Université de Montréal

Le triage et le transfert de patients aux soins intensifs : une revue systématique des critères de sélection

par Joseph Dahine

École de santé publique de l'Université de Montréal, Département de gestion, d'évaluation et de politique de santé

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Résumé

Contexte: L'utilisation efficiente des ressources en soins intensifs représente un défi potentiellement surmontable dans un contexte de régionalisation des services. Conséquemment, il importe de convenir de critères homogènes et transparents permettant de trier et de transporter les patients là où ils peuvent recevoir les soins nécessaires à leur condition.

Objectif: L'objectif principal de cette étude est d'identifier et d'évaluer les publications définissant les critères utilisés pour prioriser ou refuser une admission aux soins intensifs.

Méthodes: Nous avons entrepris une revue systématique en accord avec les lignes directrices PRISMA. Nous avons identifié tous les articles pertinents publiés jusqu'au 8 novembre 2016 au moyen des bases de données PubMed, Embase, Medline, EBM Reviews, CINAHL Complete, les bases de données recensant la littérature grise ainsi qu'en effectuant une revue manuelle d'articles supplémentaires. Nous avons ensuite évalué la qualité des articles retenus selon une échelle d'appréciation que nous avons développée. Finalement, nous avons extrait puis évalué chaque critère individuel en plus de les regrouper par thème.

Résultats: L'étude nous a permis d'identifier 5818 abrégés. Nous avons révisé 416 articles exhaustivement pour en retenir 129 qui correspondent aux critères d'inclusion. Il s'agit d'articles de recherche originale (34%), de lignes directrices (26 %) ou de revues de la littérature (21 %). Nous avons extrait 200 critères de triage et de transport au sein des 129 articles. Ceux-ci proviennent surtout des États-Unis (43 %) et privilégient un mécanisme d'exclusion (71 %) plutôt que de priorisation (17 %) des clientèles. Peu d'articles abordent les critères de transport (4 %). Nous avons classifié les critères selon qu'ils soient reliés à l'un ou l'autre des quatre thèmes qui ont émergé de notre analyse : au patient; à la condition clinique; au médecin qui évalue le cas; ou au contexte. Le critère le plus fréquemment cité est celui de la préférence du patient suivi de l'évaluation du médecin.

Conclusion: Une revue systématique a permis de générer une liste de 200 critères utilisés pour prioriser ou exclure certains types de patients dans un état critique. Malgré les limites de notre étude, celle-ci peut permettre aux cliniciens et aux preneurs de décision de concevoir des politiques de triage et d'admission au niveau local, régional ou national. De plus, l'étude identifie des champs de recherche potentiels où le développement de critères spécifiques et mesurables pourrait contribuer au développement de lignes directrices diminuant la variabilité dans les pratiques et améliorant le processus d'admission aux soins intensifs.

Mots-clés : triage, transport, transfert, critères, soins intensifs, admission, politiques de santé

Summary

Context: Intensive care bed unavailability negatively affects patients' outcomes. Strategies that reduce inefficient use of resources and reduce unavailability may increase quality and accessibility of critical care. As advocacy for regionalization of critical care resources increases, there is a need for agreed triage and transport criteria. However, outside of the trauma population, such agreed criteria and recommendations are lacking.

Objective: We aimed to identify and appraise articles defining criteria used to prioritize or withhold a critical care admission.

Methods: We undertook a systematic review according to PRISMA guidelines. Relevant articles were identified through searches of PubMed, Embase, Medline, EBM Reviews, CINAHL Complete from inception until November 8th, 2016. We also undertook searches through gray literature as well as a manual review of references. We then assessed the quality of identified articles through an appraisal scale we developed. Finally, we extracted and evaluated all criteria within the articles and grouped them by theme.

Results: A total of 5818 abstracts were identified. After screening, we reviewed 416 articles in full and 129 articles met study criteria. These articles were mainly original research (34%), guidelines (26%) and reviews (21%). Amongst them, we identified 200 unique triage and transport criteria. Most articles were published in the United States (43%) and highlighted exclusion criteria (71%) rather than a prioritization mechanism (17%). Very few articles pertained to transport of critically ill patients (4%). We classified criteria as they related to one of four emerging themes: patient, condition, physician and context. The most commonly found triage criteria was patient preference followed by physician's assessment that the patient was too well to benefit from ICU admission.

Conclusion: A systematic review aimed at identifying triage and transport criteria used to prioritize or exclude certain patient populations under different settings helped to generate a list of 200 criteria classified within 4 themes. Despite its limitations, this study may help clinicians and decision makers devise local, regional or national ICU triage criteria. It also identifies gaps in knowledge where future clinical research yielding specific and measurable criteria tailored to clearly defined patient populations may help to decrease ICU triage variability.

Keywords: triage, transport, transfer, criteria, critical care, ICU admission, health policy

Table des matières

La liste des tableaux

La liste des figures

La liste des sigles et abréviations

ACCM	American College of Critical Care Medicine
ACLF	Acute on Chronic Liver Failure
ADL	Activities of daily living
AGILITIES	Age Glasgow coma score Infusion Lung Intervention Tests Informal Excessive weight Subtract
APACHE	Acute Physiology And Chronic Health Evaluation
ASA	American Society of Anesthesiologists
BMI	Body Mass Index
BMT	Bone Marrow Transplant
CAP	Community Acquired Pneumonia
CIP	Central Intensivist Physician
CNS	Central Nervous System
COPD	Chronic Obstructive Pulmonary Disease
DLE	Demande de lits élevée
DLR	Demande de lits réduite
DNR	Do not resuscitate
E-CPR	ECMO-Cardiopulmonary Resuscitation
ECLS	Extracorporeal life support
ECMO	Extracorporeal Membrane Oxygenation
ECOG	Eastern Cooperative Oncology Group
EF	Ejection Fraction
FEV1	Forced Expiratory Volume in one second
Fig.	Figure
GESIQ	Groupe d'experts en soins intensifs du Québec
GRACE	Global Registry of Acute Coronary Events
GVHD	Graft vs. Host Disease
Hem-Onc	Hematological Oncology
HIV	human immunodeficiency virus
MELD	Model for End-Stage Liver Disease

MV	Mechanical ventilation
NSTE ACS	Non-ST Elevation Acute coronary syndrome
NYHA	New-York Heart Association
P-POSSUM	Portsmouth Physiological and Operative Severity Score for the enumeration of mortality and morbidity
PaO2	Partial Pressure of Oxygen
PAP	Pulmonary artery pressure
PARS	Post Anesthesia recovery score
PHTN	Pulmonary Hypertension
PIB	Produit intérieur brut
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
RS	Robustness Score
SAPS	Simplified acute physiology score
SDH	Subdural Hematoma
SCCM	Society of Critical Care Medicine
SOFA	Sequential organ failure assessment
TAVI	Transcatheter aortic valve implantation
TBA	Total body area
TLC	Total Lung Capacity
USI	Unité de soins intensifs
VC	Vital Capacity
VF	Ventricular Fibrillation
y	Years

1. Introduction

1.1. Définir le contexte

1.1.1 La médecine de soins intensifs chez l'adulte

La médecine de soins intensifs est la spécialité médicale qui a pour but de dispenser des soins complexes aux patients qui souffrent, ou qui sont à risque de souffrir, de défaillance d'un ou de plusieurs organes. Généralement, ces soins de nature complexe sont dispensés dans une unité de soins intensifs (USI). Pour ce faire, des ressources très spécialisées sont mises à la disposition des professionnels qui soignent cette clientèle. L'utilisation de ces ressources, telles que la chirurgie cardiaque, la radiologie d'intervention ou la thérapie continue de remplacement rénal, est habituellement dictée par la condition du patient. Malheureusement, il arrive que le patient dont la condition médicale requiert ces soins se présente dans un milieu clinique qui ne possède pas ces ressources spécialisées ou que celles-ci ne soient pas disponibles.(1) Dans de telles situations, la prestation des soins est dictée par la disponibilité des ressources plutôt que par les besoins du patient. Le clinicien doit par conséquent décider s'il transfère le patient dans un autre établissement.

1.1.2 Le transfert et le triage

Le transfert d'un patient dont la condition est critique résulte d'un processus décisionnel complexe où plusieurs facteurs humains et logistiques interagissent. La disponibilité des ressources, les caractéristiques des patients et la variabilité des évaluations médicales sont autant d'éléments qui contribuent à l'incertitude entourant le devenir des patients.(2) À l'heure actuelle, cette incertitude est accentuée par l'inexistence d'un processus standardisé de collecte de données et d'allocation des ressources. Conséquemment, intensivistes et administrateurs d'ici et d'ailleurs sont témoins de situations d'inefficience technique ainsi que de rapports coût-efficacité défavorables. La conséquence bien tangible de ce constat est qu'un bon nombre de patients reposant dans un état critique n'ont pas accès aux ressources dont ils auraient besoin dans une USI, ce qui influence directement leur pronostic.(3) Une autre couche de complexité s'ajoute lorsque les logiques professionnelles et technocratiques s'opposent : cette situation survient lorsque les médecins

doivent choisir entre leur obligation de mettre tout en œuvre pour le bien de leur patient et leur responsabilité sociale où ils sont tenus de distribuer les ressources judicieusement à la société.(4)

Les centres de triage offrent la possibilité de résoudre ces dilemmes. Ils supposent une organisation des hôpitaux en réseau au sein d'une région géographique. Grâce à la mise en commun des ressources détenues par les membres dudit réseau, le centre de triage, ou toute autre forme de guichet d'accès unique, se voit offrir l'accès à un plus large éventail de services. Cela lui permet d'allouer les ressources de façon plus appropriée selon les besoins de chaque individu et amoindrit les restrictions de ressources inhérentes aux limites logistiques imposées par un établissement dont le fonctionnement est indépendant.(5) Par contre, en pratique, les centres de triage doivent se doter de critères qui précisent le moment où ce processus est enclenché. Or, lorsque les critères sont mal choisis, il peut survenir deux situations indésirables : que des patients qui auraient bénéficié des soins soient exclus ou que des patients qui n'auraient pas pu survivre peu importe les soins les reçoivent au détriment d'autres patients. On appelle respectivement ces concepts le surtriage et le sous triage. Le Collège américain de chirurgie recommande que ces paramètres soient utilisés comme indicateurs de qualité afin d'évaluer la performance des centres de triage en trauma. Il va même jusqu'à fixer un seuil de surtriage maximal à 1 % et précise l'importance de le minimiser afin de diminuer les décès évitables.(6) D'ailleurs, puisant inspiration dans le domaine de la traumatologie, où les données probantes étudiant les centres de triage ont montré un bénéfice sur la mortalité(7) et sur les délais de transferts inter établissements,(8) plusieurs groupes d'experts ont proposé que des structures similaires soient créées pour les autres patients dans un état critique.(9, 10) Cependant, malgré deux décennies pendant lesquelles était soutenu un tel plaidoyer, peu d'initiatives concrètes furent développées.

1.1.3 Le portrait québécois

Le sujet des centres de triage a fait son chemin au Québec, où un tel outil provincial a été proposé par le Groupe d'experts en soins intensifs du Québec (GESIQ).(1) Dans son rapport, le GESIQ releva des manquements au niveau de la qualité lors des transferts de patients dans un état critique. Au Québec, les USI sont organisées selon trois niveaux qui reflètent la complexité des soins qui

peuvent y être offerts.[1] Les unités de niveau 1 peuvent soigner n'importe quel patient dans un état critique et offrir du soutien d'organes défaillants ; les unités de niveau 2 peuvent généralement dispenser des soins à la majorité des patients dans un état critique, mais doivent systématiquement transférer certains patients (p. ex. ceux nécessitant une thérapie de remplacement rénal, du monitorage invasif du système nerveux central, des supports ventriculaires cardiaques, etc.) ; finalement, les unités de niveau 3 peuvent mettre en œuvre la stabilisation initiale, mais ne peuvent offrir des soins plus avancés aux patients dans un état critique. Une telle hiérarchisation permet théoriquement la création d'un réseau capable de coordonner l'allocation de ressources limitées et organiser le transfert sécuritaire et efficient du patient nécessitant des expertises non disponibles à l'endroit où il développe initialement sa condition critique.

Cependant, dans le même rapport, le GESIQ souligne que les unités de niveau 1 peinent à accommoder les transferts des unités des niveaux 2 et 3 en raison de la non disponibilité des lits de soins intensifs. Qui plus est, le rapport identifie de nombreuses lacunes technologiques. Par exemple, au Québec, il n'existe pas d'outils permettant d'identifier les lits disponibles dans les USI en temps réel. Conséquemment, les médecins désirant transférer leurs patients doivent « magasiner » un lit de soins intensifs en appelant plusieurs hôpitaux. Cela se révèle d'autant plus une perte de temps qu'il est utilisé aux dépens des soins au chevet du patient. L'idée d'un guichet d'accès provincial unique a été proposée en réponse à ces problématiques et a recueilli l'appui de 70 % des USI sondées avec l'intention d'améliorer la qualité et l'accessibilité aux soins intensifs.(1)

Ce mémoire s'inscrit dans une volonté de contribuer au développement d'un tel guichet d'accès provincial unique étant donné que cette proposition retient autant l'attention de preneurs de décisions que celle des cliniciens. Nous concevons que ce guichet devra se doter d'un algorithme de triage incluant des critères précis afin de répartir les patients dans les USI appropriées. Or, hormis pour la clientèle de la traumatologie, il n'existe pas de consensus sur les critères de triage et de transport à appliquer systématiquement aux soins intensifs. Qui plus est, les recommandations deviennent particulièrement vagues quand vient le temps de définir des situations où il est

[1] La classification des USI a été modifiée au Québec en 2018. Nous utilisons la classification historique, car c'est celle qui est citée dans la référence.

acceptable, voire nécessaire, de priver un patient ou une clientèle de ressources au terme du processus de triage. Les ressources financières, humaines et matérielles, n'étant pas illimitées, pourraient notamment contraindre cliniciens et gestionnaires à de telles décisions difficiles. De tels enjeux sont délicats et notre travail se veut un outil pour alimenter la réflexion des décideurs qui auront à développer de telles politiques.

1.2 Définir l'objectif de recherche

Notre objectif est d'identifier tous les critères de triage et de transport aux soins intensifs utilisés à travers le monde. Plus particulièrement, nous souhaitons recenser les critères discriminants utilisés pour refuser ou prioriser une demande d'admission aux soins intensifs. Ce mémoire présente les résultats de notre revue systématique.

2. La recension des écrits

Avant d'entamer notre revue systématique, nous avons effectué une recherche préliminaire qui nous a permis de documenter l'état des lieux ainsi que de mieux comprendre les éléments qui sous-tendent le processus décisionnel en lien avec une demande d'admission aux soins intensifs. Nous résumons ici les principales données probantes illustrant les facteurs clés de la prise de décision : la disponibilité des lits et l'effet sur les décisions au triage; les décisions de triage et l'impact sur le patient; l'utilisation inefficiente des ressources; et le processus décisionnel des médecins au triage. Comme nous l'avons mentionné plus tôt, un centre de triage peut pallier l'influence de ces facteurs et potentiellement améliorer l'accès aux ressources appropriées. La dernière section de notre recension des écrits détaille brièvement l'architecture de telles structures existantes.

2.1 La disponibilité des lits et l'effet sur les décisions au triage

L'accessibilité aux soins intensifs constitue un défi croissant pour les cliniciens bien qu'il commence déjà à prendre racine tôt après la naissance de la spécialité. En effet, dès les années quatre-vingt, il est reconnu que les intensivistes doivent prendre des décisions de triage et refuser l'accès aux soins intensifs à un certain nombre de patients.(11, 12) En 1986, Strauss décrit déjà le rationnement des ressources aux soins intensifs comme étant une chose commune dans son article *Rationing of Intensive Care Unit Services : An Everyday Occurrence :*

> "One relatively unique feature of care within ICUs compared with medical care in other settings is that the emergency demand for the technology can often exceed the existing supply. Physicians are required to provide ICU care to some patients at the risk of denying the care to others."[(12)] (p.1143)

Strauss s'appuyait sur les travaux de Singer *et al.* qui, en 1983, fut le premier à examiner la corrélation entre la capacité réduite de lits aux soins intensifs et le nombre d'admissions. Ainsi, dans un contexte où la disponibilité des lits était réduite en raison du manque de ressources infirmières, Singer a montré une diminution de 22 % des admissions mensuelles aux soins intensifs, notamment parce que les intensivistes compensaient la pénurie en devenant plus sélectifs.(11) Trente ans plus tard, la

problématique de la disponibilité des lits aux soins intensifs demeure tout aussi prépondérante. Dans une étude française menée par Robert *et al.* où quatre USI à disponibilité de lits réduite (DLR) furent observées pendant 90 jours, le nombre moyen de jours où aucun lit n'était disponible était de 48. Ces unités étaient comparées à six USI où la disponibilité des lits était élevée (DLE) (moyenne de 30 jours sur 90 où aucun lit n'était disponible).(13) Or, une plus grande proportion de patients se voyait refuser une demande d'admission aux soins intensifs lorsque la disponibilité des lits était diminuée (20 % vs 38 % dans les unités DLE vs DLR respectivement, $p<0,0001$). Des résultats similaires furent obtenus par Stelfox *et al.* dans un contexte canadien.(14) Le groupe examina un total de 3494 demandes d'admission aux soins intensifs. Dans 20 % des cas, le triage s'est fait lorsqu'il ne restait qu'un seul ou aucun lit dans l'USI. Dans pareilles circonstances, les auteurs ont déterminé que les chances d'être admis aux soins intensifs diminuait de 33 % ($p=0,03$). Malheureusement, aucune étude ne s'est penchée sur l'effet de la mise en commun des ressources dans une région géographique sur la disponibilité des lits aux soins intensifs et son impact sur les décisions de triage.

2.2 Les décisions au triage et l'effet sur le devenir des patients

Alors que les études menées dans les années 80 ont montré qu'une disponibilité réduite de lits menait à l'admission de patients généralement plus malades, les études plus récentes semblent envoyer un tout autre signal. En effet, l'étude de Stelfox citée précédemment a montré que les situations d'indisponibilité de lits étaient associées à une augmentation de l'ordre de 90 % de changements de niveaux de soins, passant d'un objectif curatif à un objectif palliatif ($p<0,01$).(14) Quant à l'étude de Robert, les patients refusés aux soins intensifs dans les unités à disponibilité de lits réduite étaient plus souvent jugés « trop malades pour bénéficier » de soins intensifs comparativement aux unités à disponibilité de lits élevée.(13) D'autres études ont également montré des conséquences néfastes sur le devenir des patients à qui on refusait une admission aux soins intensifs. Une revue systématique, publiée en 2004, examinant dix études observationnelles, a montré que le risque de mortalité de ces patients était significativement augmenté (rapport de cotes : 3,04).(15) Depuis, en 2010, une étude de cohorte multicentrique menée dans onze hôpitaux de sept pays différents a montré qu'une admission dans une USI était corrélée avec une réduction du risque de mortalité de l'ordre de 21 à 27 %.(16) De façon similaire, en 2011, une étude de cohorte menée

par Cardoso *et al.* montrait que chaque heure passée à attendre un lit aux soins intensifs augmentait le risque de mortalité de 1,5 %.(17) Finalement, dans un modèle de régression multivarié, une admission aux soins intensifs après un refus initial dû à une indisponibilité de lits était indépendamment corrélé avec un risque de mortalité plus élevé (rapport de cotes : 1,78).(18)

2.3 L'utilisation en apparence inefficiente des ressources

Existe-t-il un nombre idéal de lits dans une unité de soins intensifs ? Après tout, un nombre de lits insuffisant mène à davantage de refus. Cependant, un nombre trop important de lits créerait des inefficiences puisque plusieurs lits demeureraient inoccupés. Une citation de Robert *et al.* illustre cette problématique:

> « The ideal ICU bed/population ratio is that capable of ensuring that all patients likely to benefit from critical care can be admitted to the ICU, while keeping bed occupancy high, as unoccupied beds result in costs for no benefit. »(13)(p.1)

En effet, aux États-Unis, le budget des soins intensifs représente 1 % du PIB (environ 150 milliards de dollars annuellement) et il en coûte en moyenne 3000 $ par jour pour occuper un lit aux soins intensifs.(19, 20) Nous complèterions donc la citation de Robert en affirmant qu'il faut également porter une attention particulière à prévenir les admissions inappropriées aux soins intensifs afin d'éviter les rapports coût-bénéfices défavorables. On trouve plusieurs études épidémiologiques soutenant ces propos. En 2000, le groupe de Lyons *et al.* a publié dans le *Lancet* un modèle mathématique tentant de calculer, avec une bonne validité externe, le nombre de lits de soins intensifs requis pour une population de 500 000 individus.(21) Pour arriver à leurs fins, les chercheurs ont demandé à des médecins britanniques d'évaluer à l'aveugle la pertinence de 4058 hospitalisations aux soins intensifs. Le modèle prédit que, pour répondre aux besoins de la population dans 95 % des circonstances, une USI nécessite 39 lits pour une population de 500 000 personnes, ou 7.8 lits/100 000 habitants. Ce ratio grimpe à 8,6 lits/100 000 habitants si on souhaite pouvoir répondre aux besoins de la population 99 % du temps. Ces résultats n'ont toutefois pas mené à une adoption de ces ratios dans le monde des soins intensifs. De nombreuses variabilités géographiques existent. Une étude ayant examiné la capacité d'absorber des admissions aux soins

intensifs en cas de pandémie a relevé que les USI aux États-Unis possèdent en moyenne 28 lits/100 000 habitants.(22) L'auteur de l'étude conclut toutefois que la variation géographique est telle qu'une pandémie pourrait rapidement épuiser les ressources dans une région du pays et en laisser d'autres avec plusieurs lits inutilisés.(22)

Par opposition, la capacité des USI en Europe est grandement inférieure à celle des États-Unis. Elle est en moyenne de 11,5 lits/100 000 habitants. Cependant, la variabilité entre les pays s'y trouve également. Ainsi, l'Allemagne est dotée de cinq fois plus de lits de soins intensifs par 100 000 habitants que la Grèce ou la Suède (29,2 vs 6). Dix ans après le modèle de Lyons, seule la Norvège détient un ratio qui avoisine les 7,8 lits par 100 000 habitants.(23) Des conclusions similaires peuvent être tirées ailleurs à l'international, tel que documenté dans une revue effectuée par Adikhari *et al.* en 2010.(24) Au Québec, le rapport du GESIQ démontre qu'une variabilité entre les régions universitaires existe aussi quant à la capacité de lits aux soins intensifs par 100 000 habitants: 9,6 à Sherbrooke, 12,3 à Montréal, 13,3 à McGill et 15,7 à Laval.(1)

Dès lors, si la proposition de Lyons est véridique, une vaste majorité d'USI à travers le monde possède une capacité plus grande que nécessaire. Conséquemment, ces USI sont potentiellement sous-utilisées, ce qui suggère l'existence d'inefficience dans les systèmes de santé. Ces soupçons sont corroborés par une élégante étude menée par Gershengorn *et al.* qui examinait le taux d'admission aux soins intensifs des cas d'acidocétose diabétique, une population reconnue pour son homogénéité en termes de présentation et de gestion médicale.(25) L'équipe a exploré les bases de données de 159 hôpitaux et 15 994 adultes hospitalisés avec un diagnostic d'acidocétose diabétique dans l'État de New-York entre 2005 et 2007. Le taux d'admission aux soins intensifs variait démesurément entre les établissements (de 2,1 % à 87,7 %) mais aucune différence significative sur les taux de mortalité ou les durées d'hospitalisation n'a pu être décelée. Cette variation suggère que plusieurs admissions aux soins intensifs étaient inappropriées et que des ressources ont été allouées de façon inefficiente.(26) En effet, la variabilité existant entre les capacités et l'utilisation des USI au sein de régions aussi géographiquement similaires, tel que le suggèrent les données présentées précédemment, soulève la possibilité que l'allocation des ressources aux soins intensifs soit inefficiente, mais, surtout, qu'elle découlerait non pas des besoins des patients, mais plutôt de la volonté des médecins.

2.4 Le processus décisionnel des médecins au triage

Les données probantes nous indiquent que le triage est inévitable et que les patients refusés aux soins intensifs en subissent les conséquences délétères sur leur devenir. Il importe d'éclaircir les facteurs qui amènent un médecin à refuser d'admettre un patient aux soins intensifs. À ce titre, les données probantes n'offrent pas de consensus. Certes, ces décisions impliquent souvent que le médecin a tenu compte des valeurs du patient, de sa directive médicale anticipée et a posé un jugement sur le bénéfice espéré de l'admission aux soins intensifs.(3, 27) Cependant, une pléthore d'articles illustre l'importante inconstance des évaluations des intensivistes.(28-33) Ces études présentent toutefois certains biais. En effet, la plupart des articles qui utilisent des méthodologies prospectives pour recueillir les opinions pronostiques des répondants sont de nature qualitative et se limitent à des termes génériques (ex : « patient trop malade » ou « trop stable pour bénéficier d'une admission aux soins intensifs »).(13) Or, ces termes ne sont pas adéquats pour capter la complexité qui sous-tend l'évaluation d'un patient dans un état critique.(34) Ces études sont aussi sujettes au risque de « prophétie autoréalisatrice »(35) faisant en sorte que l'intensiviste qui prédit un sombre pronostic pour son patient est celui-là même qui prend la décision de passer à des soins de confort alors qu'un autre intensiviste plus optimiste aurait poursuivi les soins actifs, ce qui aurait peut-être résulté en une survie prolongée du patient. Une étude menée par Cook *et al.* procure une parfaite démonstration de ce concept. Lorsque les intensivistes estimaient la probabilité de survie d'un patient à moins de 10 %, les utilisations de ventilation mécanique, d'inotropes et de dialyse étaient toutes significativement plus à risque d'être retirées résultant en une augmentation du risque de décès.(36) Au-delà de l'influence du pronostic établi par les médecins sur le devenir des patients, ces estimations sont également plus souvent qu'autrement erronées. Par exemple, dans l'étude de Cook, le taux de survie réel des patients dont la probabilité de survie était estimée en deçà de 10 % était en fait de 30 %. Dans une autre étude, des chercheurs se sont intéressés à la propension qu'ont les médecins de placer des patients ayant subi un traumatisme crânien en soins de confort. Ils ont établi à nouveau qu'une grande variabilité existait entre les décisions individuelles des médecins, et ce, au sein d'une même équipe. Ces observations ont poussé les auteurs de l'étude à conclure qu'il existait un certain « nihilisme » médical dans la pratique de certains cliniciens.(37)

Les études rétrospectives comportent aussi leur lot de biais inhérents. Cependant, elles tirent des conclusions similaires quant à l'imprécision et à la variabilité des pronostics. Une étude récente comparant la capacité des intensivistes de prédire le devenir des patients avec celle des internistes n'a pas montré de différence attribuable à la spécialisation des médecins.(38) Cependant, dans les deux groupes, la justesse des prédictions était, au mieux, moyenne. Une étude publiée en 2005 par de Rooji *et al.* jette possiblement un peu de lumière sur les raisons expliquant ces résultats. Les auteurs suggèrent, en effet, que les médecins ont tendance à surestimer l'impact des facteurs tels que l'âge ou le diagnostic et sous-estimer des facteurs ayant une influence beaucoup plus grande sur le pronostic, tel l'état fonctionnel de base.(39)

L'inconstance des pronostics posés par les intensivistes a un impact direct sur l'intensité des traitements offerts aux patients. Tel que ci-haut mentionné, la prédiction d'un médecin qui assigne à son patient une faible probabilité de survie corrèle significativement avec le risque de décès aux soins intensifs, même après avoir ajusté pour les directives anticipées des patients ou la gravité de leur condition.(36) Dans un important sondage canadien mettant de l'avant 12 cas cliniques hypothétiques, Cook a aussi démontré une importante variabilité de ce qu'une « intervention appropriée » signifie.(40) En effet, un seul des scénarios a réussi à rallier plus de 50 % des répondants à choisir la même intensité de traitement, alors que, dans huit des douze scénarios, les participants ont choisi des niveaux d'intervention complètement opposés (c.-à-d. « soins maximaux incluant la réanimation cardiaque » vs « soins de confort seulement »). Qui plus est, parmi une liste d'une douzaine de facteurs, la probabilité de survivre à l'épisode de soins (telle qu'estimée par les intensivistes) corrélait le plus fortement avec le retrait des soins actifs (rapport de cotes : 6,3). Vingt ans plus tard, une étude que nous avons conduite a montré que l'inconstance des décisions médicales persiste toujours, mais qu'elle n'est pas due à la spécialisation de base des cliniciens.(38) Ainsi, les différences relevées entre les internistes et les intensivistes sont probablement davantage dues aux différences individuelles, telles que les valeurs ou les expériences passées, plutôt que les disparités des formations ou des champs de pratique.

Plusieurs auteurs identifient aujourd'hui l'inconstance des décisions médicales comme un important problème éthique et pratique aux soins intensifs.(41-43) En réponse à cette situation, et en lien avec

l'hétérogénéité de l'offre des USI, certains experts, tels que Mery et Kahn, font la promotion d'une plus grande participation des patients dans le processus d'attribution des ressources :

> « The decision to initiate comfort measures should be a patient-centered decision, based on patient preferences, family discussions, and severity of illness, not on ICU bed availability. Additional proactive efforts to address goals of care at hospital admission, rather than at the time of sudden clinical deterioration, are needed to ensure that our limited supply of ICU beds is used most effectively and efficiently. » (44) (p. 2)

Aux soins intensifs, cet objectif représente un changement de culture et risque toutefois de se buter à certains obstacles. Tel que l'écrit Cook : « Many seriously ill patients lose their decision-making ability. Furthermore, wishes of patients' surrogates and clinicians correlate only modestly with the patients' wishes, and barriers to advance care planning exist in healthcare systems. »[36] (p. 270)

2.5 Un plaidoyer en faveur de modèles de triage alternatifs

Azoulay offre une description du processus classiquement utilisé pour trier les patients aux soins intensifs. Les décisions se prennent localement, c'est-à-dire que l'intensiviste en charge de l'USI reçoit une demande d'admission, évalue le patient et décide s'il accepte d'admettre le patient.(45) Cependant, certains modèles alternatifs fonctionnent de façon plus centralisée. Romig *et al.* présentent les résultats d'une initiative mise en place à la *John Hopkins School of Medicine* pour répondre aux problématiques d'inefficience et d'inconstance décisionnelle.(46) Un « intensiviste centralisé » (*Central Intensivist Physician, CIP)* est responsable des 65 lits de soins intensifs de l'organisation et a pour tâche d'évaluer toutes les demandes d'admission. Ce travail était auparavant effectué par cinq à sept intensivistes en même temps. L'unique rôle du CIP est d'assurer l'orientation des patients. Un autre intensiviste soigne le patient une fois qu'il est admis. Ce modèle, exemple de centralisation locale, a amélioré la fluidité des transferts de patients et la satisfaction du personnel.

La centralisation à plus large échelle est appelée « régionalisation » et est un concept prôné par l'American College of Critical Care Medicine (ACCM) depuis 1994.(47) Par la suite, plusieurs intervenants ont pressé les principaux acteurs à entreprendre la régionalisation des soins intensifs.(9) Un modèle informatisé simulant la régionalisation et les transferts bilatéraux entre 119 117 patients provenant de 11 centres périphériques et 76 817 patients de 3 centres de référence a démontré la faisabilité et la sécurité d'une telle structure.(48)

Nonobstant ce qui précède, les modèles existants sont rares. La plupart des implantations fructueuses ont été élaborées via les réseaux de traumatologie et les résultats publiés sont encourageants.(5, 49, 50) Par exemple, les centres de triage en traumatologie ont engendré des diminutions du taux de mortalité suivant les accidents automobiles de la même envergure que les lois rendant obligatoire le port de la ceinture de sécurité.(50) À l'extérieur de la traumatologie, l'Ontario a régionalisé le processus de triage et de transferts de patients aux soins intensifs via une structure appelée *CritiCall Ontario*. Une étude évaluant l'impact de la régionalisation des services de chirurgie vasculaire après l'implantation de leur *Politique concernant les malades en phase critique*,(51) un élément appartenant à *CritiCall Ontario*, a montré une augmentation de 500 % des demandes de transfert, un taux d'acceptation de 95 % et une diminution du nombre d'intervenants (de 2,9 à 1,7 en moyenne). Malheureusement, des études d'implantation n'ont pas été menées et il est donc difficile de déterminer si certains facteurs ou éléments spécifiques de l'intervention sont davantage responsables du succès.

2.6 Conclusions tirées de la recension des écrits

En résumé, plusieurs facteurs posent obstacle à l'accessibilité aux soins intensifs, mais nous avons principalement décrit l'influence de la rareté des ressources ainsi que l'inconstance des évaluations pronostiques sur la décision d'admettre un patient ou non dans une USI. Par la suite, nous avons également décrit l'impact d'une admission aux soins intensifs sur les chances de survie du patient. Cependant, la plupart des conclusions qu'il est possible de tirer de ces études sont limitées par la méthodologie utilisée. En effet, la plupart des données probantes proviennent d'études unicentriques ou d'analyses rétrospectives, ce qui engendre des biais compromettant la validité interne et externe. Par ailleurs, d'importantes variabilités dans les capacités de lits aux soins intensifs

ainsi que dans la gestion de cas similaires suggère une utilisation inappropriée (autant la sous-utilisation que la surutilisation) des ressources des soins intensifs. Malheureusement, ces études ne nous éclairent pas sur l'ampleur des bénéfices attendus des modèles de triage alternatifs dans la mesure où aucune étude ne compare le triage classique au triage régionalisé. Malgré la recension d'études en traumatologie suggérant le bien-fondé des centres de triage, la nature des cas en traumatologie fait en sorte que le triage est effectué dans la phase pré hospitalière. Par opposition, aux soins intensifs, les complications surviennent souvent pendant l'hospitalisation; le besoin de transfert se présente, dès lors, bien après la présentation initiale.

Ainsi, même si une forme de triage et de rationnement des ressources est inéluctable, et, jusqu'à un certain point, nécessaire, cela ne devrait pas se faire aux dépens des patients référés de façon appropriée et à qui on interdit un accès aux soins intensifs dont ils bénéficieraient. Nous proposons un modèle illustrant les principaux obstacles à l'accès pertinent et approprié aux soins intensifs dans un contexte québécois et les façons dont un guichet d'accès unique peut les surmonter (Fig. 2-1). Cependant, la question d'identification des patients qui bénéficieraient des soins intensifs reste entière. Notamment, nous avons cherché à déterminer comment sont définies les clientèles qui ne tirent pas avantage d'une admission aux soins intensifs et qui sont conséquemment exclues au terme du processus de triage. Ainsi, les prochaines sections de ce mémoire présentent, respectivement, la méthodologie puis les résultats de notre revue systématique qui cible cette problématique de front.

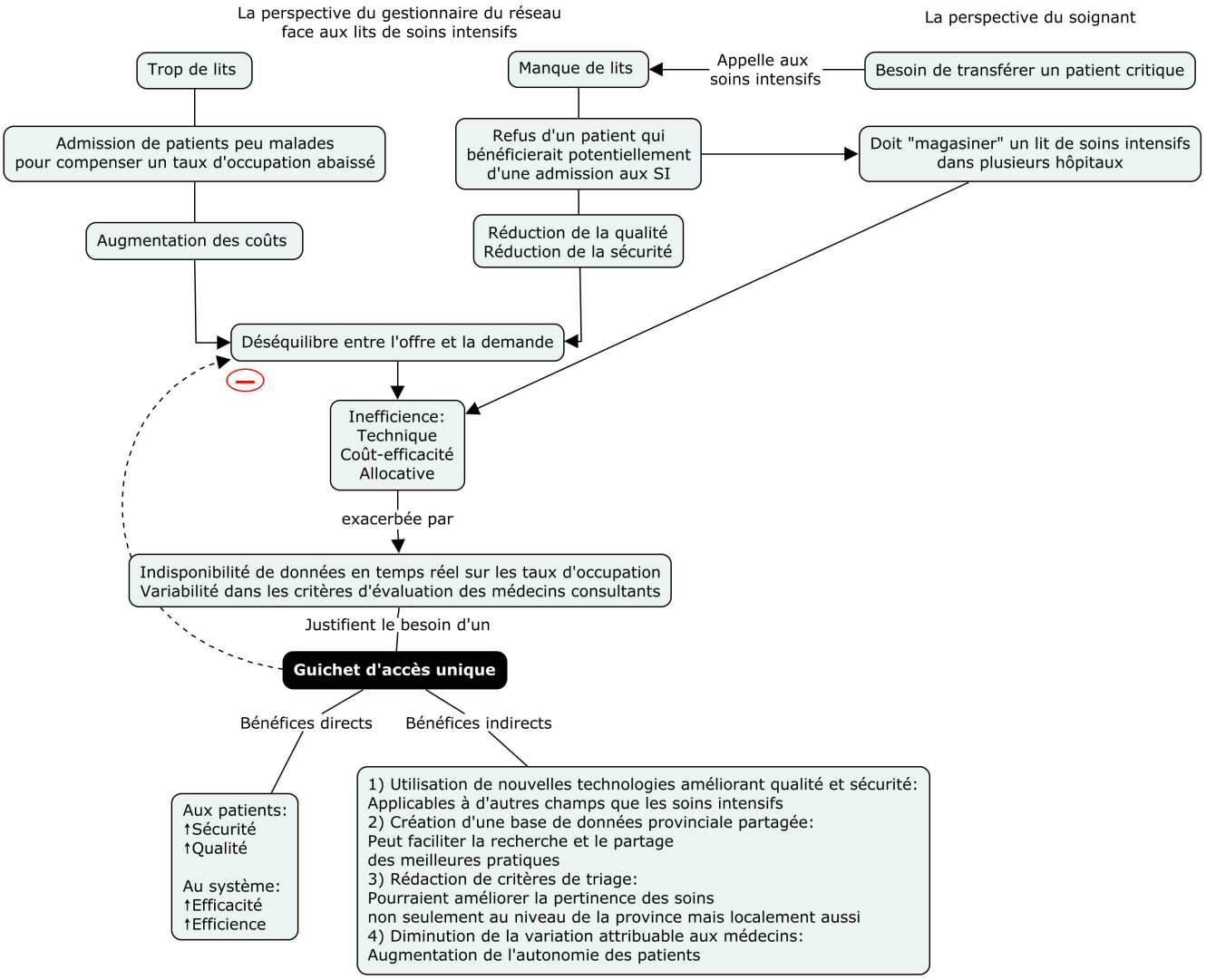


Figure 2-1. Modèle proposé présentant les problèmes systémiques actuels compromettant l'accès aux soins intensifs aux patients en phase critique et les bénéfices hypothétiques d'un guichet d'accès unique au Québec.

3. La méthodologie de la revue systématique

Nous avons réalisé une revue systématique en accord avec les lignes directrices PRISMA. La section suivante contient les descriptions pour la stratégie de recherche, les critères d'inclusion et d'exclusion, le choix des études ainsi que l'extraction et l'analyse de données.

3.1 La stratégie de recherche

Afin de maximiser la sensibilité de nos recherches, nous avons souhaité trier autant les articles décrivant le processus d'admission aux soins intensifs que ceux décrivant les interventions exclusivement faites aux soins intensifs (p. ex. oxygénation par membrane extra-corporelle, greffe pulmonaire, etc.). Le but de cette stratégie est de capter des articles qui n'ont pas comme objectif principal de décrire les critères d'exclusion, mais qui, accessoirement, en font l'énumération puisque l'admission aux soins intensifs est tacite une fois le patient qualifié pour l'intervention en question. Nous avons interrogé les bases de données *PubMed, Medline (Ovid), Embase (Ovid), EBM Reviews (Ovid), CINAHL Complete (EBSCO)* depuis leur création jusqu'au 8 novembre 2016. Pour chaque base de données, nous avons utilisé des termes du vocabulaire contrôlé (*MESH*, *EMTREE*, descripteurs *CINAHL*) ainsi que des termes libres dans les champs des titres, des résumés et des mots-clés des auteurs. Nous avons également mené une recherche dans la littérature grise en utilisant les sources suivantes : *Health Development Agency; National Guideline Clearing House*; *National Institute for Health and Clinical Excellence (NICE)*; *National Institutes of Health*; *Research Service Delivery and Organisation Programme (SDO)*; *Research Register for Social Care*; *Google Scholar* et *OpenGrey*. Nous avons limité les résultats aux articles en français et en anglais. Nous avons également manuellement scruté les références des articles retenus au terme de notre revue afin d'identifier ceux potentiellement non répertoriés par notre recherche électronique. Les termes de recherche ont été développés avec l'aide d'une bibliothécaire médicale (Annexe 1).

3.2 Les critères d'inclusion et d'exclusion

Nous avons inclus tous les articles et abrégés d'études originales (essais et études observationnelles), de lignes directrices, de résumés, d'éditoriaux et de commentaires publiés dans les journaux révisés

par les pairs. De plus, nous avons inclus des politiques locales et nationales d'allocation de ressources. Nous avons exclu les études décrivant des clientèles de pédiatrie, de traumatologie ou de maladies non critiques. Nous avons également exclu les études si les critères mentionnés étaient non discriminatoires ou s'ils n'étaient pas adoptés systématiquement et uniformément.

3.3 Le choix des études

Un seul réviseur a systématiquement révisé les résultats de la stratégie de recherche au moyen d'un tri des titres suivi d'un tri des abrégés. Tout article correspondant aux critères d'inclusion a été sélectionné pour lecture complète. Il est à noter que tous les articles n'ayant pas d'abrégés ont automatiquement fait l'objet d'une lecture complète.

3.4 L'extraction et l'analyse de données

Nous avons procédé à l'extraction de données et les avons colligées dans une base de données que nous avons développée sur *Excel* (*Microsoft*, Seattle, Washington). Nous avons recueilli les informations relatives au type d'article, la méthodologie utilisée (s'il y a lieu), l'année de publication, le pays d'origine ainsi que le mécanisme de triage et/ou de transport. Nous avons également relevé si les critères étaient applicables à des conditions ou clientèles spécifiques et s'ils étaient proposés ou en cours d'utilisation. Étant donné l'hétérogénéité des articles, nous avons développé une échelle d'appréciation comportant trois niveaux de qualité : le premier niveau englobe les études randomisées contrôlées, les lignes directrices de sociétés savantes et les politiques nationales; le deuxième niveau est attribué aux études observationnelles multicentriques ainsi qu'aux revues rigoureuses; finalement, on retrouve les études monocentriques, les éditoriaux et les commentaires ne citant pas de données probantes ainsi que les autres articles comportant des failles méthodologiques dans le troisième et dernier niveau de qualité. Il est à noter que certaines exceptions à cette classification ont été accordées à certains articles qui, avec le temps, sont devenus des articles influents et hautement référencés dans le domaine. Afin de permettre l'appréciation de la valeur des critères extraits, nous avons élaboré un score de robustesse qui est un produit du nombre d'études citant chaque critère ainsi que leur qualité. Ainsi, le score de robustesse tel que nous l'avons élaboré se définit comme suit : Score de robustesse = $(n_{L1} \times F_{L1})+(n_{L2} \times F_{L2})+(n_{L3} \times F_{L3})$, où n= nombre d'études; F =facteur; L1= premier niveau de qualité; L2= deuxième niveau de

qualité; L3 = troisième niveau de qualité. Les premiers, deuxièmes et troisièmes niveaux de qualité se sont vus accorder un facteur de 2 points, 1 point et 0.25 point respectivement. Au terme de ce calcul, nous avons fait correspondre une preuve qualifiée de solide aux critères dont le score de robustesse était supérieur à deux déviations standards au-dessus de la moyenne. Les critères dont le score était supérieur à la moyenne mais insuffisant pour se qualifier de preuve solide ont vu leur preuve qualifiée de moyennement solide. Les autres critères ont été classées comme ayant un faible niveau de preuve. Pour chaque critère de triage extrait, nous avons également évalué s'il correspondait à l'un ou l'autre des cinq critères de qualité suivants : spécifique, scientifique (c.-à-d. fondé sur les données probantes), mesurable, implantable et utilisable.(52, 53) Finalement, chaque article retenu a été évalué pour en extraire des thèmes génériques. Nous avons ensuite pu classifier chacun des critères de triage parmi l'un des quatre thèmes identifiés :

1) les critères propres au patient;
2) les critères propres à la condition médicale;
3) les critères propres au médecin;
4) les critères propres au contexte.

Les critères propres au contexte sont ceux qui ne doivent être utilisés que lors de circonstances particulières (p. ex. temps de la journée, endroit, ou pénuries ponctuelles).

3.5 La rédaction

Nous avons publié le protocole de notre revue systématique sur PROSPERO (CRD42016047239). Nous avons également suivi les lignes directrices PRISMA pour la conformité des présentations de résultats de revues systématiques, telles qu'adaptées à notre étude.

4. La revue systématique

Authors: Joseph Dahine, Paul Hébert, Réjean Hébert, Daniela Ziegler, Nicolay Ferrari.
Title: Practices in triage and transfer of critically ill patients: a qualitative systematic review of selection criteria.

Introduction

The decision to admit a patient to the Intensive Care Unit (ICU) is the result of a complex process in which several human and logistic factors intertwine. Resource availability, patient characteristics and physician assessment' variability all contribute to patients' outcome uncertainty. (2) A lack of a standardized process to evaluate patient referrals and optimize resource allocation accentuates those differences leading to several critically ill patients being prevented access to ICU resources, which directly impacts their prognosis.(3, 14, 15)

Triage centers, or the process of regionalization, can potentially help solve these issues. It involves access to a larger pool of resources provided by members of a network and allocation, as appropriate, according to the needs of each individual patient triaged.(5) Drawing from the trauma literature, where implementation of organized and coordinated triage systems was shown to decrease mortality(7) and reduce time-consuming inter-hospital transfers(8), several groups have proposed that similar structures could be beneficial to critical care patients.(9, 10) However, despite two decades of advocacy(47), only few initiatives were developed.

In the Province of Quebec (Canada), such a proposition has garnered the interest of policymakers and clinicians alike.(1) However, there is currently a lack of universally agreed specific recommendations as to the triage criteria that should be used outside of the trauma population for ICU transport and admission. Namely, recommendations are especially vague when it comes to describing circumstances where the triage should result in the withholding of critical care resources. Therefore, the purpose of this review was to systematically identify and appraise the published literature that defined criteria under which ICU admissions (triage and transport) should be withheld or not prioritized.

Methods:

Search strategy:

In order to capture the broadest scope of articles, we aimed to include articles pertaining to critical care triage for admission to the unit or for interventions that mandatorily require critical care admission (e.g. Extracorporeal membrane oxygenation (ECMO), heart or lung transplant, etc.) We searched PubMed, Medline (Ovid), Embase (Ovid), EBM Reviews (Ovid), CINAHL Complete (EBSCO) using relevant keywords from inception to November 8th, 2016. For each database we used terms from controlled vocabulary (MESH, EMTREE, CINAHL Headings) and also performed a free text searching in title, abstract and author keywords fields. A grey literature search was also executed in the following sources: Health Development Agency; National Guideline Clearing House; National Institute for Health and Clinical Excellence (NICE); National Institutes of Health; Research Service Delivery and Organisation Programme (SDO); Research Register for Social Care; Google Scholar and OpenGrey. We limited our search to English and French languages. We also manually searched the reference lists of all articles remaining at the full-text review step for any potentially relevant article missed by our electronic searches.

Inclusion and Excluded Criteria:

We sought all articles and abstracts of original research, such as trials and observational studies, guidelines, reviews, editorials and commentaries published in peer-reviewed journals which listed criteria for ICU admission. Moreover, we sought to include local, provincial and/or national policies on the topic of ICU resource allocation. We excluded studies whose population of interest was neonatal, pediatric, trauma or non-critically ill. Furthermore, we excluded studies if the ICU selection criteria did not permit to discriminate between ICU candidates or if they did not reflect systematic practice.

Study Identification and Selection

After removal of duplicates, one reviewer systematically reviewed the results and performed a title screen. All potentially relevant records, as well as those that did not contain enough information to determine eligibility, were retained for abstract screening. We went on to perform an abstract screen and retained all records that met inclusion criteria for full-text review. If no abstract was available, the citation was automatically selected for full-text review.

Data Extraction and Analysis

Data extraction was completed by one team member. Data were collected on an electronically prepared Excel-based data collection tool (Microsoft Corp, Seattle, Washington). Information extracted were the type of article and study design when applicable, year and country of publication, mechanism and setting of the triage and/or transport process, including whether it was condition-specific, and whether the criteria were proposed or currently in use. Given the heterogeneity of the studies, we developed a 3-level appraisal scale to allow quality grading: Level 1: randomized controlled trials, society guidelines and national policies; Level 2: rigorous reviews and multicenter observational studies; and Level 3: single center studies, editorials/commentaries where criteria are not backed up by evidence and other articles with methodological flaws. Of note, certain exceptions, where papers that became highly cited references with time, were assigned a higher level. In order to appraise the strength of the triage and transport criteria, we developed a robustness score which factors the number of studies listing each criteria as well as their quality (Robustness score (RS) = $(n_{L1} \times F_{L1})+(n_{L2} \times F_{L2})+(n_{L3} \times F_{L3})$, where n= number of studies; F =factor; L1= level 1 quality (highest); L2= level 2 quality; L3 = level 3 quality (lowest)). Level 1, 2 and 3 quality studies were given a factor of 2 points, 1 point and 0.25 point respectively. Deriving from this score, we classified the robustness of the evidence supporting all criteria within one of three categories: strongly robust evidence (defined as greater than two standard deviations from the average Robustness score), averagely robust evidence (above average RS but less than 2 standard deviations) and weakly robust evidence (below average RS). In addition, we assessed whether extracted criteria met the following criteria: specific, scientifically-sound, measurable, feasible to implement and usable.(52, 53) (Supplementary Appendix 4-2 – 4-5). Finally, all articles were evaluated by identifying key themes. Criteria were grouped by theme and classified as patient, condition, physician or context related.

Context related criteria are those criteria that are to be triggered only under specific circumstances. For example, they may pertain to time, location or resource shortages.

Reporting Guidelines

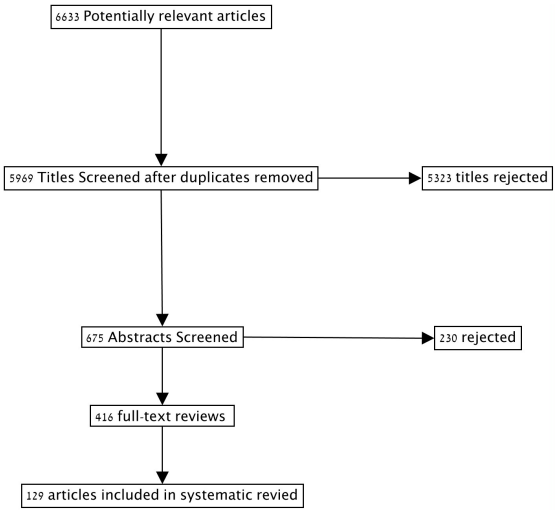
We published our review protocol on PROSPERO (CRD42016047239). We also followed the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guideline as applicable to this study's design.(54)

Results

Eligible studies

The literature search identified 5818 unique articles. Review of titles and abstracts resulted in the retrieval of 416 potentially full-text articles. Manual search of the reference lists of these articles led to 29 further full-text reviews. Of these, we identified 129 articles that met inclusion criteria and were included in this review (Fig. 4-1)

Figure 4-1. Flow Diagram of Studies Identified and Included in the Systematic Review



Characteristics of studies

Table 4-1 summarizes the characteristics of the articles. All articles were in English except for 5 written in French (3.8%). Most articles were original research studies (n=44, 34%) of which the vast

majority were cohort studies (n=31, 70%). Of note, no randomized controlled trials were identified. Pertaining to triage criteria, 62 articles (48%) were specific to certain patient populations or situations. Most articles described a triage process which relied on complete exclusion from ICU admission (n=91, 70.5%) rather than a prioritization process (n=22, 17%) whereas a few more articles described a combination of both. About a third of identified articles listed criteria that addressed more than one theme (n=48, 37%). The most common theme for triage criteria was condition related (n=63, 48.8%) followed by patient related criteria (n=48, 37%).

Table 4-1. Characteristics of studies included in review (n = 129 articles)

Characteristics	Articles n (%)
Type of article	
Original research	44 (34)
• Cohort study	31 (24)
• Systematic review	1 (1)
• Non-Randomized Control Trial with contemporaneous controls	1 (1)
• Series of consecutive cases	2 (2)
• Policy analysis	1 (1)
• Qualitative study	1 (1)
• Other original research	7 (5)
Policy/Guideline	33 (26)
Editorial/Commentary	19 (15)
Review	27 (21)
Other	6 (5)
Country of Origin	
United States of America	56 (43)
France	21 (16)
United Kingdom	13 (10)
Canada	7 (5)
Rest of Europe	12 (9)
Asian countries	12 (9)
Other	8 (6)
Language of publication	
English	124 (96)
French	5 (4)

Year of publication	
1970-1979	1 (1)
1980-1989	5 (4)
1990-1999	23 (18)
2000-2009	36 (28)
2010-2016	64 (50)
Type of process	
Triage	124 (96)
Transport	3 (2)
Both	2 (2)
Process type	
Complete exclusion	91 (71)
Prioritization/waiting lists	22 (17)
Both	12 (9)
Other	4 (3)
Themes	
Patient-related	48 (37)
Condition-related	63 (49)
Physician-related	45 (35)
Context-related	37 (29)

Triage and Transport Criteria

A total of 200 unique triage and transport criteria were extracted from the 129 articles. Only 5 articles (4%) discussed transport criteria. Triage and transport criteria are listed in Table 4-2. As mentioned previously, we grouped identified criteria under four themes. Where possible, synonymous criteria were grouped unless it was felt that the differences in terminology evocated significant clinically relevant nuances. Condition related criteria consisted in the most diverse and populous theme.

Table 4-2. Triage and Transport Criteria for ICU admission

Theme/ Category	Specific Criteria	Specific patient population	Citations	**Robustness score**
Patient				
Age	Advanced age	Severe cirrhosis[55],ECMO[56]	(16, 55-57)	2.5*
	Late 70s early 80s		(58)	0.25*

	≥65y	Lung transplant	(59)	2*
	≥70y	ECMO	(60)	2*
Age and functional status	Elderly failing to thrive	Oncology[61]	(61, 62)	3*
Age and prognosis	"Too ill, too old"		(63)	0.25*
Agitation	Aggressive or agitated patient (CI to air ambulance)	Burns	(64)	0.25*
Functional Status	Poor functional status	Lung transplant[59],Oncology[65], H1N1 ECMO[66]	(59, 65-67)	3.5**
	Bedridden	Oncology[61, 68-70]	(61, 68-71)	2.75*
	ECOG performance status 3 or 4	Lung Cancer	(72, 73)	2*
	Dependency		(57, 74)	2*
Patient preference	Patients or families who decline intensive care or some of its components (e.g. mechanical ventilation, DNR, etc.)	Oncology[68, 70],Lung Cancer[73], E-CPR[75], CAP(76), Age>80y[77], Hem-Onc(78, 79)	(2, 44, 62, 65, 68, 70, 73, 75-96)	26.25***
Social support	Absence of a consistent or reliable social support system (CI to lung transplant)	Lung transplant	(59)	2*
Technical	BMI≥30	Lung transplant	(59)	2*
	BMI≥45	ECMO	(97)	1*
	Limited ability to receive blood products	ECMO	(97)	1*
	Limited vascular access	ECMO	(97)	1*
	Weight≥150 kg	ECMO	(60)	2*
Condition				
Comorbidities	Brain injury or CNS deficit	ECMO[56, 60, 97], E-CPR[75]	(56, 60, 75, 97)	4.25**
	CNS hemorrhage	ECMO	(56, 98)	0.5*
	Colonization with highly resistant or highly virulent bacteria, fungi or mycobacteria	Lung transplant	(59)	2*
	Contraindication to use of anticoagulant therapy	ECMO[60, 97], H1N1ECMO[66]	(60, 66, 97)	4**
	Documented nonadherence or inability to follow through with medical therapy or office follow-up or both	Lung transplant	(59)	2*

	Excessive/irreversible comorbidities	CAP[76], ECMO[97, 99]	(76, 97, 99, 100)	3.5**
	Hepatitis B, C and HIV	Lung transplant	(59)	2*
	Intubation longer than 10 days, intracranial pathology, and vascular access issues	Lung transplant	(59)	2*
	Major immunosuppression	ECMO	(56, 60, 97, 98)	3.5**
	Malignancy in the past 2 years	Lung transplant	(59)	2*
	Metastatic/terminal malignancy	ECMO[56, 101], H1N1ECMO[66], E-CPR[75]	(56, 66, 75, 101)	2.5*
	Moribund ASA-V patients	Surgery	(102)	0.25*
	Multiple organ failure	ECMO[60], Bridge to lung transplant on ECMO[103]	(60, 62, 84, 95, 103, 104)	7.25**
	Not a lung transplant candidate	ECMO	(60, 101)	2.25*
	Severe or symptomatic osteoporosis	Lung transplant	(59)	2*
	Significant chest wall/spinal deformity	Lung transplant	(59)	2*
	Substance addiction (e.g. alcohol, tobacco, or narcotics) that is either active or within the last 6 months	Lung transplant	(59)	2*
	Unknown mental status after cardiac arrest	ECMO	(101)	0.25*
	Untreatable advanced dysfunction of another organ system	Lung transplant	(59)	2*
	Untreatable psychiatric or psychologic condition associated with the inability to cooperate or comply with medical therapy	Lung transplant	(59)	2*
Comorbidities and functional status	Decompensated comorbidities with severe dependency or advanced comorbidities with partial, severe dependency or prognosis of death		(74)	1*
Diagnosis	3 or more organ failure in the elderly		(90)	1*

	3rd line of chemotherapy or beyond	Lung Cancer	(73)	1*
	Absence of severity criteria		(45, 105)	1.25*
	Acute respiratory disease and GVHD	Allogenic BMT	(106)	1*
	Acute respiratory failure after BMT		(107)	0.25*
	Another unit more appropriate		(108)	1*
	Aortic dissection	E-CPR	(75)	1*
	ARDS not severe enough to meet inclusion criteria (CI to ECMO)	ECMO	(60)	2*
	Arrest and uncontrolled bleeding	E-CPR	(75)	1*
	Arrest of septic origin	E-CPR	(75)	1*
	Brain death who are not donors		(62, 84, 93, 95, 109)	7.25**
	Brain herniation	Age>80y	(110)	1*
	Burned surface area >60%	Burns	(111)	0.25*
	Child Pugh C	Cirrhosis	(112)	1*
	CNS catastrophe	ECMO[60]	(60, 62, 84, 95, 104)	6.25**
	Conditions incompatible with a normal life if patient recovers	ECMO[99]	(99)	2*
	CPR > 60 minutes	E-CPR	(113)	0.25*
	Critical or unstable clinical condition	Lung transplant[59], Bridge to lung transplant on ECMO[103]	(59, 103)	3*
	Death within 3 hours of intubation	ECMO	(60)	2*
	Deeply comatose patients with a low probability of a favorable outcome	Stroke	(114)	0.25*
	End-stage dementia		(115)	0.25*
	HIV		(104, 105)	0.5*
	Intracranial hemorrhage	H1N1ECMO[66], E-CPR[75]	(66, 75)	2*
	Irreversible organ failure	E-CPR	(75)	1*
	Mechanical ventilation	Lung transplant	(59)	2*
	Mechanical ventilation on high settings >7 days	ECMO[56, 60, 97], H1N1ECMO[66]	(56, 60, 66, 97)	4.25**

	No further oncological treatment options	Oncology[61, 68-70, 116], Hem-Onc[78, 117], Surgery[102]	(61, 62, 68-70, 78, 84, 95, 102, 104, 116, 117)	11.25**
	No transplantation plan		(55)	0.25*
	NSTE ACS		(118)	2*
	Persistent vegetative state		(62, 84, 90, 93, 95, 115, 119, 120)	9.5**
	Rapidly progressing fatal illness		(109, 121)	0.5*
	Severe peripheral arterial disease	E-CPR	(75)	1*
	Severe sepsis	Allogenic BMT[106], Bridge to lung transplant on ECMO[103]	(103, 106)	2*
	Subdural hemorrhage less than 10 cm^3	Traumatic SDH	(122)	1*
	Terminal diagnosis	Oncology[71], Hem-Onc[79], Surgery[102]	(62, 67, 71, 79, 84, 102, 123, 124)	8*
	Uncontrolled GVHD	Allogenic BMT	(61)	1*
	Unresponsive and progressive end-stage condition (e.g. GVHD, pulmonary failure)	Hem-Onc	(117)	1*
diagnosis and comorbidities	Absence of intraoperative complications, complex aneurysm morphology, or severe medical comorbidities	Neuroradiological procedures	(125)	0.25*
	Absence of ongoing bleed and unstable comorbidities	Acute GI bleed	(126)	0.25*
	ASA≤3 + APACHE II ≤12 + <2 packed red blood cells	Radical cystectomy	(127)	0.25*
	Deterioration of nutritional status while on ECMO	Bridge to lung transplant on ECMO	(103)	1*
	EF>40%, transfemoral access, absence of severe pulmonary disease, stable hemodynamic state and absence of	TAVI	(128)	1*

	complications occurring until 2 hours after the procedure			
	Excessive bleeding and transfusion requirements while on ECLS	Bridge to lung transplant on ECMO	(103)	1*
	Extended period of immobility and deconditioning	Bridge to lung transplant on ECMO	(103)	1*
Diagnosis and cost	Economic appropriateness model		(129)	1*
Diagnosis and functional status	Failure to thrive due to chronic illness		(84)	2*
	Poor performance status and unsuitable for life-prolonging therapy	Hem-Onc	(79)	2*
Diagnosis and utility	Medical appropriateness model		(129)	1*
Nutritional status	Major malnutrition	Lung Cancer	(73)	1*
Prioritization	In-house medical and surgical emergencies		(130)	1*
	Critically ill patients in the emergency departments		(130)	1*
	Patients considered to be in a priority program, specifically neurosciences, transplantation, oncology, cardiovascular diseases, and the patient ambulatory care program		(130)	1*
	Patients referred from another institution who require urgent management only available at, or specifically suited to, the expertise offered at the hospital intensive care units		(130)	1*
	All other patients		(130)	1*
Scoring	2 step score		(131)	2*
	admit APACHE III <30		(132)	0.25*
	APACHE II > 24		(133)	0.25*
	ASA>3 + P-POSSUM Total >35	Surgery	(134)	1*
	GRACE 2.0 <190	STEMI	(135)	0.25*
	Logic dysfunction score ≥4	Lung Cancer	(73)	1*

	MELD >30 and ACLF ≥3	Cirrhosis	(112)	1*
	PARS score	Total joint arthroplasty	(136)	1*
	SOFA ≥10.5 or SAPS 2 ≥47.5		(55)	0.25*
Technical	Diagnostic and therapeutic procedures such as bronchoscopy and endoscopy		(104)	0.25*
	Monitoring only		(123)	1*
	Required nursing intensity 1:3		(104)	0.25*
Physician				
Physician evaluation	More data required for a decision		(108)	1*
Prognosis	Intuitive prognosis of death		(74, 91, 94, 95, 100)	4.5**
	Moribund patients with no possibility of recovery		(81, 90, 92, 96, 105, 137)	4.75**
	Likelihood of benefit		(3, 84, 93, 95, 105, 107, 109, 138)	7**
	Too well	Age>80y[77]	(3, 16, 57, 63, 67, 77, 82, 87-89, 95, 100, 139-147)	12.5**
	Too sick	Age>80y[77]	(3, 16, 57, 63, 77, 82, 88, 139-141, 143-148)	12**
	Irreversible clinical setting		(142, 149, 150)	0.75*
	Medical futility		(2, 85, 91, 138, 147, 151)	4.75**
	Successful treatment would not be of overall benefit to the patient	CAP[76]	(76, 107)	0.5*
	Strong likelihood of dependency or cognitive impairment if discharged alive		(57)	1*
	Good prognosis		(62, 108)	3*

	Bad prognosis		(62, 108)	3*
	No hope of recovering to an acceptable quality of life		(89, 95, 152)	2.25*
	Patient would never leave the ICU		(90)	1*
Context				
Bed availability	Full unit: do not admit additional patients	Surgery[102]	(16, 45, 82, 88, 102, 108, 153)	6.25**
Burn disasters	American Burn Association ratio-to-benefit grid	burns	(154, 155)	3*
Epidemics and pandemics (including influenza) or other mass disasters	**AGILITIES score >100**		(156)	1*
	SOFA score		(157, 158)	2*
	>11	Pregnancy[159]	(147, 151, 159-168)	14.5***
	>15		(169, 170)	4**
	>5 for 5 days		(169, 170)	4**
	Other scores			
	Combination of SOFA, age and comorbidities		(171)	1*
	Burns			
	Any two of: >60yo, >40% TBA, inhalational injury	Pregnancy[159]	(147, 151, 159, 160, 162-167, 169, 170)	17.25***
	Predicted mortality>90%		(172)	2*
	Cardiac arrest	Pregnancy[159]	(159, 168, 173)	4**
	Any of: unwitnessed cardiac arrest, witnessed cardiac arrest not responsive to electrical therapy, recurrent cardiac arrest		(147, 151, 160, 162-167, 169, 170, 172)	18.25***
	Non-VF arrest		(161)	0.25*

	Severe baseline cognitive impairment		(147, 151, 160, 164, 165, 167, 169, 170)	11.25**
	Dependent in ADLs or institutionalized due to cognitive impairment	Pregnancy[159]	(147, 159, 162, 163)	6**
	Advanced untreatable neuromuscular disease	Pregnancy[159]	(147, 151, 159, 160, 162-165, 167, 169, 170)	16.25***
	Malignant disease			
	Metastatic	Pregnancy[159]	(147, 151, 159, 160, 162-167, 169, 170, 172-174)	22.25***
	Hematologic malignancy with poor prognosis		(172)	2*
	Advanced and irreversible neurologic event or condition	Pregnancy[159]	(147, 151, 159, 160, 162-170, 173, 174)	21.25***
	Severe anoxic brain injury post cardiac arrest		(172)	2*
	Massive stroke		(172)	2*
	End-stage organ failure			
	Heart:			
	NYHA III or IV	Pregnancy[159]	(147, 159, 162-167, 169, 170, 172)	16.25***
	EF <25%		(173, 174)	3*
	Persistent ischemia unresponsive to therapy + pulmonary edema		(173, 174)	3*
	Lung			

	COPD <25% or PaO_2<55mmHg or secondary PHTN or on home O_2[159]	Pregnancy[159]	(147, 151, 159, 160, 162-167, 169, 170)	17.25***
	Cystic fibrosis with post bronchodilator FEV_1<30% or baseline PaO_2<55mmHg	Pregnancy[159]	(147, 151, 159, 160, 162-165, 167, 169, 170)	16.25***
	Pulmonary fibrosis with VC or TLC <60% predicted or PaO_2<55mmhg or secondary pulmonary hypertension	Pregnancy[159]	(147, 151, 159, 160, 162-165, 167, 169, 170)	16.25***
	Primary pulmonary hypertension with NYHA class III or IV heart failure, right atrial pressure >10mmHg or mean PAP >50mmHg	Pregnancy[159]	(147, 151, 159, 160, 162-165, 167, 169, 170, 173)	18.25***
	Severe chronic lung disease[172] requiring continuous home oxygen		(163, 172-174)	7**
	High pressure, high FiO_2, positive pressure ventilation > 1 week		(173)	2*
	PaO_2<55mmHg or secondary pulmonary hypertension		(163)	2*
	Liver			
	Child-Pugh score ≥ 7	Pregnancy[159]	(147, 151, 159, 160, 162-165, 167, 169, 170)	16.25***
	Cirrhosis with ascites, history of variceal bleeding, fixed coagulopathy or encephalopathy		(173, 174)	3*
	Acute hepatic failure[159] with hyperammonemia	Pregnancy[159]	(159, 173, 174)	4**
	MELD >20		(166, 172)	3*
	Renal			
	Acute renal failure requiring hemodialysis	Pregnancy[159]	(159, 166, 173, 174)	5**
	Multiple organs involved		(173)	2*
	≥6 organ failures		(169, 170)	4**

	Respiratory failure requiring intubation with persistent hypotension unresponsive to adequate fluid resuscitation and signs of additional end-organ dysfunction		(173, 174)	3*
	≥4 organs failure		(173, 174)	3*
	Elective palliative surgery		(147, 151, 160, 162-165, 167, 169, 170)	15.25***
	Age			
	>65 years old		(173)	2*
	>85 years old		(147, 151, 160, 164, 165, 167, 169, 170)	11.25**
	Very advanced age		(172)	2*
	Prognosis		(158, 164, 173)	4**
	Patients who are too well		(162)	2*
	Epidemic-specific epidemiological or SOFA scores data associated with poor prognosis		(173, 174)	3*
	Short-term survival	Haiti earthquake	(175)	0.25*
	Long-term survival	Haiti earthquake	(175)	0.25*
	Life expectancy ≤6 months		(168)	1*
	Life expectancy ≤1 year		(172)	2*
	Severe life-limiting disease		(161)	0.25*
	Other			
	Failure to respond to mechanical ventilation and antibiotics after 72h		(173, 174)	3*
	Immunodeficiency (AIDS[172-174], end-stage renal disease[159], post-organ transplant requiring immunosuppressive therapy[159] or other diseases leading to opportunistic pathogens susceptibility[173, 174]) with	Pregnancy[159]	(159, 163, 172-174)	8**

	respiratory failure requiring intubation[173, 174]			
	Patient's role in society	Haiti earthquake	(175)	0.25*
	Dependents	Haiti earthquake	(175)	0.25*
	Potential for saving or harming others	Haiti earthquake	(175)	0.25*
	Shared life experiences	Haiti earthquake	(175)	0.25*
	Empathy	Haiti earthquake	(175)	0.25*
	Perceived quality of life	Haiti earthquake	(175)	0.25*
	First come first serve		(176)	1*
	Random allocation		(176)	1*
	Multiplier effect		(157, 164)	2*
	Healthcare personnel		(157, 164, 173)	4**
	Caregivers of children		(157, 164)	2*
	Fair-Innings/life-cycle		(157, 164)	2*
	Patient preference to decline treatment		(173)	2*
	Weight >120kg		(173)	2*
	Severe aortic valve regurgitation		(173)	2*
	Aortic dissection		(173)	2*
	Severe peripheral vascular disease		(173)	2*
	Duration of need (predicted >7days of MV)		(158)	1*
Lack of resources	Triage as per justice[85], utilitarian or egalitarian principles		(2, 85)	1.25*
	Triage as per 5 categories: 1. Reasonable chance of recovery and ICU mandatory; 2. Monitoring and high risk of life-threatening complication; 3. Comatose patients with poor expected outcome; 4. Futility 5. Monitoring and low risk of life-threatening complication		(177)	1*
	Age + reversibility of condition		(178)	1*
	Poor prognosis		(178)	1*

	DNR		(178)	1*
	Alzheimer's disease		(178)	1*
	Equipment failure	Surgery	(102)	0.25*
Local policies	Futility		(90)	1*
Weather	Unsuitable flying conditions	Burns	(64)	0.25*

***: strongly robust evidence supporting criteria; **averagely robust evidence supporting criteria; *weakly robust evidence supporting criteria

ACLF: Acute on Chronic Liver Failure; ADL: Activities of daily living; AGILITIES: Age Glasgow coma score Infusion Lung Intervention Tests Informal Excessive weight Subtract; ASA: American Society of Anesthesiologists; BMI: Body Mass Index; APACHE: Acute Physiology And Chronic Health Evaluation; BMT: Bone Marrow Transplant ; CAP: Community Acquired Pneumonia; CNS: Central Nervous System; COPD: Chronic Obstructive Pulmonary Disease; DNR: Do not resuscitate; ECLSL Extracorporeal life support; ECMO: Extracorporeal Membrane Oxygenation; E-CPR: ECMO-Cardiopulmonary Resuscitation; ECOG: Eastern Cooperative Oncology Group; EF: Ejection Fraction; FEV_1: Forced Expiratory Volume in one second; GRACE: Global Registry of Acute Coronary Events; GVHD: Graft vs. Host Disease; Hem-Onc: Hematological Oncology; HIV: human immunodeficiency virus; MELD: Model for End-Stage Liver Disease; MV: Mechanical ventilation; NSTE ACS: Non-ST Elevation Acute coronary syndrome; NYHA: New-York Heart Association; PaO_2: Partial Pressure of Oxygen; PAP: Pulmonary artery pressure; PHTN: Pulmonary Hypertension; PARS: Post Anesthesia recovery score; P-POSSUM: Portsmouth Physiological and Operative Severity Score for the enumeration of Mortality and morbidity; SAPS: Simplified acute physiology score; SDH: Subdural Hematoma; SOFA: Sequential organ failure assessment; TAVI: Transcatheter aortic valve implantation; TBA: Total body area; TLC: Total Lung Capacity; VC: Vital Capacity; VF: Ventricular Fibrillation; y: years

Table 4-3. Criteria achieving the highest Robustness Score (top 10%)

Rank	*Theme*/ Category	Specific Criteria	Robustness score
1	***Patient*/**Patient preference	Patients or families who decline intensive care or some of its components (e.g. mechanical ventilation, DNR, etc.)	26.25
2	***Context***/Epidemics	Metastatic malignant disease	22.25
3	***Context***/Epidemics	Advanced and irreversible neurologic event or condition	21.25
4	***Context***/Epidemics	If cardiac arrest: Any of: unwitnessed cardiac arrest, witnessed cardiac arrest not responsive to electrical therapy, recurrent cardiac arrest	18.25
5	***Context***/Epidemics	End-stage lung failure: Primary pulmonary hypertension with NYHA class III or IV heart	18.25

		failure, right atrial pressure >10mmHg or mean PAP >50mmHg	
6	***Context***/Epidemics	If burn injury: Any two of: >60yo, >40% TBA, inhalational injury	17.25
7	***Context***/Epidemics	End-stage lung failure: COPD <25% or PaO_2<55mmHg or secondary PHTN or on home O_2[159]	17.25
8	***Context***/Epidemics	Advanced untreatable neuromuscular disease	16.25
9	***Context***/Epidemics	End-stage heart failure: NYHA III or IV	16.25
10	***Context***/Epidemics	End-stage lung failure: Cystic fibrosis with post bronchodilator FEV_1<30% or baseline PaO_2<55mmHg	16.25
11	***Context***/Epidemics	End-stage lung failure: Pulmonary fibrosis with VC or TLC <60% predicted or PaO_2<55mmhg or secondary pulmonary hypertension	16.25
12	***Context***/Epidemics	End-stage liver failure: Child-Pugh score ≥ 7	16.25
13	***Context***/Epidemics	Elective palliative surgery	15.25
14	***Context***/Epidemics	SOFA score >11	14.5
15	***Physician***/Prognosis	Too well	12.5
16	***Physician***/Prognosis	Too sick	12
17	***Condition***/Diagnosis	No further oncological treatment options	11.25
18	***Context***/Epidemics	Severe baseline cognitive impairment	11.25
19	***Context***/Epidemics	Age > 85 years old	11.25
20	***Condition***/Diagnosis	Persistent vegetative state	9.5

COPD: Chronic Obstructive Pulmonary Disease; DNR: Do not resuscitate; FEV_1: Forced Expiratory Volume in one second; NYHA: New-York Heart Association; PaO_2: Partial Pressure of Oxygen; PAP: Pulmonary artery pressure; SOFA: Sequential organ failure assessment; TBA: Total body area; TLC: Total Lung Capacity; VC: Vital Capacity; yo: years old

Analysis for patient related criteria yielded 8 categories and 18 unique criteria stemming from 48 citations. Patient preference was the most common reason cited to exclude patients from ICU

admission (n=29, 60,4%). Articles citing functional status (n=13, 27%) and age to exclude patients were also common (n=7, 14.6%), but only 2 citations used a specific age cutoff. Social support and technical considerations were found, but related to specific interventions (transplant or ECMO).

We found 63 articles that contained at least one condition-related criteria. Analysis yielded 11 categories and 87 unique criteria of which most related to comorbidities or diagnosis (n=69). The most common criteria cited for ICU refusal was when no further oncological treatment options were available (n=12) followed by persistent vegetative state and terminal diagnosis (n=8). The majority of criteria had only one citation supporting it (n=67). Thirteen articles pertained to a prioritization process but only one article described a prioritization that was exclusively condition-related (130).

A total of 45 articles addressed physician-related criteria. Only two categories were extracted from this theme: prognosis and physician evaluation. All articles contained a criterion attributable to prognosis, although one article also listed incomplete physician evaluation as a reason to deny ICU admission. Within the prognosis category, 14 unique criteria were found. Most citations were encompassed by two criteria: patients who were judged by the physician to either be too well (n=20) or too sick (n=15). Fifteen citations used a prioritization scheme rather than exclusion.

Finally, analysis for context-related criteria yielded 6 categories and 81 unique criteria stemming from 37 articles. Citations citing metastatic malignant disease (n= 14), advanced and irreversible neurological disease (n=13) and SOFA (Sequential Organ Failure Assessment) Score> 11 (n=11) led to these three criteria being the most common within this theme. The most populous category is that of epidemics and pandemics (including influenza) or other mass disasters (24 citations, 65.9%). Within this category, we further divided the data into 19 themes and 70 criteria. Several subthemes pertained to clinical conditions (n=13 criteria, 68.4%) while the balance pertained to age (n=1, 5.3%) or other forms of prognostication (n=4, 21.1%). Within the context related criteria, only 7 studies were published prior to 2006 and none addressed pandemics or other large-scale disasters. Other relevant categories pertained to bed availability (n=7 citations, 18.9%) or other lack of resources (n=5, 13.5%). Moreover, only one study specifically pertained to transport criteria and related to unsuitable flying conditions.

Developing and ranking criteria per our Robustness Scale provided further insight. We extracted the top 10% most robust criteria for a total of 20 criteria (Table 4-3). While the most robust criteria related to patient preference (i.e. avoiding admission of patients or families who decline intensive care), 75% of those triage criteria pertained to epidemics, which falls under the context theme.

The overlap between context and the three other themes was further analyzed. All but 5 of the 81 context criteria (Table 4-2 in red) were not akin to being classified under patient, condition or physician related criteria. Furthermore, the terminology used for context related criteria tended to be more specific as 66% of criteria were measurable as opposed to patient (51.6%) or condition (44.8%) related. None of the physician related criteria were measurable (Supplementary appendix 4-4). Moreover, we analyzed the data across geographic regions using the 3 most commonly cited criteria for each theme (Table 4-4). This analysis generally showed international consistency.

Discussion

The objective of this systematic review was to identify published criteria about recommended or used criteria for the triage or transport of patients to a critical care facility. We identified 200 unique criteria, stemming from 129 articles and 23 countries depicting a wide variety of ICU organizational models. Yet, despite an ICU exclusion mechanism identified in 71% of the articles, several cited exclusion criteria do not meet minimal standards of a good criteria as was previously defined (Appendix 4-2 to 4-5). For example, none of the physician-related criteria are quantitative while only 45% to 66% of the patient, condition and context-related criteria are measurable. Moreover, while we assessed 16% of the articles to be of high quality (i.e. national policies, society guidelines), none of the criteria stemmed from randomized controlled trials. More importantly, not a single study evaluated the impact of the implementation of its triage criteria.

Vague wording of ICU triage guidelines such as "likelihood of benefit", "futility" or "advanced age" provides practical issues, notably not allowing for measurement of compliance rates. (179, 180) It also results in unintended externalities such as lack of transparency(181) or, at least, that of significant physician decision-making variation.(28-33, 38, 40, 182) Hence, despite the SCCM

recommending each unit develops its own admission policy as early as in 1999 (143) and again in 2016 (81), there is no universally accepted set of specific and measurable admission criteria. This probably relates to the importance that physician autonomy holds in modern medical practice and its consequent freedom of treatment options based on best clinical judgement.(183)

Nonetheless, our results show that there may be an emerging trend in the past decade where exclusion criteria are becoming more specific. The temporal trend seems to correlate with the publication in 2006 of Christian's article describing a triage protocol for an Influenza pandemic which described 12 exclusion criteria. The interest generated by this highly-cited study largely accounts for the findings of our study where criteria were ranked by robustness. Indeed, out of the 20 most robust criteria according to the score we developed, 15 pertain to epidemics situations and, when not identical, draw inspiration from Christian's propositions. This is a testimony to the acceptability within the triage community of such specific criteria, but it is important to point out that they are to be used in exceptional circumstances and not currently recommended for "day to day" critical care triage. However, this "tailoring" strategy may be key to future triage criteria development, rather than tackling a "one size fits all" solution.

Our study adds to existing reviews documenting the process of ICU triage and transport. (89, 144, 147, 184) Namely, our study is the first systematic review documenting criteria, either currently in use or proposed, adopted homogeneously within a team or organization. Indeed, previous studies aimed to document individual practices and usually used survey methodology. Such studies identified different themes than ours, mainly religion (185), country of practice (186), socio-economic status (187) or even nursing morale (108).

Limitations

Despite the strengths of our study, its conclusions are bound by a few limitations. First, we did not include articles published in languages other than English or French. We also may have missed local or national policies that are not cross-referenced in any of our search engines or that are only available offline. However, such an endeavor would have been beyond the scope of this work.

Finally, only a single author performed the screens and full-text reviews which may have impacted the sensitivity of the review.

Table 4-4. Thematic Top 3 Most Commonly Cited Criteria by Geographic Region

Specific Criteria	Citations	All articles N (%)	North America n (%)	Europe n (%)	Asia n (%)	Other n (%)
Patient						
Patients or families who decline intensive care or some of its components	(44, 65, 73, 75, 80-86) (2, 62, 68, 70, 76-79, 87-96)	29	10 (16)	14 (30)	4 (33)	1 (14)
Bedridden	(61, 68-71)	5	0 (0)	5 (11)	0 (0)	0 (0)
Advanced age	(16, 55-57)	4	1 (2)	3 (9)	0 (0)	0 (0)
Condition						
No further oncological treatment options	(61, 62, 68-70, 78, 84, 95, 102, 104, 116, 117)	12	2 (3)	8 (17)	2 (17)	0 (0)
Persistent vegetative state	(62, 84, 90, 93, 95, 115, 119, 120)	8	6 (9)	1 (2)	1 (8)	0 (0)
Terminal diagnosis	(62, 67, 71, 79, 84, 102, 123, 124)	8	4 (6)	2 (4)	2 (17)	0 (0)
Physician						
Too well	(3, 16, 57, 63, 67, 77, 82, 87-89, 95, 100, 139-147)	20	7 (11)	9 (20)	1 (8)	3 (43)
Too sick	(3, 16, 57, 63, 77, 82, 88, 139-141, 143-148)	15	5 (8)	7 (15)	1 (8)	2 (29)
Likelihood of benefit	(3, 84, 93, 95, 105, 107, 109, 138)	8	3 (5)	3 (7)	2 (17)	0 (0)
Context						
Metastatic	(147, 151, 159, 160, 162-167, 169, 170, 172-174)	14	9 (14)	3 (7)	1 (8)	1 (14)
Advanced and irreversible neurologic event or condition	(147, 151, 160, 162-170, 173, 174)	13	8 (13)	3 (7)	1 (8)	1 (14)
SOFA score >11	(147, 151, 159-168)	11	6 (9)	4 (9)	1 (8)	0 (0)

SOFA: Sequential organ failure assessment

Future research

Optimization of triage and transport practices for critically ill patients will require further research to help address the process deficiencies identified by our study. Namely, environmental scans should be undertaken to identify organizations where triage criteria were objectively evaluated after successful implementation to help benchmark expected process and outcome changes. These environmental scans should not be limited to the realm of intensive care as other patient populations with similar challenges may offer valuable insight (ex: trauma, pediatric ICU, organ transplant, etc.) Then, acceptability of identified triage and transport criteria should be determined using Delphi methodology with knowledge users. Finally, formal triage and transport criteria performance should be rigorously tested. A stepped wedge cluster randomized trial may provide the ideal design if the new triage and transfer criteria are implemented within the context of a change in regional health policies. (188)

Conclusion

A systematic review aimed at identifying triage and transport criteria used to prioritize or exclude certain patient populations under different settings helped to generate a list of 200 criteria classified within 4 themes (patient, condition, physician and context related). These criteria may help clinicians and decision makers devise local, regional or national ICU triage criteria. However, further high-quality studies or policies yielding specific and measurable criteria tailored to clearly defined patient populations are needed to promote wider clinical adoption in an effort to decrease practice variability and improve transparency.

Appendix 4-1. Supplementary characteristics of selected studies

Citation, (in-text reference)	Triage or Transport	Themes	Type of Article	Design (if Original Research)	Publication year	Country of Corresponding Author	Mechanism of triage	Is the process condition-specific?	If yes, which one	Are the criteria in use or proposed ?	If in use, since when?	Number of criteria identified	Does the study cite scientific evidence for the use of the criteria?	Quality of the citation
ELSO guidelines (2017), (99)	Triage	Cd, Ph, Pt	Policy/Guideline		2017	USA	Prioritization/waiting lists	yes	ECMO	proposed		4	no	Level 1
Van Diepen (2016), (118)	Triage	Cd	Original Research	Cohort study	2016	Canada	Complete exclusion	yes	Stable NSTE ACS	proposed		1	yes	Level 1
Sen (2016), (97)	Triage	Cd, Pt	Review		2016	USA	Complete exclusion	yes	ECMO	proposed		8	no	Level 2
Ramos (2016), (10)	Triage	Cd, Pt, Ph	Original Research	Single center Survey/tool development	2016	Brazil	Prioritization/waiting lists	no		proposed		3	yes	Level 2
Oerlemans (2016), (153)	Triage	Cx	Original Research	National Survey	2016	Netherlands	Complete exclusion	no		in use	2009	1	no	Level 2
Nates (2016), (81)	Triage	Ph, Pt, Cd	Policy/Guideline		2016	USA	Prioritization/waiting lists	no		proposed		2	yes	Level 1
Conrad (2016), (113)	Triage	Cd	Review		2016	USA	Complete exclusion	yes	ECMO	proposed		1	no	Level 3
Bohman (2016), (60)	Triage	Pt, Cd	Original Research	Non-RCT with contemporaneous controls	2016	USA	Complete exclusion	yes	ECMO	proposed		11	yes	Level 1
Blanch (2016), (139)	Triage	Pt	Policy/Guideline		2016	Spain	Prioritization/waiting lists	no		proposed		1	yes	Level 1
Albertine (2016), (122)	triage	Cd	Original Research	Cohort study	2016	USA	Complete exclusion	yes	Traumatic subdural hemorrhage	proposed		1	no	Level 2
Wise (2015), (79)	Triage	Pt, Cd	Policy/Guideline		2015	UK	Complete exclusion	yes	Hematologic malignancy	proposed		3	yes	Level 1
Toffart (2015), (72)	Triage	Pt	Review		2015	France	Complete exclusion	yes	Lung cancer	proposed		1	no	Level 2
Shamim (2015), (125)	Triage	Cd	Review		2015	Pakistan	Complete exclusion	yes	Endovascular cerebral aneurysm repair by interventional radiology	proposed		1	yes	Level 3
Namendys-Silva (2015), (65)	Triage	Pt	Editorial		2015	Mexico	Complete exclusion	yes	Oncology patients	proposed		2	no	Level 3
Morton (2015), (160)	Triage	Cx	Original Research	Cohort study	2015	UK	Complete exclusion	yes	Influenza	in use	2009	1	yes	Level 2
Lindvig (2015), (112)	Triage	Cd	Original Research	Systematic review	2015	Denmark	Complete exclusion	yes	Cirrhosis	proposed		2	yes	Level 2
Leclercq (2015), (128)	Triage	Cd	Original Research	Cohort study	2015	France	Complete exclusion	yes	TAVI	proposed		1	yes	Level 2
Kose (2015), (134)	Triage	Cd	Original Research	Cohort study	2015	Turkey	Complete exclusion	yes	Post-operative	proposed		1	yes	Level 2
Franco (2015), (135)	Triage	Cd	Original Research	Cohort study	2015	USA	Complete exclusion	yes	STEMI	proposed		1	no	Level 3
Courtney (2015), (136)	Triage	Cd	Original Research	Cohort study	2015	USA	Prioritization/waiting lists	yes	Total joint arthroplasty	in use	2006	1	yes	Level 2
Biscotti (2015), (101)	Transport	Cd	Original Research	Cohort study	2015	USA	Complete exclusion	yes	ECMO	in use	2011	6	no	Level 3

Baruch (2015), (80)	Triage	Pt	Review		2015	UK	Prioritization/waiting lists	no		proposed		6	yes	Level 3
Bargues (2015), (111)	Triage	Cd	Review		2015	France	Complete exclusion	yes	Burns	in use	2006	1	yes	Level 3
Artru (2015), (55)	Triage	Cd, Pt	Review		2015	France	Complete exclusion	yes	Severe cirrhosis	proposed		3	yes	Level 3
Alentorn (2015), (116)	Triage	Cd	Review		2015	France	Complete exclusion	yes	Malignant primary brain tumor	proposed		1	yes	Level 3
Winsor (2014), (176)	Triage	Cx	Original Research	Policy analysis	2014	Canada	Prioritization/waiting lists	yes	Pandemic	proposed		2	yes	Level 2
Schulman (2014), (56)	Triage	Cd, Pt	Review		2014	USA	Complete exclusion	yes	ECMO	proposed		5	yes	Level 3
Meyfroidt (2014), (114)	Triage	Cd	Editorial		2014	Belgium	Complete exclusion	yes	Stroke	proposed		1	yes	Level 3
Malak (2014), (117)	Triage	Cd	Policy/Guideline		2014	France	Complete exclusion	yes	Hematologic malignancies	proposed		2	yes	Level 2
Conlon (2014), (154)	Triage, Transport	Cd, Pt	Policy/Guideline		2014	USA	Prioritization/waiting lists	yes	Burn disaster	in use		1	yes	Level 1
Christian (2014), (172)	Triage	Cd, Pt, Cx	Policy/Guideline		2014	Canada	Complete exclusion	yes	Pandemics and disasters	proposed		10	yes	Level 1
Carr (2014), (83)	Transport	Pt	Editorial		2014	USA	Other: Consider	no		proposed		1	yes	Level 3
Williams (2013), (98)	Triage	Cd	Review		2013	USA	Other: Consider	yes	ECMO	proposed		4	yes	Level 3
Toffart (2013), (73)	Triage	Pt, Cd	Review		2013	France	Complete exclusion	yes	Metastatic lung cancer	proposed		5	yes	Level 2
Sprung (2013), (84)	Triage	Ph, Pt, Cd	Original Research	Survey study	2013	Israel	Prioritization/waiting lists, Complete exclusion	no		proposed		8	yes	Level 1
Orsini (2013), (63)	Triage	Pt, Cd	Original Research	Cohort study	2013	USA	Complete exclusion	no				3	yes	Level 3
Mery (2013), (44)	Triage	Pt	Editorial		2013	USA	Other: Consider	no		proposed		1	yes	Level 3
Luchetti (2013), (149)	Triage	Ph	Editorial		2013	Italy	Complete exclusion	no		proposed		1	yes	Level 3
Lazzeri (2013), (75)	Triage	Cd, Pt	Review		2013	Italy	Complete exclusion	yes	E-CPR	in use		9	yes	Level 2
Sprung (2012), (131)	Triage	Cd	Original Research	prospective observational study and score tool development	2012	Israel	Complete exclusion	no		proposed		1	yes	Level 1
Marriott (2012), (161)	Triage	Cx	Original Research	Series of consecutive cases	2012	UK	Complete exclusion	no		in use	December '10	1	yes	Level 3
Louriz (2012), (82)	Triage	Ph, Cx, Pt	Original Research	Cohort study	2012	Morocco	Complete exclusion	no		in use	unclear	4	yes	Level 2
Javidfar (2012), (103)	Triage	Cd	Review		2012	USA	Complete exclusion	yes	ECMO as bridge to lung transplant	in use	unclear	8	yes	Level 2
Daniel (2012), (175)	Triage	Cx	Editorial		2012	USA	Prioritization/waiting lists	no		in use	January '10	8	no	Level 3
Cohen (2012), (67)	Triage	Ph, Pt, Cd	Original Research	Cohort study	2012	USA	Complete exclusion	no		in use	unclear	3	yes	Level 3
Patroniti (2011), (66)	Triage	Cd	Original Research	Cohort study	2011	Italy	Complete exclusion	yes	H1N1 ECMO	in use	Aug'09 -March '10	4	yes	Level 2

McKeown (2011), (100)	Triage	Ph, Pt	Original Research	Cohort study	2011	UK	Complete exclusion	no		in use	unclear	3	no	Level 3
Joynt GM (2011), (85)	Triage	Ph, Pt, Cx	Editorial		2011	Hong Kong	Complete exclusion	no		proposed		3	yes	Level 3
Howe (2011), (140)	Triage	Ph	Original Research	Cohort study	2011	Australia	Complete exclusion	no		in use	unclear	3	yes	Level 3
Elnour (2011), (86)	Triage	Pt	Review		2011	UK	Complete exclusion	no		proposed		1	no	Level 3
Conlon (2011), (155)	Triage, Transport	Cd, Pt	Policy/Guideline		2011	USA	Prioritization/waiting lists	yes	Burn disaster	in use	2006	1	yes	Level 2
Chalmers (2011), (76)	Triage	Pt, Cd, Ph	Original Research	Cohort study	2011	UK	Complete exclusion	yes	Community acquired pneumonia	proposed		3	yes	Level 3
Azoulay (2011), (106)	Triage	Cd	Review		2011	France	Complete exclusion	yes	Allogenic BMT	proposed		1	no	Level 2
Wilkens (2010), (156)	Triage	Cx	Policy/Guideline		2010	USA	Complete exclusion	yes	Mass disaster	proposed		1	yes	Level 2
Sprung (2010), (162)	Triage	Cx	Policy/Guideline		2010	Israel	Complete exclusion	yes	Influenza epidemic or mass disaster	proposed		1	yes	Level 1
Kaposy (2010), (157)	Triage	Cx	Policy/Guideline		2010	Canada	Prioritization/waiting lists	yes	influenza epidemic	in use		1	yes	Level 2
Iapichino (2010), (16)	Triage	Ph, Cx	Original Research	Cohort study	2010	Italy	Complete exclusion	no		proposed		4	no	Level 2
Christian (2010), (163)	Triage	Cx	Policy/Guideline		2010	Canada	Complete exclusion	yes	Influenza pandemic or mass disaster	proposed		1	yes	Level 1
Chipp (2010), (64)	Transport	Pt, Cx	Original Research	Cohort study	2010	UK	Complete exclusion	yes	Burns	proposed		2	no	Level 3
Capuzzo (2010), (147)	Triage	Cx	Review		2010	Italy	Prioritization/waiting lists, Complete exclusion	yes	Influenza	proposed		3	yes	Level 2
Beigi (2010), (159)	Triage	Cx	Policy/Guideline		2010	USA	Complete exclusion	yes	Influenza and maternity	proposed		1	yes	Level 2
Clinical and ethical aspects of admission in intensive care unit of patients with malignant hemopathies (2009), (78)	Triage	Pt, Cd	Policy/Guideline		2010	France	Complete exclusion	yes	Hematologic malignancies	proposed		2	no	Level 1
NSW Health Department (2010), (173)	Triage	Cx	Policy/Guideline		2010	Australia	Complete exclusion, Prioritization/waiting lists	yes	Influenza	proposed		>10	yes	Level 1
Veterans Health Administration (2010), (168)	Triage	Cd	Policy/Guideline		2010	USA	Complete exclusion	yes	Influenza pandemic	proposed		4	yes	Level 2
White (2009), (171)	Triage	Cx	Policy/Guideline		2009	USA	Prioritization/waiting lists	yes	Public health emergency	proposed		1	yes	Level 2
Frolic (2009), (164)	Triage	Cx	Policy/Guideline		2009	Canada	Complete exclusion, Prioritization/waiting lists	yes	Influenza Pandemic	proposed		1	yes	Level 2
Darmon (2009), (61)	Triage	Pt, Cd	Review		2009	France	Complete exclusion	yes	Cancer patient	proposed		4	yes	Level 2

Birch (2009), (148)	Triage	Cd	Review		2009	UK	Complete exclusion	no		proposed		1	no	Level 3
Altevogt (2009), (170)	Triage	Cx	Policy/Guideline		2009	USA	Prioritization/waiting lists, Complete exclusion	yes	Disaster situations	proposed		11	yes	Level 1
Department of health (2009), (151)	Triage	Cx	Policy/Guideline		2009	UK	Complete exclusion	yes		proposed		11	yes	Level 1
Vanhecke (2008), (87)	Triage	Ph, Pt	Original Research	Cohort study	2008	USA	Complete exclusion	no		in use	n/a	2	yes	Level 3
Taylor (2008), (167)	Triage	Cx	Policy/Guideline		2008	UK	Prioritization/waiting lists	yes	Influenza pandemic and other mass casualty events	proposed		1	yes	Level 3
Reignier (2008), (141)	Triage	Ph	Original Research	Cohort study	2008	France	Complete exclusion	no		in use	n/a	2	yes	Level 3
Powell (2008), (166)	Triage	Cx	Policy/Guideline		2008	USA	Complete exclusion	yes	Public health disaster	proposed		5	yes	Level 2
Pateron (2008), (110)	Triage	Cd, Pt	Original Research	Delphi survey	2008	France	Complete exclusion	yes	Patients older than 80yo	proposed		1	yes	Level 2
Markou (2008), (68)	Triage	Pt, Cd	Review		2008	Greece	Complete exclusion	yes	Cancer patients	proposed		3	yes	Level 3
Devereaux (2008), (169)	Triage	Cx	Policy/Guideline		2008	USA	Complete exclusion	no		proposed		2	yes	Level 1
Das (2008), (126)	Triage	Cd	Original Research	Cohort study	2008	USA	Complete exclusion	yes	Acute GI bleed	proposed		1	yes	Level 3
Thiery (2007), (69)	Triage	Cd	Review		2007	France	Complete exclusion	yes	Cancer patients	proposed		2	no	Level 3
Lecuyer (2007), (70)	Triage	Pt, Cd	Original Research	Cohort study	2007	France	Complete exclusion	yes	Cancer patients	in use		3	no	Level 2
Hick (2007), (158)	Triage	Cx	Review		2007	USA	Prioritization/waiting lists	no		in use	n/a	3		Level 2
Simchen (2007), (96)	Triage	Pt, Ph	Original Research	Cohort study	2007	Israel	Complete exclusion	no		in use	n/a	2	no	Level 2
Shanker (2006), (102)	Triage	Cx, Cd	Original Research	Cohort study	2006	India	Complete exclusion	yes	Surgical patients	in use	n/a	4	no	Level 3
Orens (2006),(59)	Triage	Cd, Pt	Policy/Guideline		2006	USA	Complete exclusion	yes	Lung transplantation	proposed		15	no	Level 1
Hick (2006),(174)	Triage	Cx	Policy/Guideline		2006	USA	Complete exclusion	yes	Epidemic	proposed		14	yes	Level 2
Garrouste-Orgeas (2006),(77)	Triage	Ph, Pt	Original Research	Cohort study	2006	France	Complete exclusion	yes	Patients older than 80yo	in use	n/a	3	no	Level 3
Christian (2006),(165)	Triage	Cx	Original Research	Mixed methods	2006	Canada	Complete exclusion	yes	Influenza pandemic				no	Level 1
Azoulay (2006),(71)	Triage	Cd, Pt	Editorial		2006	France	Complete exclusion	yes	Cancer patients	proposed		2	yes	Level 3
Sottiaux (2005),(138)	Triage	Ph	Review		2005	France	Complete exclusion, Prioritization/waiting lists	no		proposed		2	no	Level 3
Joynt (2005),(2)	Triage	Ph	Review		2005	Hong Kong	Complete exclusion, Prioritization/waiting lists	no		proposed		3	yes	Level 2
Garrouste-Orgeas (2005),(88)	Triage	Cx, Pt, Ph	Original Research	Cohort study	2005	France	Complete exclusion	no		in use	n/a	4	no	Level 2
Augier (2005),(142)	Triage	Ph	Original Research	Cohort study	2005	Jamaica	Complete exclusion	no		in use	n/a	2	yes	Level 3
Mielke (2003),(130)	Triage	Cd	Original Research	Qualitative study	2003	Zimbabwe	Prioritization/waiting lists	no		in use	1998	4	no	Level 2

Gruppo di Studio ad Hoc della Commissione di Bioetica (2003),(95)	Triage	Ph	Policy/Guideline		2008	Italy	Complete exclusion, Prioritization/waiting lists	no		proposed		4	no	Level 2
Garrouste-Orgeas (2003),(57)	Triage	Ph, Pt	Original Research	Cohort study	2003	France	Complete exclusion	no		in use	n/a	5	no	Level 2
Roupie (2001),(105)	Triage	Cd, Ph	Review		2002	France	Prioritization/waiting lists	no		proposed, in use	n/a	4	yes	Level 3
Joynt (2001),(3)	Triage	Ph	Original Research	Cohort study	2001	Hong Kong	Complete exclusion, Prioritization/waiting lists	no		in use	n/a	3	no	Level 2
Dahm (2001),(127)	Triage	Cd	Original Research	Cohort study	2001	USA	Complete exclusion	yes	Post op radical cystectomy	proposed		1	no	Level 3
Azoulay (2001),(45)	Triage	Cx, Cd	Original Research	Series of consecutive cases	2001	France	Complete exclusion	no		in use		2	no	Level 2
Dawson (2000),(132)	Triage	Cd	Editorial		2000	USA	Complete exclusion	no		proposed		1	no	Level 3
Sprung (1999),(108)	Triage	Ph, Cx, Cd	Original Research	Cohort study	1999	Israel	Complete exclusion	no		in use	n/a	5	no	Level 2
Smith (1999), (89)	Triage	Ph, Pt	Review		1999	UK	Complete exclusion	no		proposed		3	no	Level 3
Crippen (1999),(115)	Triage	Cd	Editorial		1999	USA	Complete exclusion	no		proposed		2	no	Level 3
American College of Critical Care Medicine of the Society of Critical Care Medicine (1999),(143)	Triage	Ph	Policy/Guideline		1999	USA	Prioritization/waiting lists	no		proposed		3	yes	Level 1
Scheinkestel (1996),(150)	Triage	Ph	Editorial		1996	Australia	Complete exclusion	no		proposed		1	no	Level 3
Lim (1996),(133)	Triage	Cd	Original Research	Cohort study	1996	Singapore	Prioritization/waiting lists	no		proposed		1	no	Level 3
Using SUPPORT to GUIDe our fix on futility (1995),(119)	Triage	Cd	Other		1995	USA	Complete exclusion	no		proposed		1	yes	Level 3
Osborne (1994),(107)	Triage	Ph	Editorial		1994	USA	Complete exclusion	no		proposed		1	no	Level 3
Murphy (1994),(120)	Triage	Cd	Policy/Guideline		1994	USA	Complete exclusion	no		proposed		1	no	Level 2
Futility guidelines (1994),(90)	Triage	Pt, Ph, Cd, Cx	Policy/Guideline		1994	USA	Complete exclusion	no		proposed		10	no	Level 2
Consensus statement on the triage of critically ill patients (1994),(62)	Triage	Ph, Pt, Cd	Policy/Guideline		1994	USA	Complete exclusion, Other: consider exclusion	no		proposed		10	no	Level 1
Guidelines for the utilisation of intensive care units (1994),(152)	Triage	Ph	Policy/Guideline		1994	Belgium	Complete exclusion	no		proposed			no	Level 2
Teres (1993),(178)	Triage	Cx	Editorial		1993	USA	Complete exclusion, Prioritization/waiting lists	no		proposed		7	no	Level 2
Strosberg (1993),(144)	Triage	Ph	Review		1993	USA	Prioritization/waiting lists	no		proposed		2	no	Level 3
Dawson (1993),(104)	Triage	Cd	Editorial		1993	USA	Complete exclusion	no		in use		3	no	Level 3

Birnbaum (1993),(123)	Triage	Cd	Review		1993	USA	Complete exclusion	no		proposed		2	no	Level 2
Swenson (1992),(177)	Triage	Cx	Other		1992	USA	Prioritization/waiting lists	no		proposed		1	no	Level 2
Osborne (1992),(91)	Triage	Ph, Pt	Editorial		1992	USA	Prioritization/waiting lists, Complete exclusion	no		proposed		3	no	Level 3
Benes (1992),(92)	Triage	Ph, Pt	Other		1992	USA	Complete exclusion	no		proposed		2	no	Level 3
Triage in the ICU (1992),(145)	Triage	Ph	Editorial		1992	USA	Complete exclusion	no		proposed		2	no	Level 3
Strosberg (1991),(146)	Triage	Ph	Editorial		1992	USA	Prioritization/waiting lists	no		proposed		2	no	Level 3
Oddi (1990),(124)	Triage	Cd	Editorial		1992	USA	Complete exclusion	no		in use	x 1988	1	no	Level 3
Murphy (1990),(129)	Triage	Cd	Original Research	model development	1990	USA	Complete exclusion	no		proposed		2	no	Level 2
ICU admission criteria need honing to block rationing (1989),(109)	Triage	Cd, Ph	Other		1989	USA	Complete exclusion	no		proposed		3	no	Level 3
Callahan (1989),(58)	Triage	Pt	Editorial		1989	USA	Complete exclusion	no		proposed		1	no	Level 3
Intensive care in the United Kingdom (1989),(94)	Triage	Ph	Policy/Guideline		1989	UK	Prioritization/waiting lists	no		proposed		3	no	Level 1
Bekes (1988),(93)	Triage	Cd, Pt	Policy/Guideline		1988	USA	Prioritization/waiting lists, Complete exclusion	no		proposed		4	no	Level 1
Jemison (1983),(137)	Triage	Ph	Other		1983	USA	Complete exclusion	no		proposed		1	no	Level 3
Cohen CB. Ethical problems of intensive care. Anesthesiology. 1977,(121)	Triage	Cd	Other		1977	USA	Complete exclusion	no		proposed		1	no	Level 3

Cd: Condition; Cx: Context; Pt : Patient; Ph : Physician; Level 1 : highest quality studies; Level 2: medium quality studies; Level 3: lowest quality studies

Appendix 4-2. Patient-related criteria as listed in each citation and their quality rating

Study ID	Category of criteria	Specific criteria	Quality of the criteria*
Sen (2016)	Technical	Concerns if limited vascular access	1,4,5
Sen (2016)	Technical	Concerns if inability to receive blood products	
Sen (2016)	BMI	concerns if BMI>45	1,3,4
Ramos (2016)	Functional status	Lowest priority if decompensated comorbidites with severe dependency, advanced disease with partial or severe dependency, or advanced disease with preserved functionality but an estimated intuitive prognosis of death (all specifically defined)	
Nates (2016)	Level of care	Patients who do not want to be intubated or resuscitated	1,3,4,5
Bohman (2016)	Age	relative contraindication if age >70y	1,2,3,4,5
Bohman (2016)	Age	relative contraindication if weight > 150 kg	1,2,3,4,5
Toffart (2015)	Functional status	ECOG 3 or 4	1,2,3,4,5
Namendys-Silva (2015)	Functional status	"poor status performance"	1,4,5
Namendys-Silva (2015)	Level of care	"patients who refuse to ICU admission to receive invasive treatment"	1,3,4,5
Baruch (2015)	Ethical principles	beneficence, non-malevolence, autonomy, justice, dignity and honesty	5
Artru (2015)	Age	“Patient âgé”	
Wise (2015)	patient preference	declines treatment	1,3,4,5
Schulman (2014)	Age	"specific contraindications with respect to age do not exist, but consider increasing risk with advancing age"	1,5
Christian (2014)	Age	Very advanced age	5
Carr (2014)	Patient preference	patient choice and established hospital preferences should be considered in the development of regionalized care systems	5
Toffart (2013)	Patient preference	patient choice	1,2,4,5
Sprung (2013)	Patient preference	Examples of patients who should be excluded from the ICU, whether beds are available or not, include those who competently decline intensive care	
Orsini (2013)	Age + prognosis	"too ill, too old"	

Mery (2013)	patient preference	ICU clinicians should evaluate their triage decisions and, if possible, routinely solicit patient preferences during medical emergencies, taking steps to ensure that ICU admission decisions are in line with the goals of the patient.	1,2,4,5
Lazzeri (2013)	level of care	patients who previously signed DNR orders	1,2,3,4,5
Louriz (2012)	Level of care	patients not admitted according to wishes of patient and family	1,2,4,5
Cohen (2012)	Functional status	"poor functional status"	1
Patroniti (2011)	Functional status	"previous severe disability"	1,2,4,5
Joynt (2011)	Patient preference	"personal autonomy"	1,2,4,5
Elnour (2011)	patient preference	"patient autonomy should always be respected"	1,4,5
Chalmers (2011)	patient preference	"cardiopulmonary resuscitation or treatment is not in accordance with a valid advanced directive or patient decision to decline treatment"	1,4,5
Iapichino (2010)	Age	"too old"	
Chipp (2010)	Agitation	aggressive or agitated patient	4,5
Clinical and ethical aspects of admission in intensive care unit of patients with malignant hemopathies (2009)	patient preference	patient refuses transfer to ICU	1,3,4,5
Darmon (2009)	Functional status	bedridden patients	1,2,3,4,5
Darmon (2009)	Age + functional status	patients >70yo and altered performance status	1,2,4,5
Department of Health (2009)	age and size	age and size of patient	
Vanhecke (2008)	Patient preference	"patients chose to decline care"	1,3,4,5
Markou (2008)	Patient preference	"Patient refuses ICU admission"	1,3,4,5
Markou (2008)	Functional status	Bedridden patients	1,3,4,5
Thiery (2007)	functional status	bedridden	1,3,4,5

Lecuyer (2007)	functional status	Bedridden patients	1,3,4,5
Lecuyer (2007)	patient preference	Patient refuses ICU admission	1,3,4,5
Simchen (2007)	patient preference	patients with DNR	1,3,4,5
Orens (2006)	social support	absence of a consistent or reliable social support system	1,4
Orens (2006)	Age (relative)	older than 65 years	1,3,4,5
Orens (2006)	functional status (relative)	severely limited functional status with poor rehabilitation potential	1,4,5
Orens (2006)	weight	severe obesity (BMI >30)	1,3,4,5
Garrouste-Orgeas (2006)	patient preference	patient/family refuses admission	4,5
Azoulay (2006)	Functional status	bedridden patients	1,3,4,5
Joynt (2005)	patient preference	patient refuses ICU admission	1,3,4,5
Garrouste-Orgeas (2005)	patient preference	patient refuses ICU admission	1,3,4,5
Garrouste-Orgeas (2003)	Functional status	dependency before the current hospital admission	1,3,4,5
Garrouste-Orgeas (2003)	age	"older age"	
Gruppo di Studio ad Hoc della Commissione di Bioetica (2003)	patient preference	patients in possession of their faculties who refuse ICU treatment	1,3,4,5
Smith (1999)	patient preference	"should not be admitted if have a stated or written desire not to receive intensive care"	1,3,4,5
Futility guidelines (1994)	patient preference	Treatment may be withheld or withdrawn following refusals when a competent patient refuses the treatment after having received relevant information	1,3,4,5
Futility guidelines (1994)	patient preference	Treatment may be withheld or withdrawn following refusals when an incompetent patient's surrogate refuses, in compliance with a valid Durable Power of Attorney for Health Care	1,3,4,5
Futility guidelines (1994)	patient preference	Treatment may be withheld or withdrawn following refusals when an incompetent patient's surrogate refuses, in compliance with patient's wishes (substituted judgment) or best interest after weighing burdens and benefits	1,3,4,5

Futility guidelines (1994)	patient preference	Treatment may be withheld or withdrawn on the basis of futility assessments when treatment offers no realistic, reasonable expectation that the physician's medical goals and the patient's personal goals and values can be realized (requires awareness of one another's goals and concurrence)	
Consensus statement on the triage of critically ill patients (1994)	patient preference	exclude patients who competently decline intensive care or request that invasive therapy be withheld	1,3,4,5
Consensus statement on the triage of critically ill patients (1994)	Age + functional status	very elderly individuals who are failing to thrive due to irreversible chronic illness should not be encouraged to use intensive care	
Osborne (1992)	patient preference	if a competent patient refuses treatment, that decision must be respected	1,3,4,5
Benes (1992)	patient preference	do not resuscitate patients	1,3,4,5
Callahan (1989)	Age	limit life-extending, high-technology care for the elderly (late 70s, early 80s)	
Intensive Care in the United Kingdom (1989)	patient preference	patient's right to refuse intensive care	1,3,4,5
Bekes (1988)	patient preference	patients who refuse life support therapy	1,3,4,5

*A quality criteria meets the following:
(1) Specific: Targets a specific criteria
(2) Scientifically-Sound: stems from the literature, not subjective and will produce consistent decisions
(3) Measurable: it is possible to tally how many decisions comply with the criteria requirement
(4) Feasible: can be implemented broadly
(5) Usable: once implemented, can be understood by knowledge users and used for decision-making

Appendix 4-3. Condition-related criteria as listed in each citation and their quality rating

Study ID	Category of criteria	Specific criteria	Quality of the criteria*
Van Diepen (2016)	diagnosis	NSTE ACS: exclude from CCU	1,2,3,4,5
Sen (2016)	diagnosis	Futility if ventilated on high settings > 7 days	1,3,4,5
Sen (2016)	Comorbidities	concerns if "irreversible conditions"	
Sen (2016)	Comorbidities	concerns if "brain injury"	1,3,4
Sen (2016)	Comorbidities	concerns if "contraindication to use of anticoagulant therapy"	
Sen (2016)	Comorbidities	concerns if "major immunosuppression"	
Ramos (2016)	Comorbidities ; functional status	Lowest priority if decompensated comorbidities with severe dependency, advanced disease with partial or severe dependency, or advanced disease with preserved functionality but an estimated intuitive prognosis of death (all specifically defined)	1,2,3,5
Conrad (2016)	timing	ECMO: do not initiate ECPR if arrest >60 minutes	1,3,4,5
Bohman (2016)	diagnosis	absolute contraindication if mechanical ventilation > 7 days	1,2,3,4,5
Bohman (2016)	diagnosis	absolute contraindication if CNS catastrophe: Significant anoxic brain injury, diffuse axonal injury, massive intracranial hemorrhage, or herniation.	1,2,4,5
Bohman (2016)	Comorbidities	absolute contraindication if irreversible condition and not lung transplant candidate	1,2,4,5
Bohman (2016)	diagnosis	absolute contraindication if death within 3h of intubation	1,2,3,4
Bohman (2016)	diagnosis	absolute contraindication if ARDS not severe enough to meet inclusion criteria	1,2,3,4,5
Bohman (2016)	Comorbidities	relative contraindication if immunocompromised state: Solid organ or stem cell transplant, solid organ or hematologic malignancy, chronic immunosuppressive therapy, HIV/AIDS, and inherited immunodeficiency	1,3,5
Bohman (2016)	Comorbidities	relative contraindication if chronic CNS deficit or CNS status unknown	5
Bohman (2016)	Comorbidities	relative contraindication if contraindication to anticoagulation	1,5
Bohman (2016)	comorbidities	relative contraindication if multiple dysfunction syndrome	1,3,5
Albertine (2016)	diagnosis	do not admit if tSDH volume less than 10cm3	1,2,3,4,5
Shamim (2015)	diagnosis and comorbidities	absence of intraoperative complications, complex aneurysm morphology, or severe medical comorbidities	4,5
Lindvig (2015)	diagnosis	Child-Pugh C	1,2,3,4,5

Lindvig (2015)	diagnosis	MELD >30 and ACLF > or = 3	1,2,3,4,5
Leclercq (2015)	diagnosis + comorbidities	EF>40%, transfemoral access, absence of severe pulmonary disease, stable hemodynamic state and absence of complications occurring until 2 hours after the procedure	
Kose (2015)	predictive scores	ASA>3 + P(POSSUM) Total >35	1,2,3,5
Franco (2015)	predictive scores	GRACE 2.0 <190 do not admit to ICU	1,3,4,5
Courtney (2015)	predictive scores	PARS score	1,2,4
Biscotti (2015)	comorbidities (absolute)	end-stage lung disease in a patient who is not a transplant candidate, unknown mental status after cardiac arrest, or cancer with a predicted survival less than 1 year	1
Biscotti (2015)	comorbidities (relative)	intubation longer than 10 days, intracranial pathology, and vascular access issues	1
Bargues (2015)	diagnosis	Burned surface area >60%	1,4,5
Artu (2015)	diagnosis	No transplantation plan	3
Artu (2015)	Comorbidities	SOFA >10.5 or SAPS 2 > 47.5	3
Alentorn (2015)	diagnosis	No further oncological treatment options	4,5
Wise (2015)	diagnosis	patients who are clearly in the process of dying should not be referred	1,4,5
Wise (2015)	diagnosis + performance status	cc likely to be futile in a patient who has a poor performance status and is unsuitable for life-prolonging therapy	1,3,4,5
Shulman (2014)	diagnosis	extreme settings of mechanical ventilation for 7 or more days (FiO2=0.9, plateau pressures >30cmH20)	1,3,4,5
Shulman (2014)	comorbidities	Major pharmacologic immunosuppression with ANC < 400/mm3	1,3,4,5
Shulman (2014)	Comorbidities	recent or increasing CNS hemorrhage	1,5
Shulman (2014)	Comorbidities	nonsurvivable comorbid condition (terminal malignancy, nonrecoverable CNS damage)	5
Meyfroidt (2014)	diagnosis	"deeply comatose patients, with a low probability of a favorable outcome"	5
Malak (2014)	diagnosis	" the hematologic underlying condition is at a palliative stage"	5
Malak (2014)	diagnosis	"the patient suffers from an end-stage progressive condition unresponsive to any undertaken therapeutic measure, even if in remission of the hematologic disease (e.g., severe GVHD or progressive pulmonary failure)"	5
Christian (2014)	Comorbidities	Metastatic malignancies	1,4,5
Christian (2014)	Comorbidities	Hematologic malignancies with poor prognosis	1,5

Christian (2014)	Comorbidities	End-stage organ failure with expected survival <1 y, such as end-stage cardiac failure (NYHA class IV), severe chronic lung disease, advanced hepatic failure (MELD score >20)	1,3,5
Christian (2014)	Comorbidities	Advanced and irreversibly immunocompromised, such as drug-resistant AIDS	1,5
Christian (2014)	diagnosis	Unwitnessed cardiac arrest, recurrent cardiac arrest or witnessed cardiac arrest not responsive to electrical therapy	1,3,4,5
Christian (2014)	diagnosis	Burns with predicted mortality >90%	1,5
Christian (2014)	diagnosis	Severe anoxic brain injury postcardiac arrest, massive stroke	1,5
Williams (2013)	Comorbidities and diagnosis	Quotes ELSO: No absolute contraindication but conditions associated with poor outcomes despite ECMO therapy may be considered relative contraindications; mechanical ventilation at high settings (FiO2>90%, Pplateau>30 for >7 days); major pharma immunosuppression (ANC<4000); recent or worsening CNS hemorrhage	2,5
Toffart (2013)	Functional status	Futile ICU admission if ECOG 3-4	1,2,3,4,5
Toffart (2013)	Nutritional status	Futile ICU admission if major malnutrition	1,2,5
Toffart (2013)	Treatment options	Futile ICU admission if 3rd line of chemo or beyond	1,2,3,4
Toffart (2013)	Diagnosis	Futile ICU admission if Logic dysfunction score > or = 4	
Sprung (2013)	Diagnosis + comorbidities	Patients with terminal, irreversible illness (excluding potential organ donors) who face imminent death should not be admitted to the ICU	5
Sprung (2013)	Functional status + comorbidities	All individuals who are failing to thrive due to irreversible, chronic illness should not be admitted to the ICU	5
Sprung (2013)	diagnosis + comorbidities	Examples of terminally ill patients (excluding potential organ donors) who may be excluded from the ICU, whether beds are available or not, include those with severe, irreversible brain damage or irreversible multiorgan failure and those with metastatic cancer unresponsive to therapy	5
Sprung (2013)	diagnosis	Examples of patients who should be excluded from the ICU, whether beds are available or not, include those declared brain dead who are not organ donors, and those in a persistent vegetative or permanently unconscious state	5
Lazzeri (2013)	Comorbidities	previous severe neurologic damage	1,2,5
Lazzeri (2013)	diagnosis	current intracranial hemorrhage	1,2,5
Lazzeri (2013)	Comorbidities	malignancy in the terminal stage	1,2,5
Lazzeri (2013)	diagnosis	arrest of traumatic origin with uncontrolled bleeding	1,2,5
Lazzeri (2013)	diagnosis	arrest of septic origin	1,2,5

Lazzeri (2013)	diagnosis	irreversible organ failure leading to cardiac arrest when no physiological benefit could be expected despite maximal therapy (hepatic failure, late stage of ARDS, etc.)	1,2,5
Lazzeri (2013)	diagnosis	aortic dissection	1,2,5
Lazzeri (2013)	diagnosis	severe peripheral arterial disease	1,2,5
Sprung (2012)	diagnosis+ physiologic variables	2 step score	1,2,3,4
Sprung (2012)	diagnosis + comorbidities	(1) Multiorgan failure unrelated to primary chronic lung failure	1,3,4,5
Sprung (2012)	diagnosis + comorbidities	(2) Sepsis (from a source other than the lung)	1,3,4,5
Sprung (2012)	diagnosis + comorbidities	(3) Extended period of immobility/decompensation (use of paralytics, ventilator >5 days, etc.)	1,3,4,5
Sprung (2012)	diagnosis + comorbidities	(4) Development of multiorgan failure while on ECMO	1,3,4,5
Sprung (2012)	diagnosis + comorbidities	(5) Active and uncontrolled source of infection while on ECMO	1,3,4,5
Sprung (2012)	diagnosis + comorbidities	(6) Deterioration in nutritional status while on ECMO	1
Sprung (2012)	diagnosis + comorbidities	(7) Inability to improve or stabilize deterioration of physical condition while on ECMO	1,5
Sprung (2012)	diagnosis + comorbidities	(8) Excessive bleeding and transfusion requirements while on ECLS	1,4,5
Cohen (2012)	diagnosis	"terminal diagnosis"	
Patroniti (2011)	diagnosis	Intracranial bleeding or other major contraindication to anticoagulation	1,2,3,4,5
Patroniti (2011)	comorbidities	Poor prognosis because of the underlying disease (i.e., unresolved malignancy)	1,2
Patroniti (2011)	diagnosis	Mechanical Ventilation>7 days (relative)	1,2,3,4,5
McKeown (2011)	Comorbidities	excessive comorbidities	
Chalmers (2011)	Comorbidities	"treatment is unlikely to be successful due to comorbid conditions"	5
Azoulay (2011)	Diagnosis	"In allogenic BMT, it seems reasonable to discourage ICU admission and mechanical ventilation in patients with severe sepsis or acute respiratory failure and uncontrolled GVHD"	5
Clinical and ethical aspects of admission in intensive care unit of patients with	diagnosis + prognosis	malignancy in palliative stage	3,4,5

malignant hemopathies (2009)			
Darmon (2009)	Prognosis	no lifetime extending treatment	1,2,4,5
Darmon (2009)	Diagnosis	Allogenic SCT with uncontrolled GVHD	1,2,3,4,5
Department of Health (2009)	diagnosis	conditions incompatible with normal life if the patient recovers	
Department of Health (2009)	Comorbidities	preexisting conditions which affect the quality of life (CNS status, end stage malignancy, risk of systemic bleeding with anticoagulation)	
Pateron (2008)	diagnosis	Intracranial hemorrhage with herniation	1,2,3,4,5
Markou (2008)	diagnosis	"non-availability of lifespan-extending treatment options for the malignancy"	1
Devereaux (2008)	Diagnosis+ comorbidities	Absence of ongoing bleed (defined) and unstable comorbidities	1,2,3,4,5
Thiery (2007)	Diagnosis	cancer for which potentially no lifespan-extending treatment	1
Lecuyer (2007)	diagnosis	"palliative care the only cancer treatment option"	1
Shanker (2006)	diagnosis	terminal illness	
Shanker (2006)	diagnosis	advanced carcinoma for palliative or debulking surgery	3,4
Shanker (2006)	Comorbidities	moribund ASA-V patients	3,4
Orens (2006)	comorbidities (absolute)	malignancy in the last 2 years	1,3,4,5
Orens (2006)	comorbidities (absolute)	untreatable advanced dysfunction of another organ system	4
Orens (2006)	comorbidities (absolute)	non-curable chronic extrapulmonary infection including hepatitis B, C and HIV	4
Orens (2006)	comorbidities (absolute)	significant chest wall/spinal deformity	1,4
Orens (2006)	comorbidities (absolute)	documented nonadherence or inability to follow through with medical therapy or office follow-up or both	1,4,5
Orens (2006)	comorbidities (absolute)	untreatable psychiatric or psychologic condition associated with the inability to cooperate or comply with medical therapy	4
Orens (2006)	comorbidities (absolute)	substance addiction (e.g. alcohol, tobacco, or narcotics) that is either active or within the last 6 months	3,4,5
Orens (2006)	diagnosis (relative)	critical or unstable clinical condition	4
Orens (2006)	comorbidities (relative)	colonization with highly resistant or highly virulent bacteria, fungi or mycobacteria	4

Orens (2006)	comorbidities (relative)	severe or symptomatic osteoporosis	1,4
Orens (2006)	diagnosis (relative)	mechanical ventilation	1,3,4,5
Azoulay (2006)	diagnosis	no lifetime extending treatment	1,4,5
Mielke (2003)	diagnosis	In-house medical and surgical emergencies	4,5
Mielke (2003)	diagnosis	Critically ill patients in the emergency departments	4,5
Mielke (2003)	diagnosis	Patients considered to be in a priority program, specifically neurosciences, transplantation, oncology, cardiovascular diseases, and the patient ambulatory care program	
Mielke (2003)	diagnosis	Patients referred from another institution who require urgent management only available at, or specifically suited to, the expertise offered at the hospital intensive care units	
Mielke (2003)	diagnosis	all other patients	
Gruppo di Studio ad Hoc della Commissione di Bioetica (2003)	diagnosis + prognosis	Patients in the terminal phase of an irreversible disease must not be treated intensively nor must they be admitted into ICU. Examples include: devastating cerebral lesions or cerebral lesions not susceptible to treatment or close to brain death who are not organ donors; irreversible multi-organ failure, cancer that is non-responsive to specific treatment, persistent vegetative state	
Roupie (2001)	diagnosis	"absence de critères objectifs de gravité"	
Roupie (2001)	diagnosis	"le fait d'être infecté par le VIH entraînait une décision de non-admission en réanimation"	1,3
Dahm (2001)	diagnosis + comorbidities + intraoperative transfusion requirement	ASA less or equal 3, APACHE less or equal 12, less than 2 units of PRBC	1,3
Azoulay (2001)	diagnosis	"condition not critical"	
Dawson (2000)	diagnosis	admit low risk APACHE III <30	1,3
Sprung (1999)	diagnosis	another critical care unit was more appropriate	
Crippen (1999)	diagnosis	persistent vegetative state	1,3,4,5
Crippen (1999)	diagnosis	end-stage dementia	1
Lim (1996)	diagnosis+ physiologic variables	"one should consider carefully before admitting patients who score beyond" APACHE 2 >24	1,3

Using SUPPORT to GUIDe our fix on futility (1995)	diagnosis	"patients in persistent vegetative states should not be sent to ICU"	1,3,4,5
Consensus statement on the triage of critically ill patients (1994)	diagnosis	may exclude patients with severe irreversible brain damage	1,3,4,5
Consensus statement on the triage of critically ill patients (1994)	diagnosis	may exclude patients with irreversible multiorgan failure	
Consensus statement on the triage of critically ill patients (1994)	diagnosis	may exclude patients with metastatic cancer unresponsive to treatment	4,5
Consensus statement on the triage of critically ill patients (1994)	diagnosis	should exclude patients declared brain dead who are not organ donors	1,3,4,5
Consensus statement on the triage of critically ill patients (1994)	diagnosis	should exclude patients in a persistent vegetative or permanently unconscious state	4,5
Consensus statement on the triage of critically ill patients (1994)	diagnosis	patients with terminal, irreversible illness who face imminent death should be excluded from the ICU	
Murphy (1994)	diagnosis	"patients in persistent vegetative states should not be sent to ICU"	1,3,4,5
Futility guidelines (1994)	diagnosis	Treatment may be withheld or withdrawn on the basis of futility assessments when treatment would only maintain permanent vegetative state (PVS) once that diagnosis had been made and its irreversibility had been confirmed	
Futility guidelines (1994)	diagnosis	Treatment may be withheld or withdrawn on the basis of futility assessments when there is clear and convincing data to indicate the lack of a successful outcome (quantitative futility)—e.g., APACHE scores, multi-system (three or more) failure in elderly patient, CPR in patient with multi-system disease, etc.	
Dawson (1993)	diagnosis	Irreversible primary pathology such as terminal cancer, HIV, MOF and central nervous system pathology that will cause the patient's demise during the current hospitalization	
Dawson (1993)	diagnosis	patients not requiring critical care nursing i.e., less than 1:2 nursing care as described in the criteria for 1:1 or 1:2 nursing	1
Dawson (1993)	procedures	diagnostic and therapeutic procedures such as bronchoscopy and endoscopy	1,3,4,5

Birnbaum (1993)	procedure	"admitted for monitoring purposes only": not likely to benefit or further benefit	1,4,5
Birnbaum (1993)	diagnosis	"the dying": not likely to benefit or further benefit	
Oddi (1990)	goals of care	a terminal patient requiring a quality of service directed toward care of pain or comfort should not be admitted to the critical care unit	4,5
Murphy (1990)	Diagnosis + cost	Economic appropriateness model	1
Murphy (1990)	diagnosis + utility	Medical appropriateness model	1
ICU admission criteria need honing to block rationing (1989)	diagnosis	brain death	1,3
ICU admission criteria need honing to block rationing (1989)	diagnosis	rapidly progressing fatal illnesses	
Bekes (1988)	diagnosis	brain death	1,3
Bekes (1988)	diagnosis	Non traumatic coma causing persistent vegetative state	1,3
Cohen (1977)	diagnosis	patients who are immediately and irreversibly dying, and for whom it has been carefully determined that there is no known therapy are not salvageable…cannot benefit from intensive care	

*A quality criteria meets the following:
(1) Specific: Targets a specific criteria
(2) Scientifically-Sound: stems from the literature, not subjective and will produce consistent decisions
(3) Measurable: it is possible to tally how many decisions comply with the criteria requirement
(4) Feasible: can be implemented broadly
(5) Usable: once implemented, can be understood by knowledge users and used for decision-making

Appendix 4-4. Physician-related criteria as listed in each citation and their quality rating

Study ID	Category of criteria	Specific criteria	Quality of the criteria*
Ramos (2016)	Prognosis	Lowest priority if decompensated comorbidities with severe dependency, advanced disease with partial or severe dependency, or advanced disease with preserved functionality but an estimated intuitive prognosis of death (all specifically defined)	1
Nates (2016)	Prognosis	Palliative care if Terminal or moribund patients with no possibility of recovery	1,5
Blanch (2016)	Likelihood to benefit	Patients who are very likely to die after ICU admission and those who will recover with care outside the ICU should not be admitted	5
Christian (2014)	Prognosis	Exclude patient groups that have a life expectancy < 1 year	1
Sprung (2013)	Prognosis	In general, patients with a greater likelihood of benefit have priority over patients unlikely to benefit	1,5
Sprung (2013)	Prognosis	In general, patients with very poor prognoses and little likelihood of benefit should not be admitted to ICUs	1,5
Sprung (2013)	Prognosis	Patients with a very good outcome with or without ICU care also should not be admitted to ICUs	1,5
Orsini (2013)	Prognosis	"too well"	
Orsini (2013)	Prognosis	"too ill"	
Luchetti (2013)	Prognosis	"the irreversibility of the clinical setting is deemed to be reasonably certain, it is appropriate not to initiate intensive measures"	
Louriz (2012)	Prognosis	"too well to benefit"	
Louriz (2012)	Prognosis	"too sick to benefit"	
Cohen (2012)	Prognosis	"not critical enough"	
McKeown (2011)	Prognosis	"too well"	
McKeown (2011)	Prognosis	"suffering likely imminently fatal insults even if ICU support was provided"	
Joynt (2011)	Prognosis	"medical futility"	
Howe (2011)	Prognosis	"too well to benefit"	
Howe (2011)	prognosis	"too sick to benefit"	
Howe (2011)	prognosis	"potentially could benefit from ICU admission but triaged"	
Chalmers (2011)	prognosis	"successful treatment would not be of overall benefit to the patient"	
Iapichino (2010)	prognosis	"too well"	

Iapichino (2010)	prognosis	"too ill"	
Birch (2009)	prognosis	"patients who are deemed too unwell to benefit, or those with no hope of recovery should not be admitted"	
Department of health (2009)	prognosis	futility: patients who are too sick, have been on conventional therapy too long, or have a fatal diagnosis	
Vanhecke (2008)	prognosis	"too well to benefit"	2
Reignier (2008)	prognosis	"too well to benefit from ICU admission"	
Reignier (2008)	prognosis	"too sick to benefit from ICU admission"	
Simchen (2007)	Prognosis	patients with a terminal illness not expected to survive the current admission	
Garrouste-Orgeas (2006)	prognosis	"too well to benefit"	
Garrouste-Orgeas (2006)	prognosis	"too sick to benefit"	
Sottiaux (2005)	prognosis	"futility"	
Sottiaux (2005)	prognosis	"insufficient benefit of ICU care compared to other patients"	
Joynt (2005)	prognosis	"futility"	
Garrouste-Orgeas (2005)	prognosis	"too sick to benefit"	
Garrouste-Orgeas (2005)	prognosis	"too well to benefit"	
Augier (2005)	prognosis	"not severe enough for admission"	2
Augier (2005)	prognosis	"health condition was considered irreversible"	2
Garrouste-Orgeas (2003)	prognosis	"too sick to benefit"	
Garrouste-Orgeas (2003)	prognosis	"too well to benefit"	
Garrouste-Orgeas (2003)	prognosis	strong likelihood of dependency or cognitive impairment if discharged alive	
Gruppo di Studio ad Hoc della Commissione di Bioetica (2003)	prognosis	It is ethically appropriate not to admit into ICU patients in whom, with reasonable cer- tainty, it is expected that intensive care will produce no appreciable benefit in terms of survival or quality of residual life, or in whom the risks and suffering attached to treatment are greater than the benefits of treatment	
Gruppo di Studio ad Hoc della	prognosis	too well	

Commissione di Bioetica (2003)			
Roupie (2001)	prognosis	"patients moribonds"	
Roupie (2001)	prognosis	"Si le bénéfice attendu de la réanimation apparaît clairement nul, il est parfaitement admis que cette orientation d'hospitalisation ne doit pas être prise"	
Joynt (2001)	prognosis	"Inappropriate referrals" - patients who were too well to benefit	
Joynt (2001)	prognosis	"triage" - prioritization based on the perceived magnitude of benefit that could be derived from ICU care	
Joynt (2001)	prognosis	"futility" - patients who were too sick to benefit	
Sprung (1999)	prognosis	"bad prognosis"	
Sprung (1999)	prognosis	"good prognosis"	
Sprung (1999)	Physician evaluation	"more data required for a decision"	
Smith (1999)	prognosis	"too well to benefit"	
Smith (1999)	prognosis	"no hope of recovering to an acceptable quality of life"	
Strosberg (1999)	prognosis	too well	
Strosberg (1999)	prognosis	too sick	
American College of Critical Care Medicine of the Society of Critical Care Medicine (1999)	Prognosis	"too sick to benefit": Patients with terminal and irreversible illness facing imminent death (too sick to benefit from ICU care). For example: severe irreversible brain damage, irreversible multi-organ system failure, metastatic cancer unresponsive to chemotherapy and/or radiation therapy (unless the patient is on a specific treatment protocol), patients with decision-making capacity who decline intensive care and/or invasive monitoring and who receive comfort care only, brain dead non-organ donors, patients in a persistent vegetative state, patients who are permanently unconscious, etc.	1,2,4,5
American College of Critical Care Medicine of the Society of Critical Care Medicine (1999)	Prognosis	"too well to benefit": Little or no anticipated benefit from ICU care based on low risk of active intervention that could not safely be administered in a non-ICU setting (too well to benefit from ICU care). Examples include patients with peripheral vascular surgery, hemodynamically stable diabetic ketoacidosis, mild congestive heart failure, conscious drug overdose, etc.	1,2,4,5
American College of Critical Care Medicine of the Society of Critical Care Medicine (1999)	Prognosis	"These are patients who are generally not appropriate for ICU admission. Admission of these patients should be on an individual basis, under unusual circumstances and at the discretion of the ICU Director"	

Scheinkestel (1996)	Prognosis	"do not admit a critically ill patient to the ICU on the basis that they will not recover"	
Osborne (1994)	Prognosis	"ICU resources should be withheld from patients unlikely to derive benefit (e.g. those with acute respiratory failure after bone-marrow transplantation)"	
Futility guidelines (1994)	Prognosis	Treatment may be withheld or withdrawn on the basis of futility assessments when treatment would only serve to prolong the dying process and bring no relief of a patient's suffering (death is inevitable and imminent and treatment includes artificial feeding and hydration where the patient is only being maintained in his/her current state with no hope of improvement)	
Futility guidelines (1994)	Prognosis	Treatment may be withheld or withdrawn on the basis of futility assessments when the patient would never leave the Intensive Care Unit for the rest of his/her life	
Futility guidelines (1994)	Prognosis	Treatment may be withheld or withdrawn on the basis of futility assessments when treatment provides physiologic effect but no benefit	
Guidelines for the utilisation of intensive care units (1994)	prognosis	Patients with no chance of recovering to a reasonable quality of life should not be admitted to the ICU.	1
Consensus statement on the triage of critically ill patients (1994)	Prognosis	very poor prognosis and little likelihood of benefit should not be admitted	
Consensus statement on the triage of critically ill patients (1994)	prognosis	very good prospects with or without ICU care should not be admitted	
Osborne (1992)	prognosis	"interventions including ICU care should be withheld or withdrawn when they are futile"	
Osborne (1992)	Prognosis	patients who are terminally ill or who will die imminently	
Benes (1992)	Prognosis	terminally-ill	
Benes (1992)	prognosis	do not perform CPR for patients with less than a 3% chance of survival	1
Triage in the ICU (1992)	Prognosis	too well	
Triage in the ICU (1992)	prognosis	too sick	
Strosberg (1991)	prognosis	too well	
Strosberg (1991)	prognosis	too sick	
ICU admission criteria need honing	prognosis	patients for whom iatrogenic risks exceed the likelihood of potential benefits	

to block rationing (1989)			
Intensive care in the United Kingdom (1989)	prognosis	death probable shortly whatever is done	
Intensive care in the United Kingdom (1989)	prognosis	death apparently imminent	
Bekes (1988)	prognosis	critically ill, unstable patients whose previous state of health, underlying disease or acute illness, either alone or in combination, severely reduces the likelihood of recovery and benefit from ICU treatment	
Jemison (1983)	prognosis	it is not medically appropriate to devote limited ICU resources to patients without reasonable prospect of significant recovery	

*A quality criteria meets the following:
(1) Specific: Targets a specific criteria
(2) Scientifically-Sound: stems from the literature, not subjective and will produce consistent decisions
(3) Measurable: it is possible to tally how many decisions comply with the criteria requirement
(4) Feasible: can be implemented broadly
(5) Usable: once implemented, can be understood by knowledge users and used for decision-making

Appendix 4-5. Context-related criteria as listed in each citation and their quality rating

Study ID	Category of criteria	Specific criteria	Quality of the criteria*
Oerlemans (2016)	Occupancy	no patients already admitted to the ICU should be transferred to make room for a new admission, unless the new admission is at great risk of further injury or death if they were transported and/or required specific care that cannot be supplied by a nearby hospital.	3
Morton (2015)	Influenza pandemic	refer to OHPIP	3
Winsor (2014)	influenza pandemic	first come first serve	4,5
Winsor (2014)	influenza pandemic	random allocation	4,5
Conlon (2014)	Burn disaster	Use American Burn Association ratio-to-benefit grid (a function of age and TBSA: low, medium, high, expectant)	1,3,4,5
Christian (2014)	Pandemic or disasters	We suggest critical care only be rationed when resources have, or will shortly be, overwhelmed despite all efforts at augmentation and a regional-level authority that holds the legal authority and adequate situational awareness has declared an emergency and activated its mass critical care plan.	4,5
Marriott (2012)	Pandemic	SOFA score ≥12, severe trauma, unwitnessed or non-VF arrest, severe life-limiting condition	4
Louriz (2012)	Available beds	"ICU was too full to pro- vide optimal care to an additional patient "	1,3
Daniel (2012)	Haiti earthquake	short-term survival; long-term survival; patient's role in society; dependents; potential for saving or harming others; shared life experiences; empathy; perceived quality of life	
Joynt (2011)	Limited resource	"triage"	
Conlon (2011)	Burn disaster	Use American Burn Association ratio-to-benefit grid (a function of age and TBSA: low, medium, high, expectant) and transform management suggestion into hospital Tiers (I-IV)	1,3,4,5
Wilkens (2010)	Mass disaster	AGILITIES score >100	1,2,3,4,5
Sprung (2010)	Influenza epidemic or Mass disaster	trauma, burns, cardiac arrest, cognitive impairment, neuromuscular disease, malignant disease, immunocompromised, neuro event, end-stage failure, elective surgery, too well (see table 4 for specific criteria)	1,2,3,4,5
Kaposy (2010)	Influenza pandemic	SOFA first, then prioritize as per: occupation (multiplier effect), healthcare personnel, caregivers of children, fair-innings/life-cycle	3
Iapichino (2010)	available beds	bed not available	1,3
Christian (2010)	Influenza pandemic or Mass disaster	trauma, burns, cardiac arrest, cognitive impairment, neuromuscular disease, malignant disease, immunocompromised, neuro event, end-stage failure, elective surgery (table 2 for specific criteria)	1,2,3,4,5

Chipp (2010)	Weather	Unsuitable flying conditions	3,4,5
Beigi (2010)	Influenza pandemic in maternity	SOFA score >11, severe trauma, burns, cardiac arrest, severe cognitive impairment, neuro disease, metastatic/terminal cancer, immunocompromised state, end-stage failure	4
NSW Health Department (2010)	Influenza pandemic	"critical care may be reasonably prioritized to a patient who is: at more immediate risk of death without such care; more likely to benefit from the treatment; likely to suffer greater harm without treatment; likely to suffer less burden or ill-effects from the treatment; or likely to gain the same therapeutic benefit from the treatment more rapidly"	
NSW Health Department (2010)	Influenza pandemic	Front-line clinical staff will be afforded rapid access to ICU treatment where possible	1,3,4,5
NSW Health Department (2010)	Influenza pandemic	treatment may be reasonably withheld or withdrawn where patient/substitute decision-maker/guardianship board has been consulted; such treatment is judged to be of minimal or no benefit to the patient; such treatment would be overly burdensome to the patient; and/or it is not reasonably available without disproportionate hardship to others	
NSW Health Department (2010)	Influenza pandemic	significant pre-existing co-morbidity such as irreversible neuro condition, cirrhosis with ascites, encephalopathy, history of variceal bleeding, active malignancy with predicted limited survival, HIV; weight/120kg	1,3
NSW Health Department (2010)	Influenza pandemic	PHTM (mPAP>50); severe right or left heart failure (EF<25%); cardiac arrest	1,3,4,5
NSW Health Department (2010)	Influenza pandemic	severe aortic valve regurgitation; aortic dissection	1,3,4,5
NSW Health Department (2010)	Influenza pandemic	age >65, multiple trauma with uncontrolled hemorrhage; multiple organ failure	1,3,4,5
NSW Health Department (2010)	Influenza pandemic	high pressure, high FiO2, IPPV for >1week	1,3,4,5
NSW Health Department (2010)	Influenza pandemic	severe peripheral vascular disease	1,3,4,5
NSW Health Department (2010)	Influenza pandemic	Three tier system (see text)	1,2,3,4,5
Veterans Health Administration (2010)	Influenza pandemic	Confirmed presence of any advanced disease with average life expectancy of 6 months or less (e.g., advanced cancer or end-stage organ failure with less than 6 months average survival).	4,5
Veterans Health Administration (2010)	Influenza pandemic	Recent cardiac arrest	1,3,4,5
Veterans Health Administration (2010)	Influenza pandemic	Confirmed severe irreversible cognitive impairment (e.g., Persistent Vegetative State (PVS) or advanced dementia).	4,5

Veterans Health Administration (2010)	Influenza pandemic	SOFA score >11	1,2,3,4,5
White (2009)	public health disaster	prioritize the lowest score combining 3 principles: Save the most lives, save the most life-years, life-cycle principle (sofa, prognosis, age)	1,3,4,5
Frolic (2009)	influenza pandemic	Exclude first based on OHPP (SOFA>11 or one other criteria - to look up) then prioritize as per prognosis, multiplier effect, HCP/ES workplace exposure, caregivers, fair-innings/life-cycle principle)	3
Altevogt (2009)	Disaster situation	SOFA>15, SOFA>5 for >5days, >6organ failures	1,2,3,4,5
Altevogt (2009)	Disaster situation	severe trauma	2
Altevogt (2009)	Disaster situation	severe burns on patient with any two of the followings: >60yo, >40% TBA, inhalational injury	1,2,3,4,5
Altevogt (2009)	Disaster situation	Cardiac arrest	1,2,3,4,5
Altevogt (2009)	Disaster situation	severe baseline cognitive impairment	2
Altevogt (2009)	Disaster situation	advanced untreatable neuromuscular disease	2
Altevogt (2009)	Disaster situation	metastatic malignant disease	2,3
Altevogt (2009)	Disaster situation	advances and irreversible neurologic event or condition	2
Altevogt (2009)	Disaster situation	end-stage organ failure	2
Altevogt (2009)	Disaster situation	age>85yo	1,2,3,4,5
Altevogt (2009)	Disaster situation	elective palliative surgery	1,2,3,4,5
Department of Health (2009)	Influenza pandemic	SOFA score >11	1,2,3,4,5
Department of Health (2009)	Influenza pandemic	severe trauma	2
Department of Health (2009)	Influenza pandemic	severe burns on patient with any two of the followings: >60yo, >40% TBA, inhalational injury	1,2,3,4,5
Department of Health (2009)	Influenza pandemic	Cardiac arrest	1,2,3,4,5
Department of Health (2009)	Influenza pandemic	severe baseline cognitive impairment	2

Department of Health (2009)	Influenza pandemic	advanced untreatable neuromuscular disease	2
Department of Health (2009)	Influenza pandemic	metastatic malignant disease	2,3
Department of Health (2009)	Influenza pandemic	advances and irreversible neurologic event or condition	2
Department of Health (2009)	Influenza pandemic	end-stage organ failure: COPD <25% or PaO2<55mmHg or secondary PHTN; cystic fibrosis with post bronchodilator FEV1<30% or baseline PaO2<55mmHg, pulmonary fibrosis with VC or TLC >60% predicted or PaO2<55mmhg or secondary pulmonary hypertension; primary pulmonary hypertension with NYHA class III or IV heart failure, right atrial pressure >10mmHg or mean PAP >50mmHg; Child-Pugh>or equal to 7	1,2,3,4,5
Department of Health (2009)	Influenza pandemic	age>85yo	1,2,3,4,5
Department of Health (2009)	Influenza pandemic	elective palliative surgery	1,2,3,4,5
Devereaux (2008)	Emergency Mass Critical Care Event	SOFA score criteria: patients excluded from critical care if risk of hospital mortality 80%	1,2,3,4,5
Devereaux (2008)	Emergency Mass Critical Care Event	Severe, chronic disease with a short life expectancy	1,2,3,4,5
Powell (2008)	public health disaster	Cardiac arrest	1,2,3,4,5
Powell (2008)	public health disaster	metastatic malignancy with poor prognosis	1,2,4,5
Powell (2008)	public health disaster	severe burn: BSA >40%, severe inhalation injury	1,2,3,4,5
Powell (2008)	public health disaster	end-stage organ failure	1,2,3,4,5
Powell (2008)	public health disaster	SOFA score >11	1,2,3,4,5
Taylor (2008)	Influenza pandemic or Mass disaster	use SOFA triaging by Christian	1,2,3,4,5
Hick (2007)	large-scale disasters	organ system function	2,3,4,5
Hick (2007)	large-scale disasters	duration of benefit/prognosis	

Hick (2007)	large-scale disasters	Duration of need	
Shanker (2006)	limited resource	full occupancy or equipment failure	3
Hick (2006)	epidemic	Respiratory failure requiring intubation with persistent hypotension (systolic blood pressure <90 mm Hg for adults) unresponsive to adequate fluid resuscitation after 6–12 hours of therapy and signs of additional end-organ dysfunction (e.g., oliguria, mental status changes, cardiac ischemia)	1,3,4,5
Hick (2006)	epidemic	Failure to respond to mechanical ventilation (no improvement in oxygenation or lung compliance) and antibiotics after 72 hours of treatment for a bacterial pathogen (timeline may be modified based on organism-specific data)	1,3,4,5
Hick (2006)	epidemic	Laboratory or clinical evidence of > 4 organ systems failing (Details in paper)	1,3,4,5
Hick (2006)	epidemic	Known congestive heart failure with ejection fraction <25% (or persistent ischemia unresponsive to therapy and pulmonary edema)	1,3,4,5
Hick (2006)	epidemic	Acute renal failure requiring hemodialysis (related to illness)	1,3,4,5
Hick (2006)	epidemic	Severe chronic lung disease including pulmonary fibrosis, cystic fibrosis, obstructive or restrictive diseases requiring continuous home oxygen use before onset of acute illness	1,3,4,5
Hick (2006)	epidemic	Acquired immunodeficiency syndrome (AIDS), other immunodeficiency syndromes at stage of disease susceptible to opportunistic pathogens (e.g., CD4 <200 for AIDS) with respiratory failure requiring intubation	1,3,4,5
Hick (2006)	epidemic	Active malignancy with poor potential for survival (e.g., metastatic malignancy, pancreatic cancer)	1,4
Hick (2006)	epidemic	Cirrhosis with ascites, history of variceal bleeding, fixed coagulopathy, or encephalopathy	1,3,4,5
Hick (2006)	epidemic	Acute hepatic failure with hyperammonemia	1,3,4,5
Hick (2006)	epidemic	Irreversible neurologic impairment that makes patient dependent for personal cares (e.g., severe stroke, congenital syndrome, persistent vegetative state)	1,3,4,5
Hick (2006)	epidemic	Restriction of treatment based on disease-specific epidemiology and survival data for patient subgroups (may include age-based criteria)	4
Hick (2006)	epidemic	Expansion of preexisting disease classes that will not be offered ventilatory support	4
Hick (2006)	epidemic	Applying Sequential Organ Failure Assessment scoring to the triage process and establishing a cutoff score above which mechanical ventilation will not be offered	4
Christian (2006)	Influenza pandemic	SOFA score >11	1,3,4,5
Christian (2006)	Influenza pandemic	severe trauma	
Christian (2006)	Influenza pandemic	severe burns on patient with any two of the followings: >60yo, >40% TBA, inhalational injury	1,2,3,4,5
Christian (2006)	Influenza pandemic	Cardiac arrest	1,2,3,4,5

Christian (2006)	Influenza pandemic	severe baseline cognitive impairment	
Christian (2006)	Influenza pandemic	advanced untreatable neuromuscular disease	
Christian (2006)	Influenza pandemic	metastatic malignant disease	3
Christian (2006)	Influenza pandemic	advances and irreversible neurologic event or condition	
Christian (2006)	Influenza pandemic	end-stage organ failure: COPD <25% or PaO2<55mmHg or secondary PHTN; cystic fibrosis with post bronchodilator FEV1<30% or baseline PaO2<55mmHg, pulmonary fibrosis with VC or TLC >60% predicted or PaO2<55mmhg or secondary pulmonary hypertension; primary pulmonary hypertension with NYHA class III or IV heart failure, right atrial pressure >10mmHg or mean PAP >50mmHg; Child-Pugh>or equal to 7	1,3,4,5
Christian (2006)	Influenza pandemic	age>85yo	1,3,4,5
Christian (2006)	Influenza pandemic	elective palliative surgery	1,3,4,5
Joynt (2005)	lack of resources	triage as per guidelines	2
Garrouste-Orgeas (2005)	lack of resources	unit too busy to provide optimal care to an additional patient	
Azoulay (2001)	lack of resources	full unit	1,3
Sprung (1999)	lack of resources	"no available beds"	1,3
Futility guidelines (1994)	local policy	Treatment may be withheld or withdrawn on the basis of futility assessments when continued treatment is in violation of an established medical center policy	5
Teres (1993)	lack of resources	"if only one bed is available, a young patient with an acute reversible process should have priority over an older patient with a not-so-reversible disease"	
Teres (1993)	lack of resources	high-probability estimate of hospital mortality	
Teres (1993)	lack of resources	persistent vegetative state	1,3
Teres (1993)	lack of resources	full DNR	1,3
Teres (1993)	lack of resources	patient considered unsalvageable clinically	
Teres (1993)	lack of resources	rapidly fatal underlying condition	

Teres (1993)	lack of resources	Alzheimer's disease	1,3
Swenson (1992)	lack of resources	in a situation of scarcity	

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(1) Specific: Targets a specific criteria
(2) Scientifically-Sound: stems from the literature, not subjective and will produce consistent decisions
(3) Measurable: it is possible to tally how many decisions comply with the criteria requirement
(4) Feasible: can be implemented broadly
(5) Usable: once implemented, can be understood by knowledge users and used for decision-making

Appendix 4-6. PRISMA Checklist for review of Triage and Transport Criteria for admission to ICU

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	Page 19
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	Pages ii-iii
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	Page 19
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	Page 19
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	Page 22
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	Pages 20
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	Page 20
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Pages 16-18
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	Page 21
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	Page 21

Section/topic	#	Checklist item	Reported on page #
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	Page 21
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	N/A But quality assessment described on page 21
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	N/A This was a review of criteria
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	N/A But quality assessment described on page 21
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	N/A
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	Page 21 (thematic analysis – pre-specified)
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	Page 22 and Figure 4-1
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Page 23 and Appendix 4-1
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome-level assessment (see Item 12).	Page 23 and Appendix 4-1

Section/topic	#	Checklist item	Reported on page #
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group and (b) effect estimates and confidence intervals, ideally with a forest plot.	N/A This was a review of criteria
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	N/A This was a review of criteria
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	Quality assessment Appendix 4-1
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression) (see Item 16).	Table 4-2, Table 4-3 and Table 4-4
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., health care providers, users, and policy makers).	Page 36
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review level (e.g., incomplete retrieval of identified research, reporting bias).	Page 37
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	Page 37
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	No funding

5. Discussion

5.1 Rappel des résultats principaux

Notre objectif était de définir les critères qui, si exhibés par un candidat potentiel, l'exclurait d'emblée de recevoir des soins intensifs. En d'autres termes, nous cherchions à générer une liste des contrindications à une admission aux soins intensifs basée sur les connaissances, publications et politiques accessibles. Deux cent critères ont ainsi été extraits de 129 articles provenant de 23 pays, offrant donc une diversité de modèles d'organisation de soins (Annexe 4-1). De plus, 71 % de ces articles décrivaient un mécanisme d'exclusion des soins intensifs. Nous avons classifié les critères selon qu'ils appartiennent à l'un ou l'autre des quatre thèmes suivants : relatifs aux patients (48 articles, 18 critères), relatifs à la condition médicale (63 articles, 87 critères), relatifs aux médecins (45 articles, 14 critères) ou relatifs au contexte (37 articles, 81 critères). Les annexes 4-2, 4-3, 4-4 et 4-5 illustrent la qualité de chacun des critères utilisant cinq paramètres. Aucun des critères relatifs aux médecins n'est mesurable alors que 45 % à 66 % des critères relatifs aux trois autres thèmes le sont. Cela illustre une certaine subjectivité qui existe dans le triage et le transport aux soins intensifs. Par exemple, la formulation de critères d'exclusion tel l'« âge avancé », un « pronostic intuitif de décès », une « immunosuppression majeure » ou un « piètre état fonctionnel » ne permet pas de mesurer un potentiel taux de respect de ces critères étant donné le flou qui existe autour de ces définitions.

Par ailleurs, en regard de la qualité des études retenues, 16 % ont été jugées de grande qualité (i.e. politiques nationales ou lignes directrices de sociétés savantes). La majorité des articles faisaient plutôt état de revues de littérature, d'éditoriaux ou d'études descriptives observationnelles (Annexe 4-1). Il s'agit là d'une conclusion majeure : notre revue systématique n'a permis d'identifier aucune étude randomisée contrôlée ou d'étude comparative visant à mesurer ou évaluer l'effet de critères de triage sur l'efficience du processus.

5.2 Contribution des résultats au domaine d'intérêt et contextualisation au regard de la littérature existante

Bien que quelques revues de littérature aient été publiées sur le sujet par le passé (89, 144, 147, 184), cette étude est la première revue systématique documentant de façon exhaustive les critères, activement utilisés ou faisant état de propositions formelles, de triage et de transport de patients nécessitant des soins intensifs. La contribution principale de notre étude est qu'elle recense les critères où l'utilisation est, ou se veut, systématique au sein d'une équipe ou d'une organisation. En effet, il existe tout un pan de littérature, exclu de notre revue systématique, visant à documenter les pratiques individuelles, souvent par le biais de sondages. Bien que certains critères de triage recoupent nos résultats, comme le pronostic du patient tel qu'évalué par l'intensiviste, d'autres thèmes émergent de ces études : la religion du médecin (185), le pays de pratique (186), les caractéristiques socio-économiques (187) ou même le morale de l'équipe des soins infirmiers (108).

Il est également important de situer notre étude dans le contexte politique. Nous devinons qu'il puisse s'agir d'un sujet sensible étant donné l'interprétation que certains pourraient faire de la démarche. En effet, d'aucuns pourraient y voir une manœuvre pour légitimer le rationnement du panier de services, un exercice connu pour soulever les passions au Québec.(189) Cependant, notre recension des écrits nous pousse à conclure que le rationnement existe déjà. Malheureusement, à l'heure actuelle, il est exercé de façon inconstante ce qui brime les principes d'équité et de transparence auxquels les citoyens sont en droit de s'attendre. C'est justement dans une volonté de réduire la subjectivité dans l'évaluation des cas requérant des soins intensifs que nous avons entrepris notre démarche et que nous la souhaitons fondée sur les données probantes. À ce titre, la principale conclusion de notre revue systématique déçoit. En effet, les critères d'exclusions aux soins intensifs demeurent majoritairement vagues et ne permettent pas de tendre vers une uniformisation des lignes directrices en la matière. Recommander d'exclure des patients dont l'âge est « avancé », qui ont « trop de comorbidités » ou qui sont « trop malades » permet à chacun qui en fait la lecture d'y aller de sa propre interprétation. Il est frappant que les termes utilisés pour gérer la priorisation des admissions aux soins intensifs soient aussi vagues vingt ans après que la *Society of Critical Care Medicine* (SCCM) ait fait la recommandation que chaque USI développe ses critères spécifiques de triage. D'ailleurs, le fait que la recommandation soit réitérée dans les plus

récentes lignes directrices en 2016 témoigne du surplace dont le sujet fait preuve. Il est possible que ce constat résulte de l'importance que l'autonomie professionnelle des médecins exerce sur la pratique aux soins intensifs. Ce principe demande d'un médecin de militer pour son patient tout en maintenant la liberté de choisir ses options de traitements basés sur le meilleur jugement clinique.(183) Une externalité significative peut toutefois en résulter. En effet, l'imprécision des critères d'admission peut mener à un manque de transparence(181) ou, du moins, à une importante inconstance des décisions prises par les médecins.(28-33, 38, 40, 182) Néanmoins, nos résultats montrent une tendance où les critères deviennent plus spécifiques depuis une décennie, tel que l'illustre l'annexe 4-5 montrant que 66% des critères de triage relatifs au contexte sont mesurables. Cela semble corréler dans le temps avec la publication en 2006 de l'article de Christian *et al.* qui décrit un protocole de triage à appliquer dans le cadre d'une pandémie d'influenza et qui comporte douze critères d'exclusion. Cette étude, largement citée, a généré beaucoup d'intérêt et explique les résultats de notre étude relatifs à la classification des critères par robustesse. En effet, dans la formule que nous avons élaborée, plus un critère est cité par un nombre important d'études de qualité, plus son score de robustesse sera élevé. Or, 15 des 20 critères de triage les plus robustes sont tirés de propositions en cas d'épidémie et proviennent d'études qui reprennent les propositions de Christian ou qui s'en inspirent fortement. Cela témoigne bien évidemment de l'acceptabilité de ces critères spécifiques dans la communauté du triage aux soins intensifs, mais il importe de souligner que leur utilisation se veut exceptionnelle; elles ne sont pas actuellement recommandées pour guider les décisions quotidiennes de triage auxquels les intensivistes font face. Néanmoins, il y a lieu d'évaluer la pertinence d'une telle approche axée sur la personnalisation des critères de triage par opposition à une recherche de critères universels.

5.3 Les limites de notre étude

Malgré les forces de notre revue systématique, celle-ci contient un nombre de faiblesses qui limitent l'interprétation des résultats. D'emblée, notre plus grande faiblesse se trouve au niveau de la méthodologie. En effet, nos résultats sont le fruit du travail d'un seul réviseur. Notre plan méthodologique initial prévoyait deux réviseurs qui, indépendamment et en double, devaient réviser les titres et les abrégés ainsi que procéder à l'extraction de données des articles retenus. Pour des raisons logistiques, nous n'avons pu coordonner les plages horaires des deux réviseurs. Par

conséquent, il est possible que la liste d'articles retenus, aussi exhaustive soit-elle, soit incomplète. Il va de soi que cette faille empêche la publication, dans sa forme actuelle, de notre revue systématique dans un journal d'envergure. Cela étant dit, il est prévu que nous prenions les mesures pour compléter la deuxième révision, mettre à jour nos résultats et préparer une version de ce manuscrit qui convienne aux standards de publications révisées par les pairs. Par ailleurs, nos résultats sont également limités par le fait que nous avons exclu les articles rédigés dans les langues autres que le français ou l'anglais et que nous nous soyons ainsi potentiellement privés de certaines politiques locales ou nationales étrangères, notamment celles qui ne sont pas en ligne et qui n'auraient pas été captées par nos moteurs de recherche. Cependant, nous jugeons qu'une telle initiative n'aurait pas été réaliste étant donné l'ampleur des moyens nécessaires.

5.4 Nos recommandations

Dans une volonté de transparence et afin de prendre les devants des appréhensions citoyennes d'une thématique pouvant être perçue comme du rationnement, nous soumettons que l'élaboration de critères de triage et de transport dans un possible guichet d'accès unique devrait se faire en partenariat avec la population dans un esprit de dialogue social. Tout comme le médecin dans sa relation de soignant favorise l'implication de son patient dans les soins qu'il reçoit, le *patient partenaire*,(190) la communauté médicale doit impliquer les citoyens dans l'élaboration des structures de services dont ils bénéficieront, une *population partenaire*. À ce titre, les travaux du Dr Antoine Boivin, titulaire de la Chaire de recherche du Canada sur le partenariat avec les patients et le public, pavent la voie à une participation citoyenne dans les décisions de politiques publiques de santé et à l'évaluation rigoureuse des résultats de cette approche.(191, 192) Nous croyons fondamentalement qu'il s'agit là d'un champ d'étude innovateur pour pallier les lacunes laissées par l'état des lieux scientifique actuel dans le domaine du triage aux soins intensifs.

5.5 Directions futures

Afin de parvenir à mettre en place un centre de triage québécois, un programme de recherche axé sur l'optimisation des pratiques de triage et de transport des patients requérant des soins intensifs pourrait combler les lacunes identifiées par notre revue systématique. Ce programme aurait pour

objectif d'identifier les pratiques optimales en transport et triage de soins intensifs, d'élaborer des recommandations puis de les appliquer au réseau québécois afin d'en faire bénéficier les patients. Un programme idéal comporterait trois phases. D'abord, il serait souhaitable de compléter l'identification du portrait de la situation actuelle au Canada et ailleurs dans le monde, notamment en recensant les modèles de triage et de transport. Cela permettrait de remédier à la faiblesse de notre revue systématique qui n'a pas permis d'identifier d'études comparatives évaluant l'utilisation de critères de triage et leurs effets selon les modèles d'organisation des soins. Pour ce faire, il serait possible de mener une autre revue systématique dont les termes de recherche viseraient à identifier des modèles d'organisation de soins intensifs ou des centres de triage ainsi que les éléments de structure et de processus associés à la haute qualité et à la performance. Il serait également bénéfique de mener un scan environnemental qui décrirait les pratiques canadiennes. Cela permettrait de documenter empiriquement ce qui est actuellement fait dans le domaine du triage et transferts de patients aux soins critiques, de combler les lacunes de connaissances avec une description des modèles utilisés pour d'autres populations faisant l'objet de triage et transferts (p. ex. trauma, pédiatrie, greffe, don d'organe, etc.) ainsi que de comparer et contraster les structures, processus et résultats.

La deuxième phase consisterait à reprendre les éléments identifiés dans la première phase et faire le choix de ceux qui doivent être adaptés et intégrés à notre centre de triage québécois. Deux méthodologies pourraient être mises à contribution afin de réaliser cet objectif. D'abord, une première sélection de critères de triage pourrait être faite par méthode Delphi. Cela permettrait d'explorer les opinions d'acteurs-clés et établir si un consensus peut être obtenu quant à l'acceptabilité de critères de triage dans un contexte canadien. Dans un deuxième temps, nous mènerions des groupes de discussion, ou « focus groups », afin d'explorer la question de la qualité et de la performance. Plus spécifiquement, nous tenterions de déterminer les définitions ou les métriques couramment utilisés en lien avec ces concepts afin d'évaluer leur pertinence en cohérence avec les objectifs d'un centre de triage. Notamment, nous chercherions à interroger des intervenants dans des unités de soins intensifs afin d'évaluer l'applicabilité d'éléments de structures ou de processus identifiés dans la seconde revue systématique ainsi que dans le scan environnemental. Ces répondants nous aideraient aussi à identifier les indicateurs de qualité et de performance à utiliser lors de projets pilotes et d'études multicentriques.

Finalement, la troisième phase consisterait à tester l'applicabilité des éléments retenus à la deuxième phase, c'est-à-dire les critères de triage et de transport ainsi que les éléments de structure et de processus associés au triage performant. Elle aurait lieu en deux temps. D'abord, nous mènerions une étude pilote de faisabilité au Québec afin de préparer l'étude multicentrique. L'étude pilote permettrait de documenter les taux de recrutement, d'adhésion au protocole, la proportion de participants perdus au suivi, les barrières et facilitateurs à la participation ainsi que les obstacles logistiques qui pourraient survenir lors de l'implantation du nouveau modèle de guichet d'accès unique. L'étude multicentrique, elle, aurait pour but de comparer les pratiques usuelles à un nouveau modèle de triage et de transferts qui comprendra les éléments identifiés en phase un et deux et qui auront été testés dans l'étude pilote. Les critères d'évaluation primaires devraient être axés sur la performance (p. ex. nombre de références, taux d'acceptation, délais de triage) et sur la qualité (p. ex. incidents durant les transferts). Les critères d'évaluation secondaires devraient mesurer les mesures de pondération (p. ex. taux de mortalité, taux d'occupation aux soins intensifs, satisfaction de la clientèle, satisfaction des cliniciens, etc.). Le devis le plus approprié pour l'objectif visé serait celui d'une étude randomisée en grappes avec permutation séquentielle (« stepped wedge cluster randomized trial »).(188) Ce devis offre le bénéfice d'être pragmatique, d'être aussi rigoureux qu'une étude randomisée contrôlée, mais permet de répondre aux contraintes des décideurs de nouvelles politiques de santé, notamment quant au besoin d'implanter un changement progressivement. En outre, en plus de comparer les groupes d'intervention aux groupes contrôles, chaque centre de triage peut être son propre contrôle, car il rapporte des données pré et post intervention dans une étude randomisée en grappes avec permutation séquentielle.

6. Conclusion

Dans une volonté d'identifier les critères de triage et de transferts utilisés ou recommandés pour prioriser ou exclure des patients de soins intensifs, nous avons mené une revue systématique qui nous a permis de générer une liste de 200 critères uniques. Nous les avons classifiés selon qu'ils appartiennent à l'un ou l'autre de quatre thèmes émergeants: liés au patient, liés à la condition médicale, liés au médecin ou liés au contexte. Ces critères peuvent aider cliniciens et preneurs de décisions à développer des politiques d'admission aux soins intensifs locales, régionales ou nationales. Ces critères peuvent également alimenter des modèles de triage alternatifs, comme un guichet d'accès unique, qui permettraient d'optimiser la distribution de ces ressources limitées. Malheureusement, nos résultats ont aussi démontré une certaine faiblesse dans la qualité des études recensées dans la littérature. Conséquemment, il existe une opportunité pour enrichir ce champ de recherche en menant des études de haut calibre visant à développer des critères spécifiques et mesurables adaptés à des clientèles particulières. Le tout s'inscrit dans un besoin de promouvoir une adoption homogène de tels critères cliniques afin d'augmenter la transparence et de diminuer les variabilités dans les pratiques médicales.

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Annexes

A.I.I Les termes de recherche

"Patient Selection"[Mesh:NoExp] OR "Triage"[Mesh:NoExp] OR "Patient Admission"[Mesh:NoExp] OR "Resource Allocation"[Mesh:NoExp] OR "Patient Transfer"[Mesh:NoExp] OR "Transportation of Patients"[Mesh:NoExp] OR "patient selection"[Title/Abstract] OR "patients selection"[Title/Abstract] OR triage[Title/Abstract] OR "patient admission"[Title/Abstract] OR "patients admission"[Title/Abstract] OR "resource allocation"[Title/Abstract] OR "patient transfer"[Title/Abstract] OR "patients transfer"[Title/Abstract] OR "subject recruitment"[Title/Abstract] OR "subject selection"[Title/Abstract] OR "patient recruitment"[Title/Abstract] OR "patients recruitment"[Title/Abstract] OR "patient transition" [Title/Abstract] OR "patients transition" [Title/Abstract] OR "care transition"[Title/Abstract] OR "patient selection"[Other Term] OR "patients selection"[Other Term] OR triage[Other Term] OR "patient admission"[Other Term] OR "patients admission"[Other Term] OR "resource allocation"[Other Term] OR "patient transfer"[Other Term] OR "patients transfer"[Other Term] OR "subject recruitment"[Other Term] OR "subject selection"[Other Term] OR "patient recruitment"[Other Term] OR "patients recruitment"[Other Term] OR "patient transition"[Other Term] OR "patients transition"[Other Term] OR "care transition"[Other Term] OR "patients transportation"[Other Term] OR "patients transportation"[Title/Abstract] OR "patient transport" [Title/Abstract] OR "patient transport"[Other Term] OR "patient transportation"[Other Term] OR "patient transportation"[Title/Abstract] OR "patients transport" [Title/Abstract] OR "patients transport"[Other Term] OR transfer system[tiab] OR transfer system[ot] OR unit transfer[tiab] OR unit transfer[ot] OR patient flow[ot] OR patient flow[tiab]

AND

"Intensive Care"[Title/Abstract] OR "Critical Care"[Title/Abstract] OR "Critical Illness"[Title/Abstract] OR ICU[Title/Abstract] OR "Intensive Care Units"[Mesh:NoExp] OR "Critical Care"[Mesh:NoExp] OR "Critical Illness"[Mesh:NoExp] OR "Burn Units"[Mesh:NoExp] OR "Intensive Care"[ot] OR "Critical Care"[ot] OR "Critical Illness"[ot] OR ICU[ot]

AND

Practice Guidelines as Topic[Mesh:NoExp] OR practice guideline[pt] OR Evidence-Based Practice[Mesh:NoExp] OR guideline*****[tiab] OR guidance[tiab] OR best practice*****[tiab] OR good practice*****[tiab] OR recommendation*****[tiab] OR guideline*****[ot] OR guidance[ot] OR best practice*****[ot] OR good practice*****[ot] OR recommendation*****[ot] OR protocol*****[tiab] OR protocol*****[ot] OR standard*****[tiab] OR "Models, Organizational"[Mesh:NoExp] OR criteria[Title/Abstract] OR criteria[Other Term] OR decision making[tiab] OR decision making[ot] OR "Decision Making"[Mesh:NoExp] OR "Clinical Decision-Making"[Mesh:NoExp] OR "Policy Making"[Mesh:NoExp] OR "Practice Patterns, Physicians'"[Mesh:NoExp] OR Policy Making[tiab] OR Policy Making[ot] OR "Guideline Adherence"[Mesh:NoExp]

A.I.II Les stratégies de recherche

A.I.II.I PubMed

Database	
Database	MEDLINE
Interface	PubMed
Research date	November, 8th, 2016
Filters	Adult, French and English

Syntax	
[MeSH Terms]	Medical Subject Heading
OR, AND	Boolean operators
*	Truncation
[Other Term] / [ot]	Author-supplied keywords
[Title/Abstract] / [tiab]	Title, Abstract

Search strategy

#	Search strategies
1	"Patient Selection"[Mesh:NoExp] OR "Triage"[Mesh:NoExp] OR "Patient Admission"[Mesh:NoExp] OR "Resource Allocation"[Mesh:NoExp] OR "Patient Transfer"[Mesh:NoExp] OR "Transportation of Patients"[Mesh:NoExp] OR "patient selection"[Title/Abstract] OR "patients selection"[Title/Abstract] OR triage[Title/Abstract] OR "patient admission"[Title/Abstract] OR "patients admission"[Title/Abstract] OR "resource allocation"[Title/Abstract] OR "patient transfer"[Title/Abstract] OR "patients transfer"[Title/Abstract] OR "subject recruitment"[Title/Abstract] OR "subject selection"[Title/Abstract] OR "patient recruitment"[Title/Abstract] OR "patients recruitment"[Title/Abstract] OR "patient transition" [Title/Abstract] OR "patients transition" [Title/Abstract] OR "care transition"[Title/Abstract] OR "patient selection"[Other Term] OR "patients selection"[Other Term] OR triage[Other Term] OR "patient admission"[Other Term] OR "patients admission"[Other Term] OR "resource allocation"[Other Term] OR "patient transfer"[Other Term] OR "patients transfer"[Other Term] OR "subject recruitment"[Other Term] OR "subject selection"[Other Term] OR "patient recruitment"[Other Term] OR "patients recruitment"[Other Term] OR "patient transition"[Other Term]

	OR "patients transition"[Other Term] OR "care transition"[Other Term] OR "patients transportation"[Other Term] OR "patients transportation"[Title/Abstract] OR "patient transport" [Title/Abstract] OR "patient transport"[Other Term] OR "patient transportation"[Other Term] OR "patient transportation"[Title/Abstract] OR "patients transport" [Title/Abstract] OR "patients transport"[Other Term] OR transfer system[tiab] OR transfer system[ot] OR unit transfer[tiab] OR unit transfer[ot] OR patient flow[ot] OR patient flow[tiab]
2	"Intensive Care"[Title/Abstract] OR "Critical Care"[Title/Abstract] OR "Critical Illness"[Title/Abstract] OR ICU[Title/Abstract] OR "Intensive Care Units"[Mesh:NoExp] OR "Critical Care"[Mesh:NoExp] OR "Critical Illness"[Mesh:NoExp] OR "Burn Units"[Mesh:NoExp] OR "Intensive Care"[ot] OR "Critical Care"[ot] OR "Critical Illness"[ot] OR ICU[ot]
3	Practice Guidelines as Topic[Mesh:NoExp] OR practice guideline[pt] OR Evidence-Based Practice[Mesh:NoExp] OR guideline*****[tiab] OR guidance[tiab] OR best practice*****[tiab] OR good practice*****[tiab] OR recommendation*****[tiab] OR guideline*****[ot] OR guidance[ot] OR best practice*****[ot] OR good practice*****[ot] OR recommendation*****[ot] OR protocol*****[tiab] OR protocol*****[ot] OR standard*****[tiab] OR "Models, Organizational"[Mesh:NoExp] OR criteria[Title/Abstract] OR criteria[Other Term] OR decision making[tiab] OR decision making[ot] OR "Decision Making"[Mesh:NoExp] OR "Clinical Decision-Making"[Mesh:NoExp] OR "Policy Making"[Mesh:NoExp] OR "Practice Patterns, Physicians'"[Mesh:NoExp] OR Policy Making[tiab] OR Policy Making[ot] OR "Guideline Adherence"[Mesh:NoExp]
4	#1 AND #2 AND #3
5	((("Infant"[Mesh] OR "Infant, Newborn"[Mesh]) OR "Child"[Mesh])) NOT "Adult"[Mesh]
6	#4 NOT #5
7	(("english"[Language] OR "french"[Language]))
8	**6 AND 7**
Total: 2368	

A.I.II.II Medline

Database	
Database	Ovid MEDLINE(R) 1946 to August Week 1 2016, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations August 16, 2016
Interface	OvidSP
Research date	August 17th, 2016
Filters	English, French / Adult

Syntax	
/	Exact Subject Heading
*/	Focus on Exact Subject Heading
tw	Text word field in MEDLINE includes Title (TI) and Abstract (AB)
kw	Keywords
or, and	Boolean operators
adj2	The Adjacent operator
*	Truncation

Search strategy

1 Patient Selection/ (55678)

2 Triage/ (9078)

3 Patient Admission/ (20574)

4 Resource Allocation/ (7493)

5 Patient Transfer/ (6563)

6 (subject* adj2 recruitment).tw,kw. (433)

7 ((patient* or subject* or client*) adj2 (selection or recruitment or admission or transfer or transport* or transition or allocation)).tw,kw. (49355)

8 "Transportation of Patients"/ (8465)

9 (care transition* or resource allocation or triage).tw,kw. (18815)

10 or/1-9 (156132)

11 Intensive Care Units/ (41598)

12 Critical Care/ (44200)

13 Critical Illness/ (20700)

14 (Intensive Care or (Critical adj2 Care) or Critical Illness or ICU).tw,kw. (139247)

15 Burn Units/ (2068)

16 or/11-15 (174146)

17 Practice Guidelines as Topic/ (94147)

18 Evidence-Based Practice/ (6172)

19 Reference Standards/ (38316)

20 Methods/ (232977)

21 Models, Organizational/ (16844)

22 (best practice* or good practice* or guidance or guideline* or protocol* or recommendation* or standard* or decision making or policy making).tw,kw. (1673064)

23 Clinical Decision-Making/ or Decision Making/ or Policy making/ or Selection Bias/ (94313)

24 Guideline Adherence/ (25283)

25 Practice Patterns, Physicians'/ (47816)

26 criteria.tw,kw. (432763)

27 or/17-26 (2389048)

28 10 and 16 and 27 (3538)

29 remove duplicates from 28 (3437)

30 Infant/ or Infant, Newborn/ or Child/ (2106316)

31 Adult/ (4324527)

32 30 not 31 (1445201)

33 29 not 32 (2936)

34 limit 33 to (english or french) (2747)

A.I.II.III Embase

Database	
Database	Embase 1974 to 2016 Week 33
Interface	OvidSP
Research date	August, 17th, 2016
Filters	English, French / Adult

Syntax	
/	Exact Subject Heading
*/	Focus on Exact Subject Heading
tw	Text word field in EMBASE includes Title (TI), Abstract (AB) and Drug Trade Name (TN).
kw	Keywords
or, and	Boolean operators
adj2	The Adjacent operator
*	Truncation

Search strategy

1 patient selection/ (76838)

2 *hospital admission/ (13911)

3 *resource allocation/ (3321)

4 patient transport/ (21787)

5 ((patient* or subject* or client*) adj (selection or recruitment or admission or transfer or transport* or transition or allocation)).ti,ab. (34900)

6 (care transition* or resource allocation or triage).ti,ab. (25541)

7 or/1-6 (155207)

8 intensive care/ (106462)

9 intensive care unit/ (110140)

10 *critical illness/ (9981)

11 (Intensive Care or Critical Care or Citical Illness or ICU).ti,ab. (206251)

12 *burn unit/ (153)

13 or/8-12 (278820)

14 practice guideline/ (281882)

15 *evidence based practice/ (6719)

16 *standard/ (3929)

17 *procedures/ (132712)

18 *nonbiological model/ (4037)

19 (best practice* or good practice* or guidance or guideline* or protocol* or recommendation* or standard* or decision making or policy making).ti,ab. (2291179)

20 decision making/ or clinical decision making/ or medical decision making/ (269372)

21 criteria.tw,kw. (651106)

22 *selection bias/ (174)

23 or/14-22 (3169249)

24 7 and 13 and 23 (3568)

25 limit 24 to embase (2783)

26 infant/ or child/ (1753094)

27 adult/ (5208684)

28 26 not 27 (1263362)

29 25 not 28 (2568)

30 limit 29 to (english or french) (2434)

A.I.II.IV EBM Reviews

Database	
Databases	EBM Reviews - Cochrane Database of Systematic Reviews 2005 to August 10, 2016, EBM Reviews - ACP Journal Club 1991 to July 2016, EBM Reviews - Database of Abstracts of Reviews of Effects 1st Quarter 2016, EBM Reviews - Cochrane Central Register of Controlled Trials July 2016, EBM Reviews - Cochrane Methodology Register 3rd Quarter 2012, EBM Reviews - Health Technology Assessment 3rd Quarter 2016, EBM Reviews - NHS Economic Evaluation Database 1st Quarter 2016
Interface	OvidSP
Research date	August, 17th, 2016
Filters	English, French / Adult

Syntax	
/	Exact Subject Heading
kw	Keywords
af	All fields
or, and	Boolean operators
*	Truncation
adj2	The Adjacent operator

Search strategy

1 Critical Care/ (1543)

2 Intensive Care/ (6)

3 Intensive Care Units/ (1794)

4 (Critical Care* or Intensive Care*).tw,kw. (13443)

5 or/1-4 (14168)

6 Patient Selection/ (3015)

7 Triage/ (267)

8 Patient Admission/ (580)

9 Resource Allocation/ (63)

10 Patient Transfer/ (126)

11 (subject* adj2 recruitment).tw,kw. (173)

12 ((patient* or subject* or client*) adj2 (selection or recruitment or admission or transfer or transport* or transition or allocation)).tw,kw. (9297)

13 "Transportation of Patients"/ (103)

14 (care transition* or resource allocation or triage).tw,kw. (1359)

15 or/6-14 (13632)

16 Practice Guidelines as Topic/ (1634)

17 Evidence-Based Practice/ (156)

18 Reference Standards/ (333)

19 Methods/ (1092)

20 Models, Organizational/ (192)

21 (best practice* or good practice* or guidance or guideline* or protocol* or recommendation* or standard* or decision making or policy making).tw,kw. (164980)

22 Clinical Decision-Making/ or Decision Making/ or Policy making/ or Selection Bias/ (1968)

23 Guideline Adherence/ (837)

24 Practice Patterns, Physicians'/ (1089)

25 criteria.tw,kw. (101575)

26 or/16-25 (231850)

27 5 and 15 and 26 (665)

28 limit 27 to (english or french) [Limit not valid in CDSR,ACP Journal Club,DARE,CLCMR,CLEED; records were retained] (648)

A.I.II.V

Database	
Databases	CINAHL Complete
Interface	EBSCO
Research date	August 17th, 2016
Filters	English, French / Adult

Syntax	
MH	Exact Subject Headings
MM	Exact Major Subject Headings
TI	Title
AB	Abstract
S (1, 2, 3…)	Search
OR, AND	Boolean operators

Search strategy

#	Question	Résultats
S1	(MH "Patient Selection") OR (MH "Triage") OR (MH "Triage (Iowa NIC)") OR (MH "Patient Admission") OR (MH "Resource Allocation") OR (MH "Transportation of Patients")	41,696
S2	((patient* or subject* or client*) N2 (selection or recruitment or admission or transfer or transport* or transition or allocation))	54,123
S3	care transition* or resource allocation or triage	20,418
S4	S1 OR S2 OR S3	72,861
S5	(MH "Intensive Care Units") OR (MH "Critical Care") OR (MH "Critical Illness") OR (MH "Burn Units")	42,794
S6	(Intensive Care or (Critical N2 Care) or Critical Illness or ICU)	91,304
S7	S5 OR S6	92,195
S8	(MH "Practice Guidelines") OR (MH "Decision Making") OR (MH "Guideline Adherence") OR (MH "Practice Patterns")	101,671

S9	(best practice* or good practice* or guidance or guideline* or protocol* or recommendation* or standard* or decision making or policy making or criteria)	592,933
S10	S8 OR S9	599,575
S11	S4 AND S7 AND S10	1,783
S12	S4 AND S7 AND S10 + Langue: English, French	1,759
S13	(MH "Child") OR (MH "Infant")	385,481
S14	(MH "Adult")	786,424
S15	s13 not s14	296,206
S16	s12 not s15	1,564