

# Assessment of the Triage System in a Pediatric Emergency Department. A pilot study on critical codes

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## Key words

Triage system • Color code • Indicators

## Summary

**Introduction.** In Italy, triage involves assigning a priority color code to patients arriving at the hospital Emergency Department: red (very critical), yellow (moderately critical), green (not very critical), and white (not critical).

**Methods.** This study was aimed at assessing the triage system in the Emergency Department of "Giannina Gaslini" Children's Hospital in Genoa, Italy. The authors examined 130 triage forms assigning a yellow code in 2003, in order to determine whether they had been correctly filled in with regard to the detection

of vital parameters, identification of main symptoms and color code assignment.

**Results.** Results showed that vital signs were recorded in 94% of patients, main symptoms were identified in 97%, and a yellow code was assigned according to hospital guidelines in 84%. The percentage of underestimation (3.2%) was higher than that reported in the literature (2%).

**Conclusions.** The study shows the need to improve compliance with the guidelines and to evaluate green and white codes.

In Italy, triage is of strategic importance in the organizational structure of Emergency Departments (ED). For about 10 years, the Triage Training Group (GFT) and, more recently, the study group on Pediatric Triage of the Italian Pediatric Emergency Society (SIMEUP) have been committed to spreading the most complete operating model (global triage) by promoting targeted training programs, whenever possible with the cooperation of local universities.

The requirements and framework for the implementation of the triage process are set forth in the relevant regulation [1].

Global triage involves assessing a patient upon arrival at the ED; this is done by a nurse through a series of steps: assessment upon arrival, data collection – interview plus physical examination and assessment of vital signs –, assignment of a priority code/color code, and reassessment. There are 4 priority codes:

- red = very critical;
- yellow = moderately critical;
- green = not very critical;
- white = not critical.

The data available on the triage system in pediatrics are rather fragmentary and reflect the great difference among the organizational models of EDs [2]. For instance, a census promoted by the technical group on emergency units of the Permanent Conference of Children's Hospitals showed that 100% of pediatric EDs had set up a triage process, but that only 80% had completed operator training.

Clearly, the effort to spread the implementation of the organizational model needs to be continued [3]. However, it is also true that assessment and quality control procedures must be implemented in order to monitor the process and to understand the impact that it has on the various aspects of the management of ED activities.

Assessment methods have been the subject of much debate. The currently adopted approach is that illustrated by studies published in the international literature and suggested by the GFT at a recent conference [4]. This involves applying Continuous Quality Improvement (CQI) methods so that each process can be improved on the basis of the information it provides [5]. Clearly, this is only possible if indicators are used, as an indicator is a quantifiable parameter that briefly describes a complex phenomenon, and hence enables a trend to be discerned over time [6].

The numerical value of an indicator must be compared with a reference value (reference standard) if it is to have any meaning. Various reference standards may be used:

- initial standard: the initial value which is already known when the measurement is taken;
- accreditation standard: a specific value that has to be achieved for official accreditation;
- quality standard: a value defined on the basis of the best results reported in the literature.

For practical purposes, the indicators used in triage can be divided into two groups:

- indicators regarding the process *per se*, such as the proper filling in of the triage form, correct identifica-

tion of the main symptom, and correct assignment of the priority code;

- indicators regarding organizational aspects, such as waiting time, number of patients who leave before being examined by the physician, monitoring of critical events, complaint monitoring, the satisfaction of clinical staff, and user satisfaction.

## Materials and methods

The Pediatric ED of "G. Gaslini" Children's Hospital in Genoa is a reference point for the whole of the Liguria region for pediatric emergencies in children up to the age of 14 years. The number of admissions is about 36,000/year. A pediatrician and a pediatric surgeon are always on call 24 hours a day. The nursing staff is made up of expert pediatric nurses.

Since the middle of 2000, our Pediatric ED has implemented an assessment system for the assignment of priority codes before medical examination, in accordance with the operating characteristics of global triage and the relevant legislation in force. The data collected are recorded on a triage nursing form, which is an electronic form used in ED patient management.

The operating phase of the process was preceded by a 1-year experimental phase, during which nurses and other medical staff underwent standardized training in order to provide a common experience. During the experimental phase, guidelines regarding the main pathologies encountered on admission were drawn up in hardcopy format. These guidelines were validated through the assessment of whether the code assigned to a given patient by different operators (physicians and nurses) within the framework of simulation scenarios matched.

In this context, we followed the procedure illustrated by the GFT, as it was presented by the group at the 1<sup>st</sup> International Conference on Triage [4].

Monitoring started in 2002, once the process had been consolidated and an Internal Triage Committee composed of both physicians and nurses and approved by the hospital's Pediatric Emergency Department Committee had been set up.

The first validation procedure took place in 2002, and was carried out on Red Codes within the framework of a multicenter research project promoted and coordinated by the "Gaslini" Institute. The assignment of Red Codes was assessed in terms of consistency between the priority code assigned during triage and the guideline defined at the beginning of the study. A consistency rate of 95% was recorded, with a range of overestimation of 5%. This study was important because it involved several centers with similar triage experiences, although it was not possible to evaluate the percentage of underestimation.

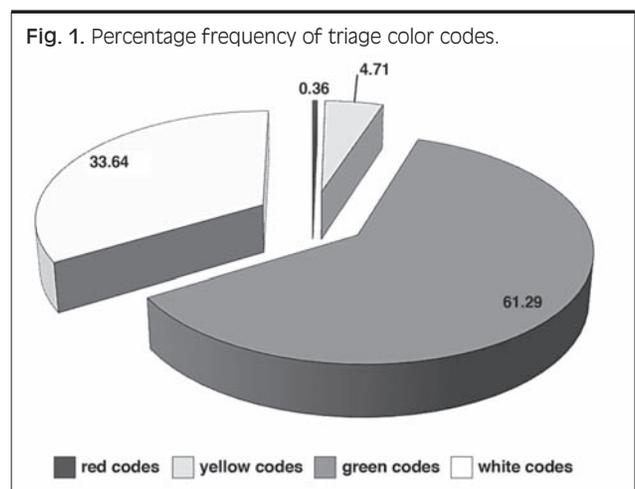
In the light of this experience, and considering the above-mentioned indicators specified by the GFT, the assignment of yellow codes at the "Gaslini" Institute was analyzed. The yellow codes recorded on triage forms during the first week of the first month of each

quarter of 2003 (130 forms; 1620 yellow codes) were examined by a working group of the Internal Triage Committee of our Pediatric ED according to the following indicators:

- 1) triage form (vital signs) filled in correctly: correct assignment of the priority code depends first of all on whether the triage form is filled in correctly. The form must report: the date and time of assessment, main problem, main items in the clinical history, main findings of the physical examination (vital signs), initial code, any change in the code following reassessment, interventions carried out, name or ID number of the operator and the time needed to perform triage;
- 2) main symptom correctly identified: correct identification of the main symptom is evaluated by assessing compatibility between the main symptom identified during triage upon arrival and the final diagnosis provided by the physician at the end of the patient's stay in the ED. These data are provided by the triage form and the clinical documentation of the pediatric ED;
- 3) priority code correctly assigned: correct assignment of the priority code is evaluated by assessing consistency with the guidelines drawn up at the level of the pediatric ED and previously validated. In this case, too, the data source is the triage form and the consultation material available for nurses (guidelines).

## Results

The distribution of the triage codes assigned in 2002 and 2003 was quite constant. The following percentages were recorded: Red Codes (RC) 0.36%, Yellow Codes (YC) 4.71%, Green Codes (GC) 61.29%, White Codes (WC) 33.64%. (Fig. 1). The percentage of critical codes assigned (i.e. RC + YC) differed markedly from that recorded in the fact-finding survey carried out by the technical group on emergency units of the Permanent



Conference of Children's Hospitals, i.e. 7.1% vs. 5.07% in our study.

Analysis of the forms with regard to the assessment and logging of vital signs (T = temperature, HR = heart rate, RR = respiratory rate, BP = blood pressure and SaO<sub>2</sub> = oxygen saturation) showed that in about 80% of the patients to whom a YC was assigned, at least 3 parameters (T, SaO<sub>2</sub>, HR) had been assessed. In 48.5% of these, 4 parameters (T, SaO<sub>2</sub>, HR, RR) had been assessed. No vital signs were recorded on 6% of the forms indicating a YC (Fig. 2). Vital signs were recorded on 94%, a value near the optimal standard of 95% or more.

In our analysis the main symptom was identified correctly in 97% of cases, indicating a good level of communication between the triage nurse and the patient. Moreover, the code assigned (yellow) was consistent with the guidelines in 84% of cases. Overestimation amounted to 12.8% and underestimation to 3.2%. According to the reference data provided by a benchmark project for general medicine in the Emilia Romagna Region, overestimation should not exceed 25%, and underestimation 2%.

## Discussion

As no other studies of this kind have yet been carried out in Italy, our results are not amenable to comparison. Nevertheless, some comment is appropriate [7].

The fact that 80% of triage forms were filled in correctly provides us with a first indicator that can be used in future comparisons. Detailed analysis showed, on the one hand, that triage personnel complied reasonably well with the global triage model and, on the other, that certain aspects require improvement in order to meet the standard according to which at least 3 vital signs must be recorded.

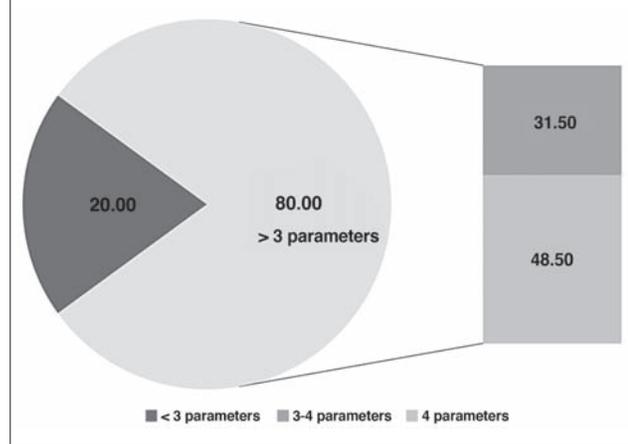
The fact that no vital signs were recorded on 6% of the forms is cause for concern. In some cases, vital signs were evaluated but not entered on the form, while in other cases, admissions regarded toxicological problems, in which triage is regulated by specific guidelines; in such cases, a yellow code is automatically assigned during patient assessment.

The main symptom was correctly identified in 97% of cases, which appears to be a satisfactory result; although no reference standard is available, it is likely that a value of 90% or higher can be regarded as optimal. This good performance is probably ascribable to the fact that the triage personnel considers patient assessment to be important and is therefore committed to implementing it correctly.

Outlines were also available for triage interviews. These were drawn up for the main problems encountered upon admission and enable interviews to be carried out methodically. The use of these outlines probably ensured greater uniformity in interview administration.

The criterion for assessing the correctness of color codes, i.e. the basic criterion for validating the code, is still widely debated. Most of the studies comparing the

Fig. 2. Percentage of pts with yellow codes in whom at least 3 vital parameters were recorded.



codes assigned by the triage nurse and those assigned by the physician have been carried out in Australia and Canada; these report contrasting results with regard to the degree of concordance [8-10].

In our study, one of the criteria used to assess triage was compliance with the GTF guidelines. This is a rational criterion which can be applied to any triage model.

The percentage of consistency with the guidelines (84%) can be regarded as acceptable, though the percentage of underestimation (3.2%) was higher than that reported in literature (about 2%) [11].

Although it is not possible to compare the data from the multicenter assessment of the RCs with those on YCs, it is quite interesting that the percentage of consistency seems to be greater in more extreme situations (95%) [12]. In our opinion, this can be ascribed to a higher degree of attention and to a greater adherence to the guidelines by the triage personnel in the most serious cases.

Furthermore, it should be borne in mind that, as stated above, the guidelines for triage nurses are available in hardcopy format and not in electronic format; this has been reported to have a negative impact on accuracy and uniformity [13].

## Conclusions

The data from our study clearly show the need for further efforts to improve compliance with the guidelines and pursue a higher degree of uniformity in assessment by triage personnel, even though the overall performance in assigning yellow codes to the sample examined can be considered satisfactory. It is important to invest further in training processes, which should involve both physicians and nurses in the ED. Training courses should be held, in particular, in community and general emergency units where personnel lack pediatric training. Besides providing "qualifying" training, it is also important to provide ongoing training in order to maintain a high level of performance.

Scientific board should promote suitable processes for assessing and monitoring quality. We hope that the working model illustrated here will be a starting-point for discussing criteria and methods in order to define a system of indicators consistent with the organizational features and characteristics of pediatric EDs.

Finally, it would be interesting to extend the research on yellow codes not only to red codes, but also to green and

white codes, the underestimation range of which can be wide and may involve substantial risks for the system.

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# The value of booster vaccinations against diphtheria, tetanus, pertussis and poliomyelitis

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## Errata

Tab. I. Qualitative and quantitative composition (1 dose: 0.5 ml).		
Ag	PoliInfanrix	PolioBoostrix
Diphtheria toxoid	not less than 30 IU	not less than 2 IU (2.5Lf)
Tetanus toxoid	not less than 40 IU	not less than 20 IU (5Lf)
Pertussis toxoid (PT)	25 µg	8 µg
Filamentous haemagglutinin (FHA)	25 µg	8 µg
Pertactin (PRN)	25 µg	8 µg
Type 1 inactivated polio (Mahoney strain)	40 D	40 D
Type 2 inactivated polio (MEF-1 strain)	8 D	8 D
Type 3 inactivated polio (Saukett strain)	32 D	32 D
Aluminium hydroxide hydrate	0.5 mg Al <sup>3+</sup>	0.3 mg Al <sup>3+</sup>
Aluminium phosphate	-	0.2 mg Al <sup>3+</sup>

## Corrige

Tab. I. Qualitative and quantitative composition (1 dose: 0.5 ml).		
Ag	PoliInfanrix	PolioBoostrix
Diphtheria toxoid	not less than 30 IU	not less than 2 IU (2.5Lf)
Tetanus toxoid	not less than 40 IU	not less than 20 IU (5Lf)
Pertussis toxoid (PT)	25 µg	8 µg
Filamentous haemagglutinin (FHA)	25 µg	8 µg
Pertactin (PRN)	8 µg	2.5 µg
Type 1 inactivated polio (Mahoney strain)	40 D	40 D
Type 2 inactivated polio (MEF-1 strain)	8 D	8 D
Type 3 inactivated polio (Saukett strain)	32 D	32 D
Aluminium hydroxide hydrate	0.5 mg Al <sup>3+</sup>	0.3 mg Al <sup>3+</sup>
Aluminium phosphate	-	0.2 mg Al <sup>3+</sup>