

# Paediatric Triage Practice and Emergency Severity Index in the Maltese Islands

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## Background

In the paediatric emergency department (PED) triage is a keystone service designed specifically for the recognition of severely ill patients. In this study, the local paediatric triage practice was assessed.

## Methods

Data was collected retrospectively for children under 16 years of age presenting to the PED during the first seven days of August 2018, September 2018, January 2019 and February 2019. A triage priority category was assigned according to the Emergency Severity Index (ESI) algorithm (version 4) and compared to that assigned by the triage nurse.

## Results

The kappa coefficient for inter-rater reliability (triage nurse vs investigator) was 0.360 (95% CI 0.329, 0.390). Weighted kappa was calculated to be 0.424 (95% CI 0.395, 0.454). Concordance between nurse triage and investigator triage was present for 51.32% of cases, whilst Chi-squared test showed significant differences between raters for the categories ESI-2, ESI-3, and ESI-5.

## Conclusion

This study has highlighted some concerns with our local paediatric triage practices, with fair to moderate agreement for inter-rater reliability, and the possibility of significant over-triage. The main recommendation is that paediatric triage is carried out by healthcare professionals who are experienced in dealing with sick children.

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A reliable paediatric triage system classifies patients into different categories of varying urgency, identifying patients who need immediate care and those who can wait.<sup>1</sup> It is necessary when demand exceeds supply of the limited resources available; be it time, physical space, staff numbers or training.<sup>2,3</sup> Correctly classifying high priority patients avoids a delay in diagnosis and management of seriously ill children, whilst correctly identifying low urgency cases avoids prolonged waiting times for high urgency cases and improves the efficiency and flow of an emergency department (ED).

The local Paediatric Emergency Department (PED) is a relatively recently established department, having opened in 2015, and thus, the setting up of services is still ongoing, including proficiency in paediatric triage. The aim of this study was to assess local paediatric triage practice.

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## MATERIALS AND METHODS

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### Study Setting

In Malta, there is one general hospital with an ED, that provides care for a population of around 0.5 million. Around 22,000 paediatric patients attend the ED every year. At the time of the study (2018-2019), adult and paediatric patients were triaged by a common cohort of nurses who usually work with adults. Paediatric patients (patients under 16 years of age) were then seen in a separate section of the ED, staffed by a separate cohort of nurses working only with children, and a combination of emergency and paediatric physicians. The PED section at the time housed six cubicles which were for use by paediatric patients only, and was staffed at any one time by two to four nurses and one to two doctors. The triage system used for both adults and children is that of Emergency Severity Index (ESI) (version 4).

### Definition of ESI

ESI is a triage system that is based on acuity and resource needs.<sup>4</sup> A patient classified as an ESI-1 is a patient that is dying or at immediate risk of dying and thus needs immediate resuscitative care. An ESI-2 is a patient that should not wait, thus a patient in a high risk situation, who is in severe pain or distress, or confused, lethargic, or disoriented. ESI-3, ESI-4, and ESI-5 patients are respectively less urgent patients, that are classified according to the number of resources that might be required to reach a disposition decision.<sup>4</sup>

### Objectives

The primary objective was to determine inter-rater reliability, that is, whether different healthcare providers (namely triage nurses and investigators) agree on their classification of case urgency.<sup>4</sup> The secondary objective was to then describe ways in which triage classification varied between the healthcare providers.

### Inclusion and Exclusion Criteria

The population targeted was children under 16 years of age presenting to the PED during the first seven days of the months of August 2018, September 2018, January 2019, and February 2019. These months were chosen in order to obtain representative data for both summer and winter months. ENT, gynaecology and ophthalmic cases were excluded as these cases are managed by separate departments.

### Data Collection And Study Design

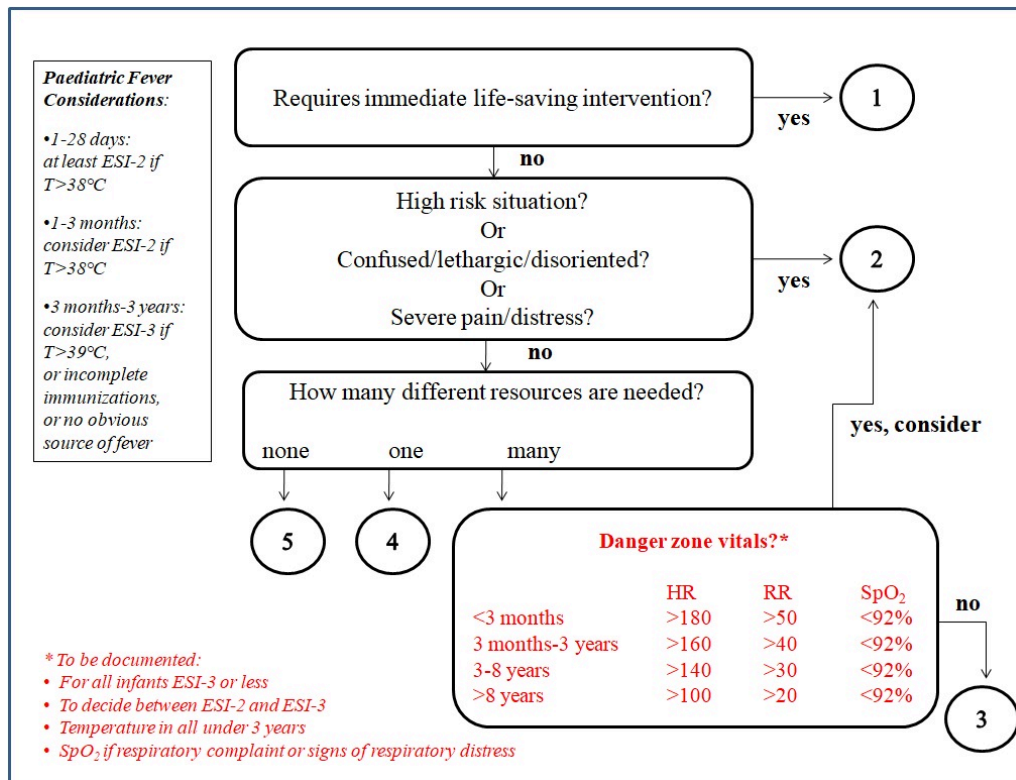
Permissions to carry out the study and to access online electronic triage records were obtained from the hospital Data Protection Office and ED management. Ethics approval was obtained from the Faculty Research Ethics Committee of the University of Malta.

Prior to conducting the study, the investigators (three paediatric physicians) underwent training in ESI system triaging using the ESI Implementation Handbook 2012 Edition, online training tools available through the Agency for Healthcare Research and Quality,<sup>4</sup> as well as discussion and practice at triaging with senior nurses officially trained in ESI triage.

Data was retrospectively collected from triage sheets obtained via the hospital electronic patient system which were immediately anonymised. Using the information available on the triage sheets (age, the presenting complaint statement, and any documented parameters), the investigators then assigned an ESI according to the algorithm outlined in the ESI handbook (Figure 1).

### Statistical Analysis

Data was interpreted using data analysis functions in Microsoft Excel. The kappa coefficient (calculated using QuickCalcs GraphPad software) was used to assess inter-rater reliability. Chi-squared test was used to assess for any significant differences in the number of cases in each ESI category between when



**Figure 1** ESI Triage Algorithm, version 4 (adapted from ESI implementation handbook).4 (T: Temperature, HR: Heart rate, RR: Respiratory rate, SpO<sub>2</sub>: oxygen saturation)

triage was performed by nurses and when the investigators assigned an ESI category.

## RESULTS

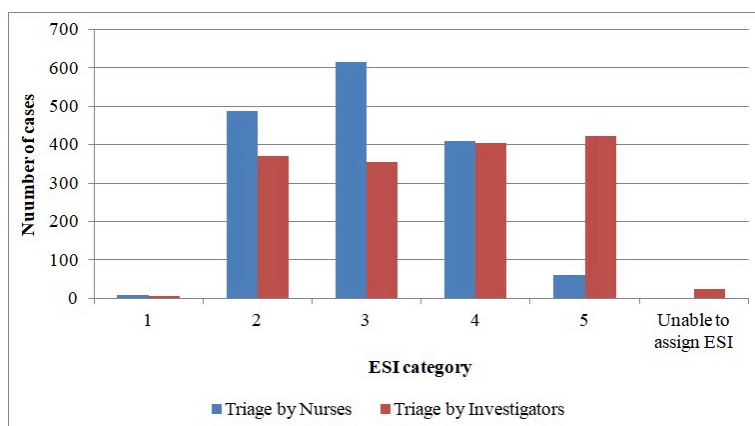
A total of 1582 cases were reviewed over the time period described, with a slight male predominance (53.22% males, 46.78% females). The mean age was 4.63 years (95% CI 4.42, 4.84), median 2.87 years. The mean door-to-triage time was 21.16 minutes (95% CI 20.35, 21.97), with a median of 17 minutes and a range of 0 to 110 minutes. The three most common presenting complaints were fever (27.24%), trauma (10.37%), and vomiting (10.30%). 19.41% of patients were admitted and 78.38% were discharged, with the rest either failing to attend when called for physician review or discharged against medical advice.

Figure 2 shows the distribution of ESI assigned to the cases reviewed by nurses, as well as the ESI given by the investigators after cases were assessed as per ESI guidelines and algorithm. It was not possible for the investigators to assign an ESI in 25 cases (1.58%) due to there being insufficient documented information available on the triage sheet.

The kappa coefficient for inter-rater reliability (triage nurse vs investigators) was 0.360 (fair agreement) (95% CI 0.329, 0.390). Linear weighted kappa was

calculated to be 0.424 (moderate agreement) (95% CI 0.395, 0.454).

Investigators agreed with the ESI category assigned by the nurse at time of triage in 51.32% of cases. Table 1 compares the different ESI categories assigned by nurses when reviewing the patients and those assigned by the investigators when reviewing triage sheets during the study. In the nurses' triage, for ESI-2 and ESI-3 there was a significantly higher number of cases ( $p < 0.001$ ), whilst for ESI-5 there was a significantly smaller number ( $p < 0.001$ ).



**Figure 2** Distribution of ESI categories assigned to the cases by nurses and investigators

**Table 1** Comparing proportion of cases in each ESI category for when triage was performed by nurses and when triage was performed by investigators

ESI Category	Number of cases when triaged by nurses	Number of cases when triaged by investigators	Observed Chi-squared	p value
1	8	5	0.695	0.404
2	487	370	21.907	< 0.001
3	616	355	101.218	< 0.001
4	409	405	0.026	0.871
5	62	422	316.127	< 0.001

## DISCUSSION

### Inter-Rater Reliability

In this study the weighted kappa score was 0.424 (95% CI 0.395, 0.454), indicating moderate agreement. Previous studies have however found good inter-rater reliability for the ESI triage algorithm.<sup>5,6,7,8</sup> The findings in this study could be explained by the fact that analysis was retrospective. In the study by Baumann, although excellent inter-rater reliability was concluded, it was noted that when triage categories were assigned retrospectively, inter-rater agreement was poor to good.<sup>6</sup>

Furthermore, the ESI assigned by the investigators was solely based on the description given in the triage statement and parameters recorded by the nurse during the triage process, without having the opportunity to physically assess the child, which is a more realistic representation and which ultimately also affects triage decisions. Such retrospective assessment lacks cues which are available when the patient is present in front of the healthcare professional,<sup>3</sup> as well as the stressful environment of an ED in which triage takes place.<sup>9</sup>

On the other hand, this mirrors the situation at the receiving end of the process, when nurses and doctors inside the PED receive the triage sheet and rely on the ESI assigned and description given at triage in order to prioritise cases especially during busy periods, whilst the patient waits in a separate waiting area. This further emphasizes the importance of communicating and conveying an accurate description of the child's general condition, including parameters as applicable, in order to minimise the chances of a possibly critically ill child not being seen within a safe time frame.

### Triage Accuracy

As described in the ESI handbook, a frequently selected threshold for accuracy of triage

categorisation is 90%.<sup>4</sup> In this study however, there was concordance in ESI categories between nurses and investigators for only 51.32% of cases. Determining which was the more accurate between the nurses' triage and the investigators' triage is equivocal. Due to the retrospective nature of the study and the lack of clinical cues, it can arguably be said that the nurses' triage performed at the time of reviewing the patient was more reflective of patient condition. However, a counter argument could be that since the investigators strictly followed the ESI algorithm, their assigned ESI category was more true to the ESI triage system described in the handbook. For the purpose of this study, the latter was taken to be the standard to compare to. As a result, this study highlights significant mis-triage of 48.68%, with the majority being over-triaged, thus implying that a significant number of cases would have required less urgent attention. Although this may be seen to be due to the triaging team attempting to err on the side of caution, one also has to consider that such over categorisation ends up putting an extra strain on the PED staff especially during busy periods, making it difficult to keep up with such a number of high priority cases at the same time. As a result, over-triaging leads to truly high priority cases ending up being attended to with delay and this might have devastating consequences for the child in question. Thus, both over-triage and under-triage require further investigation, as they can both affect patient care.<sup>10,11,12</sup>

A possible explanation for such results might be that the local triage team consists of nurses mainly trained in adult care and triage, with minimal exposure to paediatrics. One has to appreciate that the needs of children in an ED differ from those of adults. Children respond differently to physiological and psychological stressors, they are more susceptible to a range of conditions such as viral infections and dehydration, and they have a limited ability to communicate their needs.<sup>4,5,13</sup> The paediatric population also varies in itself according to

the specific child's age and development.<sup>1</sup> Additionally, in a mixed adult and paediatric ED, there is a tendency to compare acuity of paediatric patients to that of adults.<sup>6</sup> Thus, this makes it harder to quickly and accurately assess a sick child when compared to an adult,<sup>14</sup> especially if one has only received basic paediatric training or has limited experience working with children. Furthermore, not working within the PED might mean that one is not aware of certain departmental specific practices or policies, and thus not being able to predict the number of resources required.<sup>1</sup> It has been shown that paediatric nurses perform more accurate and consistent paediatric triage when compared to general ED nurses, since they have more experience with children.<sup>15,16</sup> To confirm this hypothesis in the local setting, further studies assessing triage specifically performed by paediatric nurses (vs other ED nurses) would need to be conducted.

### Specific ESI Measures

A study by Mirhaghi et al, showed that the ESI triage system has a tendency to allocate patients to ESI-2 and in Travers et al, it was found that ESI-5 is under-utilized for paediatric patients.<sup>15,17</sup> The ranges of normal values for parameters suggested by the ESI guidelines are not evidence-based,<sup>15</sup> and certain other modifications to the current ESI system in use might be necessary to account for the differences in the paediatric population described above. Moreover, there are varying local patterns of care which are followed for certain cases in the PED. What constitutes an ESI resource may vary between different centres, and ESI resources may need to be defined differently when caring for children, since a simple procedure in an adult may require more training, time, and staff when performed on a child.<sup>15</sup> It is however important to point out that resources in the context of ESI are not a nursing workload measure, but they are used as a proxy for acuity.<sup>4</sup>

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### RECOMMENDATIONS

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Thus, based on the above findings it is our recommendation that paediatric triage is performed by paediatric nurses working regularly with children. Since the onset of the COVID-19 pandemic, pressures on adult ED services have required nurses who work in the PED regularly to take over paediatric triage. A separate study is required to reassess local paediatric triage practices under these conditions. There have been other changes to the PED brought about by the

### SUMMARY BOX

What is already known about this subject:

- There are several paediatric-specific considerations when it comes to triage.
- The Emergency Severity Index can have limitations with respects to paediatric triage.
- Under- and over-triaging can provide challenges to appropriate emergency service.
- Experience in dealing with children is essential for good quality paediatric triage.
- What are the new findings:
- Fair to moderate agreement for inter-rater reliability was found in our local paediatric triage practice.
- The possibility of significant over-triage in the local setting is brought forward.
- The main recommendation is that paediatric triage is carried out by healthcare professionals who are experienced in dealing with sick children.

COVID-19 pandemic: relocation of the PED and triage areas, changes in PED attendance rates and patient flow, and new infection control measures. These would be important confounding factors that would need to be considered should this separate study be performed.

Should these COVID-19 pandemic related changes be reversed, our recommendation would be to offer paediatric training and adequate exposure to general ED nurses.<sup>3,5,18</sup> For example, visual aids with normal ranges of parameters according to age could be used. This could be supplemented by having the ESI electronic system alerting the user when parameters are in the danger zone. Computerized software-led triage systems are also available.<sup>3,19</sup> ED nurses could also have a job shadowing period in the PED. Continuous education, such as through regular refresher training courses and competency evaluation for triage nurses, is also recommended.<sup>3,20</sup> Such sessions could also be an opportunity to divulge usual practices at the PED and train triage nurses in recognising rashes (blanching versus non-blanching) and clinical signs to spot the unwell child (signs of respiratory distress, etc.), which they may otherwise not be accustomed to since they usually work with adult patients.



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## LIMITATIONS

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This data was collected from one hospital, making it a single centre study. Although being the sole hospital providing paediatric emergency services in the country ensures a comprehensive and diverse case mix, it may not reflect the care and services in other hospitals or countries and thus generalisations with these results cannot be made. As already highlighted earlier, a significant limitation of this study is its retrospective nature. Thus one also has to consider the unequal settings when the ESI category was assigned by the triage nurse in a real-life stressful scenario versus that assigned by the investigators in a relatively calmer environment with no actual patient present. Furthermore, although the investigators went through ESI triage training, they lacked the experience offered when working daily in the triage room. Incomplete documentation on triage sheets was another limitation in this study.

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## CONCLUSION

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This study has highlighted some concerns with our local paediatric triage practices, with fair to moderate agreement for inter-rater reliability, and the possibility of significant over-triage. The main recommendation is that paediatric triage is carried out by healthcare professionals who are experienced in dealing with sick children. Thus, the key action is to improve the knowledge, skills, and confidence in paediatric triage. This can be achieved by continuous education, encouraging specialisation, and promoting interdisciplinary collaboration.<sup>5,15</sup>

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