

Interrater agreement of Canadian Emergency Department Triage and Acuity Scale scores assigned by base hospital and emergency department nurses

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ABSTRACT

Objective: We sought to assess the applicability of the Canadian Emergency Department Triage and Acuity Scale (CTAS) in the prehospital setting by comparing CTAS scores assigned during ambulance transportation by base hospital (BH) nurses with CTAS scores given by emergency department (ED) nurses on patients' arrival.

Methods: We recruited a prospective sample of consecutive patients who were transported to the ED by ambulance between December 2006 and March 2007 for whom a contact was made with the BH. Patients were triaged by the BH nurse with online communication and vital signs transmission. On arrival, patients were blindly triaged again by the ED nurse. We used the quadratic weighted κ statistic to measure the agreement between the 2 CTAS scores.

Results: Ninety-four patients were triaged twice by 2 nursing teams (9 nurses at the BH and 39 nurses in the ED). The agreement obtained on prehospital and ED CTAS scores was moderate ($\kappa = 0.50$; 95% confidence interval 0.37–0.63).

Conclusion: The moderate interrater agreement we obtained may be a result of the changing conditions of patients during transport or may indicate that CTAS scoring requires direct contact to produce reliable triage scores. Our study casts a serious doubt on the appropriateness of BH nurses performing triage with CTAS in the prehospital setting.

Keywords: triage, Canadian Emergency Department Triage and Acuity Scale, emergency medical services, emergency department

RÉSUMÉ

Objectif : Nous avons cherché à évaluer l'applicabilité de l'échelle canadienne de triage et de gravité (ÉTG) pour les services d'urgence dans le contexte préhospitalier en comparant

les niveaux de triage assignés pendant le transport en ambulance par les infirmières de l'hôpital de rattachement avec les niveaux de triage attribués par les infirmières du service d'urgence à l'arrivée des patients.

Méthodes : Nous avons formé un échantillon prospectif de patients recrutés consécutivement. Ces patients avaient été transportés à l'urgence par ambulance entre décembre 2006 et mars 2007 et une communication avait été établie avec l'hôpital de rattachement. Les patients ont été triés par l'infirmière de l'hôpital de rattachement, qui était en communication en ligne et avait reçu les données sur les signes vitaux. À l'arrivée, les patients ont été triés de nouveau par une infirmière de l'urgence travaillant à l'insu. Nous avons utilisé une analyse statistique kappa (κ) pondérée de type quadratique pour mesurer la concordance entre les 2 niveaux de triage attribués.

Résultats : Quatre-vingt-quatre patients ont fait l'objet d'un triage à deux reprises par 2 équipes d'infirmières, 9 infirmières à l'hôpital de rattachement et 39 infirmières à l'urgence. L'accord obtenu entre les niveaux de triage préhospitaliers et les niveaux de triage à l'urgence était modéré ($\kappa = 0,50$; intervalle de confiance à 95 % de 0,37 à 0,63).

Conclusion : L'obtention d'un accord inter-évaluateurs modéré peut être fonction du changement de l'état des patients en cours de transport ou peut indiquer que l'assignation de niveaux de triage selon l'ÉTG requiert un contact direct avec le patient pour assigner un niveau de triage fiable. Notre étude jette de sérieux doutes sur la pertinence de faire effectuer le triage selon l'ÉTG par les infirmières de l'hôpital de rattachement dans le contexte préhospitalier.

INTRODUCTION

Triage systems have been in use in Canadian emergency departments (EDs) for decades; however, the method

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used to establish priority scores has varied widely among hospitals. The situation changed in the mid-1990s with the introduction of the Canadian Emergency Department Triage and Acuity Scale (CTAS).¹⁻³ Besides standardizing triage and improving efficiency, a scale such as CTAS facilitates comparisons and communication among EDs.⁴ Triage nurses use the scale to establish a priority score between CTAS-1 (resuscitation) and CTAS-5 (nonurgent), depending on the severity of the patient's condition (Box 1).⁵

For patients transported by ambulance to the ED, many jurisdictions have established base hospitals (BHs), with objectives that include patient monitoring, expansion of the scope of practice of paramedics, and ambulance diversion. Other interesting avenues are possible with the communication systems established by a BH. For example, BHs can enable nurses to triage patients while the patients are being transported by ambulance. This would allow hospital personnel to bypass the ED triage process and assign a stretcher to the patient before ED arrival. Such a system could permit patients to see a physician more rapidly, and expedite investigations and treatments. This could decrease patients' throughput time, release paramedics sooner and make ambulances more readily available for other emergencies, and possibly reduce the overall length of stay of ED patients.

The goal of this study was to explore the feasibility of BH triage by measuring the agreement between the triage scores assigned by BH nurses and those assigned by ED nurses, both using CTAS. We hypothesized that the patients' prehospital triage assessment, performed through telecommunications between paramedics and BH nurses, would lead to a triage score similar to the score obtained at ED triage and that the κ value would be more than acceptable.^{1,6-9}

METHODS

Design and setting

We used a prospective study design between December 2006 and March 2007. The Chaudière-Appalaches

region, in Quebec, established a BH in 2006. The BH is integrated into the regional emergency medical services (EMS), and calls to 911 are relayed to a health communication centre in which standardized protocols are used to assign first responders (if required) and/or paramedics. The region has a population of 400 000 spread over 15 216 km², most of it being of rural density. There are 17 000 transports in the region and the BH receives more than 3000 annual calls from EMS. First responders, who for the most part are volunteers, are present in 15% of municipalities and do not have access to the BH. Paramedics have access to the BH from any location in the region.

All paramedics have the same basic training, they administer 5 medications (acetylsalicylic acid, epinephrine, nitroglycerin, glucagon and albuterol), and they use Combitubes (Tyco Healthcare Group LP), semiautomatic defibrillators and the provincial clinical protocols. There are 33 ambulances available, each equipped with Ortivus technology, a terminal that records and transmits vital signs and electrocardiograms (ECGs) en route to the hospital. The mean duration for transport in the region is 21 minutes,¹⁰ and by standardized protocol, the paramedics were requested to contact the BH for unstable patients or those patients with chest pain, shortness of breath or trauma. Paramedics could also engage BH communication for any other reason if they thought input from the personnel would be helpful. Prehospital data (i.e., vital signs, ECGs and online communication) were relayed through cellular technology and the Réseau de télécommunications sociosanitaire, Quebec's socio-sanitary telecommunication network linking all hospitals. During transport, all usual prehospital treatments were allowed, including oxygen and the 5 medications listed previously. Of note, narcotic analgesics are not allowed in Quebec's prehospital system.

The BH employs 9 nurses with backgrounds in critical care (5) or emergency care (4). Base hospital nurses received Quebec's CTAS educational course for triage a few weeks before the study. Base hospital nurses were exclusively dedicated to BH operations, which run 24 hours per day, 7 days per week, and nurses have the option to seek advice from one of the assigned physicians at any time. The BH received continuous monitoring and ECG transmission from the ambulances as soon as a contact was established. All communications were securely encrypted and recorded. Base hospital nurses knew that the patients they triaged would be triaged again in the ED and that a comparison would be performed.

Box 1. The levels of the Canadian Emergency Department Triage and Acuity Scale

- I — Resuscitation
- II — Emergent
- III — Urgent
- IV — Less urgent
- V — Nonurgent

For convenience, we conducted the ED triage phase in a single academic urban ED within the Chaudière–Appalaches region with a census of 55 000 visits per year and 10 000 patients arriving by ambulance annually. The 39 ED nurses involved in our study were staff ED nurses who had been trained for triage through Quebec's CTAS educational course and had between 2 and 6 years of continuous and frequent experience with CTAS. Emergency department nurses were blinded to the study objectives.

This study was approved by our institution's research ethics committee.

Population

Our study included all consecutive patients older than 17 years who were transported to our ED by ambulance and for whom the paramedics made contact with the BH. We excluded patients who died on route, those for whom transportation was aborted and those who did not have a CTAS score assigned by both the BH and an ED nurse.

Data collection

The BH nurses did not have direct access to patients; they assigned a CTAS score on the basis of transmitted vital signs via the Ortivus terminal and the verbal information given by paramedics during ambulance transportation. For long transport times, triage had to be performed within 15 minutes of arrival. On arrival at the hospital, each patient was triaged by the ED nurse who was blinded to the score assigned by the BH nurse. The ED nurse completed the process of triage using the standardized procedure with a paper-based decision support system. Of note, the study took place before the 2008 CTAS revision. The triage process was not computerized and the score was assigned by nurses from the clinical information. Once the nurse assigned the triage score, it was entered using either the BH or ED software.

Table 1. Ages of 94 patients included in the study

Age groups, yr	No. (%) of patients
17–49	11 (11.7)
50–64	18 (19.2)
65–74	12 (12.8)
75–84	30 (31.9)
85–100	23 (24.5)

A trained research assistant abstracted data from the BH and ED databases into a Microsoft Excel spreadsheet using a standardized form. Abstracted variables included patient characteristics and BH and ED CTAS scores.

Data analysis

We estimated interrater agreement with quadratic weighted κ statistics along with asymptotic 95% confidence intervals (CIs). As described by Altman,¹¹ we categorized κ agreement as very good (0.81–1.00), good (0.61–0.80), moderate (0.41–0.60), fair (0.21–0.40) or poor (< 0.20).

RESULTS

During the study period, 100 patients were eligible for inclusion in our study. Of those, we excluded 6 because a CTAS score was not assigned by the BH nurse. The 94-patient sample contained a high proportion of older patients (Table 1) and 44% were male. Nine BH nurses and 39 ED nurses triaged those patients in their respective setting.

We made calculations for 94 pairs of triage scores. The weighted agreement between BH and ED nurses was moderate with a κ score of 0.50 (95% CI 0.37–0.63). The highest agreement proportion between BH and ED CTAS scores was at level 3 (33.0%), followed by level 2 (12.8%) (Table 2).

DISCUSSION

In our study, we assessed the applicability of the CTAS score in the prehospital setting by measuring the agreement between the CTAS scores assigned by BH nurses who communicated with paramedics before ED arrival,

Table 2. Number (and percentage) of CTAS scores assigned by base hospital and emergency department nurses*

ED nurses; CTAS score	BH nurses; CTAS score				
	1	2	3	4	5
1	1 (1.1)	6 (6.4)	0	0	0
2	1 (1.1)	12 (12.8)	2 (2.1)	0	0
3	0	20 (21.3)	31 (33.0)	2 (2.1)	0
4	0	3 (3.2)	12 (12.8)	3 (3.2)	1 (1.1)
5	0	0	0	0	0

BH = base hospital; CTAS = Canadian Emergency Department Triage and Acuity Scale; ED = emergency department.
*Bold characters indicate matching BH and ED scores

and the CTAS scores provided by ED triage nurses. As far as we could determine, triage scoring performed through a BH during ambulance transportation had never been studied before. In the literature, the agreement on ED triage scores, measured by quadratic weighted κ , varied from fair to very good.^{1,6-9,12-14}

One of the most important strengths of our study is the fact that it is entirely based on real triage situations, comparing the scores given by nurses at 2 locations performing triage on the same patients independently and blindly. Our results showed only moderate agreement between the 2 CTAS scores. This may be explained in part by the way the scale was applied. At the BH, triage had to be performed from a distance without interacting directly with the patient. This is an unplanned use of CTAS, which was not designed for that perspective.^{15,16} Base hospital nurses had to apply the scale on the basis of the clinical information relayed by a paramedic during ambulance transportation. Since the paramedic acted as a filter between the nurse and the patient, the BH nurse's perception of the patient's condition might have been altered. To work and be efficient, CTAS scoring may have to be performed live, using direct contact with the patient.

In addition, there were differences in the scope of information nurses could access. Although the BH nurse relied on paramedics to collect clinical information, the ED nurse could access the patient's medication or medical record. Even though BH nurses could have investigated the patient's medical and drug history through questions to paramedics, emergency transportation rendered that task difficult, as paramedics had to answer BH nurse's questions while attending to the patient's care. On the other hand, BH nurses could interact indirectly with the patient during all of the transport duration and could therefore receive more information than the ED triage nurse, who had to abide by a limited time frame.¹⁶ Previous studies have shown that triage is a more complex process than it appears and it is influenced by many factors. Some authors have suggested that visual cues about the patient and the environment such as the number of patients waiting for triage, may play an important role in the triage process.¹⁷⁻²¹ So the presence or absence of visual elements may partly account for the differences observed in our study. Furthermore, experience and triage training were not uniform between the 2 groups, as BH nurses were trained more recently.

The agreement between the triage scores could also have been influenced by the clientele targeted by the

BH. As stated, not all patients transported by ambulance triggered a BH communication. This could have skewed the study population toward older patients and more severe cases. Hence, BH nurses might have considered that they were triaging patients in a more severe condition, expecting higher triage scores.

Of great importance, in the prehospital setting patients' conditions can either improve or worsen during transportation depending on factors such as EMS interventions and transport duration. The poor agreement between the triage scores that were measured could have been influenced by the patients' evolving conditions. We requested triage to be performed within the last 15 minutes of transport, but this might have been insufficient as patients' conditions can fluctuate within minutes. To be reliable, triage through the BH may have to be performed as close to the hospital as possible in order to more accurately predict patients' conditions on arrival.

Limitations

We conducted our study during the implementation phase of the BH 6 months after it began its operations. Base hospital nurses, as well as paramedics, were adapting to the BH service, which means that a variety of problems or malfunctions might have had an impact on BH triage. Moreover, the sample size was small and we only examined one centre. Additional research on this novel use of CTAS seems warranted.

CONCLUSION

The moderate interrater agreement between BH and ED triage scores suggests that further exploration and research are warranted before considering implementing BH triage. The moderate reliability we observed implies that CTAS use may not be appropriate for triage performed through a BH. Before implementation of prehospital triage, modifications to CTAS or the creation of a specific tool for BH triage may have to be considered. Furthermore, a positive impact of triage in the prehospital setting has not been demonstrated and should also be studied.

Competing interests: None declared

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