

Review

Systematic review of clinical practice guidelines on the Canadian Triage and Acuity Scale (CTAS)

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ABSTRACT

Aim: Identify quality indicators for nursing triage outlined in the Canadian Triage and Acuity Scale (CTAS) guidelines and describe the skills and professional attributes required for nurses to perform high-quality triage. **Data sources:** Embase, PubMed, CINAHL, Cochrane Library, Web of Science, and 37 professional association websites.

Methods: This systematic review included CTAS guidelines published between January 1990 and August 2025. Guideline quality was appraised using the AGREE II tool. Quality indicators and nursing skills were standardized, grouped into conceptual categories, and their frequency was documented.

Result: Nine guidelines were included, all of which were low quality. Twelve key quality indicator categories were identified. Of these, 100% of guidelines required that triage report chief complaints, objective clinical assessment, use of CTAS modifiers, and triage acuity levels. Documentation of the mode of arrival to the emergency department (22%) and infection risk screening and control measures (11%) were the quality indicators least reported on. Nursing skills were grouped into three core areas. The first was knowledge, encompassing clinical proficiency in physical and mental health as well as familiarity with ethical and legal concepts. The second comprised clinical skills, namely advanced judgment, therapeutic communication and accurate record keeping. The third focused on behavioral and professional attitudes, emphasizing empathy, confidence and autonomy.

Conclusion: These findings underscore the need to reinforce triage quality through education, audit tools, and monitoring. Given the low quality of existing guidelines, future consensus efforts are needed to validate and refine indicators, providing a foundation for improving triage quality.

1. Introduction

Triage is the gateway to the emergency department (ED), and the accuracy of this process can mean the difference between life and death [1–3]. Triage nurses are at the heart of this critical process, using clinical judgment, rapid decision-making, and a validated triage scale to shape

patients' trajectory of care [4,5]. Triage determines which patients should be prioritized, and the assigned triage level directly influences the timeliness of care. Its primary goal is to promptly identify individuals at risk of rapid deterioration, ensuring appropriate resource allocation and improved patient-important outcomes [6].

However, several factors can considerably affect triage quality,

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particularly in the context of overcrowded EDs exerting pressure that extends beyond the ED and impacts the entire hospital system. Under such conditions, the risks of triage errors increase [7]. These errors, also known as mis-triage, include undertriage, when a patient's condition is assessed as less life-threatening than it truly is, or overtriage, when the emergency is overestimated [8,9]. The causes of mis-triage are multifactorial, often arising from complex systemic and contextual factors.

Because triage priority level is intrinsically linked to the patient's clinical condition [10], mis-triage can have serious implications for both individual outcomes and healthcare system performance [11–15]. Inaccurate triage decisions have been associated with a range of adverse effects, such as: delays in time-sensitive care [11], contributing to preventable harm [16], clinical deterioration [15,17], prolonged ED stays [15], increased demand on healthcare resources [12,18], reduced patient satisfaction [19,20], and, ultimately, an increased risk of mortality [21,22]. A recent review by Suamchaiyaphum et al. [23] underscored these findings, reporting the association between inappropriate triage and unfavorable clinical outcomes.

To improve triage quality and efficacy while reducing mis-triage, validated triage scales have been implemented worldwide, beginning in the 1990 s. There are five internationally recognized validated triage scales: the Australasian Triage Scale (ATS) [24], the Emergency Severity Index (ESI) [25], the Manchester Triage Scale (MTS) [26], the South African Triage Scale (SATS) [16], and the Canadian Triage and Acuity Scale (CTAS) [24]. These scales are generally structured into five acuity levels, and the priority level, assigned by the triage nurse, is a key determinant of the prioritization, recommended wait time for physician assessment and/or nursing re-evaluation.

In Canada, the most commonly used triage scale is the CTAS, the cornerstone of ED operations nationwide, in both urban and rural settings, since its introduction in 1999. The current version of the CTAS is the result of multiple updates to improve triage accuracy in EDs across diverse populations. Originally adapted from Australia's National Triage Scale, the CTAS was developed by a national working group that included representatives from the Canadian Association of Emergency Physicians (CAEP), the National Emergency Nurses Affiliation (NENA), the Association des médecins d'urgence du Québec (AMUQ), and the Society of Rural Physicians of Canada (SRPC) [27].

The CTAS categorizes patients into five acuity levels, each with a recommended maximum time to initial physician assessment or nursing re-evaluation: Level 1 – Resuscitation (life-threatening conditions) – immediate assessment; Level 2 – Emergent (potential threat to life, limb, or function) – assessment within 15 min; Level 3 – Urgent (conditions that could progress to serious problems if untreated) – assessment within 30 min; Level 4 – Less Urgent (stable conditions related to discomfort or complications); assessment within 60 min; Level 5 – Non-Urgent (stable conditions that can safely wait) – assessment within 120 min. The CTAS includes several subcategories within the Chief Complaint category, namely first-order modifiers (vital signs and ABCD assessment) and second-order modifiers (patient factors and age-specific considerations) to refine triage acuity and ensure accurate patient prioritization [10].

Recognizing the need for paediatric-specific criteria, the Canadian Paediatric Triage and Acuity Scale (PaedCTAS) was introduced in 2001 in collaboration with the Canadian Paediatric Society [28]. In 2003, the Canadian Emergency Department Information System (CEDIS) working group standardized presenting complaints, providing a structural foundation for CTAS improvements [29]. The 2004 update redefined adult triage by introducing 17 complaint groups and incorporating first-order modifiers (e.g., related to ABCD assessment and vital signs) and second-order modifiers (e.g., other chief complaints, such as chest pain, mental health, or pregnancy) to improve the consistency of acuity assignments, particularly for complex cases such as mental health emergencies and atypical chest pain [30].

In 2008, the adult and paediatric versions of the CTAS were structurally aligned, with paediatric-specific additions [31]. Subsequent

updates in 2012 and 2016 focused less on structural changes and more on improving training resources and formalizing CTAS certification processes [32]. A new CTAS update is anticipated in 2025, reflecting the ongoing commitment to a four-year revision cycle. Fig. 1 presents a timeline of CTAS updates, along with the key modifications introduced in each version.

Despite these extensive refinements and widespread adoption of CTAS in Canada, there is a lack of standardized triage quality assessments [33]. Considering that nurses are the primary decision-makers at triage with a direct impact on patient outcomes, there is a growing need to implement robust, evidence-based quality improvement strategies, such as audit and feedback, training, and performance monitoring [34,35], to optimize the accuracy and safety of nurse-led triage practices. However, to the best of our knowledge, there is no valid and reliable instrument to assess the quality of nursing triage based on standardized criteria. Identifying the specific quality indicators and skills expected of nurses, as outlined in CTAS guidelines, is therefore a crucial preliminary step. This systematic review addresses this knowledge gap and provides a foundation toward developing a nurse triage quality assessment tool based on the CTAS.

1.1. Objectives

This systematic review of CTAS guidelines aimed to: 1) identify the

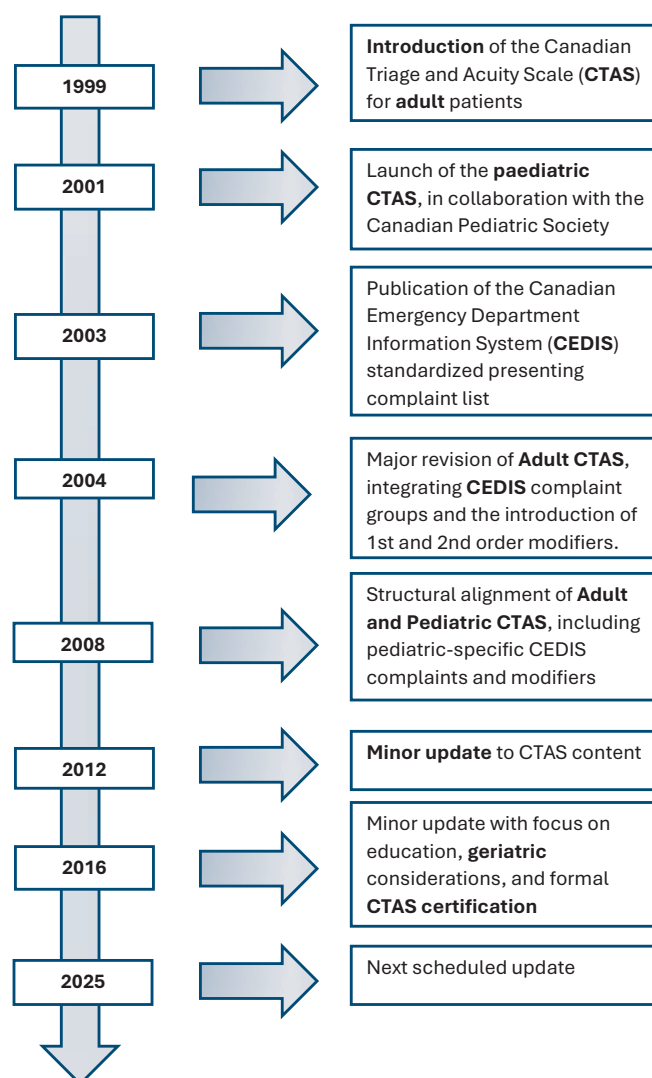


Fig. 1. Timeline of CTAS Development and Updates.

quality indicators for nursing triage and 2) describe the skills and professional attributes required for nurses to perform high-quality triage.

2. Methods

We conducted our systematic review according to the guidelines of the Cochrane Handbook for Systematic Reviews of Interventions [36] and the methodological standards for systematic reviews of clinical practice guidelines [37]. Our systematic review was conducted in collaboration with a research team that included experts in emergency nursing, emergency medicine, as well as implementation science and quality improvement. Our review is reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [38]. Our protocol was registered a priori on the International Register for Systematic Reviews (<https://www.crd.york.ac.uk/PROSPERO/XXX>).

2.1. Eligibility criteria

We identified eligible triage guidelines according to the PICAR framework, which is commonly used to assess the relevance of clinical practice guidelines [37]. Population (P): nurses working in emergency departments; Intervention (I): CTAS quality indicators, skills and professional attributes; Comparison (C): no specific comparator; Attributes (A): published between 1990 (marking the early implementation of CTAS) and April 2024, limited to studies in English or French; Recommendation (R): quality criteria for nursing triage (e.g., triage accuracy, documentation, time management) and the skills required for nurses to perform triage.

We excluded studies that were not conducted in the ED (e.g., pre-hospital triage, simple triage and rapid treatment (START), telephone triage). We also excluded studies focusing on mass casualty triage, as these use different scales and are not usually performed by nurses. Information sources and search strategy.

2.2. Information sources and search strategy

We searched the following databases to identify guidelines: Excerpta Medica Database (Embase), Medline (PubMed), Cumulative Index to Nursing and Allied Health Literature (CINAHL), Web of Science, and 37 professional association websites, using a source list iteratively developed in collaboration with an expert advisory committee in emergency triage (see [Supplemental Digital File 1](#) for a complete list of websites). In accordance with the Peer Review of Electronic Search Strategies (PRESS) [39], the search strategy was initially developed by our team of experts in emergency triage and systematic review methodology. It was then independently reviewed by a second information specialist to ensure comprehensiveness and accuracy. The final search strategy was structured around four key concepts: triage, emergency department (ED), nursing, and guidelines. An example of the PubMed search strategy is provided in [Supplemental Digital File 2](#). Given that the implementation of the CTAS began in the late 1990 s, we conducted a systematic database search covering the period from January 1, 1990, to August 15, 2025.

2.3. Data selection and processing

All articles (titles and abstracts) were managed using Covidence online software (Veritas Health Innovation, Melbourne, Australia). We identified and removed duplicates through electronic and manual screening [40]. The selection was pilot-tested by two independent reviewers (SO,SESP) using an iterative approach on 10% of the citations until reaching the 75% agreement needed for the screening process to begin [41]. Titles, abstracts, and then full texts were screened by the two independent reviewers (SO,SESP) to determine whether articles were relevant or not, based on the eligibility criteria. Any disagreement was

resolved through discussion among reviewers and, if necessary, in consultation with a third senior reviewer (MB).

2.4. Data management

A standardized data extraction form was developed and iteratively pilot-tested by two reviewers with both methodological and clinical expertise (SO,SESP). The form was tested on a sample of five guidelines, and adjustments were made until at least 75% agreement was reached. The same two reviewers then independently extracted the following information from each included guideline: 1) general characteristics (e.g., guideline, year of publication, endorsing organization), 2) nursing triage quality indicators (e.g., documentation of vital signs, chief complaint, clinical assessment), and 3) nursing skills required for triage (e.g., communication, interpersonal skills, formal training).

2.5. Appraisal of the evidence

The quality of the evidence in the CTAS guidelines was assessed by three independent reviewers (SO,SESP,MAG) with expertise in nursing triage and research methodology, using the Appraisal of Guidelines Research and Evaluation (AGREE) II tool [42]. The AGREE II instrument includes six domains encompassing a total of 23 items: Domain 1 – Scope and Purpose (items 1–3), Domain 2 – Stakeholder Involvement (items 4–6), Domain 3 – Rigor of Development (items 7–14), Domain 4 – Clarity of Presentation (items 15–17), Domain 5 – Applicability (items 18–21), and Domain 6 – Editorial Independence (items 22–23). Each item was rated on a seven-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree).

For each item, a mean score was calculated for the three reviewers. Subsequently, the average score per domain was converted into a percentage using an automated scoring calculator in Excel. Whenever a difference of more than three points was observed between any two of the three reviewers for a given item, a consensus meeting was held to resolve the disagreement [37]. A fourth senior reviewer (MB) was consulted when consensus could not be reached.

In accordance with the methodological guide for conducting systematic reviews of clinical practice guidelines [37] and prior guideline reviews [43–46], we applied a three-tier classification system to assess the overall quality of each guideline: High: $\geq 60\%$ in at least three domains, including Rigor of Development (Domain 3); Moderate: $\geq 60\%$ in at least three domains, but with a score between 50% and 60% for Domain 3; Low: $< 60\%$ in two or more domains, and $< 50\%$ in Domain 3.

2.6. Data analysis and synthesis

Data analysis and synthesis were conducted in three sequential stages: 1) standardization of terminology across CTAS guidelines, 2) development of conceptual categories grouping similar quality indicators, and 3) frequency distribution of quality indicators across guidelines.

In the first stage, we standardized the terminology used across the CTAS guidelines to ensure consistency in the extracted data. For example, blood pressure, arterial pressure, BP, and AP were consolidated under a single standardized label (blood pressure) for a single quality indicator across documents. Once standardized, each indicator was systematically entered into a structured data extraction table, organized by guideline version and publication year (see [Supplemental Digital File 3](#)). This process facilitated cross-comparison and frequency analysis of each indicator across the different guidelines on the use of CTAS.

In the second stage, each quality indicator was classified into broader conceptual categories based on thematic similarity. For example, indicators addressing similar clinical elements, such as time-related processes (e.g., time to triage initiation, total triage duration), were grouped under the category Triage time metrics and chronology. These

conceptual categories were then used to define chief CTAS quality indicator categories to structure the presentation of the results.

In the third stage, we analyzed the frequency distribution of the quality indicator categories identified in stage two across the selected guidelines [47]. The presence or absence of each quality indicator category in each guideline was determined, based on the inclusion of at least one quality indicator. These counts were then added together and converted into percentages to illustrate how frequently each quality indicator category appeared across the selected guidelines (see Table 2 and Section 3.3).

These three stages were independently conducted by two authors (SO,SESP), followed by review and validation by a third author (MB) to ensure accuracy, conceptual clarity, and consistency.

3. Results

Our systematic review initially identified 4,461 records. After removing duplicates, 3,143 records remained for title and abstract screening. Of these, 3,104 records were excluded, primarily because they did not meet the inclusion criteria. A total of 39 full-text documents

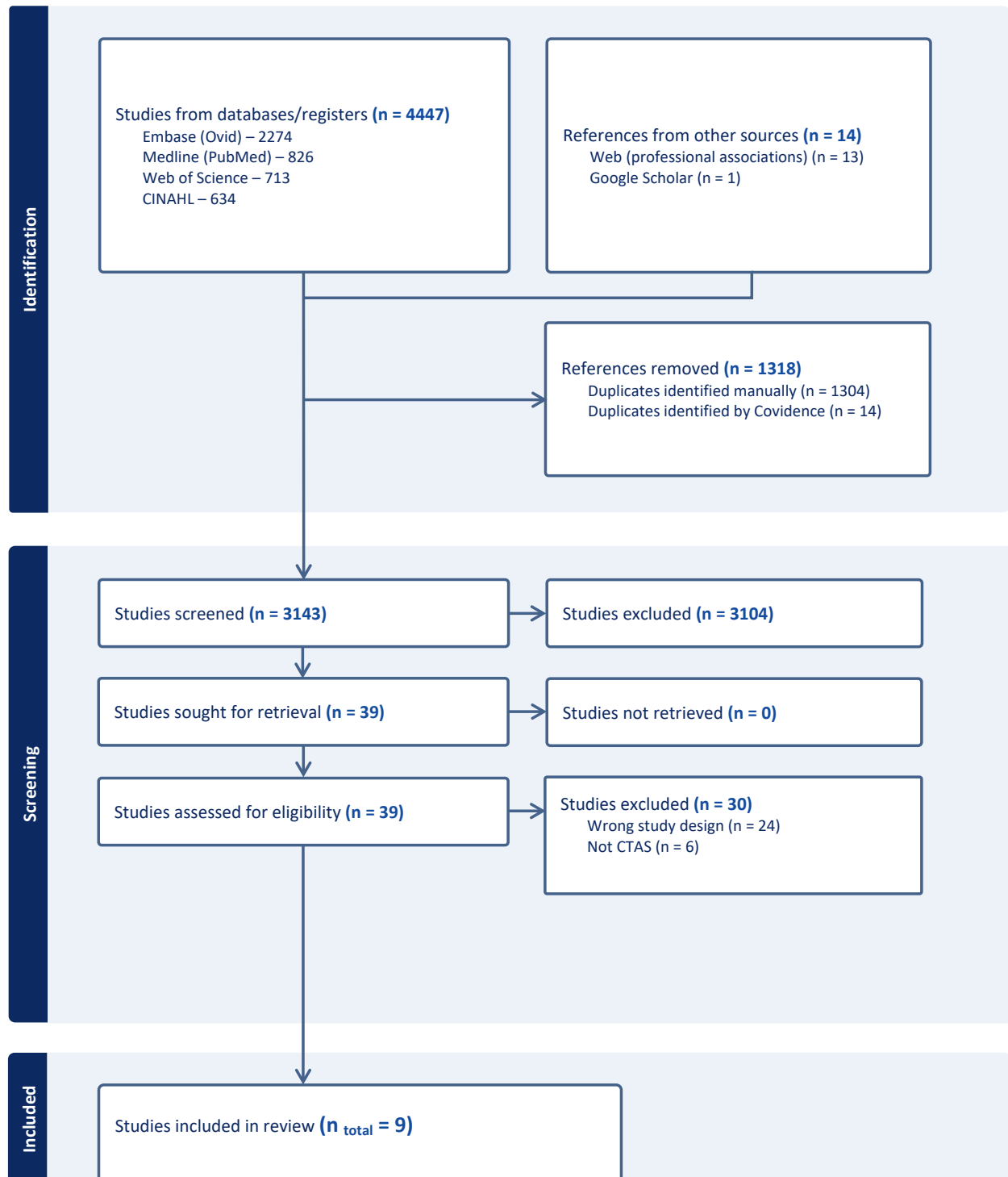


Fig. 2. The flowchart describing article searching, screening, and selection.

were subsequently assessed for eligibility, and 30 were excluded (see [Supplemental Digital File 4](#) for details). The two primary reasons for exclusion were: documents that were not a guideline (n = 24), and irrelevant guidelines that did not pertain to CTAS (n = 6).

3.1. Guideline characteristics

Ultimately, nine CTAS guidelines met the inclusion criteria and were retained for full-text analysis [10,28,30–32,48–56]. Among these, six guidelines were available in both English and French, while two were only available in English [32,49] and one guideline only in French [10]. The search, screening, and selection process are summarized in [Fig. 2](#).

The characteristics of the nine CTAS guidelines included in this review are detailed in [Supplemental Digital File 3](#). All guidelines were published between 1999 and 2017 and originated from North America, specifically Canada.

These guidelines were developed through collaborative efforts involving multiple professional associations, including the Canadian Association of Emergency Physicians (CAEP), the National Emergency Nurses Affiliation (NENA), the *Association des médecins d'urgence du*

Québec (AMUQ), the Society of Rural Physicians of Canada (SRPC), and *l'Ordre des infirmiers et infirmières du Québec* (OIIQ).

3.2. Methodological quality of guidelines

Using the AGREE II tool [42], all nine CTAS guidelines were rated low quality ([Table 1](#)). Overall standardized domain scores ranged from 38% to 60% (mean 51%). The highest scores were observed for Domain 1 (scope and purpose) and Domain 4 (clarity of presentation), each ranging from 52% to 87%. Domain 3 (rigor of development) consistently scored lowest, with values from 2% to 23%. Common weaknesses within Domain 3 included the absence of documented systematic search methods, unclear criteria for evidence selection, limited appraisal of the strengths and limitations of the evidence base, insufficient description of how recommendations were formulated, and a lack of documented external expert review prior to publication. Domain 5 (applicability) also scored poorly, ranging from 11% to 28%. The gaps noted for this domain included the absence of implementation tools to support guideline use, no information on barriers and facilitators to implementation, and no clear strategies for applying or evaluating

Table 1
CTAS guidelines quality rating according to AGREE II.

Guidelines	Domain 1 ^a Scope and purpose (%)	Domain 2 ^b Stakeholder involvement (%)	Domain 3 ^c Rigor of development (%)	Domain 4 ^d Clarity of presentation (%)	Domain 5 ^e Applicability (%)	Domain 6 ^f Editorial independence (%)	Global Scores ^g (%)	Global quality ^h
OIIQ, 2019 ^[10]	56	52	10	73	25	52	45	Low
CTAS geria., 2017 ^[50]	78	50	19	56	18	90	52	Low
CTAS, 2016 ^[49]	87	52	23	76	28	93	60	Low
CTAS, 2013 ^[32]	52	50	13	57	13	47	38	Low
CTAS adult, 2008 ^[31]	81	63	18	77	11	92	57	Low
CTAS ped, 2008 ^[51–52]	80	46	15	76	13	86	56	Low
CTAS, 2004 ^[30–53]	81	43	12	78	15	86	53	Low
CTAS ped, 2001 ^[28–56]	87	46	2	76	13	50	46	Low
CTAS, 1998 ^[54–55]	78	59	3	74	25	50	48	Low

Notes:
a - Objectives, health questions, and population to whom the CPG applies are specifically described.
b - Development groups include all relevant professionals, views of target population (patients, public etc.) are sought, target users clearly defined.
c - Systematic methods to search for evidence; criteria for selecting evidence, strengths and limitations of body of evidence, methods for formulating recommendations clearly described; health benefits, side effects, and risks considered explicit link between evidence and recommendations; externally reviewed by experts; process for updating the CPG provided.
d - Recommendations specific and unambiguous, different management options clearly presented, key recommendations easily identifiable.
e - Barriers & facilitators to application described advice and/or tools for implementation, potential resource implications considered, monitoring/auditing criteria presented.
f - Views of the funding body have not influenced the content, competing interests are reported and addressed.
g - Calculated as (sum of all scores - global minimum [1 × 23 × 3]) / (global maximum [7 × 23 × 3] - global minimum [1 × 23 × 3]) (100).
h - **High:** ≥60% in at least 3 domains, including rigor of development.
Moderate: ≥60% in at least three domains, but with a score between 50% and 60% for Domain 3.
Low: <60% in 2 or more domains and <50% in domain 3.
■ = ≥60% ■ = 50% to 60 % ■ = <50%

Table 2
Synthesis of nursing triage quality domains and their frequency in CTAS guidelines.

CTAS Domains	Domain description and examples	Frequency of occurrence ^a	References
1. Chief complaint	The chief complaint must be clearly documented and aligned with standardized terminology such as the CEDIS (e.g., fever, trauma).	100%	[10,28,30–32,49,50,52,54]
2. Objective assessment	All objective clinical findings must be documented, including complete vital signs, weight, and height, when clinically relevant to the chief complaint.	100%	[10,28,30–32,49,50,52,54]
3. CTAS modifiers applied	Any clinical modifiers that influence the CTAS level must be documented, such as severity, mechanism of injury, or risk factors.	100%	[10,28,30–32,49,50,52,54]
4. Triage acuity level assignment	This refers to the assignment of the appropriate CTAS level, from Level 1 (resuscitation) to Level 5 (non-urgent).	100%	[10,28,30–32,49,50,52,54]
5. Triage time metrics and chronology	This domain refers to all time-related elements in the triage process (e.g., time to triage initiation, total triage duration).	89%	[10,28,30–32,49,52,54]
6. Clinical interventions initiated (diagnostic and therapeutic)	All interventions initiated during triage must be recorded. These include diagnostic protocols (e.g., EKG, blood tests) and therapeutic protocols (e.g., analgesia, antiemetics).	67%	[10,28,30,49,50,54]
7. Patient orientation	The triage nurse must document the initial orientation of the patient post-triage, such as returning to the waiting room, being placed on a stretcher, or directed to the resuscitation area.	44%	[10,28,30,54]
8. Subjective assessment	Subjective data reported by the patient must be documented using structured approaches such as PQRSTU, AMPLE, or CIAMPED mnemonics.	44%	[10,28,30,54]
9. Reassessment and/or Reorientation	All reassessments must be documented according to the assigned triage level. Where permitted by institutional protocols, patients may also be reoriented to appropriate services (e.g., clinics or community resources) when clinically indicated.	44%	[10,28,30,54]
10. Patient and triage nurse identification	Includes all documentation standards related to patient identification (e.g., name, date of birth). The triage nurse's identification must also be recorded.	44%	[10,28,30,54]
11. Mode of arrival to the emergency department	Includes documentation of arrival mode (e.g., ambulance, private vehicle, ambulation).	22%	[10,28]
12. Infection risk screening and control measures	The triage nurse must document whether infection control screening and control measures were implemented, if indicated, based on the patient's clinical presentation and institutional protocols.	11%	[10]

Abbreviations: AMPLE = Allergies, Medications, Past medical history, Last meal or intake, and Events; CEDIS = the Canadian Emergency Department Information System; CIAMPEDS= Chief Complaint, Immunizations/Isolation, Allergies, Medications, Past health history, Events preceding problem, Diet/elimination, and Symptoms associated with the problem; CTAS= Canadian Triage and Acuity Scale, EKG = Electrocardiogram; PQRSTU= Provocative/Palliative, Quality/Quantity, Region/Radiation, Severity, Timing, and Understanding.

^a Frequency of occurrence was calculated by: (the number of time criteria was mentioned in guidelines)/(9 guidelines) × 100.

recommendations in clinical practice.

3.3. Nursing triage quality indicators outlined in CTAS guidelines

Building on the guideline analysis, this section presents the twelve nursing triage quality indicator categories derived from the CTAS guidelines. Table 2 provides a synthesis of the twelve nursing triage categories, including a description and examples of quality indicators within each, along with their frequency of being mentioned in each CTAS update. The complete extraction of all quality indicators is available in Digital Supplement 3.

The following section details three quality indicator categories: 1) triage assessment and prioritization, 2) procedural and documentation requirements, and 3) clinical intervention.

3.3.1. Triage assessment and prioritization indicators

The triage assessment and prioritization category refer to items directly related to the quality of the initial clinical evaluation and the assignment of a triage priority level. Based on the CTAS guidelines, these include the documentation of the *chief complaint*, assignment of the *triage acuity level* considering CTAS modifiers, *subjective and objective clinical assessments*, *initial patient orientation*, and *reassessment and/or reorientation*.

Across all versions of the CTAS guidelines, the documentation of the *chief complaint* has consistently been identified as the cornerstone quality indicator about the quality of triage assessment. This quality indicator was mentioned in every CTAS guideline and update [10,28,30–32,48,49,51,54]. It serves as the starting point of assessing the quality of the triage process, guiding the quality evaluation of the subsequent clinical assessment and prioritization. The introduction of the CEDIS working group's standardized list of *chief complaints*, which provided an essential framework for subsequent CTAS guideline

revisions [29]. This list was further updated in 2008 and formally integrated into the 2012 CTAS edition [57].

As shown in Table 2, two additional quality indicators were found in 100% of the included CTAS guidelines, the application of *CTAS modifiers* and the assignment of a *triage acuity level* [10,28,30–32,48,49,51,54]. While closely related, these two quality indicators should be considered independently. *Triage acuity level assignment* refers to the urgency level assigned by the triage nurse, ranging from Level 1 (resuscitation) to Level 5 (non-urgent), based on the patient's condition. Whereas the application of *CTAS modifiers* reflects the use of standardized CTAS modifiers (e.g., pain scales or mechanisms of injury) by the triage nurse to guide patient prioritization, ensuring decisions are structured and evidence-based rather than solely based on each triage nurse's intuition.

Two further clinical quality indicators were: the completion of an *objective clinical assessment* and a *subjective clinical assessment*. The completion of an *objective clinical assessment* was reported in 100% of the CTAS guidelines reviewed [10,28,30–32,48,49,51,54], while the completion of a *subjective clinical assessment* was only mentioned in 44% of included CTAS guidelines [10,28,30,54]. The completion of an *objective clinical assessment* includes the collection of clinical measurements, such as patients' vital signs, weight, and height, when clinically relevant to the *chief complaint*. Conversely, the completion of a *subjective clinical assessment* involves the collection of subjective information directly from the patient, often using structured mnemonics such as PQRSTU (Provocation, Quality, Region or Radiation), Severity or Scale, Timing, Understanding), AMPLE (Allergies, Medications, Past medical history, Last oral intake and/or Last Menstrual Period, and Events leading to the current presentation), or CIAMPEDS (Chief complaint, Immunizations/Isolation, Allergy, Medications, Past medical history, Events surrounding the illness, Diet/diapers, and Symptoms) to ensure comprehensive symptom exploration.

Finally, the determination of the *initial patient orientation* and the

completion of a patient *reassessment and/or reorientation* were reported in only 44% of CTAS guidelines [10,28,30,54]. The determination of the *initial patient orientation* refers to documenting where a patient is placed following triage (i.e., waiting room, stretcher in an monitored or unmonitored observation unit, resuscitation area), while the completion of *reassessment and/or reorientation* refers to the subsequent clinical nursing reassessments, modification of the initial triage priority, and, where applicable, redirection to alternative care pathways according to institutional protocols.

3.3.2. Procedural and documentation requirement quality indicators

Quality indicators related to procedural and documentation requirements encompass the standardized recording of essential administrative and logistical information during the triage process. According to CTAS guidelines, these quality indicators include the documentation of triage time metrics and chronology, the identification of the patient and triage nurse, and the documentation of the patient's mode of arrival to the emergency department.

Among the included CTAS guidelines, the documentation of triage time metrics and chronology were reported in 8 out of 9 guidelines (89%) [10,28,30–32,48,51,54]. This quality indicator encompasses all time-related elements of the triage process, including time to triage initiation, total triage duration, and time of patient discharge from the

ED. Documentation of both the triage nurse's identity and accurate patient identification was reported in 44% of the included CTAS guidelines [10,28,30,54]. Regarding the documentation of the *mode of arrival*, this quality indicator was only reported in two (22%) CTAS guidelines [10,28].

3.3.3. Clinical intervention quality indicators

This category covers quality indicators on the identification of clinical risks and the initiation of early interventions during the triage process. This category can be further subdivided into two additional subcategories: the documentation of *clinical interventions initiated* during triage, including both diagnostic and therapeutic measures, and *infection risk screening and control measures*, which are each detailed below.

The documentation of *clinical interventions initiated* during triage (*diagnostic and therapeutic*) were identified as a key quality indicator in 67% of the included guidelines [10,28,30,48,49,54]. This quality indicator involves the systematic documentation of any diagnostic or therapeutic interventions initiated at triage. These may include the use of specific diagnostic protocols (e.g., electrocardiograms, blood tests) and therapeutic interventions (e.g., administration of analgesics or antiemetics).

Infection risk screening and control measures were explicitly mentioned as a quality indicator in one CTAS guideline (11%) [10]. This quality

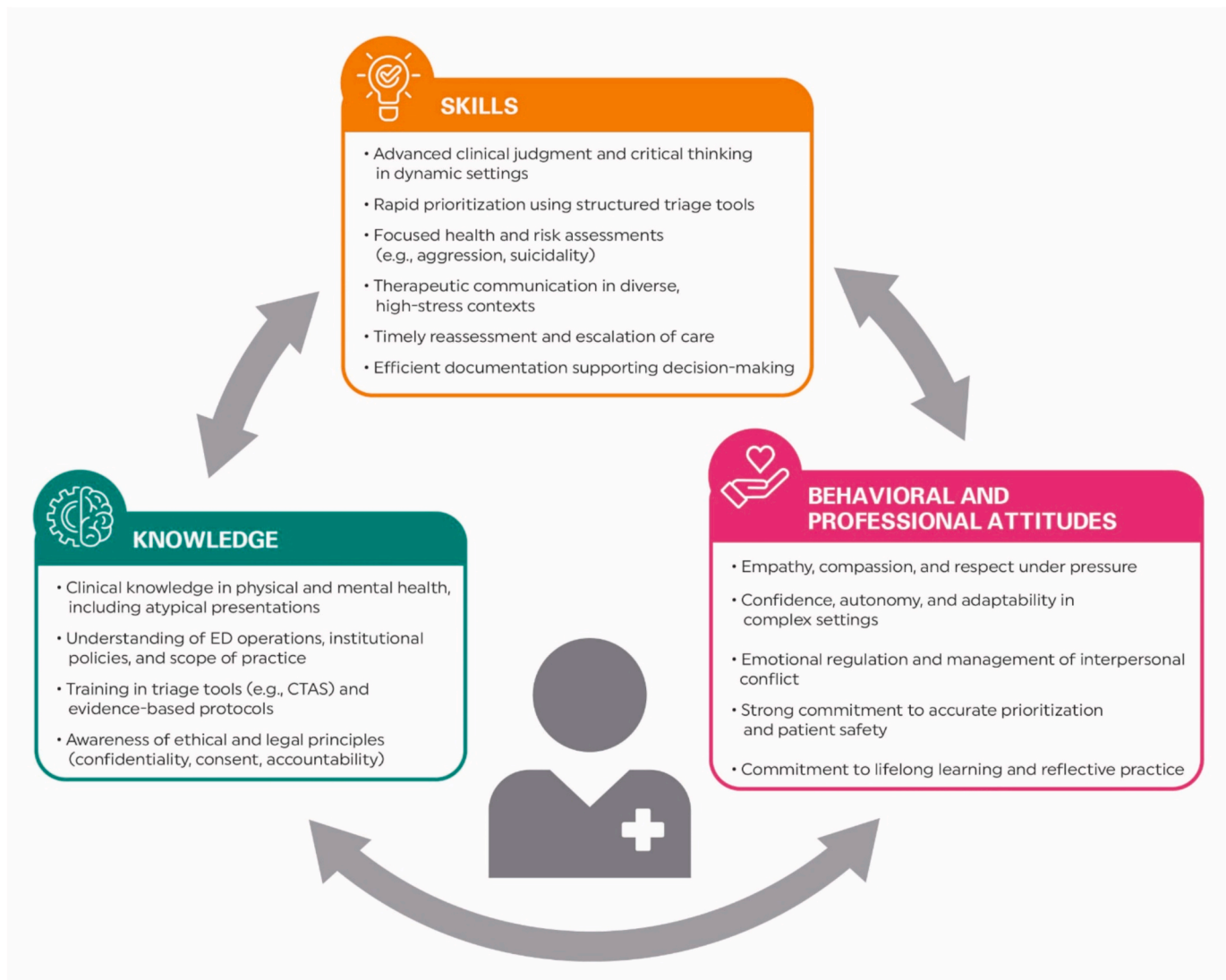


Fig. 3. Nursing skills and professional attributes for high-quality CTAS triage.

indicator refers to the documentation of the use of infection prevention protocols or screening procedures performed during triage, such as identifying patients requiring preventive isolation.

3.4. Nursing skills and professional attributes for high-quality CTAS triage

Related to the second objective of this review, the CTAS guidelines outline a broad range of skills, reflecting both technical and professional expectations for nursing practice in emergency settings. These skills were grouped into three areas: *nursing knowledge requirements*, *clinical skills and technical abilities*, and *behavioral and professional attributes*. Only three CTAS guidelines explicitly identified the skills and professional attributes required for nurses to perform triage [10,28,54]. These skills and attributes are further detailed in the following sections and are illustrated in Fig. 3.

3.4.1. Knowledge-based skills

CTAS guidelines highlight the importance of having nurses develop comprehensive clinical knowledge in both physical and mental health, including the ability to recognize atypical presentations across diverse populations [48,54,58]. In addition, nurses are expected to demonstrate an in-depth understanding of ED operations, institutional policies, professionals' scope of practice, and interprofessional collaboration [48,58]. Formal education and continuous training about the use of triage tools (such as CTAS), evidence-based guidelines, and decision-support protocols were also emphasized throughout the included guidelines [48,58]. Notably, the 2016 CTAS guideline revision included a dedicated section underscoring the importance of standardized CTAS training programs for triage nurses [48]. Furthermore, nurses are encouraged to develop and continuously update their knowledge about ethical and legal principles on patient privacy, informed consent, and professional accountability [54,58]. While not always explicitly stated, most CTAS guidelines promote continuous education on these knowledge-based skills throughout a nurse's career, rather than limiting them to initial training alone.

3.4.2. Clinical and decision-making skills

As detailed in Fig. 3, these clinical skills encompass the essential decision-making abilities and technical expertise that triage nurses require to deliver safe and effective care in emergency settings. First, given the often chaotic and time-sensitive nature of situations in the ED, nurses must develop advanced clinical judgment and critical thinking abilities to operate effectively in dynamic and unpredictable environments [48,58]. Rapid patient prioritization and acuity assessment using structured triage frameworks are also emphasized as crucial skills to ensure timely and appropriate care [48,54,58].

In addition, triage nurses are expected to possess the ability to perform focused and comprehensive health assessments, including behavioral and risk evaluations, to identify aggressive or suicidal behaviors [58]. Across CTAS guidelines, particular emphasis is placed on therapeutic communication skills, especially in high-stress, culturally diverse, and emotionally charged settings [48,58], as these skills facilitate more accurate information gathering from patients and improve clinical assessments.

Guidelines also highlight the necessity for nurses to perform timely reassessments and care escalation as patient condition evolves [48,54]. Finally, effective record keeping that supports clinical decision-making without causing care delays is considered a fundamental skill for triage nurses [48,58].

3.4.3. Behavioral and professional attitudes

Beyond clinical and knowledge-based skills, CTAS guidelines emphasize the importance of specific behavioral and professional attitudes for triage nurses, which build patient trust and contribute to the overall quality of care. One of the most consistently cited attributes

across guidelines is the ability to demonstrate empathy, compassion, and respect during patient interactions, even in high-pressure situations [28,48,54,58].

Nurses are also expected to exhibit confidence, autonomy, flexibility, and adaptability, particularly in fast paced and complex clinical environments. Given that triage nurses are often the first healthcare professionals to see patients, it is essential for them to maintain professional boundaries, manage interpersonal conflicts, and control emotional responses [58].

A strong commitment to accurate prioritization and patient safety at the first contact is also a key professional attitude outlined in the CTAS guidelines [48,58]. Finally, lifelong learning and reflective practice are required to sustain these professional skillsets throughout the nursing career [48,58].

4. Discussion

This systematic review addressed two objectives: to identify the nursing triage quality indicators outlined in the CTAS guidelines and to describe the skillset and professional attributes required for nurses to perform high-quality triage. To meet the first objective, we extracted and synthesized relevant triage quality indicators from nine CTAS guidelines, which were appraised as low quality. These quality indicators were grouped into twelve categories, with the most frequently reported in the CTAS guidelines being documentation of the chief complaint, completion of an objective clinical assessment, application of CTAS modifiers, and the assignment of a triage acuity level. For the second objective, the evidence was grouped into three areas: knowledge, clinical skills, and behavioral and professional attitudes.

4.1. Integration and interpretation of quality domains across CTAS guidelines

Several studies have examined quality indicators in triage and emergency nursing, comparing the different indicators identified in the present review. A scoping review on telephone triage in prehospital and ED settings highlighted key quality indicators similar to the ones our study identified such as timeliness, safety, documentation, and accuracy of assessment [59]. While most of these indicators align with the CTAS quality indicators identified in our systematic review, they notably exclude ED-specific elements such as the completion of an objective clinical assessment and the application of CTAS modifiers. Similarly, an integrative review of emergency nursing quality indicators emphasized broader dimensions of care, such as timeliness, patient safety, and communication, without detailing triage-specific elements such as timely reassessments or triage acuity level assignment [60]. A third study focusing on under-triage underlined the importance of timely interventions, accurate determination of the chief complaint, and appropriate triage acuity level assignment, concur with our findings on the value of time sensitive triage decision-making and structured reassessment to reevaluate initial triage determination [61]. These studies all highlight a shared emphasis on core nursing values while underscoring the need to refine and structure triage specific quality indicators.

Time-related quality indicators were also deemed essential across other ED triage studies. A comparative evaluation of the Manchester Triage System identified strict adherence to time benchmarks by triage acuity level as a central performance metric [62]. While CTAS also defines target times, our review noted variations in how these benchmarks are emphasized and applied across guidelines. In parallel, Hinson, Martinez [16] emphasized the fundamental role of identifying the chief complaint as the starting point of a high-quality triage process. They found that inconsistent documentation of presenting complaints may undermine triage accuracy and comparability across institutions, reinforcing the importance of standardized classification systems like CEDIS [29]. These findings align with our own, as we found that time metrics and the documentation of the chief complaint were the two most

consistently reported quality indicators, reflecting their essential role in assessing ED triage quality.

Although recent CTAS guidelines have introduced a frailty modifier to better reflect the clinical needs of older adults [48], several marginalized populations, including those defined by age, gender, sexual orientation, ethnicity, disability and socioeconomic status remain underrepresented in CTAS modifiers [63]. Individuals from these groups are more likely to report negative emergency care experiences [63], encounter prolonged wait times [64], and face increased risks of diagnostic errors [65]. Addressing the needs of marginalized populations is essential to ensure equitable emergency care delivery [66]. However, our systematic review found no CTAS guidelines that included evidence-based quality indicators aimed at supporting equitable and inclusive triage practices.

Strengthening the consistency of time-related indicators and chief complaint documentation across CTAS guidelines could represent a meaningful step toward more equitable and efficient emergency care. While these two indicators were the most consistently reported, other quality indicators, such as reassessment procedures, the application of CTAS modifiers, and comprehensive documentation, were also found to contribute significantly to high-quality triage. Future efforts should aim to standardize these key quality indicators in a way that reflects the full scope of nursing responsibilities in triage. This comprehensive approach would not only improve the comparability and reliability of triage processes across institutions, but would also highlight the essential role of triage nurses, whose skillset underpins the successful implementation of these quality indicators.

4.2. Essential competencies and professional attributes for effective triage practice

Triage nursing relies on a skillset that integrates clinical skills, communication, and professional judgment. Our review identified several competency areas across CTAS guidelines that other authors have also highlighted. For instance, Berkowitz et al. [61] discuss the importance of advanced clinical skills, situational awareness, and sound decision-making under uncertainty as prerequisites to prevent inappropriate acuity assignments. These findings align closely with the need for specific professional attributes and responsiveness to deteriorating patient conditions identified in our review. Indeed, beyond the structured application of CTAS guidelines, triage performance depends on nurses' ability to synthesize evolving clinical information under pressure.

Patient satisfaction is often closely linked to wait times in the ED [20,67]. However, beyond timely care, patient perceptions may also be directly shaped by the competence of the triage nurse [19]. An investigation into patient satisfaction identified clinical knowledge, empathy, and communication as central to positive experiences in the ED [68]. These skills are strongly associated with those identified in our review, including knowledge of clinical presentations, emotional regulation, and therapeutic communication. This convergence between patient-centred care and clinical expertise reflects the importance of embedding relational skills into triage-specific recommendations, as emphasized in CTAS guidelines.

A consensus study on triage nurse skills identified five key elements: clinical judgment, communication, timely decision-making, psychological care, and professional development [69]. Several of these competencies overlap with those highlighted in our review, particularly clinical assessment and communication. However, our findings expand upon this prior work by emphasizing the ethical and legal responsibilities outlined in the CTAS guidelines, elements not addressed in the consensus study [69]. Additionally, other authors have drawn attention to a lack of cultural competence and awareness among triage nurses in caring for vulnerable populations [70]. Taken together, these observations suggest that the CTAS-based view of triage nursing encompasses not only core clinical competencies but also accountability

dimensions that are essential to safe and equitable decision-making.

4.3. Implications for practice and future research

While all nine CTAS guidelines were rated as low quality, this systematic review represents an essential first step toward identifying common quality indicators that could help measure and improve the quality of ED nursing triage. To support nurses in developing their triage competencies, CTAS-related training, guidelines, and audit tools should integrate evidence-based, patient-centered practices in emergency care. In addition to strengthening clinical and relational skills, these efforts should be aligned with the core quality indicators identified in this review. Integrating key elements to evaluate the quality of ED nursing triage such as tracking triage time, verifying the quality of documentation, checking for timely reassessments and the application of adequate modifiers into triage audit tools would enable a more consistent assessment of both individual and system-level triage performance. These findings also lay the groundwork for expert consensus efforts aimed at validating and refining triage quality indicators, ultimately strengthening nursing triage practices across emergency settings.

To ensure that these practices promote not only clinical excellence but also equity, future indicator development should explicitly consider the needs of marginalized populations and incorporate measures that foster inclusive and culturally competent triage. Furthermore, as AI-assisted triage tools become more widespread in emergency departments [71–73], future research should focus on how this technology facilitates decision-making in assigning priority levels during triage and conducting quality audits.

5. Strengths and limitations

This systematic review offers a comprehensive synthesis of both the quality indicators for nursing triage outlined in CTAS guidelines and the skills required to ensure high-quality triage performance. The methodological rigor of the review supports the validity of its findings and offers a solid foundation for continuous quality improvement. Importantly, it also highlights key gaps in the literature that supports the relevance of future research.

Several limitations should be noted. First, the review focused exclusively on CTAS guidelines, which may have led to the omission of relevant insights from other triage systems, such as the ESI or ATS. Second, all included guidelines were appraised as low quality using the AGREE II tool, particularly with regard to development rigor and applicability (Domains 3 and 5), which may limit the strength of some of the extracted recommendations. Third, the review included only documents in English and French, consistent with the official languages of the regions where CTAS is implemented.

6. Conclusions

This systematic review identified twelve key quality indicator categories outlined in CTAS guidelines, with the most frequently reported being the documentation of the chief complaint, objective clinical assessment, use of CTAS modifiers, and assignment of triage acuity levels. Less frequently reported indicators, such as the mode of arrival and infection prevention protocols, highlight important gaps in current guideline comprehensiveness. In addition to structural indicators, this review highlighted the critical nursing skills required for high-quality triage. These were grouped into three core areas: knowledge, encompassing clinical proficiency in physical and mental health, and familiarity with ethical and legal concepts; clinical skills, including advanced judgment, therapeutic communication, and accurate record keeping; and behavioral and professional attitudes, such as empathy, confidence, and autonomy. Although all included guidelines were rated as low quality, this review serves as a valuable starting point for future expert consensus efforts aimed at developing validated quality indicators based

on CTAS guidelines. These findings underscore the ongoing need for standardization, targeted training, and structured audit practices tailored to diverse clinical contexts and patient populations. Strengthening collaboration between researchers, educators, and clinicians may ultimately support the triage nurse's gatekeeping role in delivering timely, equitable, and high-quality emergency care.

Ethical considerations

This systematic review used previously published data to assess CTAS guidelines. Since no participants were recruited, no ethics approval was required.

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CRediT authorship contribution statement

Simon Ouellet: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Maria Cécilia Gallani:** Writing – review & editing, Validation, Methodology, Conceptualization. **Sarah-Eve St-Pierre:** Writing – review & editing, Formal analysis, Data curation. **Éric mercier:** Writing – review & editing, Investigation, Formal analysis. **Marc-Aurèle Gagnon:** Writing – review & editing, Software, Methodology. **Patrick Archambault:** Writing – review & editing, Validation, Methodology. **Mélanie Bérubé:** Writing – review & editing, Validation, Supervision, Methodology, Formal analysis.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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References

- [1] Wolf LA, Delao AM, Perhats C, Moon MD, Zavotsky KE. Triage of the emergency department, not the patient: United States emergency nurses' experience of the triage process. *J Emerg Nurs* 2018;44(3):258–66.
- [2] Fry M, Stainton C. An educational framework for triage nursing based on gatekeeping, timekeeping and decision-making processes. *Accid Emerg Nurs* 2005; 13(4):214–9.
- [3] Johannessen LE. Narratives and gatekeeping: making sense of triage nurses' practice. *Sociol Health Illn* 2018;40(5):892–906.
- [4] Corbett A, Quinn Griffin MT. Triage nurse expertise. *Nursing Concept Analysis: applications to Research and Practice*. New York, UNITED STATES: Springer Publishing Company; 2016. p. 249–55.
- [5] Stanfield LM. Clinical decision making in triage: an integrative review. *J Emerg Nurs* 2015;41(5):396–403.
- [6] Peta D, Day A, Lugari WS, Gorman V, Ahayalimudin NA, Pajo VMT. Triage: a global perspective. *J Emerg Nurs* 2023;49(6):814–25.
- [7] Sartini M, Carbone A, Demartini A, Giribone L, Oliva M, Spagnolo AM, et al. Overcrowding in emergency department: causes consequences, and solutions-a narrative review. *Healthcare* 2022;10(9).
- [8] Moon S-H, Shim JL, Park K-S, Park C-S. Triage accuracy and causes of mistriage using the Korean Triage and Acuity Scale. *PLoS One* 2019;14(9):e0216972.
- [9] Davis JW, Dirks RC, Sue LP, Kaups KL. Attempting to validate the overtriage/ undertriage matrix at a Level I trauma center. *J Trauma Acute Care Surg* 2017;83(6).
- [10] OIIQ, CMQ. Le triage à l'urgence : lignes directrices pour l'infirmière au triage à l'urgence. OIIQ, editor. Montréal (Québec): OIIQ; 2019.
- [11] Hitchcock M, Gillespie B, Crilly J, Chaboyer W. Triage: an investigation of the process and potential vulnerabilities. *J Adv Nurs* 2014;70(7):1532–41.
- [12] De Freitas L, Goodacre S, O'Hara R, Thokala P, Hariharan S. Interventions to improve patient flow in emergency departments: an umbrella review. *Emerg Med J* 2018;35(10):626–37.
- [13] . Swedish Council on Health Technology A. Triage Methods and Patient Flow Processes in Emergency Departments : a Systematic Review. [Place of publication not identified]: Swedish Council on Health Technology Assessment (SBU); 2010. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK447967>.
- [14] Pollyane Liliane S, Luciana P, Veridiana Bernardes F, Rosali Isabel Barduchi O, Suzel Regina Ribeiro C. Triage in an adult emergency service: patient satisfaction. *Revista da Escola de Enfermagem da USP* [Internet]. 2016; 50(3):[427-33 pp.].
- [15] Ahmad S, Molyneux E, Robertson A. Improved triage and emergency care for children reduces inpatient mortality in a resource-constrained setting. *Bull World Health Organ* 2006;84(4):314–9.
- [16] Hinson JS, Martinez DA, Cabral S, George K, Whalen M, Hansoti B, et al. Triage performance in emergency medicine: a systematic review. *Ann Emerg Med* 2019; 74(1):140–52.
- [17] Hosking J, Considine J, Sands N. Recognising clinical deterioration in emergency department patients. *Australas Emerg Nurs J* 2014;17(2):59–67.
- [18] Ausserhofer D, Zaboli A, Pfeifer N, Solazzo P, Magnarelli G, Marsoner T, et al. Errors in nurse-led triage: an observational study. *Int J Nurs Stud* 2021;113: 103788.
- [19] Rehman SA, Ali PA. A review of factors affecting patient satisfaction with nurse led triage in emergency departments. *Int Emerg Nurs* 2016;29:38–44.
- [20] Janerka C, Leslie GD, Gill FJ. Patient experience of emergency department triage: an integrative review. *Int Emerg Nurs* 2024;74:101456.
- [21] Rogers A, Rogers FB, Schwab CW, Bradburn E, Lee J, Wu D, et al. Increased mortality with undertriaged patients in a mature trauma center with an aggressive trauma team activation system. *Eur J Trauma Emerg Surg* 2013;39(6):599–603.
- [22] Ageron F-X, Porteaud J, Evain J-N, Millet A, Greze J, Vallot C, et al. Effect of under triage on early mortality after major pediatric trauma: a registry-based propensity score matching analysis. *World J Emergency Surg* 2021;16(1):1.
- [23] Suamchaiyaphum K, Jones AR, Markaki A. Triage accuracy of emergency nurses: an evidence-based review. *J Emerg Nurs* 2024;50(1):44–54.
- [24] Ebrahimi M, Heydari A, Mazlom R, Mirhaghi A. The reliability of the Australasian Triage Scale: a meta-analysis. *World J Emerg Med* 2015;6(2):94.
- [25] Mirhaghi A, Heydari A, Mazlom R, Hasanadeh F. Reliability of the emergency severity index: meta-analysis. *Sultan Qaboos Univ Med J* 2015;15(1):e71.
- [26] Mirhaghi A, Mazlom R, Heydari A, Ebrahimi M. The reliability of the Manchester Triage System (MTS): a meta-analysis. *J Evid Based Med* 2017;10(2):129–35.
- [27] Beveridge R, Ducharme J, Janes L, Beaulieu S, Walter S. Reliability of the Canadian emergency department triage and acuity scale: interrater agreement. *Ann Emerg Med* 1999;34(2):155–9.
- [28] Warren D, Jarvis A, Leblanc L. Canadian pediatric triage and acuity scale: implementation guidelines for emergency departments. *Can J Emerg Med* 2001;3(4 Suppl).
- [29] Grafstein E, Unger B, Bullard M, Innes G. Canadian emergency department information system (CEDIS) presenting complaint list (version 1.0). *Can J Emerg Med* 2003;5(1):27–34.
- [30] Murray M, Bullard M, Grafstein E. Revisions to the Canadian emergency department triage and acuity scale implementation guidelines. *Can J Emerg Med* 2004;6(6):421–7.
- [31] Bullard MJ, Unger B, Spence J, Grafstein E. Revisions to the Canadian Emergency Department Triage and Acuity Scale (CTAS) adult guidelines. *Can J Emerg Med* 2008;10(02):136–42.
- [32] Bullard MJ, Chan T, Brayman C, Warren D, Musgrave RNE, et al. Revisions to the Canadian Emergency Department Triage and Acuity Scale (CTAS) guidelines. *Can J Emerg Med* 2014;16(06):485–9.
- [33] Malmström T, Harjola V-P, Torkki P, Kumpulainen S, Malmström R. Triage quality control is missing tools-a new observation technique for ED quality improvement. *International Journal for Quality in Health Care: Journal of the International Society for Quality in Health Care*. 2017;29(2):295–300.
- [34] Robbie F, Martin PE. Audit and feedback interventions. *Knowledge translation in health care: moving from evidence to practice*. 2 ed: John Wiley & Sons; 2013. p. 183–8.
- [35] Ouellet S, Gallani MC, Fontaine G, Mercier É, Lapierre A, Severino F, et al. Strategies to improve the quality of nurse triage in emergency departments: a systematic review. *Int Emerg Nurs* 2025;81:101639.
- [36] Higgins JPT TJ, Chandler J, Cumpston M, Li T, Page MJ, Welch VA (editors). *Cochrane Handbook for Systematic Reviews of Interventions* version 6.5 (updated August 2024) 2024. Available from: www.training.cochrane.org/handbook.

- [37] Johnston A, Kelly SE, Hsieh S-C, Skidmore B, Wells GA. Systematic reviews of clinical practice guidelines: a methodological guide. *J Clin Epidemiol* 2019;108: 64–76.
- [38] Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71.
- [39] McGowan J, Sampson M, Salzwedel DM, Cogo E, Foerster V, Lefebvre C. PRESS peer review of electronic search strategies: 2015 guideline statement. *J Clin Epidemiol* 2016;75:40–6.
- [40] Wichor MB, Dean G, Gerdien BJ, Leslie H, Tanja B. De-duplication of database search results for systematic reviews in EndNote. *J Med Lib Assoc [Internet]* 2016; 104(3).
- [41] Higgins J, Thomas J, Chandler J, Cumpston M, Li T, Page M, et al. *Cochrane Handbook for Systematic Reviews of Interventions* version 6.2. 2021. Available from: www.training.cochrane.org/handbook.
- [42] Brouwers MC, Kho ME, Browman GP, Burgers JS, Cluzeau F, Feder G, et al. AGREE II: advancing guideline development, reporting and evaluation in health care. *CMAJ* 2010;182(18):E839–42.
- [43] Chiappini E, Bortone B, Galli L, de Martino M. Guidelines for the symptomatic management of fever in children: systematic review of the literature and quality appraisal with AGREE II. *BMJ Open* 2017;7(7):e015404.
- [44] Brosseau L, Rahman P, Toupin-April K, Poitras S, King J, De Angelis G, et al. A systematic critical appraisal for non-pharmacological management of osteoarthritis using the appraisal of guidelines research and evaluation II instrument. *PLoS One* 2014;9(1):e82986.
- [45] Bérubé M, Bradley N, O'Donnell M, Stelfox HT, Garraway N, Vasiliadis H-M, et al. Clinical practice guideline recommendations to improve the mental health of adult trauma patients: protocol for a systematic review. *BMJ Open* 2024;14(3):e079205.
- [46] Bérubé M, Lapierre A, Panenka W, O'Donnell M, Bradley N, Moore L, et al. Clinical Practice Guideline Recommendations on Mental Health in Trauma: a Systematic Review. *JAMA Surg* 2025.
- [47] Polit DF, Beck CT. *Nursing research : generating and assessing evidence for nursing practice*. Eleventh edition. ed. Philadelphia: Wolters Kluwer; 2021.
- [48] Bullard MJ, Musgrave E, Warren D, Unger B, Skeldon T, Grierson R, et al. Revisions to the Canadian emergency department triage and acuity scale (CTAS) guidelines 2016. *Can J Emerg Med* 2017;19(S2):S18–27.
- [49] Bullard MJ, Melady D, Emond M, Musgrave E, Unger B, van der Linde E, et al. Guidance when applying the Canadian Triage and Acuity Scale (CTAS) to the geriatric patient: executive summary. *Can J Emerg Med* 2017;19(S2):S28–37.
- [50] Bullard MJ, Unger B, Spence J, Grafstein E. Révision des lignes directrices de l'échelle canadienne de triage et de gravité (ÉTG) pour les adultes. *Can J Emerg Med* 2008;10(2):143–50.
- [51] Warren DW, Jarvis A, LeBlanc L, Gravel J, Group CNW. Revisions to the Canadian triage and acuity scale paediatric guidelines (PaedCTAS). *Can J Emerg Med* 2008; 10(3):224–32.
- [52] Warren DW, Jarvis A, LeBlanc L, Gravel J. Révision des lignes directrices de l'échelle canadienne de triage et de gravité (ÉTG) applicable aux enfants. *Can J Emerg Med* 2008;10(3):233–43.
- [53] Murray M, Bullard M, Grafstein E. Révision de l'échelle canadienne de triage et de gravité pour les départements d'urgence: Guide d'implantation. *Can J Emerg Med* 2005;7(1):28–35.
- [54] Beveridge R, Clarke B, Janes L, Savage N, Thompson J, Dodd G, et al. Implementation guidelines for the Canadian emergency department Triage & Acuity Scale (CTAS). *Can Assoc Emerg Phys* 1998;1–32.
- [55] Beveridge R, Clarke B, Janes L, Savage N, Thompson J, Dodd G, et al. L'échelle canadienne de triage & de gravité pour les départements d'urgence Guide d'implantation. *Can J Emerg Med* 1999;1(3).
- [56] Warren D. Échelle canadienne pédiatrique de triage et de gravité : guide d'implantation pour les départements d'urgence. *CJEM* 2001;3(4).
- [57] Grafstein E, Bullard MJ, Warren D, Unger B, Group CNW. Revision of the Canadian Emergency Department Information System (CEDIS) presenting complaint list version 1.1. *Can J Emerg Med* 2008;10(2):151–61.
- [58] Ordre des infirmières et infirmiers du Qb. Triage à l'urgence : lignes directrices. Montréal (Québec): Ordre des infirmières et infirmiers du Québec; 2019. Available from: <https://www.oiiq.org/documents/20147/237836/2510-triage-urgence-lignes-directrices-web.pdf>.
- [59] Vainio H, Soininen L, Castrén M, Torkki P. Identifying performance indicators to measure overall performance of telephone triage—a scoping review. *Scand J Prim Health Care* 2024;42(1):38–50.
- [60] Mustonen M, Ameel M, Ritmala M, Leino-Kilpi H. Nursing quality indicators in emergency nursing: a scoping review. *J Nurs Care Qual* 2024;39(4):376–82.
- [61] Berkowitz D, Morrison S, Shaikat H, Button K, Stevenson M, LaViolette D, et al. Under-triage: a new trigger to drive quality improvement in the emergency department. *Pediatric Qual Safety* 2022;7(4).
- [62] Jesus APS, Batista REA, Campanharo CRV, Lopes MCBT, Okuno MFP. Evaluation of the manchester triage system quality indicator: service time. *Revista Gaúcha de Enfermagem* 2021;42:e20200371.
- [63] Bartels SA, MacKenzie M, Douglas SL, Collier A, Pritchard J, Purkey E, et al. Emergency department care experiences among members of equity-deserving groups: quantitative results from a cross-sectional mixed methods study. *BMC Emerg Med* 2023;23(1):21.
- [64] McDonald EJ, Quick M, Oremus M. Examining the association between Community-Level marginalization and emergency room wait time in Ontario, Canada. *Healthcare Policy* 2020;15(4):64.
- [65] Farcas AM, Joiner AP, Rudman JS, Ramesh K, Torres G, Crowe RP, et al. Disparities in emergency medical services care delivery in the United States: a scoping review. *Prehosp Emerg Care* 2023;27(8):1058–71.
- [66] Leeies M, Mohindra R, Hrymak C, McColl T, Ratana P, Hayward J, et al. Enhanced sociodemographic variable collection in emergency departments. *Can J Emerg Med* 2024;26(6):371–6.
- [67] Özhanlı Y, Akyolcu N. Satisfaction of patients with triage and nursing practice in emergency departments. *Florence Nightingale J Nurs* 2020;28(1):49–60.
- [68] López Hernández M, Puig-Llobet M, Higon Fernández S, Franco Freirut M, Moreno Mateos Y, Galimany MJ. patient satisfaction with the level of competence of the triage nurse in hospital emergency departments. *J Clin Nurs* 2025;34(9):3893–907.
- [69] Wolf L, Delao A, Simon C, Jodelka FM. Establishing triage competencies and verification processes: a survey study. *J Emerg Nurs* 2025;51(1):59–78.
- [70] Castaneda-Guarderas A, Glassberg J, Grudzen CR, Ngai KM, Samuels-Kalow ME, Shelton E, et al. Shared decision making with vulnerable populations in the emergency department. *Acad Emerg Med* 2016;23(12):1410–6.
- [71] Da'Costa A, Teke J, Origbo JE, Osonuga A, Egbon E, Olawade DB. AI-driven triage in emergency departments: a review of benefits, challenges, and future directions. *Int J Med Inf* 2025. 105838.
- [72] Tyler S, Olis M, Aust N, Patel L, Simon L, Triantafyllidis C, et al. Use of artificial intelligence in triage in hospital emergency departments: a scoping review. *Cureus* 2024;16(5).
- [73] El Arab RA, Al Moosa OA. The role of AI in emergency department triage: an integrative systematic review. *Inten Critical Care Nurs* 2025;89:104058.