

The Validity and Reliability of the Canadian Triage Acuity Scale (CTAS) in Emergency Department: A Systematic Review

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ABSTRACT

Introduction

CTAS considers five priority levels of triage: CTAS level 1: resuscitation; CTAS level 2: Emergency; CTAS level 3: Urgent; CTAS level 4: Less Urgent; CTAS level 5, No urgent. The aim of this review is to check the level of validity and reliability of the Canadian Triage Acuity Scale.

Method

This systematic review conduct by searching and analyzing all eligible studies from 2007-2017 through electronic database: Science Direct, Proquest, and PubMed. This review consist of quantitative research investigating the reliability and validity of the Canadian Triage Acuity Scale for the broad population of adults and children visiting the emergency department.

Result

Seven studies were included in the review. The studies investigated the inter- and intra-rater reliability using the “kappa” statistic; the validity was tested with many measures: validity in predicting mortality, hospital admission, under- and over triage, used resources, and length of stay in the emergency department, as well as a reference standard rating.

Conclusions

Canadian Triage Acuity Scale shows a wide inter-rater agreement range with a prevalence of good and very good agreement. Its safety was low because of the high rate of under triage and the low sensitivity in predicting higher urgency levels. The quality of the reporting in studies of the reliability and validity of the Canadian Triage Acuity Scale (CTAS) is good.

Keywords

Validity; Reliability; Canadian Triage Acuity Scale (CTAS); Emergency Department

INTRODUCTION

The introduction of triage into emergency care first occurred in the United States. In 1950, there was an increase in the number of patients seeking care in the emergency room, resulting in the need for safer and more effective ways to privatize patients [1]. To overcome this situation, care in the ED began to use quality health personnel, often Registered Nurse (RN) was used to serve patients when they arrived at the ED. Registered Nurse will conduct initial assessment and prioritize patients, which aims to identify patients who can still wait for safe treatment and patients who are in critical condition and need immediate attention. Since that time, began to be introduced about the concept of mempriotaskan patients based on the severity of the disease or injury, and not on arrival.

Several levels of the triage scale are applied in assessing the patient's fear and severity, each level dividing the criteria for patients starting from those using 2 levels: emergent and non emergent, 3 levels namely Emergent, Urgent, Nonurgent, Reffered [2] . The four 5-scale triages have been developed over the past 15 years, including The Australasian Triage Scale (ATS), formerly known as The National Triage Scale (NTS) [3]. The Canadian Triage and Acuity Scale (CTAS) [4], The British Manchester Triage Scale (MTS) [5] and The Emergency

Severity Index (ESI), developed by US emergency doctors and nurses. ATS, CTAS, and MTS are all designed with a specified time frame for each triage level, where the time period is the maximum waiting time for patients who are estimated to be safe for patients who have already been triaged.

CTAS was adopted from the National Triage Scale made by Fitzgerald and Jelinek, Australia. First developed and implemented in the city of New Brunswick, Canada by Dr. Bob Beveridge. In its implementation a national working group was formed which was responsible for implementing and shaping the guidelines represented by the Association of Emergency Doctors and Nurses (CAEP and NENA) and the Canadian Pediatric Emergency Association. CTAS considers five priority levels of triage: CTAS level 1: resuscitation; CTAS level 2: Emergency; CTAS level 3:urgent; CTAS Level 4: Less Urgent; CTAS level 5:Nonurgent[4, 6].

In recent years, many studies have been published on CTAS reliability and validity. There is an inter-rater reliability and intra-rater reliability for triage systems. They are usually analyzed using the κ statistic (Cohen's kappa). The inter-rater reliability refers to the statistical measurement of agreement obtained by two or more users of the scale. It measures the agreement beyond chance between raters. Kappa equals zero when the amount of agreement is what would be observed by chance alone, and κ is equal to one when there is a perfect agreement. Kappa levels are frequently evaluated with the following terminology [7] : poor agreement, κ less than 0.20; fair agreement if κ is from 0.20 to 0.40; moderate agreement, κ from 0.40 to 0.60; good agreement, κ from 0.60 to 0.80; very good agreement, κ from 0.80 to 1. The CTAS inter-rater reliability is determined by the agreement in triage urgency level if multiple raters triage one patient or patient scenario. The intra-rater agreement presents the agreement in triage urgency level if one triage nurse triages one case scenario at different points in time. Validity refers to the agreement between the value of a measurement and its true value; a triage scale is valid if it measures what it is supposed to measure: the "true urgency." To assess the triage systems' validity, a "gold standard" as a proxy for urgency has to be defined. Many outcome measures and reference standard for urgency have been used. The CTAS validity can be expressed in sensitivity and specificity. CTAS sensitivity presents its ability to identify high-urgency patients; CTAS specificity presents its ability to identify patients with low-urgency problems.

METHODS

The primary aim was to check the state of studies on the reliability and validity of the Canadian Triage Acuity Scale for the broad population of adults and children visiting the ED. The question for the review were: (1) What is the level of reliability of CTAS among the selected studies? (2) How valid is CTAS in predicting outcomes and workload among the selected studies? (3) How is the quality of reporting among published studies on reliability and validity of CTAS?

This systematic review conducted by searching and analyzing all eligible studies from 2007 – 2017 through electronic databases: Science Direct, ProQuest, and PubMed. This systematic review with narrative synthesis of the main finding on the reliability of CTAS. The review is based on the PRISMA guideline on reporting systematic reviews [8] and on the STARD (Standard for Reporting of Diagnostic Accuracy) guidelines [9] the PRISMA guideline for the first part of the review protocol: the selection of studies. The PRISMA guideline is an evidence-based minimum set of items for reporting in systematic reviews and meta-analyses.

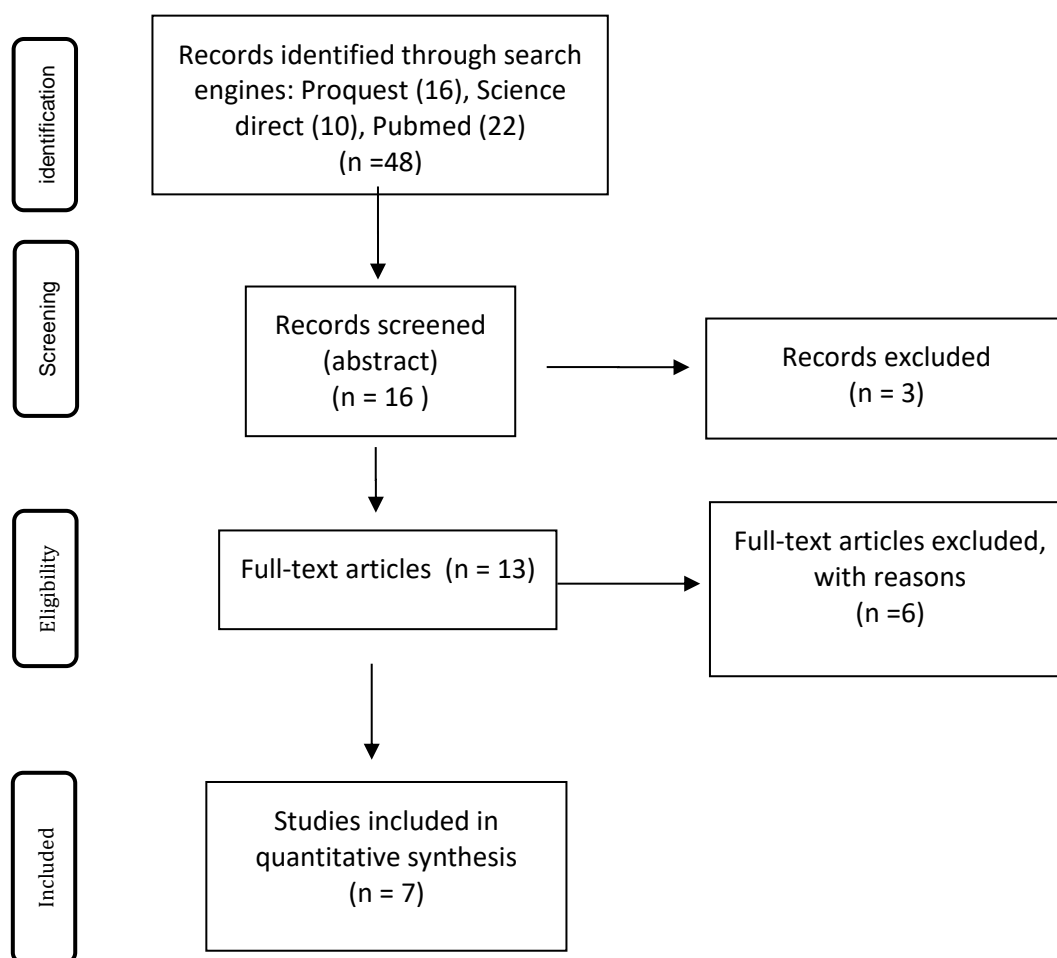


Figure 1. The process of tracing journal articles with a prism chart (Prisma 2009, flowchart)

RESULT & DISCUSSION

Of the 7 studies, four tested validity of CTAS, two tested reliability, and two tested both indicators. Three of the 7 were on pediatric population. There were one Observational Study, three retro-spectie studies and three prospective studies.

Reability of CTAS

Two articles on CTAS reliability were observational studies, conducted using triage scenarios. The results on reliability of CTAS Based on the quality review, all studies on CTAS reliability satisfied a high number of STARD items (>70%), but only one (Fernandes, 2013) was found to be of moderate quality by the authors, who used a threegrade. Score based on methodology analysis of studies. The main reasons for low-quality ratings were deficient external validity, little information on the selection of patients and triage nurses, and the absence of methods to calculate the sample of scenarios and raters, use of scenarios, and design of study. There was a wide inter-rater agreement range amongm all included studies: from “fair” to “very good agreement” according to ACEP/ENA Triage Task Force indications [10]. In particular the range for unweighted, weighted, and quadratic weighted K inter was 0.31–0.76; 0.40–0.80 and 0.81–0.82, respectively. Three studies used unweighted and weighted K measures in the same

population [2, 10]. Only one study (Fernandes, 2013) analyzed intra-rater reliability of CTAS and tested the reliability of CTAS in a pediatric population.

Validity of CTAS

Based on an overview of studies on validity of CTAS when applied to general (adult and children) and pediatric population. CTAS urgency levels correlate to workload and several other outcomes: length of stay in the ED, admission, and mortality. But few studies (Fernandes, 2013; Smith, 2015; Gravel, 2013) tested how valid CTAS is in predicting workload (resource utilization and length of stay in the ED) and its validity in predicting mortality [13]. In respect to the workload, it seems that the number of resources used for a patient increases with the higher level of urgency level of CTAS, and patients with the highest urgency level spend more time in the ED ([14]. Regarding the relation between admission and the level of urgency assigned using CTAS, Fernandes, 2013 showed that the probability of admission increases for patients triaged as urgency level 1–3. In two studies (Smith, 2015; Gouin, 2005), the rate of hospital admission increases with a higher level of urgency: more than 80% of the patients admitted were triaged as urgency level 1 or 2 [13]; less than 6% of patients triaged as urgency level 4 or 5 were admitted. However, the percentage of mortality relating to urgency level is not comparable between the two studies that test this outcome: in one study (Lee, 2011), 97% of the patients triaged as urgency level 1 or 2 died; Lee, 2011, showed that only the 10% of patients triaged as urgency level 1 died. In both studies, no patient triaged as urgency level 4 or 5 died. Furthermore, undertriage rates for CTAS with respect to a reference standard rating seems to be lower than overtriage in pediatric studies that tested this endpoint. Instead, the findings on the percentage of over- and undertriage among studies on general population (adult and children) were not in agreement: in two studies (Gravel, 2013; Gouin, 2006) undertriage was more prevalent than overtriages, in one other (Storm- Versloot) overtriage was more prevalent than undertriage. Finally, seven studies tested a rating comparison between raters and a group of triage experts providing the reference standard. Sensitivity and specificity in predicting the assignment of the raters' higher urgency levels (1–2) compared to the reference standard ranged from 17% to 63% (median 44%) and from 78% to 100% (median 95%), respectively.

Summary of evidence The purpose of this review was to check the level of reliability and validity of CTAS and to verify the quality of reporting among published studies on this topic. The results suggest that there is a wide inter-rater agreement range among all studies included, from fair to very good agreement. The wide inter-rater agreement range could likely be explained by the difference in populations studied, the difference among the raters who used CTAS, and the difference in the way CTAS was applied in each setting. There was a prevalence of good to very good agreement: five of the six studies reported a K inter value higher than 0.6.

CONCLUSIONS

In this review, CTAS seems to have a wide range of inter-rater agreement. More studies should be conducted on its intra-rater reliability and on its validity in predicting workload (use of resources, and length of stay in the ED). Additionally, the use of CTAS as a triage system for special patient categories (the elderly and young children) should be studied. CTAS should probably be changed, and educational programs should be designed to improve CTAS safety. Particular care should be taken to reduce undertriage and improve sensitivity (especially for higher urgency levels). Moreover, the quality of future research of CTAS should improve: there

need to be prospective multicenter studies based on real patients, planned with statistical method to calculate sample size, without bias on recruitment.

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