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Impacts of the introduction of a triage system in Japan: A time series study

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ABSTRACT

The aim of the present study was to measure and compare the effectiveness of nursing triage before and after introduction of the Japanese Triage and Acuity Scale (JTAS), the Japanese version of the Canadian Triage and Acuity Scale (CTAS), during emergency treatment. Surveys of triage nurses and emergency physicians were conducted before and after JTAS introduction. Respondents were triage nurses (before 112 cases, after 94 cases), emergency physicians (before 50, after 41), and triaged patients (before 1057, after 1025) from seven separate emergency medical facilities. The results showed that nursing triage using the JTAS shortened "time from registration to triage" by 3.8 min, "triage duration" by 1 min, "time from registration to physician" by 11.2 min, and "waiting time perceived by patients to see a physician" by 18.6 min ($p < 0.001$). The difference in assigned level of urgency between triage nurses and emergency physicians decreased from 34.2% to 12.2% ($p < 0.001$), over-triage decreased from 24.7% to 8.6% ($p < 0.001$), and under-triage decreased from 9.5% to 3.6% ($p < 0.001$). Furthermore, assessment agreement between triage nurses and emergency physicians increased significantly, from weighted $\kappa = 0.486$ to weighted $\kappa = 0.820$. These findings suggest that the introduction of the JTAS promoted more effective nursing triage and medical care.

Introduction

Emergency department (ED) overcrowding is one of the most complex and challenging issues currently facing health care systems worldwide (Holroyd et al., 2007). Studies in other countries have shown that about 50–80% of patients visit an ED for non-urgent care (Baker and Baker, 1994; Carter and Chochinov, 2007; Qureshi, 2010). This indicates the presence of a mixture of non-urgent patients and highly urgent patients in EDs.

A similar situation is occurring in Japan, where an increase in patient visits to EDs has also been seen. However, EDs in Japan have had difficulties in dealing with incoming patients due to the shortage of emergency physicians. This has resulted in insufficient medical care of patients in EDs.

In 2010, the Japanese Society for Emergency Medicine, the Japanese Association for Acute Medicine, the Japanese Society of Emergency Pediatrics, and the Japanese Association for Emergency Nursing developed the Japanese Triage and Acuity Scale (JTAS). This is the first standardized triage system in Japan. Its fundamental ideas are based on the Canadian Triage and Acute Scale (CTAS) developed by the Canadian Association of Emergency Physicians. The prototype of the JTAS was made through translation of the CTAS; it was later evaluated by the four official emergency healthcare associations, and items related to medical conditions commonly seen in Japan, such as heat stroke, were included in the scale.

The reason why the CTAS was used as the model was that it has demonstrated excellent interrater reliability when assigning patients to acuity categories (Beveridge et al., 1999a,b; Manos et al., 2002; Grafstein et al., 2003; Dong et al., 2007). The JTAS was expected to function in a similar way. The purpose of this study was to measure and compare the effectiveness of nursing triage in EDs before and after the introduction of the JTAS. This is the first attempt to evaluate the JTAS.

Methods

A time series study was used to measure the effects of triage before and after the introduction of the JTAS. This design was selected because it permits differences in the background of triage cases, differences between the facilities where the survey was conducted, and differences among the regions where the facilities are located to be eliminated.

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Data collection

Two surveys, one before and one after the introduction of the JTAS, were conducted in each facility; the data collection period was equal for each site, with 1 month allocated for each before and after introduction survey. The before introduction surveys were conducted between November 2010 and February 2011. The after introduction surveys were conducted between March 2011 and January 2012. It is worth noting that a 1-month JTAS trial period was required before the after introduction surveys were performed. Data were collected from nurses and emergency physicians of seven EDs. More precisely, there were 112 triage nurses before the introduction of the JTAS and 94 after. As for emergency physicians, there were 50 before and 40 after its introduction. The differences in the numbers of survey participants were due to various factors. One was that some nurses and emergency physicians were transferred to different sections in the same hospital. Other participants just stopped working at the hospitals. In this study, the reasons for stopping work were not surveyed.

After the registration of patients was completed, triage nurses determined the level of urgency of the patients in each facility where the survey was being conducted. Before introduction of the JTAS, triage nurses judged the level of urgency of patients based on their experience, and emergency physicians determined the level of urgency while examining each patient. Patients who were examined immediately after registration with no waiting time before being seen by a physician were not included in the survey. For collecting the data, the Triage Evaluation Questionnaire was used. This questionnaire was designed by the first author (Fig. 1).

To introduce the JTAS, triage nurses were asked to attend a one-day CTAS/JTAS provider course organized by the Japanese Society for Emergency Medicine, or guidance based on an educational program was provided by the investigators of the present study.

The emergency medical facilities included six hospitals that could initially accept tertiary care cases and one hospital that could initially accept secondary care cases. These facilities consisted of six 400- to 600-bed hospitals and one 1000-bed hospital. Five of the facilities were in Kyushu, in the western part of Japan, and the remaining two facilities were from areas near Tokyo, in the central part of the country.

Regarding "patients' perception of waiting time before seeing a physician," triage nurses distributed survey questionnaires to patients who had finished their consultations, had shown improvement in their symptoms, and were judged to be able to fill out the other questionnaire.

Data analysis

The "summary of triage cases" before and after the introduction of the JTAS was then analyzed and compared using both the *t*-test and the chi-square test, as appropriate.

To eliminate differences in time of patient examination, type of facility, region where the facility was located, and the number of patients waiting for consultation that could affect "time related to triage," triage cases with similar conditions were grouped together. These groups were used for the before–after JTAS introduction comparison. Since the standard deviation of average times appeared biased, the median of each group was calculated, and the Mann–Whitney *U* test was used for the before–after JTAS introduction comparison. In addition, the *t*-test was used to analyze "patients' perception of waiting time before seeing a physician."

To analyze inter-rater degree of agreement in "Patient assignment of level of urgency by triage nurses and emergency physicians" to five levels (level 1 resuscitation, level 2 emergent, level 3 urgent, level 4 less urgent, and level 5 non-urgent), the weighted kappa coefficient was calculated. When nurses determined a level of urgency below the level of urgency determined by emergency physicians, the case was considered under-triage, and the opposite situation was considered over-triage. The respective ratios were calculated, and Pearson's chi-square was used for testing. SPSS statistics version 19.0 software was used for the statistical analysis.

Ethical considerations

The purpose of the survey, issues concerning anonymity, the voluntary nature of cooperation, and the fact that the data obtained in the survey would not be used for other purposes were explained to the triage nurses and emergency physicians. Similar items were then explained to patients by the triage nurses before consent was obtained.

This study was approved by the Japanese Society for Emergency Medicine and the Ethical Review Board at the Japanese Red Cross Kyushu International College of Nursing.

Results

A total of 2082 triage cases, comprising 1057 cases before and 1025 cases after JTAS introduction, was analyzed. The triage cases for the first 3 days after starting the survey were excluded from analysis because the triage nurses were not yet accustomed to filling out the survey form.

Summary of triage cases

The age (mean ± standard deviation (SD)) of the triage case patients was 39.7 ± 27.1 years before and 39.5 ± 26.9 years after JTAS introduction. The *t*-test showed no significant difference ($p = 0.831$). The percentages of pediatric, adult, and elderly cases did not differ significantly ($p = 0.925$). No significant differences were observed in sex ($p = 0.620$), transportation to hospital ($p = 0.291$), and patient disposition ($p = 0.247$). However, significant differences were seen in "number of patients waiting for a physician" ($p < 0.001$) and "registration time" ($p < 0.001$) (Table 1).

The patients' chief complaints according to the 17 categories in the JTAS were classified as "general," "neurologic," and "gastrointestinal" in 50.5% of all cases before and 55.9% of all cases after JTAS introduction. In addition, the same symptoms accounted for the top 12 chief complaints of patients before and after JTAS introduction. "Fever, general" was the most common, followed by "abdominal pain, gastrointestinal."

Comparison of time related to triage

The median time (IQR, 25th–75th percentile) from "registration to the start of triage" was 7 (2–14) min before and 6 (2–10) min after JTAS introduction ($p < 0.001$). Median "triage duration" was 2 (1–4) min before and 2 (1–3) min after JTAS introduction ($p < 0.031$). Median "time from registration to physician" was 23 (10–40) min before and 18 (10–32) min after JTAS introduction ($p < 0.001$). The mean time showed that nursing triage accompanied by the JTAS shortened "time from registration to triage" by 3.8 min, "triage duration" by 1 min, and "time from registration to physician" by 11.2 min (Table 2).

Median "time from triage to physician" was 8 (2–20) min before and 8 (3–18) min after JTAS introduction; however, this difference was not significant ($p = 0.124$).

Comparison of waiting time perceived by patients to see a physician

Responses for this item were obtained in 367 cases, including 174 cases before and 193 cases after JTAS introduction. The