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Reviews and Meta-Analysis

Decision-making in ICU – A systematic review of factors considered important by ICU clinician decision makers with regard to ICU triage decisions

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ABSTRACT

Background: The ICU is a scarce resource within a high-stress, high-stakes, time-sensitive environment where critically ill patients with life-threatening conditions receive expensive life-sustaining care under the guidance of expert qualified personnel. The implications of decisions such as suitability for admission into ICU are potentially dire and difficult.
Objectives: To conduct a systematic review of clinicians' subjective perceptions of factors that influence the decision to accept or refuse patients referred to ICU.
Results: Twenty studies yielded 56 different factors classified into patient, physician and environmental. Common, important factors were: acute illness severity and reversibility; presence and severity of comorbidities; patient age, functional status, state-of-mind and wishes; physician level of experience and perception of patient QOL; and bed availability. Within-group variability among physicians and thought-deed discordance were demonstrated.
Conclusions: The complex and dynamic ICU triage decision is affected by numerous interacting factors. The literature provides some indication of these factors, but fail to show complexities and interactions between them. A decision tree is proposed. Further research should include a reflection on how decisions for admission to ICU are made, such that a better understanding of these processes can be achieved allowing for improved individual and group consistency.

1. Introduction

The Intensive Care Unit (ICU) is a high-stress, high-stakes, time-sensitive environment where critically ill patients with life-threatening conditions receive expensive life-sustaining care under the guidance of expert personnel. In most settings it is a scarce resource. The critical nature of the patients' conditions places them on the cusp of death. The decision to accept patients into the ICU in such contexts is a difficult one, particularly where resources are limited. The implications of decisions such as suitability for admission into ICU are potentially dire as they seek to minimize deserving patients that do not get admitted and die, and inappropriately admitted patients that block a vital resource [1,2].

The escalating demand for critical care outstrips the available resources for the provision of such care. Consequently, the need for rationing and triage has become vital as the most appropriate patients are selected for these scarce resources [3,4]. ICU triage is a process of placing patients at their most appropriate level of care, based upon their need for medical treatment and the assessment that they will benefit from ICU care [3]. Rationing is defined as the "allocation of potentially beneficial health care services to some individuals in the face of limited availability that involves the withholding of those services from other individuals" [2, 5]. Rationing may be influenced by several factors, including clinical judgment, patient and family preferences, and best evidence of therapeutic efficacy [2].

In an ideal situation, all patients who could potentially benefit by admission into ICU, should be admitted. However, admission to ICU comes with its own set of potentially disastrous consequences such as infectious and iatrogenic complications [6]. Accordingly, patients who are

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unlikely to benefit from ICU should not be admitted. Such patients would include those very likely to die soon after admission to ICU, or those in whom recovery is likely with care available outside of the ICU [7].

Various factors contributing to triage decisions have been identified in the literature. One classification suggests that such factors may be viewed as patient, physician and contextual [8]. Other studies have looked at different aspects of these factors impacting the admission decision [2,9,10]. These studies may be further categorized into objective and subjective factors [9]. Studies exploring objective factors involve quantitative, empirical research and have typically explored patient databases analyzing the data (usually by logistic regression methods) to identify independent factors associated with admission or refusal of patients referred to ICU [11,12]. Studies exploring the subjective perception of the clinical ICU admission decision makers with regard to factors impacting their admission decisions, are largely qualitative in nature and have typically used surveys or questionnaires with or without clinical scenario decision making to elicit factors considered important [13,14]. Both groups of studies have often demonstrated similar factors. The view of practitioners who actually make the admission decision is vital to better understand the decision making process to improve consistency. Further, the distinction between these two groups of studies, (objective and subjective) is important as they often demonstrate a thought-deed disconnect with some decision makers.

Identifying and understanding the impact of the various factors involved in ICU triage decisions may help explain the huge variation in the proportion of patients admitted to ICU both within and between different jurisdictions. Such variations may, for example, occur on a geographical basis (e.g. between countries) [15-17], or on an organisational basis (e.g. between public and private) [14].

We conducted a systematic review of the extant literature about clinicians' subjective perceptions of factors that influence the decision to accept or refuse patients referred to the ICU.

2. Method

Using the PICO (*p*opulation, *i*ntervention, *c*omparison, *o*utcome) approach as a frame for formulating an evidence based research question: [18] the population studied was adult critically ill patients; the intervention was referral to ICU with patients admitted compared to patients refused admission; and the outcome in question was acceptance into ICU. In this paper, we use the PRISMA (Preferred Reporting Systematic Reviews and Meta-Analyses) method to conduct a literature review of the following databases: Pubmed, CINAHL and EMBASE [19]. Databases were searched from their inception to 05 June 2018. In addition, we reviewed other search engines such as Google Scholar and the bibliographies of selected articles for articles not previously identified. The search strategy included the following search words: “critically ill”, “critical care”, “intensive care unit” to identify the population; “referral”, “ICU triage”, “admission triage” to identify the intervention; “ICU admission”, “admission”, “accepting”, “refusal” to identify the comparison and outcome. In addition, the search words “factors affecting ICU admission”, “clinical decision making”, “influences on clinical decision making”, “non-clinical influences on clinical decision-making”, “influences on patient management decisions”, “factors influencing clinical decision making” and “subjective factors” were used to explore the reasons and factors involved in the decision making. Limits applied to searches included original research, human studies, adults, English language and where the participants were the decision makers rather than the patients/referrals as in the objective factor studies. Study abstracts, where available, were screened for relevance by the investigators. For consensus purposes both investigators independently read through all full-text identified studies to evaluate their eligibility to the study by limiting selection to studies that sought views of ICU decision makers. There were no conflicts, thus providing complete consensus and no need for arbitration. Data extracted included study aims/objectives, study design and context, participants and relevant results and conclusions.

3. Results

After an extensive search 20 studies were identified for inclusion (Fig. 1). A summary of the studies is reflected in Table 1. The studies used various combinations of questionnaires, case scenarios, interviews, observation and simulation in their methods. Fourteen of the studies involved some form of a questionnaire, while 13 employed case scenarios. One involved a Delphi process, one developed an algorithm, and two studies incorporated simulation in their case scenarios. Three studies used interviews, two of these also incorporating direct observation.

A total of 56 different factors were identified across the studies. A summary of these, classified into three groups of patient, physician and environmental factors, is reflected in Table 2. There was no consistent explicit indication across the studies on whether factors identified increased or decreased the likelihood of admission or refusal.

3.1. Patient factors

3.1.1. Acute illness

The characteristics of the acute illness are important factors in the decision for ICU admission. Nuckton et al., ranked severity of illness as the most important factor at 3.92 ± 0.2 (mean $\pm$ SD) with a maximum of 4 [22]. Severity may be assessed by a variety of critical clinical and physiological parameters which affect admission decisions [32]. The prognosis of the acute illness was scored 4 or 5 out of 5 by 81% of respondents in one study [13]. In another study, 57% of physicians indicated that the prognosis of the acute illness always or frequently affected decisions [14]. Reversibility of the acute illness importantly favoured admission [16,26,31]. Patients making poor progress and deemed unlikely to survive current hospitalization appeared to be less likely to be admitted [16,31]. The need for monitoring or treatment of the acute illness was considered an important factor in the creation of an admission decision algorithm [29].

3.1.2. Patient health background

The presence of chronic disorders, comorbidities or underlying diseases affected decision making in seven studies [13,14,16,22,26,29,31]. Ramos et al. classified comorbidities into four groups for their algorithm; none, compensated, decompensated and advanced disease with probable life expectancy of months [29]. Patients' functional status defined by, for example, activities of daily living into independent, partially dependent or severely dependent was also found to impact admission decisions [13,27,29]. Patients' current health status (in respect of alcohol, drugs, tobacco and exercise), psychiatric/mental health, and previous compliance with medical recommendations were all considered to be minor or non-significant factors [13,16,22,31].

3.1.3. Patient profile

Of all the patient characteristics, age has been the most explored with some studies showing no impact, some considering age as important and some suggesting the consideration of physiological age or frailty instead of numerical age [13,16,22,26-28,31]. Consideration of patient wishes was constantly considered an important determinant in reaching an admission decision [13,14,27,31]. Patient state-of-mind in respect of alertness, being motivated or “up-beat” was found to positively impact on the admission decision [13,16,22,31]. Socioeconomic and religious status were not seen as important factors [13]. Patient race was also not important when European and African Americans were compared, despite respondents' view that African Americans preferred to receive more ICU care [23].

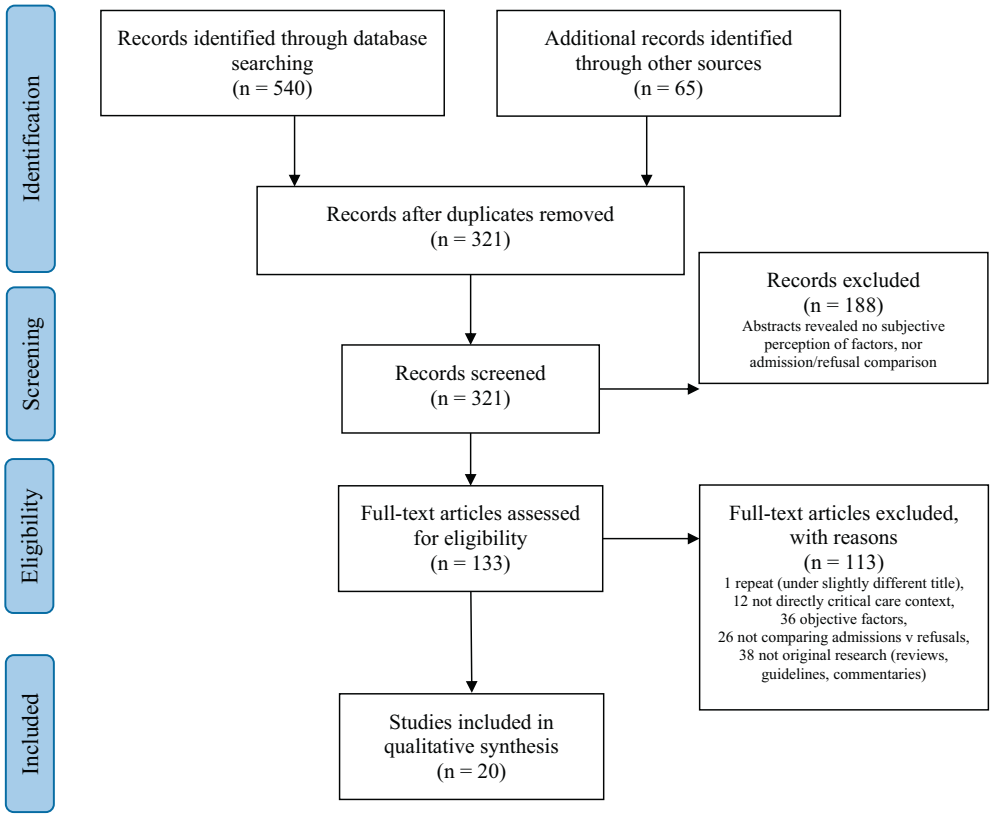

Fig. 1. Prisma Flow Diagram reflecting selection of studies.

3.1.4. Other patient factors

The literature argues that patient's contribution to society should not be considered when deciding [16,22,31]. Family's wishes were considered important [13,25,31], while family support was considered less important [22,27].

3.2. Physician factors

3.2.1. Physician personal profile

Physician characteristics impacted decision making. Physicians from different countries had different perceptions of survival [15] and had different restriction practices [17]. The influence of physician gender has not been conclusively described. Female physicians appear less inclined to acknowledge that their decisions were affected by assessment error, clinical doubt, or threat of legal action [30]. They were also more likely than men to consider no bed availability an ethical dilemma [31]. Patients suffering from HIV were less likely to be admitted by older physicians [16]. Religious physicians perceived their "personal attitude" to be of greater importance [16].

3.2.2. Physician professional profile

The specialty of the physician showed mixed effects. Intensivists and Emergency Department (ED) physicians were more likely than hospitalists to accept admissions [24]. In contrast, other studies showed no difference between specialties, although there were within-group differences [20,27,33]. The experience of the decision maker was a regular factor in the admission decision. Experienced practitioners more readily: acknowledged inappropriate admissions [30], initiated palliative care [24], and refused admissions [17]. Clinician experience was noted to have a significant impact on ICU admission decisions, especially where the benefit of admission was unclear [26]. Physician's intuitive prognosis and assessment of patients quality of life was an important factor in four studies [16,26,29,31].

3.3. Environmental factors

3.3.1. Unit profile

Five studies commented on bed status as a lesser consideration to a greater one in changing decisions [8,13-15,27]. Four studies used the last bed scenario to explore determinants of the admission decision [16,20,22,31]. Nursing workload and morale was identified as a low impact factor [13,16,31].

Four studies, commenting on the utility of unit policies/guidelines suggested that such were often not present, or if present were not often used, or tacit guidelines rather than strict policies were followed [8,13,21,31]. Unit processes for decision making highlighted the need for shared decision making with other staff members and the achievement of consensus [8,28].

One study explored the public-private hospital differences showing scarcity-related factors as being higher rated in public ICU [14]. Public ICU physicians were more likely to rate previous performance status, acute illness prognosis, number of ICU beds available and full operating room as important. Private ICU physicians were more likely to rate pressure from the requesting physician and fear of malpractice suits as important [14]. Larger units in larger hospitals were less likely to admit terminal patients [16].

3.3.2. Economic influences

Factors such as cost-benefit ratios [13,16,30,31], cost to society [16,20,31], economic impact on family [31], and patient's ability to pay [22] were unimportant in ICU admission decisions. Five percent of respondents had refused admission of appropriate cases because they had received instruction not to admit for financial reasons [30].

3.3.3. External pressures

Although uncommon, external pressure on physicians to accept patients occurred. Such pressure lead to inappropriate admissions and

Table 1
Summary of studies included in systematic review.

Author	Aim/Objective	Design	Participants	Results
Kohn et al. [20]	To examine ICU clinicians' willingness to trade off societal benefit in favour of small chance of rescuing an identifiable critically ill patient	Mixed methods questionnaire based on last bed scenario	684/ 2206 (31%) ICU physicians and 438/988 (44.3%) critical care nurses in USA	Physicians more likely than nurses to adhere to "rule of rescue" by allocating last bed to gravely ill patient. Magnitude of societal benefit through transplants had small & inconsistent effects on clinicians willingness to prioritize donor. Qualitative analysis showed strong obligations to identifiable living patient. In multivariable model being a physician, believing that OPO staff do not respect patients' interests, and the life-years to be gained through organ donation were significant. Trend towards men being more likely to make rule of rescue decisions. Physician specialty not significant (medicine vs surgery vs anaesthesia)
Walter et al. [21]	To determine how medical ICU admission decisions made	22-question web-based questionnaire	121/146 academic medical ICU directors in USA	88% had written admission criteria. Only 25% used to make daily admission decisions on regular basis. 47% used guidelines "not at all" or "rarely." Written restriction guidelines present in 21% although 53% of directors felt should have.
Nuckton et al [22]	To determine importance of age as admission factor	Hypothetical multi-stage case scenario with choice of 1 of 2 patients for last bed + questionnaire	114 intensivists in USA	Severity/degree of presenting illness, underlying/previous medical illness & DNR status more important than age. Patient attitude/ motivation, family support, patient's contribution to society and ability to pay for care less important than age. Current health status same as age. When age only difference, 80.7% chose younger patient, changing to 53.5% after more medical & social information given. 95.1% felt definitive age criterion should not be used.
Barnato et al. [23]	To test for different decisions for otherwise identical African American (AA) & European American (EA) patients	2 High fidelity simulation encounters followed by self-administered questionnaire	33 hospital-based attending physicians, including 12 emergency physicians, 8 hospitalists, & 13 intensivists in USA	Hospital-based physicians did not make different treatment decisions for otherwise identical terminally ill AA and EA elders despite believing that AA patients more likely to prefer intensive, life-sustaining treatment. Underlying pathology (type of cancer) made a difference to admission decision.
Barnato et al. [24]	To determine feasibility of high fidelity simulation for studying variation in ICU admission decision making	Mixed qualitative & quantitative analysis using questionnaire & simulation scenario	27 attending physicians (6 emergency, 13 hospitalists, 8 intensivists) in USA	All felt case & simulation highly realistic. Intensivists & ED physicians more likely to admit to ICU. Years since medical school graduation inversely associated with initiation of palliative care.
McNarry et al. [25]	To explore futility by asking clinicians for survival estimates & admission decisions	Questionnaire based on real case scenario vs database query of similar patients	146/169 ICU consultants in UK	Median estimated hospital survival was 5%; Database survival 9% for similar patients. 60% of consultants & 76% of trainees would have admitted patient. 17.2% admitted when estimated survival probability <1%. Family wishes important to 90.2%. 59.3% respondents requested additional information before decision.
Charlesworth et al. [8]	To understand ways in which critical care physicians reach a decision to admit or decline patients	Qualitative constant comparative using observation and interviews	30 critical care doctors (consultants & seniors) in England	Factors grouped as patient, physician and contextual. Decision making by consensus was common; Negotiation between critical care & parent team doctors was common; Number of available beds a constant pressure with decisions changing according to high/low bed occupancy; Tacitly held admission criteria used rather than written local/national guidelines/policies
Emerson et al. [26]	To create a model describing factors that influence referral patterns from ED to ICU	Mixed methods using 10 case scenarios via interviews	11 ED + 11 ICU consultants in Scotland	3 core themes - Clinician factors: experience, perception of quality of life, peer standards, ceiling of care. Patient factors: comorbidities, age, reversibility, patient wishes. Resource factors: airway, multiorgan failure, evidence of benefit, current capabilities.
Garrouste-Orgeas et al. [27]	To assess variability in physician admission decisions based on patient, ICU, & hospital characteristics	Questionnaire & observational simulation using case scenarios for patients aged >80 years	100/220 intensivists in France	Factors associated with admission for NIV + IMV were age < 85 years, self-sufficiency, & bed availability. Factors associated with admission for IMV were previous ICU stay

Table 1 (*continued*)

Author	Aim/Objective	Design	Participants	Results
				for cancer. Factors associated with admission for RRT (after IMV) were living spouse & respiratory disease. Knowledge of patient preferences changed physician decisions. Additional bed available increased admissions for NIV & IMV.
Fassier et al. [28]	To explore physicians' perceptions of, & attitudes towards EOL decisions for elderly critically ill patients at the ED-ICU interface	Qualitative using observation & interviews	24 physicians in France	6 themes emerged: representation of elderly patients & concept of physiologic age; age-related factors influenced physicians' decision making; communication patterns of interdisciplinary decisions, decisions by 2 physicians, and unilateral decisions; conflicts and communication gaps at ED-ICU interface; EOL decisions more complex in ED, in absence of family or of information about elderly patients' EOL preferences, & when conflict with relatives, time pressure, & lack of training in EOL decision making; during decision making, patients' safety & quality of care compromised by delayed or denied care.
Ramos et al. [14]	To evaluate factors potentially associated with ICU admission decision	Electronic, self-administered questionnaire rating 14 variables 1–5.	125 ICU public & private physicians in Brazil	Factors grouped as patient-related, scarcity-related; administrative-related. Patient related factors higher potential to affect decision than scarcity & administration. Underlying illness prognosis rated by most as always or frequently affecting decisions, followed by acute illness prognosis, no. of available beds, and patient's wishes. Receiving specific training on ICU triage associated with higher ratings of patient-related & scarcity-related factors; working in public vs private ICU associated with higher ratings of scarcity-related factors.
Ramos et al. [29]	To evaluate reliability & validity of a computerized algorithm to aid ICU triage decisions	Algorithm development + evaluation of 40 real clinical scenarios against reference standard	9 of 10 physicians in Brazil	Algorithm development using 4 factors: Active intervention or monitoring; patient comorbidities; patient's previous functionality & physician's most probable intuitive prognosis. Algorithm showed good agreement with reference standard median. Intuitive prioritization into 1–4 as per SCCM showed good agreement with reference standard median. Physicians' judgment of appropriateness of admission correlated with algorithm-based priorities in both non-ICU bed scarcity & ICU bed scarcity settings. Algorithm-based ICU triage decision-making tool has good interrater reliability outperforming interrater reliability of physicians' prioritization.
Vincent et al [15]	To determine current views of European ICU physicians regarding EOL	Questionnaire including case scenario	504/1272 West European ESICM physician members	Physician's perception of length & quality of survival linked to country of origin. 46% admissions generally/frequently affected by bed status; 73% admit patients with no hope of survival although only 33% thought such patients should be admitted.
Young et al. [17]	To compare attitudes towards common triage scenarios & to evaluate triage practice	web-based questionnaire +7 case scenarios	238/ 731 (32.6%) ICU specialists & trainees in Australia & New Zealand	In 3 scenarios, Australian respondents more likely to admit. In other 4, no difference. New Zealand doctors more restrictive. No associations with having additional qualifications, but in two scenarios trainees more likely to admit vs specialists.
Escher et al. [13]	To determine what influences doctors' decisions about admission of patients	Questionnaire using Likert 5-point scale (1 = not at all important, 5 = very important) to evaluate 19 factors +8 hypothetical case scenarios	232/381 physician members of Swiss ICM Society	Scoring of factors: prognosis of underlying disease, prognosis of acute illness, patient's wishes considered very important (>70% scored 4/5). Socioeconomic circumstances, religious beliefs, emotional state & psychiatric disease considered unimportant. Other factors: bed used to prejudice of another patient, no. of available beds, current nursing workload, policy of intensive care unit, legal liability, patient's functional status, family's wishes, patient's

(*continued on next page*)

Table 1 (*continued*)

Author	Aim/Objective	Design	Participants	Results
				age, cost relative to expected outcome, patient's compliance with medical recommendations, drug misuse, chronic alcoholism. With scenarios, underlying disease (cancer vs non-cancer) not associated with ICU admission. Four other significant factors: patients' wishes, "upbeat" personality, younger age & a greater no. of ICU beds available. In unmatched cases, source of income & family's attitude not significant, while family's wishes & social commitment significant.
Giannini et al. [30]	To assess perceptions & attitudes of ICU physicians regarding inappropriate admissions & resource allocation	Anonymous self-administered questionnaire +3 clinical scenarios	225/259 permanently employed ICU physicians in Italy	86% acknowledged inappropriate admissions with reasons of clinical doubt, limited decision time, assessment error, pressure from superiors and referring clinicians. Low frequency reasons: pressure from patient's family & threat of legal action. More acknowledged by experienced vs less experienced; Women less inclined to acknowledge assessment error, clinical doubt, or threat of legal action. Those with religious beliefs more threat of legal action. Those working in ICU less influenced by fear of legal threat. 5% had refused admission of appropriate cases for financial reasons. 15% occasionally and 6% frequently admitted patients after elective surgery from most profitable depts.
Oerlemans et al. [31]	To assess factors which play a role in decision making process regarding ICU admission (+ adherence to Dutch guideline + factors influencing adherence to guideline)	On-line questionnaire + interviews using last bed scenario	166/761 ICU physician members in Netherlands	Factors potentially influencing admission to last bed: nature of chronic disorders, patient wish, unlikely to survive current hospitalization, QOL as per physician, reversibility of acute disorder, future QOL, previous hospital admissions, bad response to therapy during current hospitalization, family wishes, patient age, pressure from other physician, physician personal attitude, patient mental history, pressure from patient/family, nursing morale, patient alertness, financial cost-benefit analysis, cost to society, social & economic impact on family, social worth of patient. Women more likely than men to consider no bed availability an ethical dilemma. Most important factors associated with patient were physical condition (predictors of treatment success) and QOL. 50% adhered to triage guideline because of unfamiliarity.
Einav et al. [16]	To evaluate attitudes of physicians regarding ICU triage	Questionnaire based on last bed scenario	43/95 physician members of Israeli Society of CCM	Very important factors: patient unlikely to survive hospitalization, patient's acute disorder probably not reversible, nature of chronic disorders, personal attitude. Important factors: QOL as per physician, QOL as per patient, patient's age, patient had done poorly during present hospitalization, patient's alertness, nursing morale, previous mental/psychiatric history, pressure from patient/physician, and patient's previous hospital admissions. Unimportant factors: costs to society, financial cost-benefit analysis, social & economic impact on family, social worth. Important factors for admission to last bed: small likelihood of surviving hospitalization; irreversibility of acute disorder, nature of chronic disorders, physician personal attitude. Physicians spending more time in ICU considered QOL as per patient & patient's degree of alertness less important. Older physicians less likely to admit HIV+ patient; Physicians working in larger and general ICUs less likely to admit terminally ill patient. Religious physicians placed greater importance on

Table 1 (*continued*)

Author	Aim/Objective	Design	Participants	Results
				"your personal attitude".
Maghsoudi et al. [32]	To identify indications in adult patients for decision making about ICU admission & rank them regarding their importance	3-phase Delphi process	22 physicians in Iran	Identified 36 patient clinical factors categorized into 3 priority levels with following considered critical: ventilatory support, irregular or gasping breathing patterns, CPR, ICP monitoring, systolic pressure > 170 or < 90, diastolic pressure > 110 or < 50, requiring ICU-level nursing care, asymmetric pupils, intra-aortic balloon pump and continuous seizures.
Dahine et al. [33]	To examine whether opinions over benefit of ICU admissions differed based on physician specialty	Web-based questionnaire with 5 case scenarios	21 intensivists (87.5%); 22 internists (35%) in Canada	No difference in prediction of likelihood of survival to ICU admission, hospital discharge & return to baseline between intensivists & internists with similar acceptance rates. Significant disagreement within each group.

AA – African American; CCM – Critical Care Medicine; CPR – Cardio-Pulmonary Resuscitation; DNR – Do-Not-Resuscitate; EA – European American; ED – Emergency Department; EOL – End-Of-Life; ESICM – European Society of Intensive Care Medicine; HIV – Human immunodeficiency virus; ICM – Intensive Care Medicine; ICP – Intra-Cranial Pressure; IMV – Intermittent Mandatory Ventilation; NIV – Non-Invasive Ventilation; OPO – Organ Procurement Organization; QOL – Quality of Life; RRT – Renal Replacement Therapy; SCCM – Society of Critical Care Medicine; UK – United Kingdom; USA – United States of America.

may have come from patients/families [16,31] and/or superiors [30]. Referring doctors also pressurized decision makers to accept their patients [16,30,31] with a negotiation process sometimes occurring [8].

3.3.4. Other environmental factors

The ward from which the patient was referred had an impact on ICU admission decisions. Fifteen percent of respondents admitted to occasionally, and 6% to frequently, accepting patients after elective surgery from the most profitable departments [30]. Challenges and conflicts may have affected the ED-ICU interface and impacted on decisions [28]. Limited decision time may have led to inappropriate admissions [30] as there was concern over patient safety and care if there was a delay [28].

3.3.5. Thought-deed discordance

Four studies demonstrated a disconnect between what practitioners thought should happen and what actually took place [15,21,22,25]. When age was the only difference, 80.7% chose a younger patient, changing to 53.5% after more medical /social information was given to the same group of intensivists [22]. Of this group, 95.1% felt that a definitive age criterion restricting all patients over a certain age should not be used [22]. European physicians admitted 73% of patients with no hope of survival although only 33% thought such patients should be admitted [15]. Even where estimated patient survival probability < 1%, 17.2% of UK consultants would have admitted the patient [25]. Medical ICU directors had written criteria for admission 88% of the time, yet only 25% used these criteria to make admission decisions on a regular basis [21]. Similarly, written restriction guidelines were present in 21%, although 53% of directors felt that they should have guidelines [21].

4. Discussion

In this systematic review we have summarized studies looking at factors impacting on the ICU triage decision from the perspective of the physicians making these difficult decisions, including only studies where the participants were the decision makers. Decision makers' subjective views, when combined with existing objective data, allow for a more complete analysis of the complex decision making process. This in turn may allow for closer reflection and subsequent individual and group consistency in decision making. We approach the determinants of this decision making process in the three groups of patient, physician and environmental factors.

4.1. Varying study designs

Soliciting physician views in contrived settings remains problematic, especially in a complex area such as decision making. The heterogeneity of study designs in the selected studies, as well as varied tools used (questionnaires, clinical scenarios, interviews, simulation) may well indicate the difficulty in this regard (Table 1). The classical approach of using questionnaires, responses to clinical scenarios and interviews remains artificial and does not necessarily elicit true responses. The use of high fidelity simulation, for example, tries to ensure clinical verisimilitude by making these more "real" [24]. Ideally, the decision making process is best observed in real-time in the real clinical situation which is not practical for the purposes of research.

4.2. Important factors

The literature identified the severity and reversibility of the acute illness, presence and severity of comorbidities, and the patient's age, functional status, state-of-mind and wishes as common important patient factors. Of the physician factors, level of experience and patient QoL as perceived by the physician were the most important. The most important environmental factor was bed availability. Our review is consistent with factors delineated by other authors [2,9]. Of the 10 included studies of admitted and refused patient cohorts in a review by Sinuff et al., only three attempted to determine objective factors associated with refusal of admission to ICU with the common factors being age, illness severity, medical diagnosis, poor performance and bed shortages [2]. James et al. identified bed availability, severity of illness, initial ward or team referred from, patient choice, do not resuscitate status, age and functional baseline as significant in their analysis of objective and subjective factor studies [9].

The role of the patient in the decision making process has increased as medicine continues to shift away from a paternalistic model. The patient's wishes should be of paramount importance. Shared decision making involving the patient where possible, or incorporating their advance directives or surrogates, has thus been recommended [34]. However, it is important to recognize that such information is often not readily available at the time of referral.

Factors such as age, sex, social status, sexual preference, ethnic origin, race, religious beliefs and financial status should not factor into the clinical decision making process [3,4]. Consequently, physician biases in respect of these factors should play no part in triage decisions. Unfortunately, as humans, intensivists are subject to these factors in their decision making, many of which are implicit. Although, with the

Table 2
Factors identified in all the studies.

Factors	References	Factors	References
Patient		Physician	
Acute Illness		Physician Profile	
Severity	[13,14,22]	Age	[16]
Reversibility	[16,26,31]	Sex	[20,30,31]
Clinical/physiological parameters	[32]	Nationality	[15,17]
ICU for monitoring or treatment?	[29]	Personal attitude	[16,31]
Poor progress during hospitalization	[16,31]	Religious status	[16,30]
Underlying pathology	[23]	Physician Professional	
Unlikely to survive hospitalization	[16,31]	Clinical doubt	[30]
		Assessment error	[30]
Patient Health Background		Spending more time in ICU	[16]
Previous medical illness and/or comorbidities	[13,14,16,22,26,29,31]	Specialty	[20,24,33]
		Additional qualification	[17]
Functional status	[13,27,29]	Level of experience	[17,24,26,30]
Current health status (alcohol, drugs, tobacco, exercise)	[13,22]	QOL as per physician	[16,26,31]
		Physician intuitive prognosis	[29]
Psychiatric/mental health	[13,16,31]		
Previous hospitalization/ICU stay	[16,27,31]	Environmental	
Compliance with medical therapy	[13]	Unit Profile	
DNR status	[22]	Bed status	[8,13-15,27]
Patient Profile		Bed use prejudicing another patient	[13]
Age	[13,16,22,26,27,28]	Nursing morale or workload	[13,16,31]
		Unit guidelines/policy	[8,13,21,31]
Race	[23]	Decision algorithm	[29]
Attitude/ motivation/alertness	[13,16,22]	No of people involved in decision	[8,28]
Patient wishes	[13,14,27,31] [26]	Private v public	[8]
		Larger hospital/ICU	[16]
Socioeconomic circumstances	[13]	Economics	
Religious beliefs	[13]	Cost/benefit ratio	[13,16,25,29]
QOL as per patient	[16]	Cost to society	[17,25,29]
		Economic impact on family	[25,29]
		Patient's ability to pay for care	[23]
Patient Other		External Pressure	
Family support	[22,27]	From patient/family	[16,30]
Family wishes	[13,25,31]	From superiors	[30]
Patient's contribution to society	[16,22,31]	From referring doctor	[8,16,30,31]
		Other	
		Limited decision time	[28,30]
		Source of patient	[28,30]
		Social impact on family	[16,31]
		Legal liability	[13,30]

exception of age, not identified as major significant factors in our review, such factors did appear in various studies and thus raise some concern about their true role and extent in the complex decision process.

Patient age remains perhaps the most controversial of all factors. There remains a perception that the elderly have a poor prognosis and should not be admitted to ICU. Our review is not conclusive with a few studies contradicting the majority that found patient age to be significant. It has been suggested that age is often clinically used as a surrogate for comorbidity and frailty [9]. Some authors have suggested that age alone should not be used as a factor when considering admission [35]. In this regard, the physiological age of a patient, or an assessment of frailty, may be more important than chronological age [3].

4.3. Poor within-group correlation

An important finding in some studies was the poor within-group correlation among decision makers [27,33]. A possible explanation for this may be the unmeasured varying characteristics such as personality, attitude, mood and biases of decision makers. In addition, the effect of personal characteristics of the decision maker such as age and sex may be much greater than previously appreciated. Bensi and colleagues, for example, demonstrated that personality traits predispose to different sorts of reasoning thereby predicting decision making behaviour in respect of uncertainty, gathering of information and revision of beliefs [36]. The exact role of these physician characteristics in ICU triage decision making is not well described.

Any decision is invariably made against a standard of judgment that may incorporate any of inter alia personal, cultural, social, religious and legal filters. Consequently, it can be expected that these will influence all decision making processes to some extent. As the influence of these filters varies from person-to-person, they may act differentially and contribute to poor within-group correlation.

These filters impact the decision making process either positively to result in an appropriate outcome, or negatively in preventing objective consideration of the situation, thereby acting as biases and potentially leading to an inappropriate outcome. Such biases exist on a spectrum of consciousness from deliberate at one end to preconscious or an incomplete awareness at the other end. Crosskerry suggests that it may be better to refer to a bias as a "cognitive disposition to respond (CDR)" [37]. A CDR becomes a cognitive error when it results in an adverse outcome. The role of cognitive bias in medical decision making was recently reviewed by Saposnik and colleagues [38].

4.4. Interaction of factors

One of our criticisms of the studies is their reductionist approach in attempting to identify factors affecting the ICU triage decision. Such an approach ignores the interaction among these factors. Decision making is the complex cognitive process of identifying and choosing between a number of options of varying probabilities by sufficiently reducing their

uncertainty according to one's preferences, values and goals with a resultant outcome that always involves risk [39-42]. Consequently, the interaction of the various factors involved becomes important.

There has, for example, been an attempt to identify an interaction between patient and physician gender. In an adjusted multivariable analysis, Sagy et al. reported that a female patient–female physician combination showed the lowest likelihood to be admitted to ICU in comparison to all other combinations [43]. Age, for example, may be a composite reflecting the interplay between chronological age, frailty, comorbidities and functional status. A better understanding of the interplay of factors may assist in better decision making.

The role of uncertainty in these high stakes decisions is vital. Uncertainty may drive clinician decision makers to adjust their decision making process. They may, for example, set their default position as one of always accepting patients unless compelling reasons are found not to admit. They may default to accepting patients in the face of any significant doubt. They may employ the primitive strategy of 'exhaustion' usually employed by novices where there is a "painstaking, invariant search for (but paying no immediate attention to) all medical facts about the patient, followed by sifting through the data for the diagnosis" [44]. This approach is symptomatic of a great degree of uncertainty that afflicts clinicians especially in early training.

Hansson, in a systematic account of decision making under greater uncertainty, described four components: i) uncertainty of demarcation where options are not well identified; ii) uncertainty of consequences where outcomes of some options are unknown; iii) uncertainty of reliance where it is not clear whether information obtained from others is reliable; and iv) uncertainty of values where the values relevant for the decision are not clearly established [42]. Understanding these uncertainties may help with the decision making process.

Consequently, as uncertainty affects all aspects of a decision making process including the factors involved, their interaction and the final outcome, it challenges the reductionist approach as an optimal means of addressing a decision making process that is complex.

4.5. Contextual variation of factors

Variations in organization of health care systems, funding models, service delivery and resources among the various jurisdictions are likely to impact on how decisions for ICU triage are made. We have reported on five studies from the USA, three from the UK, two each from France and Brazil, and one each from Switzerland, Netherlands, Italy, Israel, Iran and Europe. (Table 1) These geographical locations have very different health care systems, bed availability, resources and reported outcomes. Such issues invariably influence the perceptions of clinicians making ICU triage decisions and may lead to a great degree of variability in decision making.

In comparing the USA and UK studies, for example, it is noteworthy that in the UK, family wishes were considered important and patients with an estimated probability of survival <1% would have been admitted to ICU, whereas in the USA patient attitude/motivation, family support, patient's contribution to society and ability to pay for care were less important than age. (Table 1) Given the different health care systems, funding models and social order in these environments, these findings may be regarded as unexpected. Einav et al., in evaluating physicians from the USA and Israel, demonstrated differences with US physicians considering patient-related factors as important [16]. Ramos et al., in exploring public versus private hospitals, showed clear differences in physician perceptions between these two settings with different factors being considered important [29]. The definition of public and private in this setting was not clear in this study but private ICU physicians rated pressure from the requesting physician and fear of malpractice suits higher.

The funding models defining each of the public and private settings vary across the world. Patient care may be based on free, government-subsidized or fully-paid models. Additionally, ICU clinicians may work on a salaried or 'fee-for-service' basis. Such variations may impact the decision making process. In the South African context, for example, the dynamics of health care delivery decisions between private health care (mainly personal medical insurance funded) and public health care (entirely government funded) varies greatly. Patients managed in the private sector, for example, are seldom refused ICU admission. James et al. recommend further investigation of how the international variation of health economics impacts on clinical decision-making in this context [9].

4.6. Organization of factors

There have been attempts at creating models or systems using identified factors to make evaluations for ICU admission more objective and easier. These have included triage models, triage scores and admission guidelines [3]. The prioritization model, for example, facilitates categorization of patients into four priority levels based on the perceived benefit of ICU admission [3]. Sprung et al. investigated the use of a triage score incorporating 15 factors in deciding about ICU admissions [45]. Ramos et al. developed a computerized algorithm to aid triage decisions by asking four questions; need for active intervention or monitoring, patient comorbidities, patient's previous functionality, and the requesting physician's most probable intuitive prognosis [29]. The algorithm demonstrated good reliability and validity in comparison to the standard process of prioritization by clinicians. All the above tools are potentially problematic with respect to: calibration for specific situations, focus on short term ICU versus overall benefits, and validation.

Various guidelines have been developed to assist clinicians on whom to admit to ICU [3,46]. Such guidelines have often been difficult to put into practice and are not regularly adhered to when triage decisions are made [21,46]. Reasons suggested for this are that the guidelines may not have been readily available, may have been difficult to apply, staff preference for use of clinical judgment, the guidelines may have been created to satisfy regulating authorities, or guidelines were perceived as unnecessary [21].

Against this current divided landscape of ICU protocols and guidelines, we propose a decision tree for the ICU triage admission decision that encapsulates the important factors (Fig. 2). When faced with the dilemma of an ICU admission decision, four component questions need to be considered. Firstly, one should consider whether the patient needs to be admitted. This focusses on the "critical" nature of the patient's acute illness i.e. Is the patient critically ill ("sick enough") needing the ICU level of monitoring and/or organ support? The second consideration is whether the patient wishes to be admitted. Next, a judgment should be made on whether the patient should be admitted. This is the most difficult part and encompasses a value judgment by the critical care practitioner of the prognosis of the patient and the likely benefit to be derived by the admission. The last consideration should be whether the patient can be admitted to ICU. This accounts for the logistics in respect of the proposed admission e.g. Is there an available bed? Is there the appropriate equipment, support service and staff? Various factors impacting each of these steps of this complex decision-making process are also reflected in Fig. 2.

Such a decision tree for ICU triage is readily available and easy to use, and may assist the clinician in this high-stress, high-stakes, time-sensitive decision making process.

4.7. Thought-deed discordance

Thought-deed discordance, where what practitioners thought should happen did not reflect their actual decisions, occurred commonly across the studies. This occurred for patient age as a factor, admission of patients with no hope or very low estimated probability of survival, and presence and use of admission and restriction guidelines [15,21,22,25]. This discordance may reflect the clash between the unconscious process and conscious thought, each of which is vitally

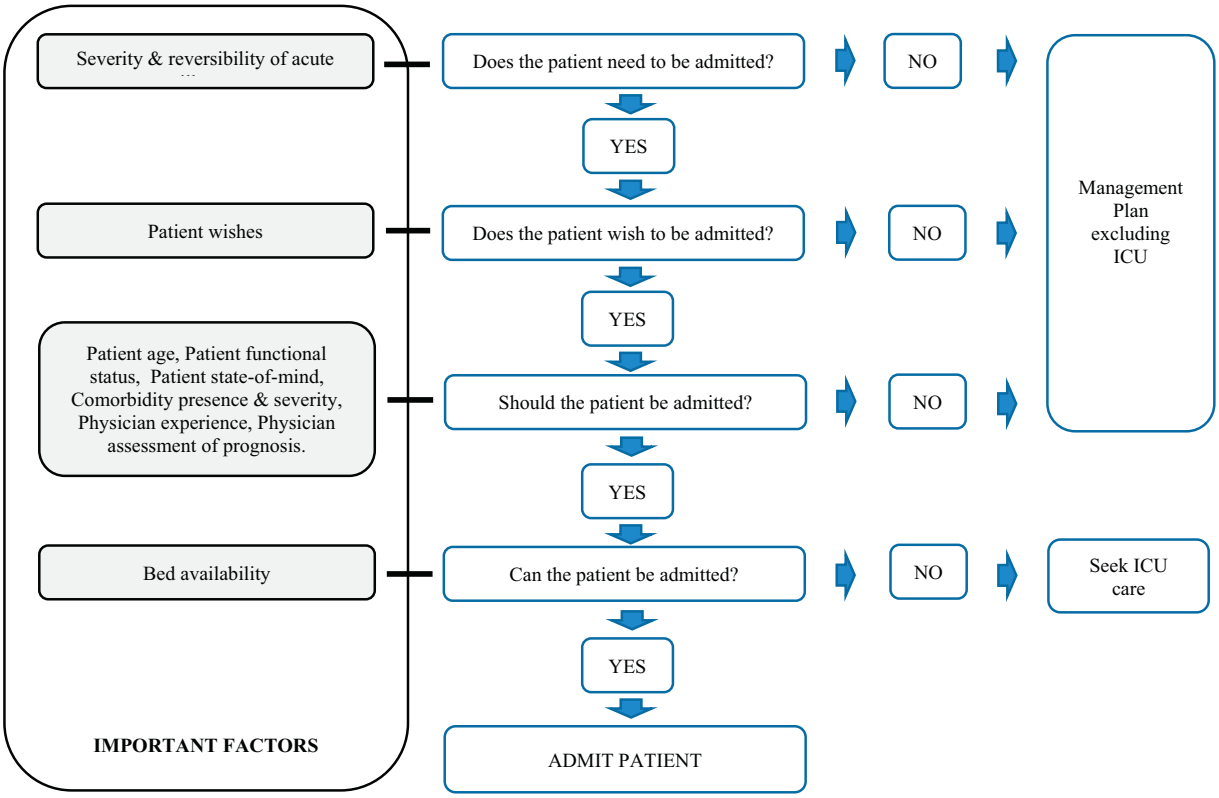

Fig. 2. A decision tree for ICU admissions incorporating important factors.

important, has different characteristics, and may be preferable in different circumstances [47]. It may also emphasize the difference between explicit bias, of which one is aware and for which one can attempt to compensate; and it's opposite, implicit bias.

The thought-deed discordance may also occur at a more conscious, deliberate level. In such instances, a clinician may feel pressurized to follow a course of action that is at odds with his/her beliefs. Such pressure may be internal to the clinician decision maker where, for example, biases are discordant with an anticipated, acceptable, course of action. The pressure may also come, expressly or tacitly, from external sources (such as colleagues, administrators or society) with defensive decision making being practised in the interests of conformity.

4.8. Intuition, bias and reflection

Although many factors that influence the ICU triage decision making process have been identified, not all may be fully appreciated by those making such decisions. Many physicians attribute their decisions to intuition defined as a "non-sequential information processing mode, which comprises both cognitive and affective elements and results in direct knowing without any use of conscious reasoning" [48]. This 'gut-feel' or intuitive aspect of decision making is often seen as positive, and may reflect deeply-ingrained expertise that has been previously learned and is now automatically applied.

A related, but slightly different concept is unconscious or implicit bias. The term "implicit bias" is used to describe when we have involuntarily formed attitudes towards people or associate stereotypes with them without our conscious knowledge [49]. Consequently, such bias is largely viewed with negative connotations. With a few notable exceptions (e.g. Zussman [50]) the role of implicit biases in ICU decision making with respect to acceptance or refusal of referrals, has not been well described or systematically studied.

To improve triage decision making, reflective learning and practice is important as it improves understanding, shows outcomes, promotes a desire for lifelong learning, improves clinical competence and performance, and ensures continual professional development [51]. Feedback derived from the outcome following the decision is key as part of the reflection process. Decisions that lead to the expected outcome are more likely to reinforce the "correctness" of the decision [52,53].

4.9. Strengths & limitations of review

To our knowledge this is the first comprehensive review in this area that solely focusses on factors from the perspective of the decision maker. The review also highlights the paucity of data, in particular around the personal characteristics and biases of the physician decision maker, as well as the complex interplay among the various factors. Limitations of the review are mainly centred around the nature of the studies used. There is marked heterogeneity among the studies that span many years. This raises temporal issues that may be relevant in the field of critical care that has grown immensely in the two decades covering the studies.

5. Conclusions

Decisions evaluating suitability of patients for admission into ICU are extremely challenging. These high-stakes and time-sensitive judgments have to be made against the backdrop of an extremely high-stress and emotionally charged environment. Determinants for the ICU triage decision are best considered in the three groups of patient, physician and environmental factors. The review has identified the common significant factors impacting this decision process as being the severity and reversibility of the acute illness, presence and severity of comorbidities, patient age, functional status, state-of-mind and wishes, physician level of experience and patient QoL as perceived by the physician, and bed availability.

The decision making process on whether or not to provide a patient with ICU care is complex and dynamic, with numerous factors, many

hitherto incompletely described or implicit, that intricately interplay with each thereby affecting the decision. The literature studied provides some indication about what these factors are, but fail to show the complexities and interaction between them. In addition, a huge variation exists in the proportion of patients admitted to ICU both within and between different jurisdictions. To help streamline this difficult process and to harmonize the huge variations to some extent, a decision tree encapsulating the important factors into component questions should be considered. Further high quality research should include a reflection on how decisions for admission to ICU are made, such that a better understanding of these processes can be achieved allowing for improved individual and group consistency, and ultimately better decisions.

Declarations of Interest

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