



Master of Public Health

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Intensive Care Unit Triage Decision-Making in Disasters: A Scoping Review

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Acronyms

ICU	Intensive Care Unit
UNDRR	United Nations Office of Disaster Risk Reduction
GHSI	Global Health Security Index
OECD	Organization for Economic Cooperation and Development
FCFS	First Come, First Serve
SOFA	Sequential Organ Failure Assessment
M-SOFA	Modified Sequential Organ Failure Assessment
Q-SOFA	Quick Sequential Organ Failure Assessment
CFS	Clinical Frailty Score
JBI	Joanna Briggs Institute
PRISMA-ScR	Preferred Reporting Items for Systematic Reviews and Meta Analyses- Extension for Scoping Reviews
OSF	Open Science Framework
MeSH	Medical Subject Headings
CHEST	American College of CHEST physicians

Abstract

Background: The global impact of COVID-19 and the increase in natural disasters has highlighted a global lack of preparedness for mounting disaster risks. In the event of a disaster, Intensive Care Units (ICU) serve as a critical resource to provide lifesaving treatments, yet the number of beds is limited. For this reason, ICU beds require hospitals to triage patients, prioritizing them for care. The aim of this thesis is to map the available evidence on ICU triage in disaster contexts.

Methods: A scoping review of ethical principles guiding triage and triage protocols was conducted for the allocation of scarce resources in disasters. The search was conducted using PubMed and Web of Science databases, and relevant grey literature of triage protocols from January 2002- February 2023. Full-text screening and data extraction were conducted by the thesis author (M.R) and verified by a second author (M.H). Publications were included in the review if they were related to 1) ethical principles guiding triage 2) triage protocols key components and validation. Data was extracted using excel and a narrative synthesis was conducted.

Results: A total of 66 publications were included, 38 of which were publications from databases on ethical principles in triage, and 28 were on triage protocols. Utilitarianism was seen as the guiding principle behind triage in 63.2% of publications. A common structure of activation, ethical principles, clinical assessment tools, and decision-making processes was used throughout triage in 67.9% protocols. None of the protocols were validated in their entirety for use in a disaster.

Conclusion: This review highlights the complexities of triage protocol development and underscores the need to adapt triage protocols to their cultural contexts and the need for future research. This thesis serves as guidance for governments aiming to develop triage protocols.

Key Words: Disaster, Triage Protocols, Intensive Care Unit Capacity, Health Policy

1. Background

This paper seeks to enhance the understanding of triage protocol development and implementation in Intensive Care Units (ICU) during a disaster. The assessment of the literature focuses on triage protocols as they are published or described in published studies and reports. We aim to answer three research questions:

1. What are the underlying ethical principles guiding ICU triage in a disaster?
2. What are the key components of ICU triage protocols in a disaster?
3. Are ICU triage protocols scientifically validated for their use in a disaster?

The global impact of COVID-19 and the increase in frequency and severity of natural disasters has highlighted the need for nations and societies to strengthen their crisis preparedness^{1,2}. The United Nations Office of Disaster Risk Reduction (UNDRR) defines a disaster as “serious disruptions to the functioning of a society at any scale due to hazardous events”³. Disasters of any scale have the potential to rapidly overwhelm healthcare facilities and strain available resources⁴. A report published by the Global Health Security Index (GHSI) revealed a global lack of preparedness for the mounting likelihood of future disasters, indicating that out of 195 countries, 64 had established comprehensive emergency plans⁵.

Surge capacity is based on the health system’s ability to meet the needs of the population while efficiently managing the sudden or rapid increase in patients given the available resources at a given time⁶. Surge capacity encompasses several elements including the availability of healthcare facilities, healthcare professionals, medical equipment, and financial resources⁷. Surge capacity planning is critical in building and maintaining healthcare resilience, ensuring facilities can cope with unexpected spikes in healthcare demand^{6,7}.

On a hospital level, three levels of care can be seen depending on the level of stress the system has been placed under (Figure 1):

1. *Conventional Standards of Care*: The use of space, staff, and supplies are consistent with daily operating practices within the hospital⁸.
2. *Contingency Standards of Care*: The use of spaces, staff, and supplies are not consistent with daily practices, and adjustments are made to everyday care, but the level of patient care remains functionally equivalent⁸.
3. *Crisis Standards of Care*: The use of space, staff, and supplies is not consistent with daily operating practices, and the level of patient care is reduced to trying to provide

the best possible care to patients under the circumstances with the resources available⁸.

SITUATION	Conventional	Contingency	Crisis
SURGE STATUS	Hospitals utilize normal bed capacity. Occasional and temporary surges of demand may occur that are temporary and may incur longer wait times for non-critical care as hospitals, ICUs, and emergency departments temporarily reach capacity.	Hospitals have surged beyond maximum bed capacity. Emergency Operations Plans are in effect. Elective procedures delayed or canceled. Hospitals may be adding patients to occupied hospital rooms and non-patient care areas. Community health care facilities may be requested to surge. Alternate care sites may be opened.	Expanded capacity is still not sufficient to meet ongoing demand for care. Some patients needing care cannot be admitted to hospitals and instead will be sent home or to alternate care sites. Hospitals are adding patients to occupied hospital rooms and non-patient care areas. Community health care facilities are operating beyond normal scope of practice.
RESOURCE LEVEL	Occasional, limited resource shortages may occur, typically of non-critical supplies or medications with substitution as the most common resource sparing strategy.	Some resources are becoming scarce. Attempts at conservation, reuse, adaptation, and substitution may be performed.	Some or even many critical resources are unavailable, potentially including hospital beds, ventilators, and medications. Critical resources are re-allocated to help as many patients as possible.
STAFF	Usual staffing. Hospital staff absenteeism is not a large problem.	Staff extension (increased patient/provider ratios, expanded scope of practice). Hospital staff absenteeism may be a problem.	Staffing levels at critical shortage. Staff are operating outside normal scope of practice and greatly increased patient/provider ratios. Hospital staff absenteeism may be greater than 30%.

Figure 1. Continuum of care model; adopted from the Interim Pennsylvania Crisis Standards of Care Guidelines⁹.

Ethical principles provide a moral framework to guide healthcare delivery¹⁰. Beauchamp and Childress presented four ethical principles: Autonomy, non-maleficence, beneficence, and justice which have become widely adopted in healthcare¹¹. These ethical principles guide physicians in delivering high-quality care to individual patients. *Autonomy* focuses on respecting patient wishes and allowing patients to make informed decisions regarding their care. *Non-maleficence* emphasizes a physician's obligation to do no harm. *Beneficence* highlights a physician's duty to act in the best interest of their patients, and *Justice*, emphasizes providing equal quality of care to all patients¹¹. Under routine circumstances, these ethical principles guide healthcare delivery, however, their application in a disaster becomes more complex.

1.1. History and Conceptualization of Triage

When available resources under surge capacity have been depleted, the prioritization of patients becomes necessary. One way of prioritizing patients is through triage to allocate resources to best serve the population. Triage, derived from the French word “tier” meaning “to sort” emerged in military settings to categorize wounded soldiers based on the severity of their injuries¹². Triage is defined as “the prioritization of patient care (or victims in a disaster) based on illness/injury, severity, prognosis, and the availability of resources”¹³.

Progressively, triage has evolved into a fundamental component of emergency medicine, serving the purpose of prioritizing patients for care within the emergency department and in allocating scarce resources in the face of a disaster¹⁴. Today, triage plays a critical role in ensuring effective healthcare delivery, enabling healthcare workers to provide necessary care to those with the most critical needs and those who may benefit from that care, thus optimizing resource utilization.

To guide clinical triage, three frameworks have been commonly used. First, and the most commonly seen in routine triage for patient prioritization in emergency medicine is a *prioritarianism* approach prioritizing the sickest patients first to receive treatment¹⁵.

Secondly, an *egalitarian* approach, giving all patients equal chance of accessing resources, and last a *utilitarian* approach, adapted from the military, saving patients with the greatest chance of survival¹⁵.

1.2. Intensive Care Units

ICUs can be defined as ‘separate units in hospitals that provide intensive care for critically ill patients which are staffed by specially trained medical personnel and have equipment that allows for continuous monitoring and life support’¹⁶. Due to their high operating costs and specialized nature they often operate near maximum capacity¹⁷. In the event of a disaster, ICUs assume a vital role in delivering essential treatments to individuals facing life-threatening conditions¹⁸. According to a report published by the Organization for Economic Cooperation and Development (OECD) across member states, there were an average of 14.1 ICU beds per 100,000 in the population and ICUs functioned consistently at a 75-85% occupancy level¹⁷.

1.3. The Effects of COVID-19 on ICU Triage

The COVID-19 pandemic caused an unprecedented surge in patients needing ICU care¹⁹. Across countries, ICUs reached its maximum capacity, forcing hospitals to make decisions on resource allocation that countries with well-established healthcare systems had not encountered in recent history²⁰. Physicians carried an immense decision-making burden in many hospitals, as they were forced to prioritize between patients, leading to mental strain across the workforce²¹. Hospitals were required to adapt when ICUs reached capacity, leading many governments or regulatory bodies across the globe to develop *ad-hoc* triage protocols to aid hospitals to structure the allocation of scarce resources²².

1.4. Triage Protocols

Triage protocols serve as structured frameworks to guide physicians and hospital managers to act when there are not enough resources for everyone²³. To adapt triage protocols for ICU in disaster contexts, various resource allocation strategies have been suggested in order to prioritize patients, these include:

1. **First Come, First Serve (FCFS):** Methodology in which resources are allocated based on patient order of arrival for medical attention that requires ICU care²⁴
2. **Lottery:** Methodology to allocate resources to ensure the principle of fairness by giving all patients an equal chance to receive them²⁴
3. **Physician Decides:** Methodology used when no formal triage plan exists, giving all decision-making authority to the senior physician²⁵
4. **Clinical Assessment Tools:** Methodology of prioritizing patients for scarce resources based on their likelihood of survival given the appropriate treatment for their illness and/or injuries. This method takes into consideration the overall prognosis based on the severity of illness, vital signs, and pre-existing medical conditions²⁶. Examples of clinical assessment tools commonly seen in the literature include:
 - a. *Sequential Organ Failure Assessment (SOFA, Modified-SOFA, Quick-SOFA):* A scoring system used to provide a standardized and objective measure of organ dysfunction across 6 different systems in the body. SOFA scores range from 0-24^{27,28}.
 - b. *Clinical Frailty Score (CFS):* Tool used to assess the degree of frailty, categorizing patients into different levels of frailty based on their overall health status, functional

abilities, and degree of dependence. The scoring system ranges from “very fit” CFS =1 to “terminally ill “CFS=9²⁹.

1.5. Knowledge Gap

The previous reviews on ICU triage emphasize singular components of a triage protocol without considering the generalized process and its context. Thus, it is important to further understand triage protocols and provide insight for policy makers on triage development and implementation.

The primary aim of this thesis is to provide a comprehensive and systematic synthesis of the published literature regarding ICU triage protocols in a disaster. This thesis comes at the request of Karolinska Institutet’s Centre for Health Crises to gain a broad understanding of triage protocols with the overall aim of developing a protocol for Sweden.

2. Methods and Materials

2.1. Study Design and Protocol

We performed a scoping review following guidelines developed by the Joanna Briggs Institute (JBI)³⁰ and the Preferred Reporting Items for Systematic Reviews and Meta Analyses- Extension for Scoping Reviews (PRISMA- ScR)³¹. A protocol was developed and will be registered using the Open Science Framework (OSF) prior to journal submission. A scoping review approach was chosen given the restrictions on time and the human resources available for the task.

The aim is to access the breadth of information that exists about triage in ICUs during disasters. The concept and practice of triage into the ICU has been well described under routine circumstances but not comprehensively under the conditions of a disaster.

2.2. Eligibility Criteria

This review included publications from January 2002- February 2023 published in the English or Spanish language. Included literature must either answer research question 1 or be a published triage protocol. The choice of languages was made by the thesis author given her skillset.

Table 1: Study Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Intensive Care Unit Admission	Specialized Intensive Care Unit Admission
Adult patients (>18)	Pediatric Patients (<18)
Ethical Principles in Triage	Disease Specific Algorithms
Disaster Context	General Resource Scarcity

2.3. Information Sources and Search

PubMed and Web of Science databases were searched for publications as well as government and university websites for published national, regional, or state triage protocols. The search strategy was developed in collaboration with Karolinska Institutet library. The search strategy included a combination of Medical Subject Headings (MeSH) terms related to ‘disasters’, ‘ethics’, ‘prioritization’ ‘intensive care unit’ and free-standing terms related to scarce resource allocation in disasters. The search applied Boolean operators (“AND”, “OR”) to string terms together. Search strategies were adapted for each database. Table 2 presents the search strategy used for both databases.

Table 2: Database Search Blocks

PubMed Search Block	Web of Science Search Block
<p>(((((intensive care unit[MeSH Terms]) OR (critical care[MeSH Terms])) OR (intensive care[MeSH Terms]) OR (ICU[Title/Abstract])) AND (COVID-19*[MeSH Terms])) OR (disease outbreak[MeSH Terms]) OR (Mass Casualty Incidents[MeSH Terms]) AND (Practice Guidelines as Topic[MeSH Terms]) AND (triage[MeSH Terms]) OR (healthcare rationing[MeSH Terms]) OR (resource scarcity[Title/Abstract])) OR (scarce resource allocation[Title/Abstract])) OR (Triage / organization & administration[MeSH Terms]) OR (Critical Care / standards[MeSH Terms]) OR (Critical Care / organization & administration*[MeSH Terms]) OR (ICU admission tool[Title/Abstract]) OR (triage protocol[Title/Abstract]) OR (ICU Triage [Title/Abstract]) AND (Triage / ethics[MeSH Terms]) OR (Health Care Rationing / ethics*[MeSH Terms]) AND (2002:2023[pdat])</p>	<p>(((((ALL=(intensive care unit)) OR ALL=(critical care unit)) OR ALL=(intensive care)) OR ALL=(critical care)) OR ALL=(ICU)) OR ALL=(CCU)) AND ALL=(COVID-19)) OR ALL=(disease outbreak)) OR ALL=(mass casualty incident)) AND ALL=(practice guidelines as topic)) OR ALL=(triage)) OR ALL=(healthcare rationing)) OR ALL=(resource scarcity)) OR ALL=(scarce resource allocation)) OR ALL=(triage organization)) OR ALL=(critical care organization)) OR ALL=(ICU admission tool)) AND ALL=(triage ethics)) OR ALL=(health care rationing ethics) and 1980 or 1981 or 1983 or 1986 or 1987 or 1988 or 1989 or 1990 or 1991 or 1992 or 1993 or 1994 or 1995 or 1996 or 1997 or 1998 or 1999 or 2000 or 2001 (Exclude – Publication Years) and English or Spanish (Languages)</p>
Publication Date: 01-01-2002 through 02-01-2023	Publication Date: 01-01-2002 through 02-01-2023

Grey literature was searched using google to identify university and government websites to find triage protocols using terms ‘ICU Crisis Standards of Care’, ‘Triage guidelines at the

state, national, and international organizations’ or ‘critical care triage plan’. Table 3 outlines the grey literature search strategy.

Table 3: Grey Literature Search Strategy

Search Engine	Date of Search	Search Terms	Hits Retrieved
Google	March 2 nd , 2023	“ICU crisis standards of care”	First 25 search hits reviewed
Google	March 4 th , 2023	“Triage guidelines state, national, and international organizations”	First 25 search hits reviewed
Google	March 4 th , 2023	“Critical care triage plan”	First 25 search hits reviewed

2.4. Selection of Sources of Evidence

Retrieved publications were exported into excel and duplicate titles were removed. The screening process consisted of an evaluation of study titles, abstracts, and a full text read through related to the inclusion criteria of the study. Studies were selected by the thesis author (M.R.) and verified by a second author (M.H.). Any discrepancies were resolved through discussion.

2.5. Data Extraction and Charting

Included publications were put into a data extraction tool in Excel according to the inclusion criteria and study objectives. The data extraction tool included study title, first author, publication year, type of study, peer reviewed status, type of disaster, ethical principles of triage, triage protocol components, and triage validation. Within the data extraction process, dual extraction was conducted, with the second author (M.H.) checking over the extracted data from the thesis author (M.R.). Any discrepancies were resolved through discussion. The full data extraction instrument is available in the appendix. Figure 2 displays an example of the data extraction tool used.

Study Title	Main Author	Year	Type of Study	Peer Reviewed	Country	Disaster Type	Ethical Principles	Triage protocol components	Triage validation
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Figure 2: Example of Data Extraction Tool

2.6. Quality Assessment

No quality assessment was conducted as it is not part of the standard methodology of a scoping review³¹.

2.7. Synthesis of Results

Extracted data was descriptively and thematically organized into three categories in line with the study objectives including (1) ethical principles guiding triage; (2) key components of triage protocols; and (3) triage validation

3. Results

3.1. Search Results

The initial search yielded 1,588 publications. 130 duplicate titles were removed, and the remaining 1,458 publications were screened on title and abstract. 1,116 publications were excluded on title alone, and 342 publications went on to abstract screening. 175 publications were selected to be included in a full-text review. Forty-eight publications were excluded due to the full text being unavailable, and 127 publications underwent a full review. Sixty-one publications were excluded on the basis of disability ethics (n=10), general resource scarcity (n=8), public perceptions (n=9), age in triage decisions (n=10), triage among minority groups (n=2), the assessment of clinical assessment tools (n=6), and publications unrelated to abstract (n=16). Sixty-six publications were included in the analysis, of which 38 were from Web of Science and PubMed databases and 28 grey literature publications of triage protocols.

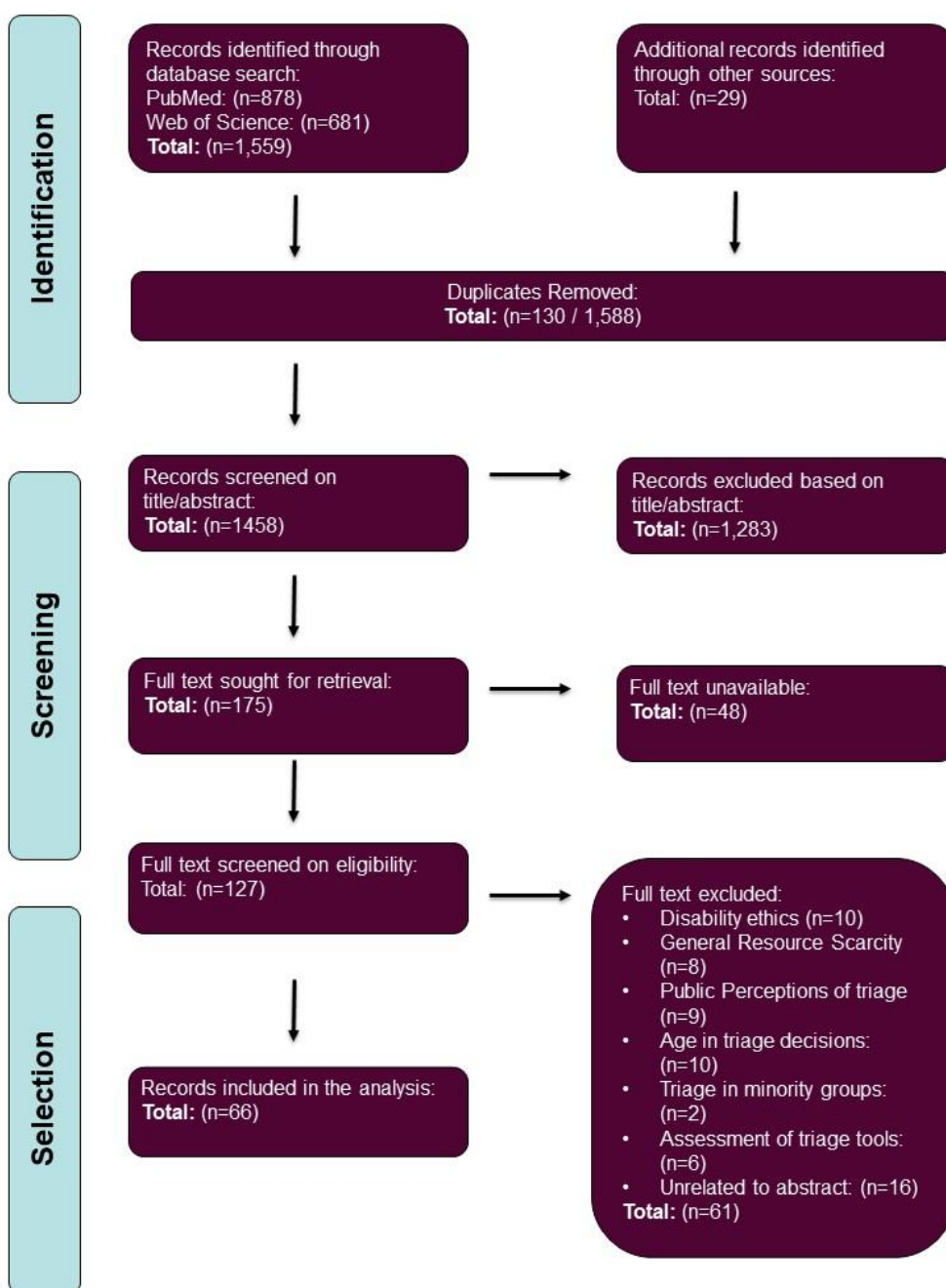


Figure 3: PRISMA Diagram³¹

3.2. Study Characteristics

Among the 66 included publications, 57.6% (n=38) answered research question one regarding ethical principles driving triage practices. 42.4% (n=28) answered research questions two and three regarding components of a triage protocol and validation. Of the included publications, 60.6% (n=40) were published in North America, 30.3% (n=20) were published in Europe, 3% (n=2) were published in Asia, 1.5% (n=1) were published in Africa,

1.5% (n=1) were published in South America and 3% (n=2) were published in Australia. 12.1% (n=8) of publications were published between 2006-2009, 15.2% (n=10) were published between 2010-2014, 45.5% (n=30) were published between 2015-2020, and 27.3% (n=18) were published in 2021-2022. Table 4 shows the type of studies included in this analysis.

The focus of the included publications was mainly on infectious disease outbreaks (n=42, 63.6%), followed by general disasters (n=14, 21.2%), public health emergencies (n=9, 13.6%), and nuclear detonation events (n=1, 1.5%).

Table 4. Study Characteristics of Included Papers

Type of Paper	Total	Peer Reviewed
Reviews		7.6% (n=5)
	Systematic Review (n=2)	100% (n=5)
	Rapid Review (n=2)	
	Critical Review (n=1)	
Qualitative Studies		4.5% (n=3)
	Delphi Methodology (n=2)	100% (n=3)
	Content Analysis (n=1)	
Comparative Studies		6.1% (n=4)
Methodological Studies		100% (n=1)
Reports		7.6% (n=5)
Expert Opinion		80% (n=4)
Discussion Papers		21.2% (n=14)
Triage Protocols		92.9% (n=13)
		9.1% (n=6)
		100% (n=6)
		42.4% (n=28)
		N/A

3.3. Principles Guiding Triage Theory

Among included literature ethical principles were proposed to guide physicians in allocating scarce resources in a disaster. The ethical principles of justice (n=20, 52.6%)³²⁻⁵¹, autonomy (n=9, 23.7%)^{33,35,38,39,41,44,45,48,52}, duty to steward resources (n=8, 21.1%)^{35,40,42,46,53-56}, duty to care (n=6, 15.8%)^{40,42,48,53-55}, beneficence (n=6, 15.8%)^{34,35,39,41,44,50}, and non-maleficence (n=5, 13.2%)^{33,39,41,44,48} were the most commonly cited. The arguments for the use of ethical principles in triage were to support physicians in allocating ICU resources equitably³³, to emphasize that all patients have intrinsic worth³², and to engage community values in the decision-making process of a disaster³⁵. One paper emphasized that no single ethical value

can determine the allocation of scarce ICU resources, highlighting the need for a multi-value ethical framework to be used⁵⁷. Moreover, in half of the publications (n=19, 50%), the principle of transparency was emphasized^{32,34,35,39,41,42,44–49,52,54,55,57–60} highlighting the need to build trust within the community, and out of respect for individuals and communities affected by a disaster. One paper emphasized that the triage decisions should not solely be communicated to the public, but a stronger role of community involvement is needed in planning and preparing for the triage protocols⁴².

Utilitarianism or ‘the greatest good for the greatest number’ was seen as the primary goal of allocating scarce resources in a disaster in included publications (n=24, 63.2%)^{32,34,36,38,39,41,43,45,47,49,51,53–55,57,60–68}. Among publications mentioning utilitarianism, 8 define its aim as saving the most lives^{36,38,47,53,63,65,67,68}. Alternatively, 6 define its aim as saving the most lives and life-years^{41,45,57,60,62,64}. Ten publications using utilitarianism did not specifically define its overall aim^{32,34,39,43,49,51,54,55,61,66}. Among publications advocating for utilitarianism, 4 highlighted the need to also include justice, to avoid unfair discrimination that could be caused by utilitarian aims^{32,36,43,51}.

Among included publications 21.1% (n=8) directly mention the use of triage protocols to allocate the final ICU bed^{32,33,35,44,51,52,54,57,63}. Reducing mental strain on front-line physicians^{32,35,52,57}, ensuring consistency in resource allocation^{32,33,35}, and planning ahead to avoid a lack of consensus when a disaster does occur⁶³ were the primary justifications for triage protocol development.

3.4. Key Components of a Triage Protocol

An analysis of 28 included triage protocols revealed a common structure including the following components: activation or trigger point (n=24, 85.7%), ethical principles (n=26, 92.9%), clinical assessment tools (n=24, 85.7%), and decision-making processes (n=23, 82.1%). More than half of the triage protocols (n=19, 67.9%) included all the key elements of the identified common structure.

3.4.1. Activation of Triage Protocols

More than three-fourths of analyzed triage protocols (n=24, 85.7%) had a clearly defined activation strategy^{9,69–91}. Of those, an equal number (n=8, 33.3%) utilized the hospital benchmark of ‘crisis care level’ from the continuum of care model^{69,71,74,82,83,85,87,88} as those that used an alternative benchmark of a ‘declared state of emergency’ or ‘declared

disaster^{73,77–80,86,89,89}. Two protocols used either crisis care level or ‘declared state of emergency’^{75,91} Health system surge capacity exhaustion^{72,76,81,90} and a mass influx of patients⁸⁴ were considered as benchmarks but less cited (n=4, 16.7% and n=1, 4.2% respectively). Moreover, one protocol used the benchmark of 95% occupancy rate in the ICU to trigger triage protocol activation⁷⁰. Additionally, 8.3% (n=2) of protocols, emphasize the need to apply triage activation uniformly across the state, region, or country to avoid ‘hospital shopping for care’ and to build trust within the community^{82,85} More than half of triage protocols with activation strategies (n=20, 82.6%) mention who has the authority to activate the triage protocol, of which 70% (n=14), gave the government the sole authority to activate the protocol^{9,69,70,73,74,77–80,83,86,87,90,91}. Whereas, 20% (n=4) gave sole authority to individual healthcare facilities to activate triage protocols^{71,75,82,88} and 10 % (n=2) stated that activation could be done by individual healthcare facilities or by the government^{85,89}.

3.4.2. Ethical Principles in Triage Protocols

Most of the analyzed protocols (n=26, 92.9%) were based on a set of ethical principles or an ethical framework to guide the allocation of ICU beds in a disaster^{9,69–72,74–79,81–95} The inclusion of ethical principles in triage protocols were motivated by several factors, including the use of ethical principles to strengthen and legitimize the allocation of resources (n=1, 3.8%)⁷² and to increase trust and ensure alignment with norms and values of communities (n=2, 7.7%)^{79,83} Table 5 presents the most commonly used ethical principles in the triage protocols.

Table 5. Ethical Principles of Triage Protocols

Ethical Principle	Example	Total (N=26)	Reference
Stewardship	“Decisions about allocating resources must be intended to achieve the best patient and public health outcomes under the circumstances” ⁷¹	50% (n=13)	69,71,74–79,81,83–85,91
Fairness	“Fairness demands that the process and criteria used for the allocation of scarce medical resources and services during public health emergencies be consistent, equitable, and non-discriminatory” ⁷⁸	46.2% (n=12)	9,70,72,74,78,81,82,86–89,95
Solidarity	“A prolonged public health emergency will alter the concept of national sovereignty and territoriality, and require collaboration across borders and between institutions” ⁷¹	38.5% (n=10)	9,69,71,72,78,84,86,88,92,94

Ethical Principle	Example	Total (N=26)	Reference
Reciprocity	“Reciprocity requires that society supports those who face a disproportionate burden in protecting the public good, and takes steps to minimize risks and burdens as far as possible” ⁹⁶	34.6% (n=9)	69,71,72,78,79,83 ,85,92,95
Autonomy	“Individuals should be given the maximum amount of liberty consistent with a like liberty for others. This should include self-determination in matters affecting their own welfare. It should also include freedom of movement and respect for personal privacy” ⁹²	19.2% (n=5)	69,71,84,92,93
Transparency	“The process by which decisions are made must be open to scrutiny, and the basis upon which decisions are made should be publicly accessible”{Citation} ⁸⁴	65.4% (n=17)	9,70,72,74– 78,81,84,85,87– 89,91,94,95
Duty to Provide Care	“Patients who are unable to receive conventional care or contingency care because capacities are overwhelmed should receive alternative forms of treatment or care, which may include palliative or comfort care if possible” ⁷⁴	50% (n=13)	69,71,72,74– 77,79,81,83– 85,91
Justice	“Requires that an allocation protocol is applied broadly and consistently to be fair to all” ⁷⁶	26.9% (n=7)	74– 78,89,910/0/0 000 0:00:00 AM
Accountability	“Decision-makers and those responding to catastrophic public health emergencies, including healthcare practitioners and providers, are responsible for their actions (including failure to act)” ⁷⁴	34.6% (n=9)	72,74,78,81,84,85 ,87,89,94
Duty to Plan	“Healthcare systems have a responsibility to plan for an event that may result in the forced initiation of crisis standards of care. The plan must address the allocation of scarce resources during times of high morbidity and/or mortality” ⁶⁹	19.2% (n=5)	69,74,76,79,83

3.4.3. Clinical Assessment Tools in Triage Protocols

The majority of protocols (n=24, 85.7%) used clinical assessment tools to allocate ICU beds during a disaster^{9,70,71,73–93}. The triage into ICU was mostly (n=19, 79.2%) based on short-term survival (<30 days or until hospital discharge)^{70,71,73,74,76,78–81,83–90,92,93} and less than a quarter (n=5, 20.8%) used a combination of short and long survival (>30 days and up to 1

year)^{9,75,77,82,91}. None of the clinical assessment tools based ICU triage admission on solely long-term survival. The need for mechanical ventilation or the presence of hypotension from shock were used to determine if a patient met the admission criteria for ICU^{9,70,73,74,78,81,84,85,87,88,93}. Admission criteria for ICU were proposed in 45.8% of the protocols with clinical assessment tools (n=11). However, more than half (n=13, 54.2%) of the protocols did not state an admission criteria for ICU^{71,75–77,79,80,82,83,86,89–92}.

All triage protocols using clinical assessment tools, used a version of SOFA (including M-SOFA or Q-SOFA)^{9,70,71,73–80,82–92} except for two which used CFS⁹³ or their own tool to predict survival⁸¹. Among the protocols using SOFA (n=22), there was substantial variation among how the score was used for inclusion and exclusion into ICU, where, 50% (n=12) used a SOFA score of >11 to exclude patients from ICU and a SOFA score of <7 as the highest priority group for ICU admission^{71,73,74,76,78–80,84,85,88,90,92}. In contrast, 31.8% (n=7) used a SOFA score of >12 to exclude patients from ICU and a SOFA score of <6 as the highest priority group for ICU admission^{9,75,77,86,87,89,92}. Only 1 protocol used a SOFA score of >14 to exclude patients from ICU and a SOFA score of <7 as the highest priority for admission⁸². Furthermore, one protocol did not use categories but instead patient's crude SOFA score to determine ICU priority for admission⁸³ and another used a combination of SOFA score and age to exclude patients from ICU⁷⁰. Table 6 presents the use of clinical assessment tools in ICU triage. The clinical assessment tools are available in the appendix.

Tie Breakers

Tie breakers (i.e. a choice in the event of two patients receiving the same clinical assessment score) were mostly based on 'life-cycle considerations or age' in which younger patients were prioritized^{75,77,78,82,91,92} or 'lottery' as a tiebreaker, highlighting fairness for its primary justification^{9,75,76,78,81,89} (n=6). Other tie breakers used 'vital to public health response' or 'essential worker' highlighting the importance of maintaining social order^{78,86,91} and "pregnancy (specified as 2nd or 3rd trimester)" justified by its ability to potentially save two lives^{9,81,86}.

Reverse Triage

Around 70% of the triage protocols with clinical assessment tools (n=16), mention the reverse triage as a way to enable a new admission^{9,73,74,76–78,80,84–89,91–93}. Reverse triage is allocation of resources from an ICU patient to another. This requires the re-assessment of patients in the ICU. Of the protocols mentioning reverse triage, half of them did not directly

state time frames for the re-assessment^{9,73,74,77,85–87,89}. Two protocols used daily reassessments^{80,93}. Three protocols used 48- and 120-hour benchmarks^{76,78,84} and 3 used 48-hour and 96-hour benchmarks were used to determine if patients are improving or if resources should be reallocated^{88,91,92}.

Table 6. Clinical Assessment Tools in Triage Protocols

Country Protocol	Clinical Assessment Tool	Categorization	Tiebreakers
Switzerland ¹	CFS	Exclusion: CFS>7 + age > 65 or CFS>6 + age >85	N/A
New York, USA ⁷⁶	SOFA	Exclusion: SOFA>11 Priority 1: SOFA<7 Priority 2: SOFA 8-11	Lottery
Michigan, USA ⁷⁸	SOFA	Exclusion: SOFA>11 Priority 1: SOFA <7 Priority 2: SOFA 8-11	Vital to public health response Age Lottery FCFS
Nevada, USA ⁷⁴	SOFA	Exclusion: SOFA>11 Priority 1: SOFA<7 Priority 2: SOFA 8-11	N/A
Florida, USA ⁷³	MSOFA	Exclusion: SOFA>11 Priority 1: SOFA<1-8 Priority 2: SOFA 8-11	N/A
South Carolina, USA ⁹²	SOFA	Exclusion: SOFA>11 Priority 1: SOFA<7 Priority 2: SOFA 8-11	Life-cycle considerations
Maryland, USA ⁹⁷	SOFA	Exclusion: SOFA>14 Priority 1: SOFA<8 Priority 2: SOFA 9-11	Life-cycle considerations
Utah, USA ⁸⁰	MSOFA	Exclusion: SOFA>11 Priority 1: SOFA <7 Priority 2: SOFA 8-11	N/A
North Carolina, USA ⁷⁷	SOFA	Exclusion: SOFA> 12 Priority 1: SOFA<6 Priority 2: SOFA 6-8	Life-cycle considerations
Tennessee, USA ⁷⁹	MSOFA/SOFA	Exclusion: SOFA>11 Priority 1: SOFA<7 Priority 2: SOFA 8-11	N/A
New Jersey, USA ⁷⁵	SOFA	Exclusion: SOFA>12 Priority 1: SOFA<6 Priority 2: SOFA 6-8	Life-cycle considerations Crude score Lottery
Pennsylvania, USA ⁹	SOFA	Exclusion: SOFA>12 Priority 1: SOFA<6 Priority 2: SOFA 6-8	Pregnancy Lottery

Country Protocol	Clinical Assessment Tool	Categorization	Tiebreakers
Kentucky, USA ⁹⁸	SOFA	Crude Score	N/A
Connecticut, USA ⁷¹	SOFA	Exclusion: SOFA>11 Priority 1: SOFA<7 Priority 2: SOFA 8-11	N/A
Washington, USA ⁸¹	Survivability Assessment	N/A	Pregnancy Social vulnerability index Lottery
Arizona, USA ⁸⁵	SOFA	Exclusion: SOFA>11 Priority 1: SOFA<7 Priority 2: SOFA 8-11	N/A
Colorado, USA ⁸⁶	SOFA	Exclusion: SOFA>12 Priority 1: SOFA<7 Priority 2: SOFA 8-11	Essential worker Pregnancy Caregiver
Vermont, USA ⁸⁸	SOFA	Exclusion: SOFA>11 Priority 1: SOFA 4-7 Priority 2: 8-11	N/A
New Mexico, USA ⁸⁷	SOFA	Exclusion: SOFA>12 Priority 1: SOFA<7 Priority 2: SOFA 8-11	N/A
California, USA ⁸⁹	SOFA/MSOFA	Exclusion: SOFA>12 Priority 1: SOFA <6 Priority 2: SOFA 6-8	Co-morbidity conditions Lottery
South Africa ⁹¹	SOFA	Exclusion: SOFA>12 Priority 1: SOFA <6 Priority 2: SOFA 6-8	Age Vital to public health response Crude Score
Ontario, Canada ⁸⁴	SOFA	Exclusion: SOFA>11 Priority 1: SOFA<7 Priority 2: SOFA 8-11	N/A
New South Wales, Australia ⁹⁰	SOFA	Exclusion: SOFA>11 Priority 1: SOFA<7 Priority 2: SOFA 8-11	N/A
Alberta, Canada ⁷⁰	SOFA	Exclusion: Age >60 + SOFA >16 or Age<60 + SOFA >18	N/A

3.4.4. Decision-Making Processes

Decision-making processes were described in 82.1% (n=23) of protocols^{9,70,73-93}. Of those, 87% (n=20) used triage committees to decide the allocation of ICU beds^{9,70,73-79,81-84,86-91,93}.

The use of triage committees or triage officers in the decision-making process was proposed to alleviate the mental burden of patient-facing physicians^{70,77,91}, to ensure objectivity^{77,91}, or to allow patient-facing physicians to focus on patient care, avoiding conflicts of interest¹⁻³. Among the 20 protocols using triage committees, 50% (n=10) directly state who should serve on them, but with substantial variation; of which, 20% (n=2) describe that at a triage committee should include at least 3 members^{73,79}. Three protocols used individual triage officers rather than a triage committee^{80,85,92}. Furthermore, five protocols specifically stated that patient-facing physicians could not serve as triage officers or on triage committees^{77,85,86,90,91}.

Table 7. Triage Committee Members in Triage Protocols

Committee Member	Total (N=10)	References
Licensed Physicians (any specialization)	90% (n=9)	70,73,75,77,79,81,82,86,91
Nursing Supervisors	80% (n=8)	70,73,75,78,79,82,86,91
Administrators	50% (n=5)	70,75,77,81,91
Ethicists	50% (n=5)	73,78,79,81,86
Hospital Medical Directors	50% (n=5)	70,73,78,79,86
Pastoral Care Representatives	20% (n=2)	73,79
Intensivists	20% (n=2)	73,79

Triage protocols with decision-making processes proposed that communication of the decision should be done solely by the triage committee or officer^{76,86,91} or through both triage officers and committees and patient-facing clinicians^{9,75}.

3.5. Triage Validation

None of triage protocols had undergone complete scientific validation for their use in a disaster. However, 32.1% (n=9), directly mention that the clinical assessment tool included in the protocol had been validated^{70,75,77,84,86,89-92}.

4. Discussion

4.1. Main Findings

This thesis aimed to understand ICU triage development and implementation. The results revealed three main findings. First, an analysis of the included publications showed a near consensus regarding the principle of utilitarianism for triage into ICU. Second, the triage

protocols revealed a common framework with four key elements including activation, ethical principles, clinical assessment tools, and decision-making processes. Finally, we found a lack of validation of the triage protocols in their entirety for their use in a disaster.

4.2. Guiding Ethical Principle in Triage

Our findings showed broad support for the utilitarian principle in the ICU allocation process during a disaster. Two papers highlighted the vague definition behind the goal of utilitarianism, showing a lack of understanding of the content ‘maximizing benefits’ with a lack of consensus whether it is lives-saved or life-years saved^{68,99}. The lack of consensus regarding a clear definition of ‘maximizing benefits’ under the utilitarian principle could lead to discrimination among patients. The use of ‘life-years’ as a proxy measurement for maximizing benefits has the potential to discriminate against older adults who would not be prioritized due to their age. Future research is needed to define ‘maximizing benefits’. If using the utilitarian principle to guide triage, training may be needed for healthcare professionals to aid in the switch from patient focused care to population centered care since it is out of line with their standard operating practices and requires a shift in practice and thinking. Moreover, among the use of ethical principles in triage, transparency was routinely mentioned, highlighting the need to communicate with the public regarding disaster planning and triage goals and anchor protocols into society to have them accepted by the community.

4.3. The Common Framework

A common framework was seen across triage protocols, however, there were prominent disparities regarding its implementation. These disparities indicate a lack of standardization between protocols and an absence of consensus within the field. If hospitals within the same community use their own triage protocols that differ in the key components of the common framework, there is a potential for discrimination due to a lack of consistency regarding patient prioritization into ICU. The potential for discrimination highlights the need for certain elements of the common framework to be uniformly applied across communities, and regions to avoid large differences in care across hospitals.

4.3.1. Activation

Among triage protocols, ‘crisis level of care’ was the most commonly seen trigger used to activate a triage protocol into effect. Within protocols, crisis level of care was vaguely defined, without using measurable indicators on when the level had been reached, leaving

room for hospital interpretation on when protocols should be activated. Alternatively, the American College of Chest Physicians (CHEST) recommended the use of a stricter, measurable benchmark. CHEST recommended that if ICU capacity increases over 95% capacity, triage protocols should be activated¹⁰⁰. This benchmark is decisive, leaving less room for interpretation, thus providing hospitals with a clear and standardized activation trigger.

Variation among healthcare systems may play a role in the lack of global consensus regarding activation points in triage protocols due to differences in functionality and capabilities. Moreover, this variation could be due in part to the nature of disasters, and the difference between sudden onset and prolonged disasters, causing the implementation of triage protocols to differ substantially. Consistently high occupancy rates may pose challenges in implementing more stringent ICU activation thresholds with hospitals unable to differentiate routine capacity from the need for ICU triage. Moreover, these findings suggest that triage protocols be activated uniformly across a region to avoid patient discrimination between hospitals or 'hospital shopping' in order to receive care.

4.3.2. Ethical Principles

Ethical principles were used to guide and justify the allocation of the final ICU bed. Several ethical principles were routinely cited among triage protocols, receiving broad support such as duty to provide care, stewardship, and justice. Several publications highlighted the inherent contradictions between ethical principles such as utilitarianism and equality, where not all patients will receive the same chance for care^{61,101,102}. The use of ethical principles in triage underscores a common understanding that clinical assessments alone cannot guide the allocation of ICU resources in the face of a disaster. Discrepancies among ethical principles could be due to differences in cultural norms and values, suggesting ethical principles in triage be tailored to the communities they serve. Moreover, the contradictory nature between ethical principles, highlights that within triage protocols, a hierarchical approach must be implemented, meaning that ethical principles be ordered based on the importance related to the decision-making process. The use of ethical principles to guide triage is complex due to their competing interests, showing that they may be better suited to justify triage decisions. If using ethical principles as guidance, there is a risk that a decision may never be made. Moreover, our findings reveal that although ethical principles will vary globally due to differences in cultural norms and values, a community consensus of ethical

principles should be considered, to ensure all patients have an equal chance for care, helping to build trust.

4.3.3. Clinical Assessment Tools

SOFA was the most commonly used clinical assessment tool, but with substantial variation regarding inclusion and exclusion criteria. Existing literature is highlighting the problematic nature of clinical assessment tools, emphasizing their potential to exacerbate existing racial and socioeconomic disparities within a community¹⁰³⁻¹⁰⁶. Marginalized groups within a community or those with limited access to healthcare may perform worse using these tools¹⁰³. Also, there is a need for clinical assessment tools to be standardized across regions to ensure that patients do not face discrimination within the same geographic bounds based on different inclusion and exclusion scores. Moreover, several triage protocols did not outline clear admission criteria for ICU. The aim of the clinical assessment tools is to prioritize patients with the greatest chance of survival. An unintended consequence of not using admission criteria for ICU could be that patients with low clinical assessment scores, not in the greatest need for ICU will be prioritized based on survivability rather than need. These findings emphasize the need for triage protocols to include admission criteria into ICU to ensure resources are not being allocated to patients who show no need for advanced care.

Several triage protocols using clinical assessment tools included tiebreakers, based on 'vital to public health response', life-cycle considerations, pregnancy, or a lottery. The use of 'vital to public health response' was used throughout several triage protocols in which, healthcare professionals were prioritized for care because of the risks they assume at work. Often justified by the ethical principle of reciprocity, its use in triage has shown to be controversial. One paper highlighted that the use of *vital to public health response* has the potential to exacerbate mistrust between community members and healthcare workers¹⁰⁷, whereas alternative viewpoints have emphasized its need in maintaining hospital staffing levels in long-term disasters^{33,57}. The variation among protocols and literature on the use of patient characteristics as tiebreakers highlights the need for future research to be conducted to determine public perceptions regarding their use, as different cultures may weigh different characteristics in higher priority.

Life-cycle considerations or age if used, were most often a tiebreaker between patients with the same clinical assessment score. Most often, 'life-cycle considerations' were used as a proxy for age, but its use in triage was contentious. Because of this, many triage protocols rejected the use of age in any capacity when allocating ICU resources. Several papers

argued in support of age or *life-cycle considerations*, highlighting their direct correlation to survivability^{108,109} or that their use is ethically justifiable because older individuals have already had the opportunity to live through life's various stages²⁴. Alternative viewpoints argue that its use in any capacity is discriminatory and ageist¹¹⁰.

4.3.4. Decision-Making Processes

Triage committees or officers were commonly used to decide on the allocation of ICU resources, with substantial variation among who should serve on them. Several papers supported the use of triage committees, to reduce the immense strain placed on frontline physicians and to allow them to focus on their clinical duties^{111,112}. Research has indicated that physicians face real mental stress in the face of a disaster when forced to make decisions regarding ICU allocation⁴⁴. One paper raises an alternative viewpoint on triage committees, arguing that they undermine physician authority in decision-making regarding their patients, and that substantial evidence is lacking regarding their ability to effectively reduce the mental strain faced by front-line physicians¹¹³.

Further research is needed to understand the potential of triage committees in reducing the mental stress faced by physicians and to study if their inclusion in the decision-making processes heightened the stress they face or not. There is a need for more transparency in how triage committees come to a final decision, whether it be based on majority votes or if a total consensus is needed. Furthermore, it is important to understand how these decisions are reached during time constraints that will naturally exist during a disaster when handling acute life-threatening conditions. The variation seen among who should make up a triage committee emphasizes the importance of creating a triage committee reflective of cultural values and norms of the communities served. Also, there is a need for trainings to prepare committees/officers to make resource allocation decisions when a disaster strikes.

4.4. Triage Validation

Our findings revealed that none of the triage protocols were validated in their entirety, however several triage protocols highlighted that their clinical assessment tool was scientifically validated to predict survival in a disaster. Existing literature on the topic shows conflicting perceptions on the use of clinical assessment tools' ability to accurately predict survival in a disaster. One paper contended that scores from the SOFA clinical assessment tool showed a high degree of overlap between scores and small difference in overall

mortality from one score to another¹¹⁴. These findings underscore the need for further research on the use of clinical assessment tools to accurately predict mortality in a disaster and highlight the need for a standardized validation tool to be implemented to ensure consistency across the triage protocols.

4.5. Strengths and Weaknesses

The strengths of this scoping review lie in the inclusion of an extensive search that captured 20 years of information. By using a wide variety of literature including qualitative research, discussion papers, comparative and methodological papers, expert opinion, and government protocols a diverse set of viewpoints and experiences were captured, contributing to a more comprehensive understanding of the topic.

However, several limitations of this review must be acknowledged. First off, this scoping review encompassed studies with a multitude of methodologies and a mix of original research and discussion papers, opinion papers, and triage protocols. The lack of original research on the topic is an inherent weakness that could impact the overall robustness of the findings. Furthermore, a quality assessment could not be performed due to the inclusion of several different types of publications and methodologies used. There was no standardized quality assessment tool that could be used across all publications included. Furthermore, it is possible that relevant information may have been inadvertently overlooked in the grey literature due to the time constraints and search strategies used.

One notable weakness of this study was the language barrier. The study's inclusion criteria mandated that only triage protocols published in English or Spanish would be considered as these were the only languages spoken by the thesis author (M.R.). Consequently, this research may have suffered from bias, specifically regarding the included triage protocols due to the exclusion of potentially significant number of triage protocols published in languages other than English or Spanish. As a result, the findings of the study may not encompass a comprehensive representation of global practices and perspectives thus diminishing the generalizability of the results.

4.6. Future Implications

This scoping review emphasizes the need for further research to validate triage protocols specifically designed for use in a disaster. Conducting rigorous research studies that

evaluate the practical application and outcomes of these protocols during disasters will provide valuable insight into their efficacy and help refine their implementation. Validation studies are essential to ensure that triage protocols align with the evolving dynamics of disasters and contribute to optimizing patient care and resource allocation.

In addition, future research is needed to understand public perceptions regarding triage protocols in relation to cultural norms and values. While this scoping review focused on the development of triage protocols, understanding how these protocols are perceived by the public is essential for effective application. Future research should explore the cultural factors that shape public perceptions of triage protocols during a disaster. Understanding the public's attitudes will provide valuable insight for policymakers to contribute to the development of culturally relevant triage protocols that respect and align with the values of their communities.

5. Conclusion

In conclusion, this study has shed light on the broad support among experts to develop and anchor triage protocols into society prior to the onset of the next disaster. Furthermore, this study underscored some of the complexities and challenges of creating a triage protocol, highlighting the need for protocols to be adapted to cultural contexts and the need for future research on how to best anchor triage protocols into society in line with cultural norms and values. This scoping review identified a core framework seen throughout triage protocols, this framework can be used to aid in the development of triage protocols at the hospital or governmental level. This research serves as a foundation for future studies, aiming to inform policy and aid in the triage-development processes to better equip healthcare systems to conduct triage in times of crisis.

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Conflict of Interest

The authors declare no conflicts of interest in this study.

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Appendix

PRISMA-ScR Checklist

Table 8: PRISMA ScR Checklist.³¹

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	1
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	4
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	6-11
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	6
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	11
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	11
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	12
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	12
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	13
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	13
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	N/A

Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	14
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	14
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	14
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	15
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	N/A
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	16-23
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	16-23
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	23-28
Limitations	20	Discuss the limitations of the scoping review process.	28
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	29
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	29

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).










Clinical Assessment Tools

SOFA score	1	2	3	4
<i>Respiration</i> PaO ₂ /FiO ₂ , mmHg	< 400	< 300	< 200 ———— with respiratory support ————	< 100
<i>Coagulation</i> Platelets × 10 ³ /mm ³	< 150	< 100	< 50	< 20
<i>Liver</i> Bilirubin, mg/dl (μmol/l)	1.2 – 1.9 (20 – 32)	2.0 – 5.9 (33 – 101)	6.0 – 11.9 (102 – 204)	> 12.0 (< 204)
<i>Cardiovascular</i> Hypotension	MAP < 70 mmHg	Dopamine ≤ 5 or dobutamine (any dose) ^a	Dopamine > 5 or epinephrine ≤ 0.1 or norepinephrine ≤ 0.1	Dopamine > 15 or epinephrine > 0.1 or norepinephrine > 0.1
<i>Central nervous system</i> Glasgow Coma Score	13 – 14	10 – 12	6 – 9	< 6
<i>Renal</i> Creatinine, mg/dl (μmol/l) or urine output	1.2 – 1.9 (110 – 170)	2.0 – 3.4 (171 – 299)	3.5 – 4.9 (300 – 440) or < 500 ml/day	> 5.0 (> 440) or < 200 ml/day

^a Adrenergic agents administered for at least 1 h (doses given are in μg/kg·min)

Figure 4: SOFA Clinical Assessment Tool²⁸

CLINICAL FRAILTY SCALE

	1	VERY FIT	People who are robust, active, energetic and motivated. They tend to exercise regularly and are among the fittest for their age.
	2	FIT	People who have no active disease symptoms but are less fit than category 1. Often, they exercise or are very active occasionally , e.g., seasonally.
	3	MANAGING WELL	People whose medical problems are well controlled, even if occasionally symptomatic, but often are not regularly active beyond routine walking.
	4	LIVING WITH VERY MILD FRAILTY	Previously "vulnerable," this category marks early transition from complete independence. While not dependent on others for daily help, often symptoms limit activities . A common complaint is being "slowed up" and/or being tired during the day.
	5	LIVING WITH MILD FRAILTY	People who often have more evident slowing , and need help with high order instrumental activities of daily living (finances, transportation, heavy housework). Typically, mild frailty progressively impairs shopping and walking outside alone, meal preparation, medications and begins to restrict light housework.
	6	LIVING WITH MODERATE FRAILTY	People who need help with all outside activities and with keeping house . Inside, they often have problems with stairs and need help with bathing and might need minimal assistance (cuing, standby) with dressing.
	7	LIVING WITH SEVERE FRAILTY	Completely dependent for personal care , from whatever cause (physical or cognitive). Even so, they seem stable and not at high risk of dying (within -6 months).
	8	LIVING WITH VERY SEVERE FRAILTY	Completely dependent for personal care and approaching end of life. Typically, they could not recover even from a minor illness.
	9	TERMINALLY ILL	Approaching the end of life. This category applies to people with a life expectancy < 6 months , who are not otherwise living with severe frailty . (Many terminally ill people can still exercise until very close to death.)


SCORING FRAILTY IN PEOPLE WITH DEMENTIA

The degree of frailty generally corresponds to the degree of dementia. Common symptoms in **mild dementia** include forgetting the details of a recent event, though still remembering the event itself, repeating the same question/story and social withdrawal.

In **moderate dementia**, recent memory is very impaired, even though they seemingly can remember their past life events well. They can do personal care with prompting.

In **severe dementia**, they cannot do personal care without help.

In **very severe dementia** they are often bedfast. Many are virtually mute.



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Clinical Frailty Scale ©2005–2020 Rockwood, Version 2.0 (EN). All rights reserved. For permission: www.geriatricmedicine.ca
Rockwood K et al. A global clinical measure of fitness and frailty in elderly people. CMAJ 2005;173:489–495.

Figure 5: CFS Clinical Assessment Tool²⁹

Data extraction tool

Study Title	Author	Study Type	Year	Country	Peer Review Status	Disaster Type	Ethical Principles	Triage Protocol Components	Triage Validation
Alabama Crisis Standards of Care Guidelines	Alabama Department of Public Health	Triage Protocol	2020	USA	N/A	General Disaster	<ul style="list-style-type: none"> • Respect for human dignity • Duty to plan • Duty to care • Reciprocity • Stewardship • Communication • Trust • Equity • Solidarity • Individual Liberties 	<ol style="list-style-type: none"> 1. Activation: Crisis Standards of Care Level <ol style="list-style-type: none"> a. Government authority 2. Ethical Principles: Mentioned 3. Clinical Assessment Tool: Not Mentioned 4. Decision Making Process: Not Mentioned 	Not mentioned
Critical Care Triage during Pandemic or Disaster- A Framework for Alberta	Alberta Health Services	Triage Protocol	2021	Canada	N/A	General Disaster/ Pandemic	<ul style="list-style-type: none"> • Capacity to benefit • Formal equality • Fairness • Transparency 	<ol style="list-style-type: none"> 1. Activation: ICU surpasses 95% capacity <ol style="list-style-type: none"> a. Government authority 2. Ethical Principles: Mentioned 3. Clinical Assessment Tool: SOFA <ol style="list-style-type: none"> a. Age>60 + SOFA >16 or Age <60 + SOFA>18 4. Decision Making Process: Triage Committee <ol style="list-style-type: none"> a. physicians b. Nursing supervisor c. Administrator d. Hospital medical director 	Clinical assessment tool validated (SOFA)
Allocation of Scarce Critical Care Resources During the COVID-19 Public Health Emergency in South Africa	Critical Care Society of Southern Africa	Triage Protocol	2021	South Africa	N/A	Infectious Diseases Outbreak	<ul style="list-style-type: none"> • Duty to care • Stewardship • Distributive and procedural justice • Transparency 	<ol style="list-style-type: none"> 1. Activation: Scarce Resources or Declared Public Health Emergency <ol style="list-style-type: none"> a. Government authority 2. Ethical Principles: Mentioned 3. Clinical Assessment Tool: SOFA <ol style="list-style-type: none"> a. Exclusion: SOFA>12 b. Priority 1: SOFA<6 c. Priority 2: SOFA 6-8 d. Tiebreakers: age, vital to public health response, crude score e. Reverse triage (48h, 96h) 4. Decision Making Process: Triage Committees <ol style="list-style-type: none"> a. Physicians b. Nursing supervisor c. Administrator d. * No patient-facing physicians 	Clinical assessment tool validated for short-term hospital survival (SOFA)

Study Title	Author	Study Type	Year	Country	Peer Review Status	Disaster Type	Ethical Principles	Triage Protocol Components	Triage Validation
								e. * Communication by triage committee	
Standards of Care: Providing Health care During a Prolonged Public Health Emergency	CT Department of Public Health	Triage Protocol	2010	USA	N/A	Prolonged Public Health Emergency	<ul style="list-style-type: none"> • Individual Liberty • Protect the public from harm • Proportionality • Privacy • Duty to provide care • Reciprocity • Equity • Trust • Solidarity • Stewardship • 	<ol style="list-style-type: none"> 1. Activation: Crisis Standards of Care Level <ol style="list-style-type: none"> a. Hospital authority 2. Ethical Principles: Mentioned 3. Clinical Assessment Tool: SOFA <ol style="list-style-type: none"> a. Exclusion: SOFA >11 b. Priority 1: SOFA <7 c. Priority 2: 8-11 4. Decision-Making Process: Not Mentioned 	Not Mentioned
Ethical Framework for Decision- Making in a Pandemic	Ireland Department of Health	Triage Protocol	2020	Ireland	N/A	Infectious Disease Outbreak	<ul style="list-style-type: none"> • Minimizing harm • Proportionality • Solidarity • Fairness • Duty to provide care • Reciprocity • Privacy • Reasonableness • Transparency • Inclusiveness • Responsiveness • Accountability 	<ol style="list-style-type: none"> 1. Activation: Surge capacity overwhelmed 2. Ethical Principles: Mentioned 3. Clinical assessment tool: Not mentioned 4. Decision-Making Process: Not Mentioned 	Not Mentioned
Pandemic Influenza: Triage and Scarce Resource Allocation Guidelines	Florida Department of Health	Triage Protocol	2011	USA	N/A	Infectious Disease Outbreak	Not Mentioned	<ol style="list-style-type: none"> 1. Activation: State of emergency or pandemic <ol style="list-style-type: none"> a. Government authority 2. Ethical Principles; Not Mentioned 3. Clinical Assessment Tool: MSOFA <ol style="list-style-type: none"> a. Exclusion: MSOFA >11 b. Priority 1: SOFA <1-8 c. Priority 2: SOFA 9-11 d. Reverse triage 4. Decision-Making Process; Triage Committee (3 member minimum) <ol style="list-style-type: none"> a. Physicians b. Nursing supervisor c. Ethicists d. Hospital Medical Director 	Not Mentioned

Study Title	Author	Study Type	Year	Country	Peer Review Status	Disaster Type	Ethical Principles	Triage Protocol Components	Triage Validation
								e. Pastoral care representatives f. Intensivists	
Nevada Crisis Standards of Care Plan	Nevada Division of Public and Behavioral Health	Triage Protocol	2017	USA	N/A	General Disaster	<ul style="list-style-type: none"> Justice Fairness Duty to care Proportionality Stewardship Transparency Accountability Respect for persons Duty to plan 	<ol style="list-style-type: none"> Activation: Crisis level of care <ol style="list-style-type: none"> Government authority Ethical Principles: Mentioned Clinical Assessment Tool: SOFA <ol style="list-style-type: none"> SOFA >11 SOFA <7 SOFA 8-11 Reverse triage Decision-Making Processes: Triage Committees 	Not Mentioned
Allocation of Critical Care Resources During a Public Health Emergency	State of New Jersey Department of Health	Triage Protocol	2020	USA	N/A	Public Health Emergency	<ul style="list-style-type: none"> Stewardship Duty to care Distributive and procedural justice Transparency 	<ol style="list-style-type: none"> Activation: Crisis level of care <ol style="list-style-type: none"> Hospital authority Ethical Principles: Mentioned Clinical Assessment Tool: SOFA <ol style="list-style-type: none"> Exclusion: SOFA>12 Priority 1: SOFA <6 Priority 2: SOFA 6-8 Tiebreakers: life cycle, crude score, lottery Decision-Making Process: Triage Committee <ol style="list-style-type: none"> Physicians Nursing supervisor Administrator *Communication by physicians and triage committees 	Clinical assessment tool validated for short-term hospital survival (SOFA)
Ventilator Allocation Guidelines	New York State Department of Health	Triage Protocol	2015	USA	N/A	Infectious Disease Outbreak	<ul style="list-style-type: none"> Duty to care Stewardship Duty to plan Distributive justice Transparency 	<ol style="list-style-type: none"> Activation: Surge capacity exhausted Ethical Principles: Mentioned Clinical Assessment Tool: SOFA <ol style="list-style-type: none"> Exclusion: SOFA >11 Priority 1: SOFA <7 Priority 2: SOFA 8-11 Tiebreakers: Lottery Reverse triage (48h, 120h) Decision-Making Process: Triage Committees 	Not Mentioned

Study Title	Author	Study Type	Year	Country	Peer Review Status	Disaster Type	Ethical Principles	Triage Protocol Components	Triage Validation
								a. *Communication by triage committee	
North Carolina Protocol for Allocating scarce Inpatient Critical Care Resources in a Pandemic	North Carolina Healthcare Association	Triage Protocol	2020	USA	N/A	Infectious Disease Outbreak	<ul style="list-style-type: none"> Duty to care Stewardship Distributive and procedural justice Inclusivity Equity Transparency 	<ol style="list-style-type: none"> Activation: State of Emergency declared or critically low resources <ol style="list-style-type: none"> Government authority Ethical Principles: Mentioned Clinical Assessment Tool: SOFA <ol style="list-style-type: none"> Exclusion: SOFA>12 Priority 1: SOFA <6 Priority 2: SOFA 6-8 Tiebreakers: Lifecycle Reverse triage Decision-Making Processes; Triage Committee <ol style="list-style-type: none"> * No patient-facing physicians Physicians Administrator 	Clinical assessment tool validated for short-term hospital survival (SOFA)
Guidelines for Ethical Allocation of Scarce Medical Resources and Services during Public Health Emergencies in Michigan	Department of Community Health – Office of Public Health Preparedness	Triage Protocol	2012	USA	N/A	Public Health Emergency	<ul style="list-style-type: none"> Benevolence Fairness Utility Procedural Justice Distributive justice Transparency Accountability Veracity Trust Respect for persons Proportionality Solidarity Reciprocity Stewardship 	<ol style="list-style-type: none"> Activation: State of Emergency or surge capacity exhausted <ol style="list-style-type: none"> Government authority Ethical Principles: Mentioned Clinical Assessment Tool: SOFA <ol style="list-style-type: none"> Exclusion: SOFA >11 Priority 1: SOFA<7 Priority 2: SOFA 8-11 Tiebreakers: Vital to public health response, age, lottery, FCFS Reverse triage (48h, 120h) Decision- Making Processes: Triage Committee <ol style="list-style-type: none"> Nursing supervisor Ethicists Hospital Medical Director 	Not Mentioned
Interim Pennsylvania Crisis Standards of care for Pandemic Guidelines	Pennsylvania Department of Health	Triage Protocol	2020	USA	N/A	Infectious Disease Outbreak	<ul style="list-style-type: none"> Fairness Consistency Proportionality Transparency Solidarity 	<ol style="list-style-type: none"> Activation: Crisis standards of care <ol style="list-style-type: none"> Government authority Ethical Principles: Mentioned Clinical Assessment Tool: SOFA <ol style="list-style-type: none"> Exclusion: SOFA> 12 Priority 1: SOFA <6 	Not Mentioned

Study Title	Author	Study Type	Year	Country	Peer Review Status	Disaster Type	Ethical Principles	Triage Protocol Components	Triage Validation
								<ul style="list-style-type: none"> c. Priority 2: SOFA 6-8 d. Tiebreakers: pregnancy, lottery e. Reverse triage 4. Decision-Making Processes: Triage Committees <ul style="list-style-type: none"> a. Communication by triage committees and physicians 	
South Carolina Prepares for a Pandemic Influenza: An Ethical Perspective	South Carolina Department of Health and Environmental Control	Triage Protocol	2009	USA	N/A	Infectious Disease Outbreak	<ul style="list-style-type: none"> • Individual liberty • Solidarity • Trust • Professionalism • Minimizing harm • Reciprocity • Flexibility 	1. Activation: Not Mentioned 2. Ethical Principles: Mentioned 3. Clinical Assessment Tool: SOFA <ul style="list-style-type: none"> a. Exclusion: SOFA >11 b. Priority 1: SOFA >7 c. Priority 2: SOFA 8-11 d. Tiebreakers; Life cycle e. Reverse triage (48h, 96h) 4. Decision-Making Process: Triage Committee/ or officer	Clinical Assessment tool is a validated predictor of mortality in ICU (SOFA)
Guidance for the Ethical Allocation of Scarce Resources during a Community-Wide Public Health Emergency as Declared by the Governor of Tennessee	Tennessee Department of Health	Triage Protocol	2020	USA	N/A	Public Health Emergency	<ul style="list-style-type: none"> • Duty to plan • Duty to care • Reciprocity • Stewardship • Respect for human dignity • Communication 	1. Activation: State of Emergency Declared <ul style="list-style-type: none"> a. Government authority 2. Ethical Principles: Mentioned 3. Clinical Assessment Tool: SOFA: <ul style="list-style-type: none"> a. Exclusion: SOFA >11 b. Priority 1: SOFA <7 c. Priority 2: SOFA 8-11 4. Decision-Making Processes: Triage Committee (3 member minimum) <ul style="list-style-type: none"> a. Physicians b. Nursing supervisor c. Ethicists d. Hospital Medical Director e. Pastoral care representatives f. Intensivists 	Not Mentioned
Utah Pandemic Influenza Hospital and	Utah Department of Health	Triage Protocol	2010	USA	N/A	Infectious Disease Outbreak	Not Mentioned	1. Activation: State of Emergency Declared or onset of pandemic/influenza <ul style="list-style-type: none"> a. Government authority 	Not Mentioned

Study Title	Author	Study Type	Year	Country	Peer Review Status	Disaster Type	Ethical Principles	Triage Protocol Components	Triage Validation
ICU triage guidelines for adults								<ol style="list-style-type: none"> 2. Ethical Principles: Not Mentioned 3. Clinical Assessment Tool: MSOFA <ol style="list-style-type: none"> a. Exclusion: SOFA >11 b. Priority 1: SOFA <7 c. Priority 2: SOFA 8-11 d. Reverse triage (daily) 4. Decision-Making Processes: Triage Officer 	
Washington State Crisis Standards of Care Triage Team Operational Guidebook	Washington State Department of Health	Triage Protocol	2021	USA	N/A	General Disaster	<ul style="list-style-type: none"> • Fairness • Duty to Care • Stewardship • Transparency • Consistency • Proportionality • Accountability 	<ol style="list-style-type: none"> 1. Activation: Surge Capacity Exhausted 2. Ethical Principles: Mentioned 3. Clinical Assessment Tool: Own Survivability Assessment Created <ol style="list-style-type: none"> a. Tiebreakers: pregnancy, social vulnerability index, lottery 4. Decision-Making Processes: Triage Committee <ol style="list-style-type: none"> a. Physicians b. Administrator c. Ethicists 	Not Mentioned
COVID-19 Pandemic: Triage for Intensive-Care Treatment under Resource Scarcity	Swiss Academy of Medical Sciences	Triage Protocol	2020	Switzerland	N/A	Infectious Disease Outbreak	<ul style="list-style-type: none"> • Beneficence • Non-Maleficence • Respect • Autonomy • Equity • Preserving as many lives as possible • Protection of the professionals involved 	<ol style="list-style-type: none"> 1. Activation: Not mentioned 2. Ethical Principles: Mentioned 3. Clinical Assessment Tools: CFS <ol style="list-style-type: none"> a. Exclusion: CFS >7 + age >65 or CFS >6 >85 b. Reverse triage (daily) 4. Decision-Making Processes: Triage committee or on call physician 	Not Mentioned
Maryland Framework for the Allocation of scarce life-sustaining medical resources in a catastrophic public health emergency	Daugherty-Biddison	Triage Protocol	2017	USA	N/A	Public Health Emergency	<ul style="list-style-type: none"> • Fairness/fair chance 	<ol style="list-style-type: none"> 1. Activation: Crisis level of care of declared emergency <ol style="list-style-type: none"> a. Hospital authority 2. Ethical Principles: 3. Clinical Assessment Tool: SOFA <ol style="list-style-type: none"> a. Exclusion: SOFA >14 b. Priority 1: SOFA <8 c. Priority 2: SOFA 9-11 d. Tiebreakers: Lifecycle 4. Decision-Making Processes: Triage Committee 	Not Mentioned

Study Title	Author	Study Type	Year	Country	Peer Review Status	Disaster Type	Ethical Principles	Triage Protocol Components	Triage Validation
								<ul style="list-style-type: none"> a. Physicians b. Nursing supervisor 	
Crisis Standards of Care; Guidance for the Ethical Allocation of Scarce Resources during a Community-wide Public Health event	Kentucky Public Health	Triage Protocol	2020	USA	N/A	Public Health Emergency	<ul style="list-style-type: none"> • Duty to plan • Duty to care • Reciprocity • Stewardship • Respect for human dignity • Communication 	<ol style="list-style-type: none"> 1. Activation: Crisis level of care/ surge capacity exhausted <ul style="list-style-type: none"> a. Government authority 2. Ethical Principles: Mentioned 3. Clinical Assessment Tool: SOFA <ul style="list-style-type: none"> a. Uses crude score 4. Decision-Making Processes: Triage Committee 	Not Mentioned
Critical Care During a Pandemic; Final Report of the Ontario health Plan for an Influenza Pandemic Working group on Adult Critical Care admission, Discharge, and Triage	OHPIP Adult. Critical Care, Admission, Discharge, Triage Working Group	Triage Protocol	2006	Canada	N/A	Infectious Disease Outbreak	<ul style="list-style-type: none"> • Individual liberty • Protection of the public from harm • Proportionality • Privacy • Duty to Provide Care • Reciprocity • Equity • Trust • Solidarity • Stewardship • Reasonable • Transparent • Inclusive • Responsive • Accountable 	<ol style="list-style-type: none"> 1. Activation: Mass influx of patients 2. Ethical Principles: Mentioned 3. Clinical Assessment Tool: SOFA <ul style="list-style-type: none"> a. Exclusion: SOFA>11 b. Priority 1: SOFA<7 c. Priority 2: SOFA 8=11 d. Reverse triage (48h, 120h) 4. Decision-Making Processes: triage committee 	Validated for its use in a disaster (SOFA)
NSW Health Influenza Pandemic Plan	NSW Government	Triage Protocol	2016	Australia	N/A	Infectious Disease Outbreak	<ul style="list-style-type: none"> • Ethical • Equitable • Practical • Simple • Scientifically valid 	<ol style="list-style-type: none"> 1. Activation: Health system surge capacity <ul style="list-style-type: none"> a. Government authority 2. Ethical Principles: Mentioned 3. Clinical Assessment Tool: SOFA <ul style="list-style-type: none"> a. Exclusion: SOFA>11 b. Priority 1: SOFA<7 c. Priority 2: SOFA 8-11 4. Decision-Making Processes: Triage Committees 	Clinical Assessment tool (SOFA) validated

Study Title	Author	Study Type	Year	Country	Peer Review Status	Disaster Type	Ethical Principles	Triage Protocol Components	Triage Validation
								a. * No patient-facing physicians	
Minnesota	Minnesota Department of Health	Triage Protocol	2021	USA	N/A	General Disaster	<ul style="list-style-type: none"> Accountable Transparent Fair Effective Respect 	<ol style="list-style-type: none"> Activation: Not mentioned Ethical principles: Mentioned Clinical Assessment tool: Not mentioned Decision making processes: Not mentioned 	Not Mentioned
British Columbia's Pandemic Influenza Response Plan	British Columbia	Triage Protocol	2012	Canada	N/A	Infectious Disease Outbreak	<ul style="list-style-type: none"> Respect Fairness Minimize harm Working together Reciprocity Flexibility Good decision making (ex. Transparency, accountability, reasonable) 	<ol style="list-style-type: none"> Activation: Not mentioned Ethical principles: Mentioned Clinical Assessment tools: Not mentioned Decision-making Processes: Not mentioned 	Not Mentioned
Arizona Crisis Standards of Care	Arizona Department of Health Services	Triage Protocol	2021	USA	N/A	General Disaster	<ul style="list-style-type: none"> Stewardship Duty to care Equity Reciprocity Proportionality Transparency Accountability 	<ol style="list-style-type: none"> Activation: Crisis /contingency level of care <ol style="list-style-type: none"> Hospital or government authority Ethical Principles: Mentioned Clinical Assessment Tool: SOFA <ol style="list-style-type: none"> Exclusion: SOFA>11 Priority 1: SOFA<7 Priority 2: SOFA 8-11 Reverse triage Decision-Making Processes: Triage Officer <ol style="list-style-type: none"> * No patient-facing physicians 	Not Mentioned
CDPHE All Hazards Internal Emergency Response and Recovery Plan	Colorado Department of public health and Environment	Triage Protocol	2022	USA	N/A	General Disaster	<ul style="list-style-type: none"> Fairness Proportionality Solidarity Participatory 	<ol style="list-style-type: none"> Activation: Declared Disaster <ol style="list-style-type: none"> Government authority Ethical Principles: Mentioned Clinical Assessment Tool: SOFA <ol style="list-style-type: none"> Exclusion: SOFA> 12 Priority 1: SOFA <7 Priority 2: SOFA 8-11 	Not Mentioned

Study Title	Author	Study Type	Year	Country	Peer Review Status	Disaster Type	Ethical Principles	Triage Protocol Components	Triage Validation
								<ul style="list-style-type: none"> d. Tiebreakers: essential worker, pregnancy, caregiver e. Reverse triage <p>4. Decision-Making Processes: Triage Committee</p> <ul style="list-style-type: none"> a. * No patient-facing physicians b. Physicians c. Nursing supervisor d. Ethicists e. Hospital Medical Director f. *Communication by triage committee 	
California SARS-CoV-2 Pandemic Crisis Care Guidelines	California Department of Public Health	Triage Protocol	2020	USA	N/A	Infectious Disease Outbreak	<ul style="list-style-type: none"> • Autonomy • Beneficence • Justice • Fairness • Transparent • Consistent • Proportionate • Accountable 	<p>1. Activation: State of Emergency / Insufficient resources</p> <ul style="list-style-type: none"> a. Hospital or government authority <p>2. Ethical Principles: Mentioned</p> <p>3. Clinical Assessment Tool: SOFA</p> <ul style="list-style-type: none"> a. Exclusion: SOFA > 12 b. Priority 1: SOFA <6 c. Priority 2: SOFA 6-8 d. Tiebreakers: comorbidity conditions, lottery e. Reverse triage <p>4. Decision-Making Processes: Triage Committee</p>	Clinical assessment tool validated for short-term hospital survival (SOFA)
New Mexico Crisis Standards of Care Plan	New Mexico Department of Health	Triage Protocol	2018	USA	N/A	General Disaster	<ul style="list-style-type: none"> • Health Status • Transparency • Consistency • Fairness • Accountability • Resilience • Evidence Based 	<p>1. Activation: Crisis level of care</p> <ul style="list-style-type: none"> a. Government authority <p>2. Ethical Principles: Mentioned</p> <p>3. Clinical Assessment Tool: SOFA</p> <ul style="list-style-type: none"> a. SOFA >12 b. Priority 1: 7 c. Priority 2: 8-11 d. Reverse triage <p>4. Decision-Making Processes: Triage Officer</p>	Not Mentioned

Study Title	Author	Study Type	Year	Country	Peer Review Status	Disaster Type	Ethical Principles	Triage Protocol Components	Triage Validation
Vermont Crisis Standards of Care Plan	Vermont Department of Health	Triage Protocol	2019	USA	N/A	General Disaster	<ul style="list-style-type: none"> Maximize lives saved Health equity Fairness Soundness Transparency Solidarity 	<ol style="list-style-type: none"> Activation: Crisis level of Care <ol style="list-style-type: none"> Hospital authority Ethical Principles: Mentioned Clinical Assessment Tool: SOFA <ol style="list-style-type: none"> SOFA>12 Priority 1: 4-7 Priority 2: 8-11 Reverse triage (48h, 96h) Decision-Making Processes: Triage Committee 	Not Mentioned
Fair Allocation of scarce medical resources in the time of COVID-19	Ezekiel J. Emanuel	Expert Opinion	2020	USA	Yes	Infectious Disease Outbreak	<ul style="list-style-type: none"> Ethical principles: <ul style="list-style-type: none"> Utilitarianism (classified as lives and life years) Transparency Fairness Triage protocol development to relieve mental burden on healthcare workers and to ground triage in ethical principles No single ethical principle can guide triage, need for multivalued ethical framework to be implemented 	Not Applicable	Not Applicable
Triaging for adult critical care in the event of overwhelming need	Eastman, Nigel	Discussion Paper	2010	UK	Yes	Infectious Disease Outbreak	<ul style="list-style-type: none"> Ethical Principles: <ul style="list-style-type: none"> Respect Minimizing harm Fairness Working together Reciprocity Proportionality Flexibility Good decision making (reasonable, inclusive, transparent) Triage model based on utilitarian principles and 	Not Applicable	Not Applicable

Study Title	Author	Study Type	Year	Country	Peer Review Status	Disaster Type	Ethical Principles	Triage Protocol Components	Triage Validation
							<ul style="list-style-type: none"> emphasis need for fairness (justice) Any method used must be explicit, transparent and justifiable Aim of triage model is to maximize consistency and reduce burden on HCW 		
Prioritization of ICU treatments for critically ill patients in a COVID-19 pandemic with scarce resources	Leclerc, Thomas	Expert Opinion	2020	France	Yes	Infectious Disease Outbreak	<ul style="list-style-type: none"> Ethical Principles: <ul style="list-style-type: none"> Respect for human dignity (ex. Autonomy, beneficence, non-maleficence) Solidarity Fairness Maximizing benefits (utilitarianism) (first lives saved, then life-years) Adoption of triage protocols to ensure treatment equity among affected areas 	Not Mentioned	Not Mentioned
Ethics guidelines on COVID-19 triage- an emerging international consensus	Joebges, Susanne	Comparative analysis	2020	Switzerland	Yes	Infectious Disease Outbreak	<ul style="list-style-type: none"> Among 5 EU countries, triage based on maximizing benefits, but there was a lack of consensus regarding definition Ethical Principles: <ul style="list-style-type: none"> Fair distribution Respect Maximizing benefits 	Not Mentioned	Not Mentioned
Recommendations on COVID-19 triage: International comparison and ethical analysis	Joebges, Susanne	Comparative analysis	2020	Switzerland	Yes	Infectious Disease Outbreak	<ul style="list-style-type: none"> Ethical principles. <ul style="list-style-type: none"> Maximizing benefits: Highlights vague definition of benefits <ul style="list-style-type: none"> Against social criteria Justice: needs to be paired with utilitarianism (equality) Fair decision making – mentioned in most 	Not Mentioned	Not Mentioned

Study Title	Author	Study Type	Year	Country	Peer Review Status	Disaster Type	Ethical Principles	Triage Protocol Components	Triage Validation
							<ul style="list-style-type: none"> ○ Transparency-mentioned in most • Comparative analysis of national and international societies 		
Ethical Considerations: care of the. Critical ill and injured during pandemics and disasters	Biddison, Lee Daugherty	Report	2014	USA	Yes	General Disaster	<ul style="list-style-type: none"> ○ Ethical Principles: ○ Autonomy ○ Justice ○ Beneficence ○ Stewardship ○ Consistency ○ Fairness ○ Transparency ○ Proportionality ○ Accountability • Emphasis on community engagement to have ethical principles match cultural context • Advanced planning to: Alleviate moral stress on HCW and ensure consistency 	Not Applicable	Not Applicable
Resource Allocation after a Nuclear Detonation	Caro, J. Jaime	Expert Opinion	2011	USA	Yes	Nuclear Detonation Event	<ul style="list-style-type: none"> • Ethical Principles ○ Utilitarianism (maximizing lives saved) needs to be in conjunction with fairness (justice) ○ Effectiveness 	Not Applicable	Not Applicable
Definitive care for the critically ill during a disaster: A Framework for allocation of scarce resources in mass critical care- From a task force for Mass Critical Care Summit meeting, January 26-27, 2007, Chicago, IL	Devereaux, Asha	Report	2008	Canada	Yes	General Disaster	<ul style="list-style-type: none"> • Ethical Principles: <ul style="list-style-type: none"> ○ Justice ○ Fairness • Ethical obligation to plan and make protocols publicly available 	Not Applicable	Not Applicable

Study Title	Author	Study Type	Year	Country	Peer Review Status	Disaster Type	Ethical Principles	Triage Protocol Components	Triage Validation
El triaje en pandemia: fundamentos eticos para la asignacion de recursos de soporte vital avanzado en escenarios de escasez	Burdiles, Patricio	Expert Opinion	2021	Chile	Yes	Infectious Disease Outbreak	<ul style="list-style-type: none"> • Utilitarianism (lives saved) • Autonomy • Justice • Proportionality 	Not Applicable	Not Applicable
Lifeboat ethics-considerations in the discharge of inpatients for the creation of hospital surge capacity	Kraus, Chadd	Discussion Paper	2007	USA	Yes	General Disaster	<ul style="list-style-type: none"> • Ethical Principles: <ul style="list-style-type: none"> ○ Autonomy ○ Beneficence ○ Non-maleficence ○ Justice ○ Proportionality ○ Transparency ○ Utilitarianism ○ *Potentially very discriminatory because it does not classify all life equally 	Not Applicable	Not Applicable
Ethical Guidance for Disaster Response, Specifically around Crisis Standards of Care: A systematic Review	Leider, Johathon P.	Systematic Review	2017	USA	Yes	General Disaster	<ul style="list-style-type: none"> • Ethical Principles: <ul style="list-style-type: none"> ○ Duty to Care ○ Duty to Plan ○ Utilitarianism (lives saved) ○ Ethical Justifications ○ Equity ○ Professional norms ○ Reciprocity ○ Research ethics ○ Duty to steward resources ○ Social utility 	Not Applicable	Not Applicable
Ethical values and principles to guide the fair allocation of resources in response to a pandemic: A rapid systematic review	O'Sullivan, Lydia	Rapid Review	2022	Ireland	Yes	Infectious Disease Outbreak	<ul style="list-style-type: none"> • Ethical Principles: <ul style="list-style-type: none"> ○ Equity ○ Reciprocity ○ Transparency ○ Justice ○ Duty to Care ○ Liberty ○ Utility ○ Stewardship ○ Trust ○ Proportionality 	Not Applicable	Not Applicable

Study Title	Author	Study Type	Year	Country	Peer Review Status	Disaster Type	Ethical Principles	Triage Protocol Components	Triage Validation
Among equity and dignity: An argument-based review of European ethical guidelines under COVID-19	Perin, Marta	Systematic review	2021	Italy	Yes		<ul style="list-style-type: none"> • Ethical Principles: <ul style="list-style-type: none"> ○ Egalitarianism ○ Utilitarianism (lives and life years saved) ○ Beneficence ○ Non-maleficence ○ Autonomy ○ Justice ○ Transparency ○ Reasonableness ○ Openness 	Not Applicable	Not Applicable
Triage in Public Health Emergencies: Ethical Issues	Petrini, Carlo	Expert Opinion	2010	Italy	Yes	Public Health Emergency	<ul style="list-style-type: none"> • Ethical Principles: <ul style="list-style-type: none"> ○ Utilitarianism ○ * Can inherently contradict values (ex. Autonomy) ○ Solidarity 	Not Applicable	Not Applicable
The duty of mind: Ethical Capacity in a Time of Crisis	Ryus, Caitlin	Expert Opinion	2017	USA	Yes	General Disaster	<ul style="list-style-type: none"> • Ethical principles: <ul style="list-style-type: none"> ○ Duty to care ○ Duty to steward resources: balance between severing greatest good and the individual ○ Duty to plan and accountability: ○ Justice/ fairness: lack of consistency can lead to mistrust ○ Transparency: community members should be informed and put input in prior to next disaster • Stress has negative impact on decision making and consistency 	Not Applicable	Not Applicable
Development of a framework for critical care resource allocation for the COVID-19 pandemic in Saskatchewan	Valiani, Sabira	Expert Opinion	2020	Canada	Yes	Infectious Disease Outbreak	<ul style="list-style-type: none"> • Ethical Principles <ul style="list-style-type: none"> ○ Transparency ○ Consistency ○ Accountability ○ Proportionality ○ Responsiveness • Emphasizes a shift in ethical principles during a disaster 	Not Applicable	Not Applicable

Study Title	Author	Study Type	Year	Country	Peer Review Status	Disaster Type	Ethical Principles	Triage Protocol Components	Triage Validation
Ethics of ICU triage during COVID-19	Vinay, Rasita	Discussion paper	2021	USA	Yes	Infectious Disease Outbreak	<ul style="list-style-type: none"> • Ethical principles <ul style="list-style-type: none"> ○ Procedural justice (against discrimination) ○ Utilitarianism • Calls for the use of utilitarianism with a stronger role for justice • Common understanding that triage should focus on maximizing benefits <ul style="list-style-type: none"> ○ 	Not Applicable	Not Applicable
Medical Ethics and Ventilator Allocation During the COVID-19 Pandemic	Yahya, Ahmed Saeed	Expert Opinion	2020	No	UK	Infectious Disease Outbreak	<ul style="list-style-type: none"> • Ethical Principles: <ul style="list-style-type: none"> ○ Utilitarianism ○ Non-maleficence ○ Autonomy ○ Social Justice ○ Beneficence. ○ Justice ○ Disclosure • Call for adoptive triage protocols, transparently communicated with public 	Not Applicable	Not Applicable
Identifying ethical values for guiding triage decisions during the COVID-19 pandemic: An Italian ethical committee perspective using Delphi methodology	Zeneli, Anita	Qualitative Study- Delphi Technique	2021	Italy	Yes	Pandemic/ Influenza	<ul style="list-style-type: none"> • Ethical Principles: <ul style="list-style-type: none"> ○ Utilitarianism (lives and life years saved) ○ Autonomy ○ Equity ○ Reciprocity ○ Instrumental Value ○ Sickest first ○ Transparency ○ * Emphasis on transparency to guide triage development 	Not Applicable	Not Applicable
Development of a triage protocol for critical care during an influenza pandemic	Christian, Micheal	Expert Opinion	2006	Canada	Yes	Infectious Disease Outbreak	<ul style="list-style-type: none"> ○ Ethical Principles: <ul style="list-style-type: none"> ○ Utilitarianism (maximize benefits) ○ Individual liberty ○ Protection of the public from harm ○ Proportionality ○ Privacy ○ Duty to provide care ○ Reciprocity ○ Equity 	Not Applicable	Not Applicable

Study Title	Author	Study Type	Year	Country	Peer Review Status	Disaster Type	Ethical Principles	Triage Protocol Components	Triage Validation
							<ul style="list-style-type: none"> ○ Trust ○ Solidarity ○ Stewardship ○ Reasonable ○ Transparent ○ Inclusive ○ Responsive ○ Accountable • When resource scarcity occurs, tenants of biomedicine dictate that triage protocols be used 		
Enhancing Fairness of Pandemic Critical Care Triage	Kirby, Jeffery	Expert Opinion	2010	Canada	Yes	General Disasters	<ul style="list-style-type: none"> • Ethical Principles: <ul style="list-style-type: none"> ○ Fidelity ○ Veracity ○ Prudence ○ Courage ○ Justice ○ Stewardship ○ Vigilance ○ Resiliency ○ Charity ○ Transparency • Main argument is enhancing fairness in triage 	Not Applicable	Not Applicable
Pandemic ICU triage challenge and medical ethics	Netters, Sabine	Expert Opinion	2021	Netherlands	Yes	Infectious Disease Outbreak	<ul style="list-style-type: none"> • Ethical Principles: <ul style="list-style-type: none"> ○ Utilitarianism (lives saved and life years) • Overall aim is the maximization of lives when making triage decisions 	Not Applicable	Not Applicable
The ethical dimension of prioritisation and allocation decisions within the context of the coronavirus disease 2019 pandemic	Pawlikowski, Jakub	Discussion Paper	2020	Poland	Yes	Infectious Disease Outbreak	<ul style="list-style-type: none"> • Ethical Principles: <ul style="list-style-type: none"> ○ Maximize benefits (lives saved) ○ Transparency, emphasis on building trust with the community ○ Fairness • Emphasis on basing triage decisions on ethical criteria 	Not Applicable	Not Applicable

Study Title	Author	Study Type	Year	Country	Peer Review Status	Disaster Type	Ethical Principles	Triage Protocol Components	Triage Validation
Ethical Guidance for Hard Decision: A Critical Review of Early International COVID-19 ICU Triage Guidelines	Aquino, Yves Saint James	Critical Review	2022	Australia	Yes	Pandemic/ Influenza	<ul style="list-style-type: none"> • Ethical principles: <ul style="list-style-type: none"> ○ Autonomy ○ Maximizing benefits ○ Justice ○ Duty to provide care ○ Non-maleficence ○ Flexibility ○ Fairness ○ Transparency ○ Objectivity 	Not Applicable	Not Applicable
Rationing in a Pandemic: Lessons learned from Italy	Craxi, Lucia	Discussion Paper	2020	Italy	Yes	Infectious Disease Outbreak	<ul style="list-style-type: none"> • Ethical Principles: <ul style="list-style-type: none"> ○ Utilitarianism (lives saved) ○ Duty to care (equality for all patients) • Emphasize need for triage due to political tensions in decision making 	Not Applicable	Not Applicable
Resource Allocation on the Frontlines of Public Health Preparedness: Report of a Summit on Legal and Ethical Issues	Barnett, Daniel J.	Report	2009	USA	Yes	Public Health Emergency	<ul style="list-style-type: none"> • Ethical Principles: <ul style="list-style-type: none"> ○ Maintain transparency ○ Education ○ Community needs and maximize benefits ○ Consider public health needs without regard to individuals ○ Accountability ○ Communication ○ Promote health and safety 	Not Applicable	Not applicable
Allocation of intensive care resources during an infectious disease outbreak: A rapid review to inform practice	Fiest, Kirsten	Rapid Review	2020	Canada	Yes	Infectious Disease Outbreak	<ul style="list-style-type: none"> • Ethical Principles: <ul style="list-style-type: none"> ○ Utilitarianism ○ Duty to provide care ○ Stewardship ○ Equity ○ Transparency 	Not Applicable	Not Applicable
Incorporating stakeholder perspectives on scarce resource allocation: Lessons learned from policy making in a time of crisis	Bruno, Bethany	Triage Protocol Development	2021	USA	Yes	Infectious Disease Outbreak	<ul style="list-style-type: none"> • Stakeholder conversations to develop set of ethical principles • Ethical Principles: <ul style="list-style-type: none"> ○ Utilitarianism (lives saved) 	Not Applicable	Not Applicable

Study Title	Author	Study Type	Year	Country	Peer Review Status	Disaster Type	Ethical Principles	Triage Protocol Components	Triage Validation
Saving the most lives- A comparison of European triage guidelines in the context of the COVID-19 pandemic	Ehni, Hans- Jorg	Comparative analysis	2020	Germany	Yes	Infectious Disease Outbreak	<ul style="list-style-type: none"> • Ethical Principles: <ul style="list-style-type: none"> ○ Transparency ○ Utilitarianism ○ Justice 	Not Applicable	Not Applicable
Fair prioritization of casualties in disaster triage	Ghanbari, Vahid	Qualitative study- content analysis	2021	Iran	Yes	General Disaster	<ul style="list-style-type: none"> • Ethical Principles: <ul style="list-style-type: none"> ○ Utilitarianism (lives saved, then life years saved) ○ Effectiveness ○ Efficiency ○ Medical Necessity 	Not Applicable	Not Applicable
Triage during the COVID-19 epidemic in Spain: Better and worse ethical arguments	Herreros, Benjamin	Discussion Paper	2020	Spain	Yes	Infectious Disease Outbreak	<ul style="list-style-type: none"> • Ethical principles: <ul style="list-style-type: none"> ○ Utilitarianism (lives saved) ○ Equity ○ Reciprocity 	Not Applicable	Not Applicable
The Italian Document: Decisions for intensive care when there is an imbalance between care needs and resources during the COVID-19 pandemic	Riccioni, Luigi	Qualitative study- Delphi	2021	Italy	Yes	Infectious Disease outbreak	<ul style="list-style-type: none"> • Ethical Principles: <ul style="list-style-type: none"> ○ Equality ○ Social solidarity ○ Self determination ○ Transparency ○ Utilitarianism (first lives saved, then life years saved) 	Not Applicable	Not Applicable
What is common and what is different: recommendations from European scientific societies for triage in the first outbreak of COVID-19	Sarmento, Joana Teles	Comparative analysis	2022	Portugal	Yes	Infectious Disease Outbreak	<ul style="list-style-type: none"> • Ethical Principles: <ul style="list-style-type: none"> ○ Distributive justice – All ○ Autonomy - All ○ Transparency -All ○ Utilitarianism (maximizing benefits) – Discrepancies on use • Emphasis on need for triage protocols to aid healthcare workers in making decisions and to specify strict criteria for resource allocation 	Not Applicable	Not Applicable

Study Title	Author	Study Type	Year	Country	Peer Review Status	Disaster Type	Ethical Principles	Triage Protocol Components	Triage Validation
Israeli Position Paper: Triage Decisions for Severely Ill patients during the COVID-19 Pandemic. Joint Commission of the Israel National Bioethics Council, the Ethics Bureau of the Israeli Medical Association and Representatives from the Israeli Ministry of Health	Steinberg, Avraham	Report	2020	Israel	No	Infectious disease outbreak	<ul style="list-style-type: none"> • Ethical Principles: <ul style="list-style-type: none"> ○ Equality ○ Stewardship ○ Value of life 	Not Applicable	Not Applicable
Principled decisions and virtuous care: an ethical assessment of the SIAARTI guidelines for allocating intensive care resources	Sulmasy, Daniel	Expert Opinion	2020	USA	Yes	Infectious Disease Outbreak	<ul style="list-style-type: none"> • Ethical Principles: <ul style="list-style-type: none"> ○ Beneficence ○ Respect for patients ○ Common good ○ Justice ○ Utility 	Not Applicable	Not Applicable
Ethics of Triage in the Event of an Influenza Pandemic	Tabery, James	Expert Opinion	2008	USA	Yes	Infectious Disease Outbreak	<ul style="list-style-type: none"> • Calls for triage protocols to use utilitarianism tempered with egalitarianism/ justice • Utilitarianism alone lends itself to discrimination 	Not Applicable	Not Applicable
Ethical Criteria for the Admission and Management of Patients in the ICU under conditions of Limited medical resources: A shared International proposal in view of the COVID-19 pandemic	Tambone, Vittoradolfo	Expert Opinion	2020	Italy	Yes	Infectious Disease Outbreak	<ul style="list-style-type: none"> • Ethical Principles: <ul style="list-style-type: none"> ○ Common good ○ Utilitarianism ○ Non-discrimination 	Not Applicable	Not Applicable
Moral Principles for Allocating Scarce Medical Resources in an Influenza Pandemic	Verweij, Marcel	Expert Opinion	2009	Netherlands	Yes	Infectious Disease outbreak	<ul style="list-style-type: none"> • Ethical Principles <ul style="list-style-type: none"> ○ Utilitarianism (save the most lives) ○ Equality ○ Reciprocity 	Not Applicable	Not Applicable

Resumé

Prise de décision en matière de triage dans les unités de soins intensifs en cas de catastrophe: Une Scoping Review

Contexte : L'impact mondial du COVID-19 et l'augmentation des catastrophes naturelles ont mis en évidence un manque global de préparation face à des risques croissants de catastrophes. En cas de catastrophe, les unités de soins intensifs (USI) constituent une ressource essentielle pour prodiguer des soins vitaux. Cependant, le nombre de lits dans ces unités est limité et c'est la raison pour laquelle les hôpitaux doivent trier les patients en fonction de leur priorité. L'objectif de ce mémoire est de cartographier les données disponibles sur le triage des unités de soins intensifs dans les contextes de catastrophe.

Méthodes : Un examen approfondi des principes éthiques guidant le triage et les protocoles de triage a été réalisé concernant l'allocation de ressources limitées en cas de catastrophe. La recherche a été effectuée dans les bases de données PubMed et Web of Science, ainsi que dans la littérature grise pertinente sur les protocoles de triage entre janvier 2002 et février 2023. La sélection du texte intégral et l'extraction des données ont été effectuées par l'auteur du mémoire (M.R) et vérifiées par un second auteur (M.H). Les publications ont été incluses dans la revue si elles étaient liées à : 1) des principes éthiques guidant le triage ; 2) des composants clés et la validation des protocoles de triage. Les données ont été extraites à l'aide d'Excel et une synthèse narrative a été réalisée.

Résultats : Au total, 66 publications ont été incluses, dont 38 étaient issues de bases de données et portaient sur les principes éthiques du triage et 28 sur les protocoles de triage. L'utilitarisme est considéré comme le principal facteur guidant le triage dans 63.2% des publications. Une structure commune d'activation, de principes éthiques, d'outils d'évaluation clinique et de processus décisionnels a été utilisée tout au long du triage dans 67.9% des protocoles. Aucun des protocoles n'a été validé dans son intégralité pour une utilisation en cas de catastrophe.

Conclusion : Cette étude met en évidence la complexité de l'élaboration des protocoles de triage et souligne la nécessité d'adapter les protocoles de triage à leur contexte culturel ainsi que le besoin de recherches futures. Ce mémoire peut servir de guide aux gouvernements désireux d'élaborer des protocoles de triage.

Mots clés : Catastrophe, Protocoles de triage, Capacité des unités de soins intensifs, Politique de santé