis should be
13 341 seen as a first step and we recognise that the use of concepts is fluid and changes over time (6).
14 342 We were limited to including literature in English and to published studies and guidelines and we
15 343 may have missed relevant publications in other languages or in other grey literature. Our sample
16 344 of experts was purposively selected and had global representation but was not perfectly
17 345 symmetrical to continents, specialty, cadre or gender and we are likely to have missed experts who
18 346 could have provided valuable contributions. We acknowledge that the proposed definitions may
19 347 not be universally accepted, and we hope our analysis and findings move the conversation
20 348 forwards, providing input about how to communicate and collaborate around these vitally
21 349 important concepts, and ultimately how to improve the care and outcomes for critically ill patients.

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33 35034 351 **Conclusion**
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36 352 The concepts critical illness and critical care lack consensus definitions and have varied uses.
37 353 Through concept analysis of the uses in the literature and among experts we propose the
38 354 definitions: “*Critical illness is a state of ill health with vital organ dysfunction, a high risk of*
39 355 *imminent death if care is not provided and the potential for reversibility*” and “*Critical care is the*
40 356 *identification, monitoring and treatment of patients with critical illness through the initial and*
41 357 *sustained support of vital organ functions.*”

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47 358 **Figure 1 : The defining attributes of critical illness**48
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50 359 **Figure 2: The defining attributes of critical care**
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9

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27

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29

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31

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33 377 Medicine approved the study (Reference number 22661).
34
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38

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40 380 reasonable request
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43 381 **Supplementary Files:** Supplementary Tables 1 and 2
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45 382 **Patient and Public Involvement:** No patient involved.
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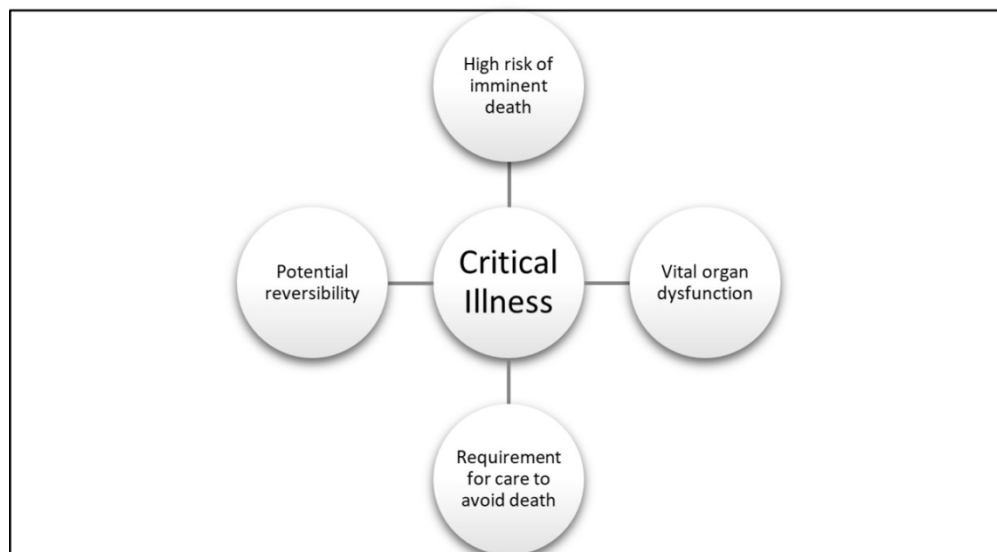
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The Defining attributes of critical illness

107x61mm (300 x 300 DPI)

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The defining attributes of critical care

114x67mm (300 x 300 DPI)

Supplementary Table 1 Literature with definitions of critical illness

	First Author and Publication Date	Country	Reference
1	Kievlan 2016	United States	Kievlan DR, Martin-Gill C, Kahn JM, Callaway CW, Yealy DM, Angus DC, et al. External validation of a prehospital risk score for critical illness. <i>Crit Care</i> . 2016;20(1):255.
2	Warttig 2018	United Kingdom	Warttig S, Alderson P, Evans DJW, Lewis SR, Kourbeti IS, Smith AF. Automated monitoring compared to standard care for the early detection of sepsis in critically ill patients (Review). <i>Cochrane Database of Syst Rev</i> . 2018(6):28.
3	Rodriguez 2018	United States	Rodriguez RM, Greenwood JC, Nuckton TJ, Darger B, Shofer FS, Troeger D, et al. Comparison of qSOFA with current emergency department tools for screening of patients with sepsis for critical illness. <i>Emerg Med J</i> . 2018;35(6):350-6.
4	Benneyworth 2015	United States	Benneyworth BD, Bennett WE, Carroll AE. Cross-sectional comparison of critically ill pediatric patients across hospitals with various levels of pediatric care. <i>BMC Res Notes</i> . 2015;8:693.
5	Hsu 2016	Taiwan	Hsu CW, Lin CS, Chen SJ, Lin SH, Lin CL, Kao CH. Risk of type 2 diabetes mellitus in patients with acute critical illness: a population-based cohort study. <i>Intensive Care Med</i> . 2016;42(1):38-45.
6	Painter 2013	United States	Painter JR. Critical Care in the Surgical Global Period. <i>Chest</i> . 2013;143(3):851-5.
7	Chandrashekar 2015	India	Chandrashekar M, Shivaraj BM, Krishna VP. A study on prognostic value of serum cortisol in determining the outcome in the critically ill patients. <i>JEMDS</i> . 2015;4(58):10130-5.
8	Liao 2014	United States	Liao MM, Lezotte D, Lowenstein SR, Howard K, Finley Z, Feng ZP, et al. Sensitivity of systemic inflammatory response syndrome for critical illness among ED patients. <i>Am J of Emerg Med</i> . 2014;32(11):1319-25.
9	Valentin 2011	23 countries	Valentin A, Ferdinande P, Improvem EWGQ. Recommendations on basic requirements for intensive care units: structural and organizational aspects. <i>Intensive Care Med</i> . 2011;37(10):1575-87.

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For peer review only

Supplementary Table 2 Literature with definitions of critical care

	First Author and Publication Date	Country	Reference
1	Wunsch 2008	United States, France, UK, Canada, Belgium	Wunsch H, Angus DC, Harrison DA, Collange O, Fowler R, Hoste EA, et al. Variation in critical care services across North America and Western Europe. <i>Crit Care Med</i> . 2008;36(10):2787-93, e1-9
2	Prin 2012	United States	Prin M, Wunsch H. International comparisons of intensive care: informing outcomes and improving standards. <i>Curr Opin Crit Care</i> . 2012;18(6):700-6
3	Painter 2013	United States	Painter JR. Critical care in the surgical global period. <i>Chest</i> . 2013;143(3):851-5
4	Royal College of Anaesthetists 2018	England	https://www.rcoa.ac.uk/sites/default/files/documents/2020-06/EMC-Guidelines2018.pdf
5	Joint Faculty of Intensive Care Medicine of Ireland and Intensive Care Society of Ireland 2019	Ireland	https://jficmi.anaesthesia.ie/wp-content/uploads/2019/09/National-Standards-for-Adult-Critical-Services-2019.pdf
6	Marshall 2017	Many countries	Marshall JC, Bosco L, Adhikari NK, Connolly B, Diaz J v., Dorman T, et al. What is an intensive care unit? A report of the task force of the World Federation of Societies of Intensive and Critical Care Medicine. <i>Journal of Critical Care</i> . 2017 Feb;37:270–6.
7	The International Surgical Outcomes Study 2016	Many countries	International Surgical Outcomes Study g. Global patient outcomes after elective surgery: prospective cohort study in 27 low-, middle- and high-income countries. <i>Br J Anaesth</i> . 2016;117(5):601-9
8	Benneyworth 2015	United States	Benneyworth BD, Bennett WE, Carroll AE. Cross-sectional comparison of critically ill pediatric patients across hospitals with various levels of pediatric care. <i>BMC Res Notes</i> . 2015;8:693.
9	Kievlan 2016	United States	Kievlan DR, Martin-Gill C, Kahn JM, Callaway CW, Yealy DM, Angus DC, et al. External validation of a prehospital risk score for critical illness. <i>Crit Care</i> . 2016;20(1):255.
10	Boyle 2008	Australia	Boyle M, Butcher R, Conyers V, Kendrick T, MacNamara M, Lang S. Transition to intensive care nursing: establishing a starting point. <i>Aust Crit Care</i> . 2008;21(4):190-8.
11	Hirshon 2013	United States	Hirshon JM, Risko N, Calvillo EJ, Stewart de Ramirez S, Narayan M, Theodosis C, et al. Health systems and services: the role of acute care. <i>Bull World Health Organ</i> . 2013;91(5):386-8
12	McCarthy 2013	United States	McCarthy C, O'Rourke NC, Madison JM. Integrating advanced practice providers into medical critical care teams. <i>Chest</i> . 2013;143(3):847-50
13	Intensive Care Society 2009	United Kingdom	https://icmwk.com/wp-content/uploads/2014/02/Revised-Levels-of-Care-21-12-09.pdf

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Towards definitions of critical illness and critical care using concept analysis

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1 Towards definitions of critical illness and critical care using concept analysis

2 Raphael Kazidule Kayambankadzanja^{1,2}, Carl Otto Schell^{3,4,5}, Martin Gerdin Wärnberg^{3,6}, Thomas
3 Tamras⁷, Hedi Mollazadegan⁸, Mats Holmberg^{9,10,11}, Helle Mølsted Alvesson³, Tim Baker^{3,12,13}

4 1. Department of Anaesthesia and Intensive Care, Queen Elizabeth Central Hospital, Blantyre Malawi

5 2. Department of Public Health, Kamuzu University of Health Sciences

6 3. Department of Global Public Health, Karolinska Institutet, Stockholm, Sweden

7 4. Centre for Clinical Research Sörmland, Uppsala University, Eskilstuna, Sweden

8 5. Department of Medicine, Nyköping Hospital, Nyköping, Sweden.

9 6. Function Perioperative Medicine and Intensive Care, Karolinska University Hospital, Solna, Sweden

10 7. Södertälje Hospital, Stockholm, Sweden

11 8. The Department of Addiction Medicine, Sankt Goran Hospital, Stockholm, Swede

12 9. Faculty of Health and Life Sciences, Linnaeus University, Växjö, Sweden

13 10. School of Health, Care and Social Welfare, Mälardalen University, Eskilstuna, Sweden

14 11. Centre for Clinical Research Sörmland, Uppsala University, Eskilstuna, Sweden

15 12. Department of Clinical Research, London School of Hygiene & Tropical Medicine, London, UK

16 13. Department of Emergency Medicine, Muhimbili University of Health and Allied Sciences, Dar es Salaam, Tanzania

17
18 Corresponding Author: Raphael Kazidule Kayambankadzanja Email: raphkazidule@gmail.com

19 Abstract

20 Objective

21 As “critical illness” and “critical care” lack consensus definitions, this study aimed to explore how
22 the concepts’ are used, describe their defining attributes, and propose potential definitions.

23 Design and Methods

24 We used the Walker and Avant approach to concept analysis. The uses and definitions of the
25 concepts were identified through a scoping review of the literature and an online survey of 114
26 global clinical experts. We used the Arksey and O’Malley framework for scoping reviews and
27 searched in PubMed and Web of Science with a strategy including terms around critical
28 illness/care and definitions/etymologies limited to publications in English since 2008. The experts
29 were selected through purposive sampling and snowballing, with 36.8% in Africa, 25.4% in
30 Europe, 22.8% in North America, 10.5% in Asia, 2.6% in South America and 1.8% in Australia.
31 They worked with Anaesthesia or Intensive Care (59.1%), Emergency Care 15.8%, Medicine
32 9.5%, Paediatrics 5.5%, Surgery 4.7%, Obstetrics and Gynaecology 1.6% and other specialties

33 3.9%. Through content analysis of the data we extracted codes, categories, and themes to determine
34 the concepts' defining attributes and we proposed potential definitions. To assist understanding,
35 we developed model, related and contrary cases concerning the concepts, we identified antecedents
36 and consequences to the concepts, and defined empirical referents.

37 **Results**

38 Nine and 13 articles were included in the scoping reviews of critical illness and critical care
39 respectively. A total of 48 codes, 14 categories and 4 themes were identified in the uses and
40 definitions of critical illness and 60 codes, 13 categories and 5 themes for critical care. The defining
41 attributes of critical illness were a high risk of imminent death; vital organ dysfunction;
42 requirement for care to avoid death; and potential reversibility. The defining attributes of critical
43 care were the identification, monitoring and treatment of critical illness; vital organ support; initial
44 and sustained care; any care of critical illness; and specialized human and physical resources. The
45 defining attributes led to our proposed definitions of critical illness as, "*a state of ill health with*
46 *vital organ dysfunction, a high risk of imminent death if care is not provided and the potential for*
47 *reversibility*", and of critical care as, "*the identification, monitoring and treatment of patients with*
48 *critical illness through the initial and sustained support of vital organ functions.*"

49 **Conclusion**

50 The concepts critical illness and critical care lack consensus definitions and have varied uses.
51 Through concept analysis of uses and definitions in the literature and among experts we have
52 identified the defining attributes of the concepts and proposed definitions that could aid clinical
53 practice, research, and policy making.

54

55 **Strengths and Limitations of the Study**

- 56 • This concept analysis is the first study to systematically describe the uses and definitions
57 of the concepts *critical illness* and *critical care*
- 58 • The study uses a scoping review of the literature and input from over one hundred clinical
59 experts from diverse settings globally to identify the defining attributes and provide
60 proposed definitions of the concepts
- 61 • Some uses and definitions of the concepts in languages other than English, in unpublished
62 grey literature and from clinical experts not included in the study may have been missed

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3 63 • As current usage of the concepts is diverse, the proposed definitions may not be universally
4 64 accepted and are aimed to stimulate further discussion
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10 66 **Introduction**

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12 67 The concepts *critical illness* and *critical care* are commonly used in healthcare. In PubMed, both
13 68 concepts are Medical Subject Headings (MeSH) terms, and searches for “critical illness” or
14 69 “critical care” return 40,000 and 220,000 articles respectively. While it may seem evident that the
15 70 concepts concern patients with very serious illness and their care, there is a lack of consensus
16 71 around their precise definitions.
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22 72 This causes problems for clinical practice, research, and policy making. For the clinician,
23 73 discordant interpretations of when a patient is critically ill can lead to differing clinical assessments
24 74 and treatments despite similar states: for example, Doctor A interprets Patient B’s low blood
25 75 oxygen level as critical illness, triggers an alarm and admits the patient to an intensive care unit,
26 76 only for Doctor C to reverse the decision and discharge the patient as she interprets the illness as
27 77 non-critical. For the researcher, it can be difficult to design a study or interpret findings: for
28 78 example studies into the effect of dexamethasone for critical COVID-19, or of another treatment
29 79 for all patients with critical illness, require clear eligibility criteria and translating the findings to
30 80 another patient group requires that the groups have similar clinical conditions. For the policy
31 81 maker, prioritising programmes and investments designed to improve care for very sick patients
32 82 relies on comparisons between similar groups and clearly defined interventions.
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42 83 Even quantifying the total global burden of critical illness has been challenging due to the lack of
43 84 an agreed definition. Proxies have been used instead, for example summing up syndromes
44 85 considered to comprise critical illness such as sepsis and acute lung injury – resulting in estimates
45 86 of up to 45 million critical illness cases each year.(1) Low- and middle-income countries are
46 87 suspected to have the highest burden (2), but the lack of a definition has hampered comparisons
47 88 across settings(3).
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52 89 Studying the care for critically ill patients has also been problematic. Studies have focused on care
53 90 provided in hospital locations such as in intensive care or emergency units, which exclude care
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3 91 provided in hospitals lacking such units, and to critically ill patients in general hospital wards.(4–
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5 92 6) In the COVID-19 pandemic, there have been great efforts to describe, scale-up and improve
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7 93 care for critically ill patients throughout the world,(4,6) and a lack of agreement around the concept
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9 94 of critical care has hampered these efforts.

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11 95 These examples illustrate how important concepts are as the building blocks of theories and
12
13 96 communication. Ideally, concepts are clearly-defined and their uses well-described for
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15 97 unambiguous communication and an understanding about exactly what is being described or
16
17 98 explained.(7) *Concept analysis* is a method for investigating how concepts are used and
18
19 99 understood. Concept analyses have been conducted in diverse fields such as in teamwork(8),
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21 100 postoperative recovery(9) and bioterrorism preparedness(10), all with the aim of providing basic
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23 101 conceptual understanding and facilitating communication. In this paper, we have used concept
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25 102 analysis, following the stepwise approach described by Walker and Avant(7). The first two steps
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27 103 in the approach are to choose the concept and determine the aim of the analysis. Our chosen
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29 104 concepts are *critical illness* and *critical care* and our aims are to explore the uses and definitions
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31 105 of the concepts in published sources and by global clinical experts, leading to a description of the
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33 106 defining attributes of the concepts and to proposed definitions.

34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 107 **Methods**

108 Concepts are the basic building blocks in theory construction, research, and communication. A
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110 concept analysis aims to define the concept's attributes and facilitate decisions about which
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112 phenomena match the concept, and which do not. In this study, Walker and Avant's method for
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114 concept analysis was chosen as a systematic approach used previously in similar studies.(7)The
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116 approach consists of eight steps: 1) Select the concept; 2) Determine the aim of analysis; 3) Identify
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118 all uses of the concept that you can discover; 4) Determine the defining attributes; 5) Identify a
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120 model case; 6) Identify borderline, related, contrary, invented, and illegitimate cases; 7) Identify
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122 antecedents and consequences; 8) Define empirical referents. In this paper steps 1 and 2 are
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124 described in the introduction section, step 3 in the method section and steps 4-8 in the results
125
126 section. Thus, the continuation of this article addresses steps 3-8 in Walker and Avant's method.
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128 (7)

129 **Step 3: Identifying the uses of the concepts**

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3 120 We identified the uses of the concepts of critical illness and critical care through a scoping review
4 121 of the literature and a web-based survey of global experts.

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6
7 122 ***Scoping Review***

8
9 123 We used the Arksey and O'Malley framework for scoping reviews(11). Relevant studies published
10 124 in English since 2008 were identified in the PubMed and Web of Science databases. To include
11 125 publications that were not found through the database searches, we hand-searched publication lists
12 126 and grey literature of intensive care medicine and emergency medicine societies. Duplicates were
13 127 removed using the software Rayyan(12). The publications were examined through title, then
14 128 abstract review and lastly by full-text review. The scoping review protocols were published in
15 129 advance on the www.protocols.io database.

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17
18 130 ***Critical Illness***

19 131 The search strategy used the terms terminolog*, etymolog*, nomenclatur*, OR definition*, AND
20 132 emergency, critical*, acute*, OR sever*, AND ill OR illness. A total of 9323 articles were
21 133 identified using these critical illness terms in the databases and an additional two articles were
22 134 identified through hand-searching. Of these, 1126 articles were identified as duplicates and the
23 135 remaining 8199 articles were screened by title and abstract review by two of the authors (TT and
24 136 HM). 8168 articles were excluded as they did not concern critical illness, were not written in
25 137 English or were not available in full text online, leaving 31 articles for inclusion for full-text
26 138 review. In the full-text review, 22 articles were excluded as they did not define critical illness,
27 139 and so nine articles were included in the analysis (Figure 1 and Supplementary Table 1).

28
29
30 140 Figure 1. Study Flow Chart

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142 **Critical Care**

143 The search strategy used the terms terminolog*, etymolog*, nomenclatur*, OR definition*, AND
 144 critical care, intensive care, emergency care, OR acute care. A total of 7286 articles were identified
 145 using these critical care terms in the databases and an additional six articles were identified through
 146 hand-searching. Of these, 1964 were identified as duplicates and the remaining 5322 articles were
 147 screened by title and abstract review by two of the authors (TT and HM). 5269 articles were
 148 excluded as they were not concerning critical care, not written in English or not available in full
 149 text online, leaving 59 articles for inclusion for full-text review. In the full-text review, 46 articles
 150 were excluded as they did not define critical care and so 13 articles were included in the analysis
 151 (Figure 1 and Supplementary Table 2).

152 **Expert survey**

153 The survey used open-ended questions to gather information about the experts' definitions of
 154 critical illness and critical care, and how they see the relationship of the concepts to connected
 155 concepts in order to provide context. The survey included the questions: i. *How would you define*
 156 *critical illness?*, ii. *How would you define critical care?*, iii. *Do critical care and intensive care*
 157 *differ? If yes, in what way?* iv. *Do critical care and emergency care differ and if yes, in what way?*
 158 v. *Do critical care and acute care differ and if yes, in what way?*

159 The inclusion criterion for an expert to be invited to participate in the survey was experience in
 160 any medical specialty that includes care of patients with acute, severe illness. Experts were
 161 identified from a stakeholder mapping of global critical care done by one of the authors (TB,
 162 unpublished), and those known to the researchers to be global experts in the field of critical care.
 163 Purposive sampling was used to invite experts with the aim of including 100 experts with a balance
 164 between specialties, geographical locations, health worker cadres and gender. In total 146 experts
 165 were invited to take part, and 114 completed the survey (78% response rate) (Figure 1 and Table
 166 1).

167 **Table 1: Characteristics of the experts who participated in the survey**

Variable	Frequency (%)
All	114
Gender	
Male	80 (70.2)
Female	34 (29.8)

Continent	
Africa	42 (36.8)
Europe	29 (25.4)
North America	26 (22.8)
Asia	12 (10.5)
South America	3 (2.6)
Australia	2 (1.8)
Cadres*	
Physician	93 (53.1)
Researcher	62 (35.4)
Nurse	12 (6.9)
Policy Maker	5 (2.9)
Other	3 (1.7)
Specialty*	
Anaesthesia/Intensive Care	75 (59.1)
Emergency Care	20 (15.8)
Medicine	12 (9.5)
Paediatrics	7 (5.5)
Surgery	6 (4.7)
Obstetrics and Gynaecology	2 (1.6)
Other	5 (3.9)

168 * As the experts were asked to select all that apply, the sum may exceed 100%

169

170 **Step 4: Analysis and determining the defining attributes**

171 All the definitions and usages of critical illness and critical care from the scoping reviews and the
 172 expert survey were charted and analysed using a content analysis based on methods developed by
 173 Erlingsson & Brysiewicz.(13) First, the data from any parts of the literature and from the expert
 174 survey that concerned the uses or definitions of the concepts were extracted. The data were coded,
 175 and the codes analysed iteratively by the study team. Repeated and redundant codes were removed
 176 and similar codes were arranged into categories. The data were revisited when new categories
 177 arose or when diverse opinions with contrasting attributes were identified. Through the process,
 178 themes emerged that captured the defining attributes of the concepts. Using the defining attributes,
 179 definitions of the concepts were constructed by the research team to be coherent and useful.

180

181 **Steps 5-8: presenting a model case, related and contrary cases, identifying antecedents and** 182 **consequences, and defining empirical referents**

183 The model cases, related, and contrary cases were developed by the researchers to provide
 184 examples to illustrate the defining attributes of the concepts that emerged from the concept
 185 analysis. Model cases were developed to be clinically realistic and to include all the defining

186 attributes. Related cases were developed that include some, but not all, of the defining attributes,
 187 and contrary cases that are clearly “not the concept”, containing none of the defining attributes.
 188 For simplicity in this study, we limited our cases to examples of patients with respiratory disease.
 189 Antecedents and consequences were identified as events that occur prior to the occurrence of each
 190 concept and as the outcomes of each concept respectively. Empirical referents were identified as
 191 phenomena that demonstrate the occurrence of each concept “in real life”.

192 **Ethical considerations:** Informed consent was provided by all of the experts. The Research Ethics
 193 Committee of the London School of Hygiene and Tropical Medicine approved the study
 194 (Reference number 22661).

195 **Patient and Public Involvement:** No patient or public involvement in this study

196 Results

197 The results relate to steps 4-8 in the Walker and Avant approach, as steps 1-3 have been described
 198 in the introduction and methods.

200 *Critical Illness*

201 Step 4: The defining attributes

202 A total of 48 codes were identified from the uses and definitions of critical illness from the scoping
 203 review and expert survey. The codes were analysed into 14 categories and 4 themes. (Table 2).
 204 The themes represent the defining attributes of critical illness: *high risk of imminent death*; *vital*
 205 *organ dysfunction*; *requirement for care to avoid death*; and *potential reversibility*. (Figure 2)

206 **Table 2. Content analysis for the concept *critical illness***

Code	Category	Theme
Severe illness	Severe illness	High risk of imminent death
Process of increasing severity		
Imminent risk of death	High risk of imminent death	
Enough severity to lead to death rapidly		
Can kill within a short time		
Medical condition that results in short term mortality	Acute onset or deterioration	
Sudden onset illness or acute deterioration		
Acute life-threatening illness		
An episode of acute illness		
Increased risk of death		

Continuous threat to life and well-being	Life-threatening	
Life-threatening or potentially life-threatening disease		
High probability of life-threatening deterioration		
Acutely life-threatening injury or illness		
At least one and often multiple organ dysfunction	Organ dysfunction or failure	Vital organ dysfunction
Failure in one or more organ systems that needs support		
Hemodynamic instability, respiratory failure, seizure, disorders of consciousness		
Diseases with vital organ failures as complications		
Threatened organ failure	Threatened organ dysfunction	Vital organ dysfunction
Potential disturbances of vital organ functions		
Threatened end-organ damage		
Deranged vital parameters	Vital signs derangements	
Physiologic reserve is diminished, as manifested by abnormal vital signs		
NEWS2 \geq 7		
Associated with significant morbidities if untreated	Treatment needed to avoid death	
Decline in a patient's ability to survive on their own		
Conditions requiring rapid intervention to avert death or disability		
An illness which without rapid treatment would result in death or disability.		
Needs prompt and sustained intervention to avert death or lifelong disability		
If no intervention is made, death is certain	Requirement for immediate treatment	Requirement for care to avoid death
Requiring minute-by-minute nursing and/or medical care		
Requires a rapid diagnosis and response to ensure good outcomes		
Illnesses where timely care can reduce the chances of death and disability		
Requires immediate intervention		
The illness needs close monitoring and prompt management	Requirement for organ support	
Treatment delays of hours or less make interventions less effective		
Requiring organ support		
Requiring vital organ support	Requires critical care	
Requiring intensified patient monitoring and organ support		
Critical care services		
ICU admission	Need for specific care	
Illness that results in need for more than standard of care		
Acute disease that needs specific treatment alongside the disease itself		
Some element of treatability	Reversible with treatment	
Any treatable life-threatening reversible illness		
Reversible life-threatening organ failure	Potentially reversible	Potential reversibility
Life-threatening situation, illness or disease that is potentially reversible		
Acute potentially reversible illness		

207

208 **Figure 2. The defining attributes of critical Illness**

209 **Proposed operational definition**

210 The proposed definition for critical illness is “*Critical illness is a state of ill health with vital organ*
 211 *dysfunction, a high risk of imminent death if care is not provided and the potential for*
 212 *reversibility.*”

213 **Cases**

214 **Step 5: A model case of critical illness (a case including all the defining attributes)**

1
2
3 215 A woman has a viral pneumonia. She is breathless and hypoxic with a low oxygen level in her
4 216 blood (oxygen saturation) of 74%. Her lungs are dysfunctional, and she has a life-threatening
5 217 condition that is likely to lead to her death in the next few hours. She requires care to support her
6 218 lungs (oxygen therapy) and if she receives that care, she has a chance of recovery.
7
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11 219 **Step 6: A related case for critical illness (a case including some of the defining attributes but**
12 220 **not the attribute of “imminently life-threatening”)**
13

14 221 A man has a chest infection. He has a fever, is coughing up green sputum and feels short-of-breath
15 222 when walking. He has an oxygen saturation of 91%. He has a serious condition, but it is not
16 223 imminently life-threatening. He requires treatment, likely with antibiotics, but it is uncertain
17 224 whether he requires any organ support such as oxygen. His condition is potentially reversible, and
18 225 he can recover.
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23 226 **A contrary case for critical illness (a clear example of “not the concept”)**
24

25 227 A woman has lung cancer. She is coughing up small amounts of blood but is able to walk to the
26 228 hospital. She has an oxygen saturation of 94%. She is sick and she requires treatment. However,
27 229 her illness is not imminently life-threatening, she has no dysfunctional vital organ and she does
28 230 not require immediate care. Her condition may or may not be reversible.
29
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33 231 **Step 7: Antecedents and consequences of Critical Illness**
34

35 232 The antecedents of critical illness are the onset of illness, in mild or moderate form, with
36 233 progressing severity. The consequences of critical illness are either recovery or death.
37
38

39 234 **Step 8: Empirical Referents**
40

41 235 There are an estimated 30-45 million cases of critical illness globally each year(1). Many patients
42 236 are cared for in hospitals with illnesses that are causing vital organ dysfunction and that are
43 237 imminently life-threatening. There is much work done to identify patients with critical illness such
44 238 as the use of single severely deranged vital signs(14), or compound scoring systems such as the
45 239 National Early Warning Score (NEWS) and The Sequential Organ Failure Assessment score
46 240 (SOFA) (15,16) . In hospitals, the severity of patients’ conditions can be assessed using tools such
47 241 as the Acute Physiology and Chronic Health Evaluation (APACHE)(17) and the Simplified Acute
48 242 Physiology Score (SAPS)(18).
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244 **Critical Care**245 **Step 4: The defining attributes**

246 A total of 60 codes were identified from the definitions of critical care from the scoping review
 247 and expert survey. The codes were analysed into 13 categories and 5 themes. (Table 3) The themes
 248 represent the concept's defining attributes: *identification, monitoring, and treatment of critical*
 249 *illness; vital organ support; initial and sustained care; any care of critical illness; and specialized*
 250 *human and physical resources.* (Figure 3)

251 **Table 3: Content analysis for the concept *critical care***

Codes	Category	Theme	
Identifying and addressing critical illness	Identification and monitoring of critical illness	Identification, monitoring, and treatment of critical illness	
Medical care with timely monitoring			
Appropriate monitoring of critical illness			
Management of critically ill patients	Treatment of critical illness		
Treat critical illness			
Care given to the critically ill			
Services required to stabilize critical illness			
Reduce the risk of death from a critical illness			
Care dedicated to patients with severe illness or potentially severe condition	Addressing life-threatening condition		
Managing life-threatening condition			
Preventing the occurrence of life-threatening conditions			
Treatment and management due to the threat of imminent deterioration	Supporting vital functions		Vital organ support
Medical care required to reduce the risk to the patient's life			
Care to sustain cardiopulmonary functions			
Support the patient's hemodynamic or cardiorespiratory status			
Supportive care in critical illness to enable body's systems to continue functioning before definitive treatment can work			
Care of vital organ failure			
Focus of care on supporting vital organs until improvement			
Providing organ support	Organ support		
Main focus on organ-supporting treatment.			
Support of vital organ function, or reverse specific organ dysfunctions			
Supportive care for organs that are failing			
Provision of support to dysfunctional body systems			
Early management for saving and maintaining life	Timely care	Initial and sustained care	
Rapid and timely intervention that is administered in critical illness			
From admission until the course of illness ends, either in full recovery or death	From start of critical illness until the patient is no longer critically ill		
From home through to discharge from hospital			
From the time of first contact with healthcare services through to stabilization			
To the point where the illness or injury is no longer acutely life-threatening	Sustained care		
Critical care could be over days to weeks			
Constant monitoring			
Irrespective of the location of the patient within the health system	Any location		Any care of critical illness
Anywhere in the emergency or inpatient setting			
Any care provided to critically ill patients			

Can be specialized care but depends on the level of resources	Any care provided to	Specialized human and physical resources
Usually located in an area with infrastructure to support these activities	Specific area	
Inside a healthcare facility, outside the emergency department		
High dependency care		
Care in ICU or Critical care unit		
A place where equipment, staff and environment is ready to save patients with life-threatening disease		
Multidisciplinary care	Multi-disciplinary and specialist staff	
Specially trained staff		
Essentially a team-based and multi-professional care		
Requires the grouping of special facilities and specially trained staff	High-intensity care	
Higher level of care than is available on a general ward		
Minute-by-minute nursing and/or medical care		
Advanced respiratory support / mechanical ventilation		
Nursing 24/7		
High nurse: patient ratio no lower than 1:2		

252

253 **Figure 3. Defining attributes of critical care**

254 **Proposed operational definition of *Critical care***

255 The proposed definition for critical care is “*Critical care is the identification, monitoring, and*
 256 *treatment of patients with critical illness through the initial and sustained support of vital organ*
 257 *functions.*”

258 ***Cases***

259 **Step 5: A model case of critical care (a case including all the defining attributes)**

260 A woman with a viral pneumonia is rapidly identified as critically ill when she arrives at the
 261 hospital. She is immediately admitted to a unit with supplies for managing critically ill patients
 262 and treatment is started. Nurses and doctors who have been trained in the care of critical illness
 263 monitor her regularly, and provide continuous care, titrating the treatments as needed. Continuous
 264 oxygen therapy is provided for her life-threatening hypoxia, supporting her respiratory
 265 dysfunction, until she has recovered and is no longer critically ill.

266 **Step 6: A related case of critical care (a case including some of the defining attributes but not the attribute of “vital organ support”)**

268 Care in a hospital is provided to a man with a chest infection. A nurse assesses him at arrival to
 269 hospital. A doctor admits him to the ward, prescribes antibiotics and decides he is not critically ill
 270 and does not require support for any of his vital organs. After four days the doctor discharges him
 271 from hospital.

1
2
3 272 **A contrary case of critical care (a clear example of “not the concept”)**
4

5 273 In the outpatient department, care is provided to a woman with lung cancer. A doctor and a nurse
6
7 274 do some investigations and prescribe some medications. She is sent home with a follow-up
8
9 275 appointment two weeks later.

10
11 276 **Step 7: Antecedents and consequences of critical care**
12

13 277 The antecedents of critical care are the contact of the patient with the healthcare system and may
14
15 278 include other care of a patient who has not deteriorated to the point of becoming critically ill. The
16
17 279 consequences of critical care are either the patient’s recovery or death.
18

19 280 **Step 8: Empirical Referents**
20

21 281 Many hospitals have wards or units for the provision of critical care, such as Emergency Units,
22
23 282 High Dependency Units or Intensive Care Units (ICUs) (19). Critical care can also be provided in
24
25 283 general wards, and a recent global consensus specified the care that should be included for all
26
27 284 patients with critical illness in any hospital location(20). Rapid Response Teams or Medical
28
29 285 Emergency Teams have been introduced into some hospitals, often consisting of staff from the
30
31 286 ICU responding to calls from the wards when a critically ill patient has been identified, and
32
33 287 providing either critical care on the ward, or transferring the patient to the ICU (21).
34

35 288

36 289 **Discussion**
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38
39 290 We have described how the concepts *critical illness* and *critical care* are used and defined in the
40
41 291 literature and by a selection of global experts using a concept analysis approach.
42

43 292 Our proposed definition for critical illness of, “*a state of ill health with vital organ dysfunction, a*
44
45 293 *high risk of imminent death if care is not provided and the potential for reversibility*”, is similar to
46
47 294 those in some key publications. Chandrashekar et al state that, “*Critical illness is any condition*
48
49 295 *requiring support of failing vital organ systems without which survival would not be possible*”
50
51 296 (22) . Painter et al write that, “*A critically ill or injured patient is defined as one who has an*
52
53 297 *illness or injury impairing one or more vital organ systems such that there is a high probability of*
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55 298 *imminent or life-threatening deterioration in the patient's condition*”(23) . Indeed, we found
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3 299 widespread agreement in the literature and expert sources that critical illness concerns the
4 300 attributes “life-threatening illness” and “organ dysfunction”.

7 301 However, we found diverse and varied usage of the concept concerning the attribute of reversibility
8 302 and the interface between critical illness and the natural process of dying. Some uses included only
9 303 illness that was potentially reversible – these sources regarded that for critical illness there should
10 304 be a possible chance of recovery. Without this, critical illness would be a concept that encompasses
11 305 the dying process – everyone would be critically ill immediately before death – which would
12 306 conflict with many clinical uses and understandings of the term. Others had a wider interpretation
13 307 including all life-threatening illness and did not include reversibility in the definition as it is
14 308 difficult to identify in the clinical setting, and the concept risks becoming context dependent, (high-
15 309 resource interventions may reverse some critical illness which would not be possible in low-
16 310 resource healthcare). Our iterative content analysis method led to our interpretation that
17 311 reversibility should be included as one of the defining attributes. This conclusion should be seen
18 312 as one possible interpretation that can stimulate further discussion.

28 313 It is hoped that the proposed definition of critical illness assists communication in the field.
29 314 Previously, studies about critical illness have focused on patients in certain hospital units, or with
30 315 diseases or syndromes as proxies for critical illness that exclude some critically ill patients.(1)
31 316 Our definition of critical illness is not diagnosis or syndrome specific and can be due to any
32 317 underlying condition. The definition could facilitate the specification of clinical criteria for the
33 318 identification of critical illness, estimates of the overall burden of critical illness, assessments of
34 319 outcomes for patients with critical illness across centres and settings, and interventions to improve
35 320 outcomes.

43 321 For critical care, there was greater diversity around its use and definition. There was widespread
44 322 agreement that critical care included the attributes of, “care of critically ill patients”, and the
45 323 “support of vital organs”. However, there were differing uses around the location of the care and
46 324 the need for specialized resources. Some sources considered critical care to be only the care
47 325 provided in certain locations, (such as ICUs or critical care units), or to be care that is always
48 326 highly specialized or resource intensive. The World Federation of Societies of Intensive and
49 327 Critical Care Medicine have suggested that critical care is synonymous with intensive care and is,
50 328 “*a multidisciplinary and interprofessional specialty dedicated to the comprehensive management*

1
2
3 329 of patients having, or at risk of developing, acute, life-threatening organ dysfunction. [Critical
4 330 care] uses an array of technologies that provide support of failing organ systems, particularly the
5 331 lungs, cardiovascular system, and kidneys.”(19) In contrast, other sources used critical care to
6
7 332 be inclusive of any care for patients with critical illness, irrespective of location or resources. The
8
9 333 Joint Faculty of Intensive Care Medicine of Ireland state that critical care units are those that,
10 334 “provide life sustaining treatment for critically ill patients with acute organ dysfunction due to
11
12 335 potentially reversible disease”,(24) and in Belgium, critical care beds have been defined as any
13
14 336 beds “for patients with one or more organ functions compromised”(3) Hirshon et al strike a
15
16 337 balance between these two contrasting views, “[Critical care is] the specialized care of patients
17
18 338 whose conditions are life-threatening and who require comprehensive care and constant
19
20 339 monitoring, usually in intensive care units.” (25)
21
22

23 340 Our proposed definition of, “the identification, monitoring, and treatment of patients with critical
24
25 341 illness through the initial and sustained support of vital organ functions”, aims to be inclusive.
26
27 342 Critical care may include the use of specialized resources, but it is not a requirement. We see this
28
29 343 as a strength in the definition, as it maintains a patient-centred rather than setting-dependent focus.
30
31 344 Critical care when defined in this way can be provided anywhere, and does not have to be resource-
32
33 345 intensive – it includes both high-resource care in ICUs and lower resource care in other settings.
34
35 346 Indeed, critical care can be provided in general wards, in small health facilities, in the community
36
37 347 or in ambulances. High-resource intensive care may not be possible in low-resource settings, but
38
39 348 such settings care for many critically ill patients who require critical care(5,26,27). The definition
40
41 349 focuses on supporting vital organ functions, emphasising that critical care’s primary focus is
42
43 350 treating the critical condition of the patient rather than definitive care for the underlying
44
45 351 condition(28,29). Critical care, as we have defined it, can be seen as a system of care of patients
46
47 352 with critical illness throughout the course of their illness, from the time of their first contact with
48
49 353 healthcare through to resolution of the critical illness or death. Critical care is part of the wider
50
51 354 concept of acute care which also includes prehospital care, emergency care, trauma and surgery
52
53 355 care, as well as in-patient care in medical, surgical, pediatric, obstetric and other wards(25).
54
55

56 356 The word “crisis” is the root for the word critical and has its origin from the Greek word “krisis”
57
58 357 referring to a “turning point” or “act of separation”, and later in English in a medical context when
59
60 358 a crisis refers to the decisive point at which a patient either improves or deteriorates.(30)The

1
2
3 359 concepts critical illness and critical care could be regarded as remaining true to these origins as
4
5 360 they refer to the point in a patient's "journey" through their illness where they are so severely ill
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7 361 that the situation has become a crisis, and managing the crisis is necessary to direct the patient
8
9 362 towards improvement rather than towards deterioration.

11 363 **Strengths and Limitations**

14 364 To our knowledge, this is the first study attempting to describe the uses and definitions of the
15
16 365 concepts *critical illness* and *critical care*, and to identify the defining attributes leading to proposed
17
18 366 definitions of the concepts. A strength is the use of both a scoping review of the literature and the
19
20 367 inclusion of over one hundred clinical experts as sources. The findings of the analysis should be
21
22 368 seen as a first step towards consensus and we recognise that the use of concepts is fluid and changes
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24 369 over time (7). We were limited to including literature in English and to published studies and
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26 370 guidelines and we may have missed relevant publications in other languages or in other grey
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28 371 literature. Our sample of experts was purposively selected and had global representation but was
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30 372 not perfectly symmetrical to continents, specialty, cadre or gender. There are many more experts
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32 373 than we were able to include, and we are likely to have missed experts who could have provided
33
34 374 valuable contributions. We acknowledge that the proposed definitions are due to one possible
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36 375 interpretation of the data and may not be universally accepted. We hope our analysis and findings
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38 376 move the conversation forwards, providing input about how to communicate and collaborate
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40 377 around these vitally important concepts, and ultimately how to improve the care and outcomes for
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42 378 critically ill patients.

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43 380 **Conclusion**

45 381 The concepts critical illness and critical care lack consensus definitions and have varied uses.
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47 382 Through concept analysis of the uses in the literature and among experts we propose possible
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49 383 definitions for the concepts: "*Critical illness is a state of ill health with vital organ dysfunction, a*
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51 384 *high risk of imminent death if care is not provided and the potential for reversibility*" and "*Critical*
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53 385 *care is the identification, monitoring, and treatment of patients with critical illness through the*
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55 386 *initial and sustained support of vital organ functions.*"

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3 387 **Figure 1: Study Flowchart**
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5 388 **Figure 2 : The defining attributes of critical illness**
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8 389 **Figure 3: The defining attributes of critical care**
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20

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22 396 Kayambankadzanja, Thomas Tamras, Hedi Mollazedagan and Tim Baker collected the data. Helle
23 397 Mølsted Alvesson, Mats Holmberg, and Martin Gerdin Wärnberg contributed to analysing the data.
24 398 RKK and TB wrote the first draft of the manuscript. All authors critically reviewed the manuscript
25 399 and approved the final version. The corresponding author attests that all listed authors meet
26 400 authorship criteria and that no others meeting the criteria have been omitted.
27

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29 402 commercial or not-for-profit sectors
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31 403 **Disclaimer:** We confirm the independence of researchers and that all authors in study can take
32 404 responsibility for the integrity of the data and the accuracy of the data analysis.
33

34 405 **Competing Interests:** None Declared
35

36 406 **Patient Consent for Publication:** Not required
37

38 407 **Ethics Approval:** The Research Ethics Committee of the London School of Hygiene and Tropical
39 408 Medicine approved the study (Reference number 22661).
40

41 409 **Provenance and Peer Review:** Not commissioned, externally reviewed
42

43 410 **Data Availability Statement:** The study data are available from the corresponding author on
44 411 reasonable request
45

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3 412 **Supplementary Files:** Supplementary Tables 1 and 2
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8 414 **References**

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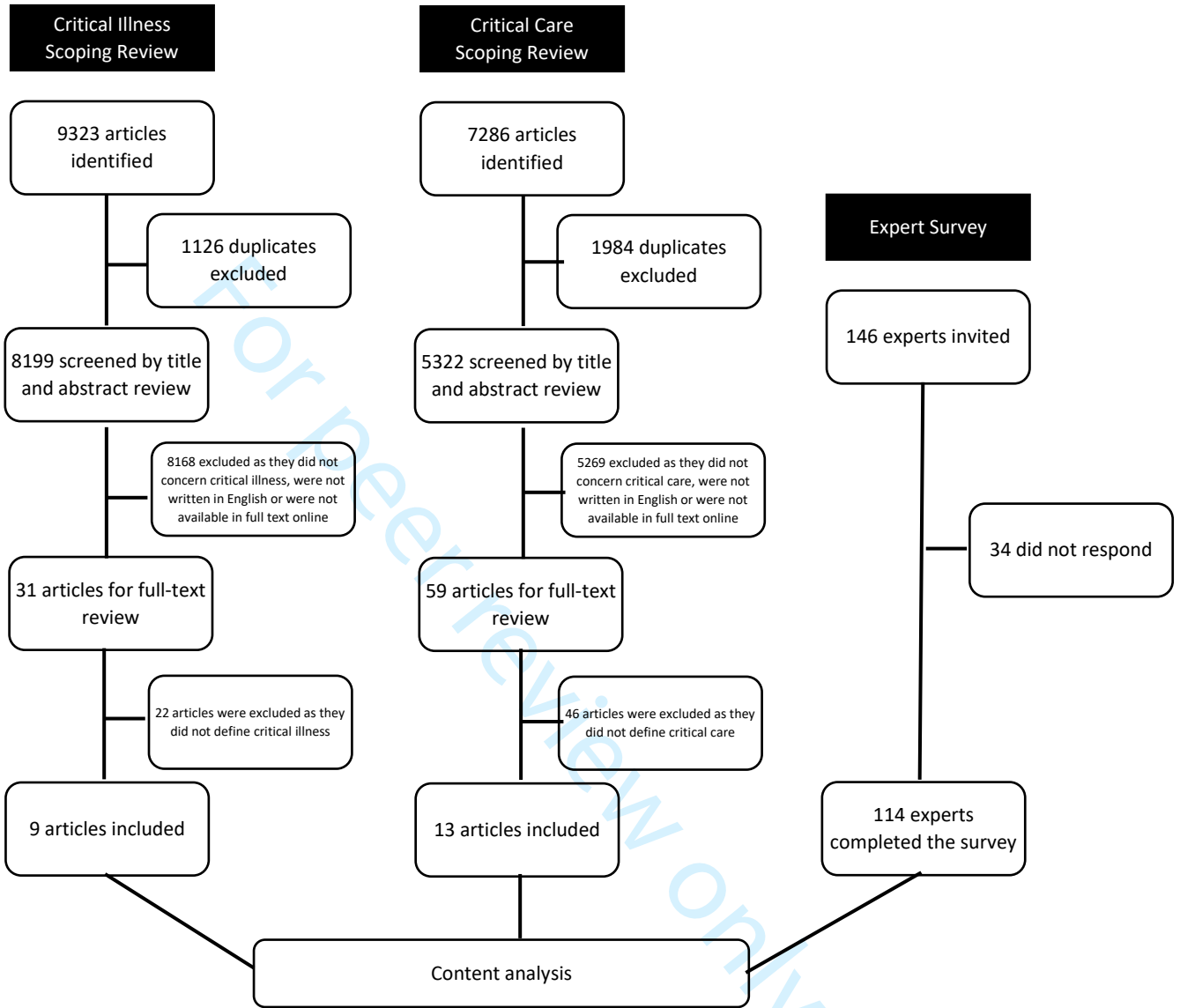
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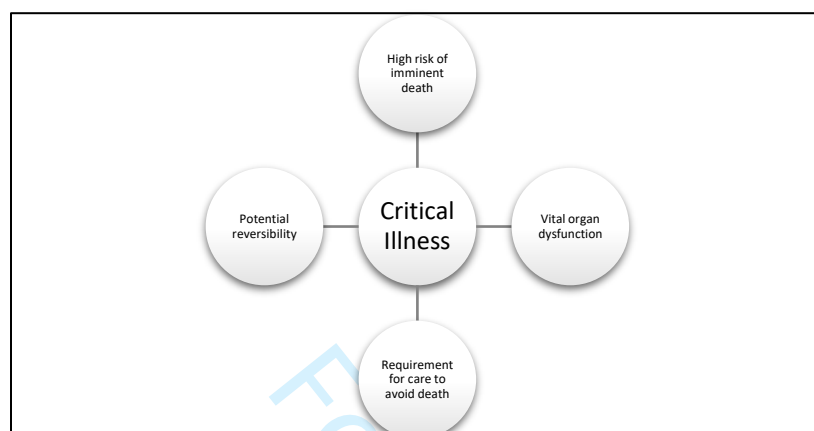
Figure 1: Study Flowchart



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3 **Figure 2: The defining attributes of critical illness**
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Figure 3: The defining attributes of critical care



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Supplementary Table 1 Literature with definitions of critical illness

	First Author and Publication Date	Country	Reference
1	Kievlan 2016	United States	Kievlan DR, Martin-Gill C, Kahn JM, Callaway CW, Yealy DM, Angus DC, et al. External validation of a prehospital risk score for critical illness. <i>Crit Care</i> . 2016;20(1):255.
2	Warttig 2018	United Kingdom	Warttig S, Alderson P, Evans DJW, Lewis SR, Kourbeti IS, Smith AF. Automated monitoring compared to standard care for the early detection of sepsis in critically ill patients (Review). <i>Cochrane Database of Syst Rev</i> . 2018(6):28.
3	Rodriguez 2018	United States	Rodriguez RM, Greenwood JC, Nuckton TJ, Darger B, Shofer FS, Troeger D, et al. Comparison of qSOFA with current emergency department tools for screening of patients with sepsis for critical illness. <i>Emerg Med J</i> . 2018;35(6):350-6.
4	Benneyworth 2015	United States	Benneyworth BD, Bennett WE, Carroll AE. Cross-sectional comparison of critically ill pediatric patients across hospitals with various levels of pediatric care. <i>BMC Res Notes</i> . 2015;8:693.
5	Hsu 2016	Taiwan	Hsu CW, Lin CS, Chen SJ, Lin SH, Lin CL, Kao CH. Risk of type 2 diabetes mellitus in patients with acute critical illness: a population-based cohort study. <i>Intensive Care Med</i> . 2016;42(1):38-45.
6	Painter 2013	United States	Painter JR. Critical Care in the Surgical Global Period. <i>Chest</i> . 2013;143(3):851-5.
7	Chandrashekar 2015	India	Chandrashekar M, Shivaraj BM, Krishna VP. A study on prognostic value of serum cortisol in determining the outcome in the critically ill patients. <i>JEMDS</i> . 2015;4(58):10130-5.
8	Liao 2014	United States	Liao MM, Lezotte D, Lowenstein SR, Howard K, Finley Z, Feng ZP, et al. Sensitivity of systemic inflammatory response syndrome for critical illness among ED patients. <i>Am J of Emerg Med</i> . 2014;32(11):1319-25.
9	Valentin 2011	23 countries	Valentin A, Ferdinande P, Improvem EWGQ. Recommendations on basic requirements for intensive care units: structural and organizational aspects. <i>Intensive Care Med</i> . 2011;37(10):1575-87.

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Supplementary Table 2 Literature with definitions of critical care

	First Author and Publication Date	Country	Reference
1	Wunsch 2008	United States, France, UK, Canada, Belgium	Wunsch H, Angus DC, Harrison DA, Collange O, Fowler R, Hoste EA, et al. Variation in critical care services across North America and Western Europe. <i>Crit Care Med</i> . 2008;36(10):2787-93, e1-9
2	Prin 2012	United States	Prin M, Wunsch H. International comparisons of intensive care: informing outcomes and improving standards. <i>Curr Opin Crit Care</i> . 2012;18(6):700-6
3	Painter 2013	United States	Painter JR. Critical care in the surgical global period. <i>Chest</i> . 2013;143(3):851-5
4	Royal College of Anaesthetists 2018	England	https://www.rcoa.ac.uk/sites/default/files/documents/2020-06/EMC-Guidelines2018.pdf
5	Joint Faculty of Intensive Care Medicine of Ireland and Intensive Care Society of Ireland 2019	Ireland	https://jficmi.anaesthesia.ie/wp-content/uploads/2019/09/National-Standards-for-Adult-Critical-Services-2019.pdf
6	Marshall 2017	Many countries	Marshall JC, Bosco L, Adhikari NK, Connolly B, Diaz J v., Dorman T, et al. What is an intensive care unit? A report of the task force of the World Federation of Societies of Intensive and Critical Care Medicine. <i>Journal of Critical Care</i> . 2017 Feb;37:270–6.
7	The International Surgical Outcomes Study 2016	Many countries	International Surgical Outcomes Study g. Global patient outcomes after elective surgery: prospective cohort study in 27 low-, middle- and high-income countries. <i>Br J Anaesth</i> . 2016;117(5):601-9
8	Benneyworth 2015	United States	Benneyworth BD, Bennett WE, Carroll AE. Cross-sectional comparison of critically ill pediatric patients across hospitals with various levels of pediatric care. <i>BMC Res Notes</i> . 2015;8:693.
9	Kievlan 2016	United States	Kievlan DR, Martin-Gill C, Kahn JM, Callaway CW, Yealy DM, Angus DC, et al. External validation of a prehospital risk score for critical illness. <i>Crit Care</i> . 2016;20(1):255.
10	Boyle 2008	Australia	Boyle M, Butcher R, Conyers V, Kendrick T, MacNamara M, Lang S. Transition to intensive care nursing: establishing a starting point. <i>Aust Crit Care</i> . 2008;21(4):190-8.
11	Hirshon 2013	United States	Hirshon JM, Risko N, Calvillo EJ, Stewart de Ramirez S, Narayan M, Theodosis C, et al. Health systems and services: the role of acute care. <i>Bull World Health Organ</i> . 2013;91(5):386-8
12	McCarthy 2013	United States	McCarthy C, O'Rourke NC, Madison JM. Integrating advanced practice providers into medical critical care teams. <i>Chest</i> . 2013;143(3):847-50
13	Intensive Care Society 2009	United Kingdom	https://icmwk.com/wp-content/uploads/2014/02/Revised-Levels-of-Care-21-12-09.pdf

Towards Definitions of Critical Care and Critical Illness: A Concept Analysis

Section Item	PRISMA-ScR Checklist Item	Page
Title	Identify the report as a scoping review.	-
Abstract		
Structured summary	Provide a structured summary that includes (as applicable) background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	1
Introduction		
Rationale	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	3-4
Objectives	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	4
Methods		
Protocol and registration	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	5
Eligibility criteria	Specify characteristics of the sources of evidence used as eligibility criteria (e.g.,	5

	years considered, language, and publication status), and provide a rationale.	
6 Information sources	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed	5
Search	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	5
Selection of sources of evidence	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	5
Data charting process	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	7
Data items	List and define all variables for which data were sought and any assumptions and simplifications made.	5
Critical appraisal of individual sources of evidence	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	Not Done
Summary measures	Not applicable for scoping reviews	N/A

Synthesis of results	Describe the methods of handling and summarizing the data that were charted.	7
Risk of bias across studies	Not applicable for scoping reviews	N/A
Additional analyses	Not applicable for scoping reviews.	N/A
Results		
Selection of sources of evidence	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	5-7
Characteristics of sources of evidence	For each source of evidence, present characteristics for which data were charted and provide the citations.	9-13
Critical appraisal within sources of evidence	If done, present data on critical appraisal of included sources of evidence (see item 12).	Not Done
Results of individual sources of evidence	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	9-13
Synthesis of results	Summarize and/or present the charting results as they relate to the review questions and objectives.	9-13
Risk of bias across studies	Not applicable for scoping reviews.	N/A
Additional analyses	Not applicable for scoping reviews.	N/A
Discussion		
Summary of evidence	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	14-17

1 2 3 4 5 6	Limitations	Discuss the limitations of the scoping review process.	17
7 8 9 10 11 12	Conclusions	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	17
13 14 15 16 17 18 19 20	Funding	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	18

BMJ Open

Towards definitions of critical illness and critical care using concept analysis

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Secondary Subject Heading:	Intensive care, Health services research, Nursing, Public health
Keywords:	Adult intensive & critical care < ANAESTHETICS, ACCIDENT & EMERGENCY MEDICINE, HEALTH SERVICES ADMINISTRATION & MANAGEMENT

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1 Towards definitions of critical illness and critical care using concept analysis

2 Raphael Kazidule Kayambankadzanja^{1,2}, Carl Otto Schell^{3,4,5}, Martin Gerdin Wärnberg^{3,6}, Thomas
3 Tamras⁷, Hedi Mollazadegan⁸, Mats Holmberg^{9,10,11}, Helle Mølsted Alvesson³, Tim Baker^{3,12,13}

4 1. Department of Anaesthesia and Intensive Care, Queen Elizabeth Central Hospital, Blantyre Malawi

5 2. Department of Public Health, Kamuzu University of Health Sciences

6 3. Department of Global Public Health, Karolinska Institutet, Stockholm, Sweden

7 4. Centre for Clinical Research Sörmland, Uppsala University, Eskilstuna, Sweden

8 5. Department of Medicine, Nyköping Hospital, Nyköping, Sweden.

9 6. Function Perioperative Medicine and Intensive Care, Karolinska University Hospital, Solna, Sweden

10 7. Södertälje Hospital, Stockholm, Sweden

11 8. The Department of Addiction Medicine, Sankt Goran Hospital, Stockholm, Sweden

12 9. Faculty of Health and Life Sciences, Linnaeus University, Växjö, Sweden

13 10. School of Health, Care and Social Welfare, Mälardalen University, Eskilstuna, Sweden

14 11. Centre for Clinical Research Sörmland, Uppsala University, Eskilstuna, Sweden

15 12. Department of Clinical Research, London School of Hygiene & Tropical Medicine, London, UK

16 13. Department of Emergency Medicine, Muhimbili University of Health and Allied Sciences, Dar es Salaam, Tanzania

17
18 Corresponding Author: Tim Baker Email: tim.baker@ki.se

19 Abstract

20 Objective

21 As “critical illness” and “critical care” lack consensus definitions, this study aimed to explore how
22 the concepts’ are used, describe their defining attributes, and propose potential definitions.

23 Design and Methods

24 We used the Walker and Avant approach to concept analysis. The uses and definitions of the
25 concepts were identified through a scoping review of the literature and an online survey of 114
26 global clinical experts. We used the Arksey and O’Malley framework for scoping reviews and
27 searched in PubMed and Web of Science with a strategy including terms around critical
28 illness/care and definitions/etymologies limited to publications in English between 1st January
29 2008 and 1st January 2020. The experts were selected through purposive sampling and
30 snowballing, with 36.8% in Africa, 25.4% in Europe, 22.8% in North America, 10.5% in Asia,
31 2.6% in South America and 1.8% in Australia. They worked with Anaesthesia or Intensive Care
32 (59.1%), Emergency Care 15.8%, Medicine 9.5%, Paediatrics 5.5%, Surgery 4.7%, Obstetrics and

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3 33 Gynaecology 1.6% and other specialties 3.9%. Through content analysis of the data we extracted
4 34 codes, categories, and themes to determine the concepts' defining attributes and we proposed
5 35 potential definitions. To assist understanding, we developed model, related and contrary cases
6 36 concerning the concepts, we identified antecedents and consequences to the concepts, and defined
7 37 empirical referents.

11 38 **Results**

13 39 Nine and 13 articles were included in the scoping reviews of critical illness and critical care
14 40 respectively. A total of 48 codes, 14 categories and 4 themes were identified in the uses and
15 41 definitions of critical illness and 60 codes, 13 categories and 5 themes for critical care. The defining
16 42 attributes of critical illness were a high risk of imminent death; vital organ dysfunction;
17 43 requirement for care to avoid death; and potential reversibility. The defining attributes of critical
18 44 care were the identification, monitoring and treatment of critical illness; vital organ support; initial
19 45 and sustained care; any care of critical illness; and specialized human and physical resources. The
20 46 defining attributes led to our proposed definitions of critical illness as, "*a state of ill health with*
21 47 *vital organ dysfunction, a high risk of imminent death if care is not provided and the potential for*
22 48 *reversibility*", and of critical care as, "*the identification, monitoring and treatment of patients with*
23 49 *critical illness through the initial and sustained support of vital organ functions.*"

32 50 **Conclusion**

34 51 The concepts critical illness and critical care lack consensus definitions and have varied uses.
35 52 Through concept analysis of uses and definitions in the literature and among experts we have
36 53 identified the defining attributes of the concepts and proposed definitions that could aid clinical
37 54 practice, research, and policy making.

41 55

44 56 **Strengths and limitations of this study**

- 46 57
- 47 58 • This concept analysis is the first study to systematically describe the uses and definitions
48 59 of the concepts *critical illness* and *critical care*.
 - 50 60 • The study uses a scoping review of the literature and input from over one hundred clinical
51 61 experts from diverse settings globally to identify the defining attributes and provide
52 62 proposed definitions of the concepts.
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3 62 • Some uses and definitions of the concepts in languages other than English, in unpublished
4 63 grey literature and from clinical experts not included in the study may have been missed.
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7 64 • As current usage of the concepts is diverse, the proposed definitions may not be universally
8 65 accepted and are aimed to stimulate further discussion.
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13 67 **Introduction**

16 68 The concepts *critical illness* and *critical care* are commonly used in healthcare. In PubMed, both
17 69 concepts are Medical Subject Headings (MeSH) terms, and searches for “critical illness” or
18 70 “critical care” return 40,000 and 220,000 articles respectively. While it may seem evident that the
19 71 concepts concern patients with very serious illness and their care, there is a lack of consensus
20 72 around their precise definitions.

23 73 Critical illness is a concept concerning a patient’s condition that is distinct from the disease
24 74 diagnosis. It has been argued that clinical practice is overly guided by diagnoses rather than
25 75 prognoses.(1) We postulate that the lack of consensus around prognostic concepts such as critical
26 76 illness may be one factor in this and could cause problems for clinical practice, research, and policy
27 77 making. For the clinician, discordant interpretations of when a patient is critically ill could lead to
28 78 differing clinical assessments and treatments despite similar states: for example, Doctor A
29 79 interprets Patient B’s low blood oxygen level as critical illness, triggers an alarm and admits the
30 80 patient to an intensive care unit, only for Doctor C to reverse the decision and discharge the patient
31 81 as she interprets the illness as non-critical. For the researcher, it could be difficult to design a study
32 82 or interpret findings: for example studies into the effect of dexamethasone for critical COVID-19,
33 83 or of another treatment for all patients with critical illness, require clear eligibility criteria and
34 84 translating the findings to another patient group requires that the groups have similar clinical
35 85 conditions. For the policy maker, prioritising programmes and investments designed to improve
36 86 care for very sick patients relies on comparisons between similar groups and clearly defined
37 87 interventions.

38 88 Even quantifying the total global burden of critical illness has been challenging due to the lack of
39 89 an agreed definition.(2) Proxies have been used instead, for example summing up syndromes
40 90 considered to comprise critical illness such as sepsis and acute lung injury – resulting in estimates

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3 91 of up to 45 million critical illness cases each year.(2) Low- and middle-income countries are
4 92 suspected to have the highest burden (3), but the lack of a definition has hampered comparisons
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6 93 across settings(4).
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9 94 Studying the care for critically ill patients has also been problematic. Studies have focused on care
10 95 provided in hospital locations such as in intensive care or emergency units, which exclude care
11 96 provided in hospitals lacking such units, and to critically ill patients in general hospital wards.(5–
12 97 7) In the COVID-19 pandemic, there have been great efforts to describe, scale-up and improve
13 98 care for critically ill patients throughout the world,(5,7) and a lack of agreement around the concept
14 99 of critical care has hampered these efforts.(8,9)
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20 100 These examples illustrate how important concepts are as the building blocks of theories and
21 101 communication. Ideally, concepts are clearly-defined and their uses well-described for
22 102 unambiguous communication and an understanding about exactly what is being described or
23 103 explained.(10) *Concept analysis* is a method for investigating how concepts are used and
24 104 understood. Concept analyses have been conducted in diverse fields such as in teamwork(11),
25 105 postoperative recovery(12) and bioterrorism preparedness(13), all with the aim of providing
26 106 basic conceptual understanding and facilitating communication. In this paper, we have used
27 107 concept analysis, following the stepwise approach described by Walker and Avant(10). The first
28 108 two steps in the approach are to choose the concept and determine the aim of the analysis. Our
29 109 chosen concepts are *critical illness* and *critical care* and our aims are to explore the uses and
30 110 definitions of the concepts in published sources and by global clinical experts, leading to a
31 111 description of the defining attributes of the concepts and to proposed definitions.
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41 112 **Methods**

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44 113 Concepts are the basic building blocks in theory construction, research, and communication. A
45 114 concept analysis aims to define the concept's attributes and facilitate decisions about which
46 115 phenomena match the concept, and which do not. In this study, Walker and Avant's method for
47 116 concept analysis was chosen as a systematic approach used previously in similar studies.(10)The
48 117 approach consists of eight steps: 1) Select the concept; 2) Determine the aim of analysis; 3) Identify
49 118 all uses of the concept that you can discover; 4) Determine the defining attributes; 5) Identify a
50 119 model case; 6) Identify borderline, related, contrary, invented, and illegitimate cases; 7) Identify
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3 120 antecedents and consequences; 8) Define empirical referents. In this paper steps 1 and 2 are
4 121 described in the introduction section, step 3 in the method section and steps 4-8 in the results
5 122 section. Thus, the continuation of this article addresses steps 3-8 in Walker and Avant's method.
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7 123 (10)
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10 124 **Step 3: Identifying the uses of the concepts**

11 125 We identified the uses of the concepts of critical illness and critical care through a scoping review
12 126 of the literature and a web-based survey of global experts.

13 127 *Scoping Review*

14 128 We used the Arksey and O'Malley framework for scoping reviews(14). Relevant studies published
15 129 in English between 1st January 2008 and 1st January 2020 were identified in the PubMed and Web
16 130 of Science databases. We began the search in 2018 and deemed that articles published prior to
17 131 2008 were more than 10 years old and would have less relevance. To include publications that
18 132 were not found through the database searches, we hand-searched publication lists and grey
19 133 literature of intensive care medicine and emergency medicine societies. Duplicates were removed
20 134 using the software Rayyan(15). The publications were examined through title, then abstract review
21 135 and lastly by full-text review. The scoping review protocols were published in advance on the
22 136 www.protocols.io database.
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34 137 *Critical Illness*

35 138 The search strategy used the terms terminolog*, etymolog*, nomenclatur*, OR definition*, AND
36 139 emergency, critical*, acute*, OR sever*, AND ill OR illness. A total of 9323 articles were
37 140 identified using these critical illness terms in the databases and an additional two articles were
38 141 identified through hand-searching. Of these, 1126 articles were identified as duplicates and the
39 142 remaining 8199 articles were screened by title and abstract review by two of the authors (TT and
40 143 HM). 8168 articles were excluded as they did not concern critical illness, were not written in
41 144 English or were not available in full text online, leaving 31 articles for inclusion for full-text
42 145 review. In the full-text review, 22 articles were excluded as they did not define critical illness,
43 146 and so nine articles were included in the analysis (Figure 1 and Supplementary Table 1).
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51 147 Figure 1. Study Flow Chart
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149 **Critical Care**

150 The search strategy used the terms terminolog*, etymolog*, nomenclatur*, OR definition*, AND
 151 critical care, intensive care, emergency care, OR acute care. A total of 7286 articles were identified
 152 using these critical care terms in the databases and an additional six articles were identified through
 153 hand-searching. Of these, 1964 were identified as duplicates and the remaining 5322 articles were
 154 screened by title and abstract review by two of the authors (TT and HM). 5269 articles were
 155 excluded as they were not concerning critical care, not written in English or not available in full
 156 text online, leaving 59 articles for inclusion for full-text review. In the full-text review, 46 articles
 157 were excluded as they did not define critical care and so 13 articles were included in the analysis
 158 (Figure 1 and Supplementary Table 2).

159 **Expert survey**

160 The survey used open-ended questions to gather information about the experts' definitions of
 161 critical illness and critical care, and how they see the relationship of the concepts to connected
 162 concepts in order to provide context. The survey included the questions: i. *How would you define*
 163 *critical illness?*, ii. *How would you define critical care?*, iii. *Do critical care and intensive care*
 164 *differ? If yes, in what way?* iv. *Do critical care and emergency care differ and if yes, in what way?*
 165 v. *Do critical care and acute care differ and if yes, in what way?*

166 The inclusion criterion for an expert to be invited to participate in the survey was experience in
 167 any medical specialty that includes care of patients with acute, severe illness. Experts were
 168 identified from a stakeholder mapping of global critical care done by one of the authors (TB,
 169 unpublished), and those known to the researchers to be global experts in the field of critical care.
 170 Purposive sampling was used to invite experts with the aim of including 100 experts with a balance
 171 between specialties, geographical locations, health worker cadres and gender. In total 146 experts
 172 were invited to take part, and 114 completed the survey (78% response rate) (Figure 1 and Table
 173 1).

174 **Table 1: Characteristics of the experts who participated in the survey**

Variable	Frequency (%)
All	114
Gender	
Male	80 (70.2)
Female	34 (29.8)

Continent	
Africa	42 (36.8)
Europe	29 (25.4)
North America	26 (22.8)
Asia	12 (10.5)
South America	3 (2.6)
Australia	2 (1.8)
Cadres*	
Physician	93 (53.1)
Researcher	62 (35.4)
Nurse	12 (6.9)
Policy Maker	5 (2.9)
Other	3 (1.7)
Specialty*	
Anaesthesia/Intensive Care	75 (59.1)
Emergency Care	20 (15.8)
Medicine	12 (9.5)
Paediatrics	7 (5.5)
Surgery	6 (4.7)
Obstetrics and Gynaecology	2 (1.6)
Other	5 (3.9)

175 * As the experts were asked to select all that apply, the sum may exceed 100%

176

177 **Step 4: Analysis and determining the defining attributes**

178 All the definitions and usages of critical illness and critical care from the scoping reviews and the
 179 expert survey were charted and analysed using a content analysis based on methods developed by
 180 Erlingsson & Brysiewicz.(16) First, the data from any parts of the literature and from the expert
 181 survey that concerned the uses or definitions of the concepts were extracted. The data were coded,
 182 and the codes analysed iteratively by the study team. Repeated and redundant codes were removed
 183 and similar codes were arranged into categories. The data were revisited when new categories
 184 arose or when diverse opinions with contrasting attributes were identified. Through the process,
 185 themes emerged that captured the defining attributes of the concepts. Using the defining attributes,
 186 definitions of the concepts were constructed by the research team to be coherent and useful.

187

188 **Steps 5-8: presenting a model case, related and contrary cases, identifying antecedents and** 189 **consequences, and defining empirical referents**

190 The model cases, related, and contrary cases were developed by the researchers to provide
 191 examples to illustrate the defining attributes of the concepts that emerged from the concept
 192 analysis. Model cases were developed to be clinically realistic and to include all the defining

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3 193 attributes. Related cases were developed that include some, but not all, of the defining attributes,
4 194 and contrary cases that are clearly “not the concept”, containing none of the defining attributes.
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6 195 For simplicity in this study, we limited our cases to examples of patients with respiratory disease.
7
8 196 Antecedents and consequences were identified as events that occur prior to the occurrence of each
9 197 concept and as the outcomes of each concept respectively. Empirical referents were identified as
10 198 phenomena that demonstrate the occurrence of each concept “in real life”.

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14 199 **Ethical considerations:** Informed consent was provided by all of the experts. The Research Ethics
15 200 Committee of the London School of Hygiene and Tropical Medicine approved the study
16 201 (Reference number 22661).

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20 202 **Patient and Public Involvement:** None

21 203 **Results**

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24 204 The results relate to steps 4-8 in the Walker and Avant approach, as steps 1-3 have been described
25 205 in the introduction and methods.

26 206 27 207 **Critical Illness**

28 208 **Step 4: The defining attributes**

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31 209 A total of 48 codes were identified from the uses and definitions of critical illness from the scoping
32 210 review and expert survey. The codes were analysed into 14 categories and 4 themes. (Table 2).
33 211 The themes represent the defining attributes of critical illness: *high risk of imminent death*; *vital*
34 212 *organ dysfunction*; *requirement for care to avoid death*; and *potential reversibility*. (Figure 2)

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43 213 **Table 2. Content analysis for the concept *critical illness***

Code	Category	Theme
Severe illness	Severe illness	High risk of imminent death
Process of increasing severity		
Imminent risk of death	High risk of imminent death	
Enough severity to lead to death rapidly		
Can kill within a short time		
Medical condition that results in short term mortality	Acute onset or deterioration	
Sudden onset illness or acute deterioration		
Acute life-threatening illness		
An episode of acute illness		
Increased risk of death		

Continuous threat to life and well-being	Life-threatening	
Life-threatening or potentially life-threatening disease		
High probability of life-threatening deterioration		
Acutely life-threatening injury or illness		
At least one and often multiple organ dysfunction	Organ dysfunction or failure	Vital organ dysfunction
Failure in one or more organ systems that needs support		
Hemodynamic instability, respiratory failure, seizure, disorders of consciousness		
Diseases with vital organ failures as complications		
Threatened organ failure	Threatened organ dysfunction	
Potential disturbances of vital organ functions		
Threatened end-organ damage		
Deranged vital parameters	Vital signs derangements	
Physiologic reserve is diminished, as manifested by abnormal vital signs		
NEWS2 \geq 7		
Associated with significant morbidities if untreated	Treatment needed to avoid death	
Decline in a patient's ability to survive on their own		
Conditions requiring rapid intervention to avert death or disability		
An illness which without rapid treatment would result in death or disability.		
Needs prompt and sustained intervention to avert death or lifelong disability		
If no intervention is made, death is certain	Requirement for immediate treatment	Requirement for care to avoid death
Requiring minute-by-minute nursing and/or medical care		
Requires a rapid diagnosis and response to ensure good outcomes		
Illnesses where timely care can reduce the chances of death and disability		
Requires immediate intervention		
The illness needs close monitoring and prompt management	Requirement for organ support	
Treatment delays of hours or less make interventions less effective		
Requiring organ support		
Requiring vital organ support	Requires critical care	
Requiring intensified patient monitoring and organ support		
Critical care services		
ICU admission	Need for specific care	
Illness that results in need for more than standard of care		
Acute disease that needs specific treatment alongside the disease itself		
Some element of treatability	Reversible with treatment	
Any treatable life-threatening reversible illness		
Reversible life-threatening organ failure	Potentially reversible	Potential reversibility
Life-threatening situation, illness or disease that is potentially reversible		
Acute potentially reversible illness		

214

215 **Figure 2. The defining attributes of critical Illness**

216 **Proposed operational definition**

217 The proposed definition for critical illness is “*Critical illness is a state of ill health with vital organ*
 218 *dysfunction, a high risk of imminent death if care is not provided and the potential for*
 219 *reversibility.*”

220 **Cases**

221 **Step 5: A model case of critical illness (a case including all the defining attributes)**

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3 222 A woman has a viral pneumonia. She is breathless and hypoxic with a low oxygen level in her
4 223 blood (oxygen saturation) of 74%. Her lungs are dysfunctional, and she has a life-threatening
5 224 condition that is likely to lead to her death in the next few hours. She requires care to support her
6 225 lungs (oxygen therapy) and if she receives that care, she has a chance of recovery.

10
11 226 **Step 6: A related case for critical illness (a case including some of the defining attributes but**
12 227 **not the attribute of “imminently life-threatening”)**

14 228 A man has a chest infection. He has a fever, is coughing up green sputum and feels short-of-breath
15 229 when walking. He has an oxygen saturation of 91%. He has a serious condition, but it is not
16 230 imminently life-threatening. He requires treatment, likely with antibiotics, but it is uncertain
17 231 whether he requires any organ support such as oxygen. His condition is potentially reversible, and
18 232 he can recover.

23 233 **A contrary case for critical illness (a clear example of “not the concept”)**

25 234 A woman has lung cancer. She is coughing up small amounts of blood but is able to walk to the
26 235 hospital. She has an oxygen saturation of 94%. She is sick and she requires treatment. However,
27 236 her illness is not imminently life-threatening, she has no dysfunctional vital organ and she does
28 237 not require immediate care. Her condition may or may not be reversible.

32 238 **Step 7: Antecedents and consequences of Critical Illness**

35 239 The antecedents of critical illness are the onset of illness, in mild or moderate form, with
36 240 progressing severity. The consequences of critical illness are either recovery or death.

39 241 **Step 8: Empirical Referents**

41 242 There are an estimated 30-45 million cases of critical illness globally each year(2). Many patients
42 243 are cared for in hospitals with illnesses that are causing vital organ dysfunction and that are
43 244 imminently life-threatening. There is much work done to identify patients with critical illness such
44 245 as the use of single severely deranged vital signs(17), or compound scoring systems such as the
45 246 National Early Warning Score (NEWS) and The Sequential Organ Failure Assessment score
46 247 (SOFA) (18,19) . In hospitals, the severity of patients’ conditions can be assessed using tools such
47 248 as the Acute Physiology and Chronic Health Evaluation (APACHE)(20) and the Simplified Acute
48 249 Physiology Score (SAPS)(21).

250

251 ***Critical Care***252 **Step 4: The defining attributes**

253 A total of 60 codes were identified from the definitions of critical care from the scoping review
 254 and expert survey. The codes were analysed into 13 categories and 5 themes. (Table 3) The themes
 255 represent the concept's defining attributes: *identification, monitoring, and treatment of critical*
 256 *illness; vital organ support; initial and sustained care; any care of critical illness; and specialized*
 257 *human and physical resources.* (Figure 3)

258 **Table 3: Content analysis for the concept *critical care***

Codes	Category	Theme
Identifying and addressing critical illness	Identification and monitoring of critical illness	Identification, monitoring, and treatment of critical illness
Medical care with timely monitoring		
Appropriate monitoring of critical illness		
Management of critically ill patients	Treatment of critical illness	
Treat critical illness		
Care given to the critically ill		
Services required to stabilize critical illness		
Reduce the risk of death from a critical illness		
Care dedicated to patients with severe illness or potentially severe condition	Addressing life-threatening condition	
Managing life-threatening condition		
Preventing the occurrence of life-threatening conditions		
Treatment and management due to the threat of imminent deterioration	Supporting vital functions	
Medical care required to reduce the risk to the patient's life		
Care to sustain cardiopulmonary functions		
Support the patient's hemodynamic or cardiorespiratory status		
Supportive care in critical illness to enable body's systems to continue functioning before definitive treatment can work		
Care of vital organ failure	Organ support	
Focus of care on supporting vital organs until improvement		
Providing organ support		
Main focus on organ-supporting treatment.		
Support of vital organ function, or reverse specific organ dysfunctions		
Supportive care for organs that are failing	Timely care	
Provision of support to dysfunctional body systems		
Early management for saving and maintaining life		
Rapid and timely intervention that is administered in critical illness		
From admission until the course of illness ends, either in full recovery or death		From start of critical illness until the patient is no longer critically ill
From home through to discharge from hospital		
From the time of first contact with healthcare services through to stabilization		
To the point where the illness or injury is no longer acutely life-threatening	Sustained care	
Critical care could be over days to weeks		
Constant monitoring	Any location	Any care of critical illness
Irrespective of the location of the patient within the health system		
Anywhere in the emergency or inpatient setting		
Any care provided to critically ill patients		

Can be specialized care but depends on the level of resources	Any care provided to	Specialized human and physical resources
Usually located in an area with infrastructure to support these activities	Specific area	
Inside a healthcare facility, outside the emergency department		
High dependency care		
Care in ICU or Critical care unit		
A place where equipment, staff and environment is ready to save patients with life-threatening disease		
Multidisciplinary care	Multi-disciplinary and specialist staff	
Specially trained staff		
Essentially a team-based and multi-professional care		
Requires the grouping of special facilities and specially trained staff	High-intensity care	
Higher level of care than is available on a general ward		
Minute-by-minute nursing and/or medical care		
Advanced respiratory support / mechanical ventilation		
Nursing 24/7		
High nurse: patient ratio no lower than 1:2		

259

260 **Figure 3. Defining attributes of critical care**

261 **Proposed operational definition of *Critical care***

262 The proposed definition for critical care is “*Critical care is the identification, monitoring, and*
 263 *treatment of patients with critical illness through the initial and sustained support of vital organ*
 264 *functions.*”

265 ***Cases***

266 **Step 5: A model case of critical care (a case including all the defining attributes)**

267 A woman with a viral pneumonia is rapidly identified as critically ill when she arrives at the
 268 hospital. She is immediately admitted to a unit with supplies for managing critically ill patients
 269 and treatment is started. Nurses and doctors who have been trained in the care of critical illness
 270 monitor her regularly, and provide continuous care, titrating the treatments as needed. Continuous
 271 oxygen therapy is provided for her life-threatening hypoxia, supporting her respiratory
 272 dysfunction, until she has recovered and is no longer critically ill.

273 **Step 6: A related case of critical care (a case including some of the defining attributes but** 274 **not the attribute of “vital organ support”)**

275 Care in a hospital is provided to a man with a chest infection. A nurse assesses him at arrival to
 276 hospital. A doctor admits him to the ward, prescribes antibiotics and decides he is not critically ill
 277 and does not require support for any of his vital organs. After four days the doctor discharges him
 278 from hospital.

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3 279 **A contrary case of critical care (a clear example of “not the concept”)**
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5 280 In the outpatient department, care is provided to a woman with lung cancer. A doctor and a nurse
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7 281 do some investigations and prescribe some medications. She is sent home with a follow-up
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9 282 appointment two weeks later.

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11 283 **Step 7: Antecedents and consequences of critical care**
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13 284 The antecedents of critical care are the contact of the patient with the healthcare system and may
14
15 285 include other care of a patient who has not deteriorated to the point of becoming critically ill. The
16
17 286 consequences of critical care are either the patient’s recovery or death.

18
19 287 **Step 8: Empirical Referents**
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21 288 Many hospitals have wards or units for the provision of critical care, such as Emergency Units,
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23 289 High Dependency Units or Intensive Care Units (ICUs) (22). Critical care can also be provided in
24
25 290 general wards, and a recent global consensus specified the care that should be included for all
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27 291 patients with critical illness in any hospital location(23). Rapid Response Teams or Medical
28
29 292 Emergency Teams have been introduced into some hospitals, often consisting of staff from the
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31 293 ICU responding to calls from the wards when a critically ill patient has been identified, and
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33 294 providing either critical care on the ward, or transferring the patient to the ICU (24).
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35 295

36 296 **Discussion**
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39 297 We have described how the concepts *critical illness* and *critical care* are used and defined in the
40
41 298 literature and by a selection of global experts using a concept analysis approach.

42
43 299 Our proposed definition for critical illness of, “*a state of ill health with vital organ dysfunction, a*
44
45 300 *high risk of imminent death if care is not provided and the potential for reversibility*”, is similar to
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47 301 those in some key publications. Chandrashekar et al state that, “*Critical illness is any condition*
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49 302 *requiring support of failing vital organ systems without which survival would not be possible*”
50
51 303 (25) . Painter et al write that, “*A critically ill or injured patient is defined as one who has an*
52
53 304 *illness or injury impairing one or more vital organ systems such that there is a high probability of*
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55 305 *imminent or life-threatening deterioration in the patient's condition*”(26) . Indeed, we found
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3 306 widespread agreement in the literature and expert sources that critical illness concerns the
4 307 attributes “life-threatening illness” and “organ dysfunction”.

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7 308 However, we found diverse and varied usage of the concept concerning the attribute of reversibility
8 309 and the interface between critical illness and the natural process of dying. Some uses included only
9 310 illness that was potentially reversible – these sources regarded that for critical illness there should
10 311 be a possible chance of recovery. Without this, critical illness would be a concept that encompasses
11 312 the dying process – everyone would be critically ill immediately before death – which would
12 313 conflict with many clinical uses and understandings of the term. Others had a wider interpretation
13 314 including all life-threatening illness and did not include reversibility in the definition as it is
14 315 difficult to identify in the clinical setting, and the concept risks becoming context dependent, (high-
15 316 resource interventions may reverse some critical illness which would not be possible in low-
16 317 resource healthcare). Our iterative content analysis method led to our interpretation that
17 318 reversibility should be included as one of the defining attributes and to make a distinction between
18 319 critical illness and illness at the end of life.(27) This conclusion should be seen as one possible
19 320 interpretation that can stimulate further discussion.

20
21 321 It is hoped that the proposed definition of critical illness assists communication in the field.
22 322 Previously, studies about critical illness have focused on patients in certain hospital units, or with
23 323 diseases or syndromes as proxies for critical illness that exclude some critically ill patients.(2,28)
24 324 Our definition of critical illness is not diagnosis or syndrome specific and can be due to any
25 325 underlying condition. The definition could facilitate the specification of clinical criteria for the
26 326 identification of critical illness, estimates of the overall burden of critical illness, assessments of
27 327 outcomes for patients with critical illness across centres and settings, and interventions to improve
28 328 outcomes.

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31 329 For critical care, there was greater diversity around its use and definition. There was widespread
32 330 agreement that critical care included the attributes of, “care of critically ill patients”, and the
33 331 “support of vital organs”. However, there were differing uses around the location of the care and
34 332 the need for specialized resources. Some sources considered critical care to be only the care
35 333 provided in certain locations, (such as ICUs or critical care units), or to be care that is always
36 334 highly specialized or resource intensive. The World Federation of Societies of Intensive and
37 335 Critical Care Medicine have suggested that critical care is synonymous with intensive care and is,

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3 336 “a multidisciplinary and interprofessional specialty dedicated to the comprehensive management
4 337 of patients having, or at risk of developing, acute, life-threatening organ dysfunction. [Critical
5 338 care] uses an array of technologies that provide support of failing organ systems, particularly the
6
7 339 lungs, cardiovascular system, and kidneys.”(22) In contrast, other sources used critical care to
8
9 340 be inclusive of any care for patients with critical illness, irrespective of location or resources. The
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11 341 Joint Faculty of Intensive Care Medicine of Ireland state that critical care units are those that,
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13 342 “provide life sustaining treatment for critically ill patients with acute organ dysfunction due to
14
15 343 potentially reversible disease”,(29) and in Belgium, critical care beds have been defined as any
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17 344 beds “for patients with one or more organ functions compromised”(4) Hirshon et al strike a
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19 345 balance between these two contrasting views, “[Critical care is] the specialized care of patients
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21 346 whose conditions are life-threatening and who require comprehensive care and constant
22
23 347 monitoring, usually in intensive care units.” (30)

24
25 348 Our proposed definition of, “the identification, monitoring, and treatment of patients with critical
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27 349 illness through the initial and sustained support of vital organ functions”, aims to be inclusive.
28
29 350 Critical care may include the use of specialized resources, but it is not a requirement. We see this
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31 351 as a strength in the definition, as it maintains a patient-centred rather than setting-dependent focus.
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33 352 Critical care when defined in this way can be provided anywhere, and does not have to be resource-
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35 353 intensive – it includes both high-resource care in ICUs and lower resource care in other settings.
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37 354 Indeed, critical care can be provided in general wards, in small health facilities, in the community
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39 355 or in ambulances. High-resource intensive care may not be possible in low-resource settings, but
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41 356 such settings care for many critically ill patients who require critical care(6,31,32). The proposed
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43 357 definition focuses on supporting vital organ functions, emphasising that critical care’s primary
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45 358 focus is treating the critical condition of the patient rather than definitive care for the underlying
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47 359 condition(9,33). Critical care, as we have defined it, can be seen as a system of care of patients
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49 360 with critical illness throughout the course of their illness, from the time of their first contact with
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51 361 healthcare through to resolution of the critical illness or death. Critical care is part of the wider
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53 362 concept of acute care which also includes prehospital care, emergency care, trauma and surgery
54
55 363 care, as well as in-patient care in medical, surgical, pediatric, obstetric and other wards(30).

56
57 364 The word “crisis” is the root for the word critical and has its origin from the Greek word “krisis”
58
59 365 referring to a “turning point” or “act of separation”, and later in English in a medical context when

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2
3 366 a crisis refers to the decisive point at which a patient either improves or deteriorates.(34) The
4 367 concepts critical illness and critical care could be regarded as remaining true to these origins as
5 368 they refer to the point in a patient's "journey" through their illness where they are so severely ill
6 369 that the situation has become a crisis, and managing the crisis is necessary to direct the patient
7 370 towards improvement rather than towards deterioration.

13 371 **Strengths and Limitations**

16 372 To our knowledge, this is the first study attempting to describe the uses and definitions of the
17 373 concepts *critical illness* and *critical care*, and to identify the defining attributes leading to proposed
18 374 definitions of the concepts. A strength is the use of both a scoping review of the literature and the
19 375 inclusion of over one hundred clinical experts as sources. The findings of the analysis should be
20 376 seen as a first step towards consensus and we recognise that the use of concepts is fluid and changes
21 377 over time (10). We were limited to including literature in English between 2008 and 2019 and to
22 378 published studies and guidelines and we may have missed relevant publications in other languages
23 379 or in other grey literature. Our sample of experts was purposively selected and had global
24 380 representation but was not perfectly symmetrical to continents, specialty, cadre or gender. There
25 381 are many more experts than we were able to include, and we are likely to have missed experts who
26 382 could have provided valuable contributions. Our proposed definitions, while based on a content
27 383 analysis of scoping reviews and an expert survey, are the outputs of one possible interpretation of
28 384 the data and may not be universally accepted. We hope our analysis and findings move the
29 385 conversation forwards, providing input about how to communicate and collaborate around these
30 386 vitally important concepts, and ultimately how to improve the care and outcomes for critically ill
31 387 patients.

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46 389 **Conclusion**

49 390 The concepts critical illness and critical care lack consensus definitions and are used in varied
50 391 ways in the literature and among global experts. Through a concept analysis of scoping reviews
51 392 and an expert survey we identify common themes in the uses and understandings of the concepts.
52 393 We propose definitions for the concepts: "*Critical illness is a state of ill health with vital organ*
53 394 *dysfunction, a high risk of imminent death if care is not provided and the potential for reversibility*"

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3 395 and “*Critical care is the identification, monitoring, and treatment of patients with critical illness*
4 396 *through the initial and sustained support of vital organ functions.*” The proposed definitions could
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6 397 aid clinical practice, research, and policy making.
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9 398 **Figure 1: Study Flowchart**

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11 399 **Figure 2 : The defining attributes of critical illness**

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13 400 **Figure 3: The defining attributes of critical care**

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22 404 **Contributors:** Tim Baker & Carl Otto Schell designed the study. Raphael Kazidule
23 405 Kayambankadzanja, Thomas Tamras, Hedi Mollazedagan and Tim Baker collected the data. Helle
24 406 Mølsted Alvesson, Mats Holmberg, and Martin Gerdin Wärnberg contributed to analysing the data.
25 407 RKK and TB wrote the first draft of the manuscript. All authors critically reviewed the manuscript
26 408 and approved the final version. The corresponding author attests that all listed authors meet
27 409 authorship criteria and that no others meeting the criteria have been omitted.
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34 411 commercial or not-for-profit sectors
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38 412 **Disclaimer:** We confirm the independence of researchers and that all authors in study can take
39 413 responsibility for the integrity of the data and the accuracy of the data analysis.
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42 414 **Competing Interests:** None Declared
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44 415 **Patient Consent for Publication:** Not required
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46 416 **Ethics Approval:** The Research Ethics Committee of the London School of Hygiene and Tropical
47 417 Medicine approved the study (Reference number 22661).
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50 418 **Provenance and Peer Review:** Not commissioned, externally reviewed
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53 419 **Data Availability Statement:** The study data are available from the corresponding author on
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3 421 **Supplementary Files:** Supplementary Tables 1 and 2
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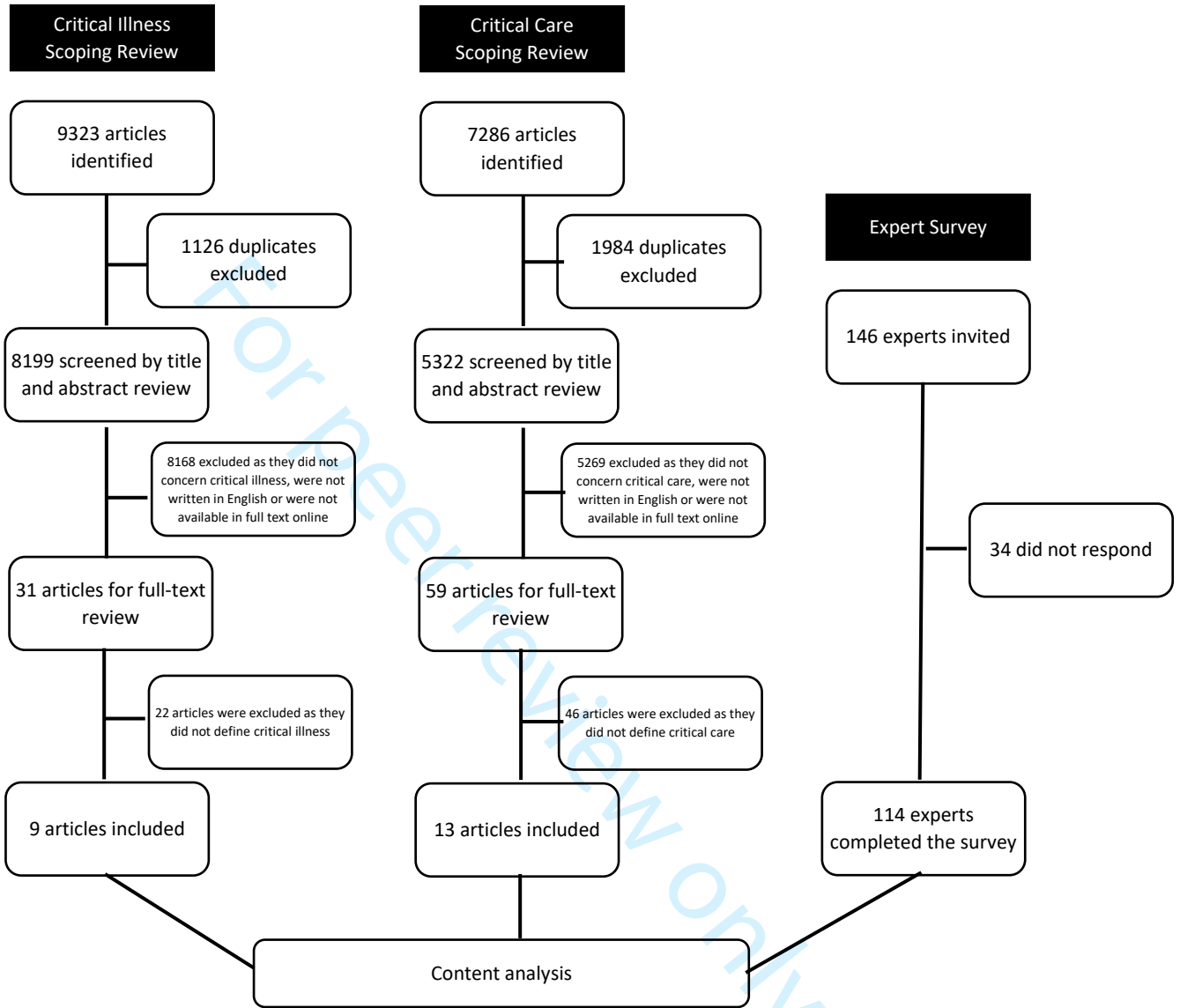
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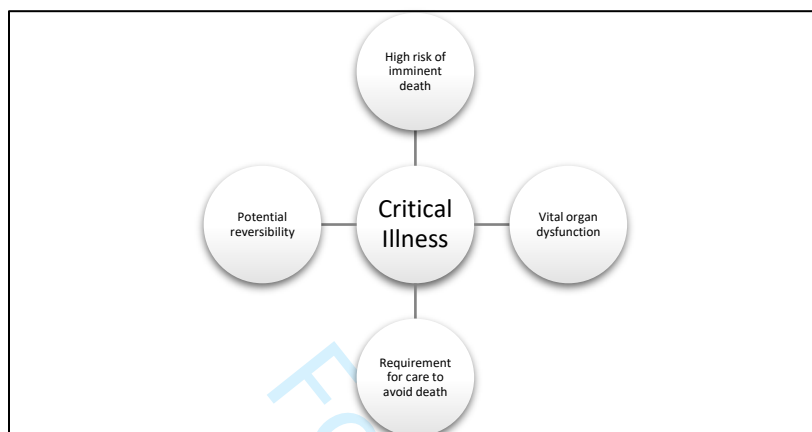
Figure 1: Study Flowchart



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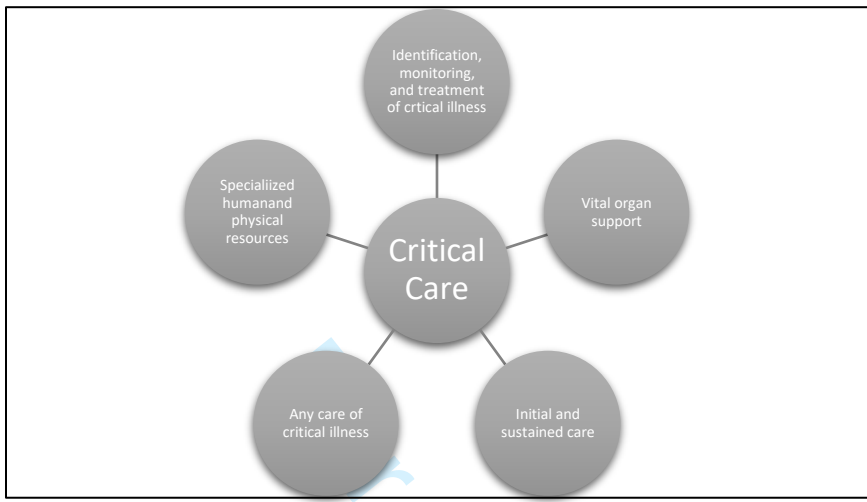
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3 **Figure 2: The defining attributes of critical illness**
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Figure 3: The defining attributes of critical care



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Supplementary Table 1 Literature with definitions of critical illness

	First Author and Publication Date	Country	Reference
1	Kievlan 2016	United States	Kievlan DR, Martin-Gill C, Kahn JM, Callaway CW, Yealy DM, Angus DC, et al. External validation of a prehospital risk score for critical illness. <i>Crit Care</i> . 2016;20(1):255.
2	Warttig 2018	United Kingdom	Warttig S, Alderson P, Evans DJW, Lewis SR, Kourbeti IS, Smith AF. Automated monitoring compared to standard care for the early detection of sepsis in critically ill patients (Review). <i>Cochrane Database of Syst Rev</i> . 2018(6):28.
3	Rodriguez 2018	United States	Rodriguez RM, Greenwood JC, Nuckton TJ, Darger B, Shofer FS, Troeger D, et al. Comparison of qSOFA with current emergency department tools for screening of patients with sepsis for critical illness. <i>Emerg Med J</i> . 2018;35(6):350-6.
4	Benneyworth 2015	United States	Benneyworth BD, Bennett WE, Carroll AE. Cross-sectional comparison of critically ill pediatric patients across hospitals with various levels of pediatric care. <i>BMC Res Notes</i> . 2015;8:693.
5	Hsu 2016	Taiwan	Hsu CW, Lin CS, Chen SJ, Lin SH, Lin CL, Kao CH. Risk of type 2 diabetes mellitus in patients with acute critical illness: a population-based cohort study. <i>Intensive Care Med</i> . 2016;42(1):38-45.
6	Painter 2013	United States	Painter JR. Critical Care in the Surgical Global Period. <i>Chest</i> . 2013;143(3):851-5.
7	Chandrashekar 2015	India	Chandrashekar M, Shivaraj BM, Krishna VP. A study on prognostic value of serum cortisol in determining the outcome in the critically ill patients. <i>JEMDS</i> . 2015;4(58):10130-5.
8	Liao 2014	United States	Liao MM, Lezotte D, Lowenstein SR, Howard K, Finley Z, Feng ZP, et al. Sensitivity of systemic inflammatory response syndrome for critical illness among ED patients. <i>Am J of Emerg Med</i> . 2014;32(11):1319-25.
9	Valentin 2011	23 countries	Valentin A, Ferdinande P, Improvem EWGQ. Recommendations on basic requirements for intensive care units: structural and organizational aspects. <i>Intensive Care Med</i> . 2011;37(10):1575-87.

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Supplementary Table 2 Literature with definitions of critical care

	First Author and Publication Date	Country	Reference
1	Wunsch 2008	United States, France, UK, Canada, Belgium	Wunsch H, Angus DC, Harrison DA, Collange O, Fowler R, Hoste EA, et al. Variation in critical care services across North America and Western Europe. <i>Crit Care Med.</i> 2008;36(10):2787-93, e1-9
2	Prin 2012	United States	Prin M, Wunsch H. International comparisons of intensive care: informing outcomes and improving standards. <i>Curr Opin Crit Care.</i> 2012;18(6):700-6
3	Painter 2013	United States	Painter JR. Critical care in the surgical global period. <i>Chest.</i> 2013;143(3):851-5
4	Royal College of Anaesthetists 2018	England	https://www.rcoa.ac.uk/sites/default/files/documents/2020-06/EMC-Guidelines2018.pdf
5	Joint Faculty of Intensive Care Medicine of Ireland and Intensive Care Society of Ireland 2019	Ireland	https://jficmi.anaesthesia.ie/wp-content/uploads/2019/09/National-Standards-for-Adult-Critical-Services-2019.pdf
6	Marshall 2017	Many countries	Marshall JC, Bosco L, Adhikari NK, Connolly B, Diaz J v., Dorman T, et al. What is an intensive care unit? A report of the task force of the World Federation of Societies of Intensive and Critical Care Medicine. <i>Journal of Critical Care.</i> 2017 Feb;37:270–6.
7	The International Surgical Outcomes Study 2016	Many countries	International Surgical Outcomes Study g. Global patient outcomes after elective surgery: prospective cohort study in 27 low-, middle- and high-income countries. <i>Br J Anaesth.</i> 2016;117(5):601-9
8	Benneyworth 2015	United States	Benneyworth BD, Bennett WE, Carroll AE. Cross-sectional comparison of critically ill pediatric patients across hospitals with various levels of pediatric care. <i>BMC Res Notes.</i> 2015;8:693.
9	Kievlan 2016	United States	Kievlan DR, Martin-Gill C, Kahn JM, Callaway CW, Yealy DM, Angus DC, et al. External validation of a prehospital risk score for critical illness. <i>Crit Care.</i> 2016;20(1):255.
10	Boyle 2008	Australia	Boyle M, Butcher R, Conyers V, Kendrick T, MacNamara M, Lang S. Transition to intensive care nursing: establishing a starting point. <i>Aust Crit Care.</i> 2008;21(4):190-8.
11	Hirshon 2013	United States	Hirshon JM, Risko N, Calvillo EJ, Stewart de Ramirez S, Narayan M, Theodosis C, et al. Health systems and services: the role of acute care. <i>Bull World Health Organ.</i> 2013;91(5):386-8
12	McCarthy 2013	United States	McCarthy C, O'Rourke NC, Madison JM. Integrating advanced practice providers into medical critical care teams. <i>Chest.</i> 2013;143(3):847-50
13	Intensive Care Society 2009	United Kingdom	https://icmwk.com/wp-content/uploads/2014/02/Revised-Levels-of-Care-21-12-09.pdf

Towards Definitions of Critical Care and Critical Illness: A Concept Analysis

Section Item	PRISMA-ScR Checklist Item	Page
Title	Identify the report as a scoping review.	-
Abstract		
Structured summary	Provide a structured summary that includes (as applicable) background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	1
Introduction		
Rationale	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	3-4
Objectives	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	4
Methods		
Protocol and registration	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	5
Eligibility criteria	Specify characteristics of the sources of evidence used as eligibility criteria (e.g.,	5

	years considered, language, and publication status), and provide a rationale.	
6 Information sources	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed	5
Search	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	5
Selection of sources of evidence	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	5
Data charting process	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	7
Data items	List and define all variables for which data were sought and any assumptions and simplifications made.	5
Critical appraisal of individual sources of evidence	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	Not Done
Summary measures	Not applicable for scoping reviews	N/A

Synthesis of results	Describe the methods of handling and summarizing the data that were charted.	7
Risk of bias across studies	Not applicable for scoping reviews	N/A
Additional analyses	Not applicable for scoping reviews.	N/A
Results		
Selection of sources of evidence	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	5-7
Characteristics of sources of evidence	For each source of evidence, present characteristics for which data were charted and provide the citations.	9-13
Critical appraisal within sources of evidence	If done, present data on critical appraisal of included sources of evidence (see item 12).	Not Done
Results of individual sources of evidence	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	9-13
Synthesis of results	Summarize and/or present the charting results as they relate to the review questions and objectives.	9-13
Risk of bias across studies	Not applicable for scoping reviews.	N/A
Additional analyses	Not applicable for scoping reviews.	N/A
Discussion		
Summary of evidence	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	14-17

1 2 3 4 5 6	Limitations	Discuss the limitations of the scoping review process.	17
7 8 9 10 11 12	Conclusions	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	17
13 14 15 16 17 18 19 20	Funding	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	18