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► To cite this version:

C. Berne, J.N. Evain, P. Bouzat, G. Mortamet. Organization of trauma management in French level-1 pediatric trauma centers: A cross-sectional survey. Archives de Pédiatrie, 2022, 29 (4), pp.326-329. 10.1016/j.arcped.2022.02.007 . hal-04817260

HAL Id: hal-04817260

<https://hal.science/hal-04817260v1>

Submitted on 19 Dec 2024

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**Organization of trauma management in French level-1 pediatric trauma centers: a
cross-sectional survey**

Short title: Pediatric trauma management in France

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Competing Interest:

The authors have no conflict of interest to declare.

Funding:

None

Abstract

Background: Due to the lack of available evidence on pediatric trauma care organization, no French national guideline has been developed. This survey aimed to describe the management of pediatric trauma patients in France.

Methods: In this cross-sectional survey, an electronic questionnaire (previously validated) was distributed to intensive care physicians from tertiary hospitals via the GFRUP (*Groupe Francophone de Réanimation et Urgences Pédiatriques*) mailing list.

Results: We collected 37 responses from 28 centers with available data, representing 100% of French level-1 pediatric trauma centers. Most of the pediatric centers ($n=21$, 75%) had a written local protocol on pediatric trauma care. In most centers ($n=17$, 61%), patients with severe trauma could be admitted in various locations, including the adult or pediatric emergency department or the intensive care unit. Usually, the location of the trauma room depended on the patients' age and/or severity of trauma. In 12 centers in which trauma could be managed by adult physicians ($n=12/18$, 70%), a physician with pediatric expertise (anesthesiologist or intensive care physician) could be called according to the patient's age or severity of trauma. The cut-off patient age for considering pediatric expertise was mainly 3–5 years ($n=10$, 83%).

Conclusion:- Although most French level-1 pediatric trauma centers have a local protocol for pediatric trauma management, organization is very heterogeneous in France. Guidelines should focus on collaboration between professionals and hospital facilities in order to improve outcomes of children with trauma.

Keywords: Trauma center, trauma room, pediatric trauma, pediatric intensive care

1. Background

Traumatic injury is the leading cause of morbidity and mortality among children. Since most preventable deaths occur in the first hours following trauma, initial management is crucial. It has been shown that dedicated pediatric trauma centers may improve the outcome of these patients [1, 2]. For this reason, efforts and resources have been devoted toward developing pediatric trauma systems worldwide [3].

The management of trauma patients in France and in some European countries differs from North America. In countries where prehospital care is performed by paramedics, most triage and initial management protocols have been adapted from adult algorithms, [4] but prehospital care is organized differently in France. Indeed, if a major trauma is suspected, a specialized physician correspondent in the regional emergency medical service call center dispatches a physician-staffed ambulance. Otherwise, a paramedic-staffed ambulance of the fire department handles the case. Due to the lack of available evidence on pediatric trauma care organization, no French national guideline has been developed.

In this context, we hypothesized a high degree of heterogeneity in the management of pediatric trauma patients in French level-1 pediatric trauma centers. This survey aimed to describe the management of pediatric trauma patients in France.

2. Methods

In March and April 2021, an electronic questionnaire (Google Forms; Mountain View, CA, USA) was distributed to intensive care physicians from tertiary hospitals via the GFRUP (*Groupe Francophone de Réanimation et Urgences Pédiatriques* [French-Speaking Group of Pediatric Resuscitation and Emergency]) mailing list, asking for one response per site. The

questionnaire was previously developed by two pediatric intensive care physicians not involved in the study, included 10 multiple choice questions, and focused on the location of pediatric trauma patient admissions and people involved in the management of severe cases. Reminder e-mails were sent to non-responding units to reach an 80% response rate. If more than one questionnaire was returned for the same center, any disagreement was resolved by a specific request to the head of the pediatric intensive care unit.

Data are expressed as median values (interquartile range [IQR]) for continuous variables, and number and/or frequency (%) for binary or categorical variables. All statistical analyses for binary or categorical variables were performed using the chi-square or Fisher's exact test where appropriate, whereas continuous variables were compared with the Student paired *t* test. All values of $p < 0.05$ were considered significant.

3. Results

We collected 37 responses from the 32 pediatric French pediatric tertiary centers. Four centers not admitting trauma patients were excluded from the analysis, resulting in 28 centers with available data (100% of French level-1 pediatric trauma centers).

Most of the pediatric centers ($n=21$, 75%) had a written local protocol on pediatric trauma management.

Figure 1 shows the locations of initial care for pediatric patients with severe trauma. Patients with severe trauma were commonly admitted to the pediatric emergency department. In most centers ($n=17$, 61%), patients with severe trauma could be admitted in various locations, including adult or pediatric emergency departments or intensive care units. Usually, the location of the trauma room depended on the patients' age and/or severity of trauma. In 10 centers (36%), the pediatric intensive care unit was not in the same building as the trauma

room. In five (18%) and 11 centers (39%), the trauma room was in a different location than the operating room and the interventional radiology unit, respectively.

Figure 2 and **Figure 3** provide data on the trauma leaders involved and the availability of other subspecialty physicians for the initial management of pediatric trauma patients, respectively.

In 12 centers in which trauma could be managed by adult physicians ($n=12/18$, 70%), a physician with pediatric expertise (anesthesiologist or intensive care physician) could be called according to the patient's age or severity of trauma. The cut-off patient age for considering pediatric expertise was mainly 3–5 years ($n=10$, 83%).

4. Discussion

In this study, we highlighted the heterogeneity in the management of pediatric trauma patients in French level-1 trauma centers. We found great variations in terms of the location of the trauma room and the physicians involved in the management. Due to the lack of national guidelines regarding the management of pediatric trauma patients, each center had to develop its own procedure according to their local constraints [5].

Similar results were previously described in French studies, reporting a great heterogeneity in the management of severely injured children in traffic accidents or during potential disasters [1, 6]. As reported by Javouhey et al. in 2009, this heterogeneity was likely explained by the absence of recommendations and regulations. More than 10 years later, despite the development of pediatric trauma center qualifications in France, this heterogeneity persists.

It is true that we focused on French centers in this study. Given the lack of published data from European pediatric trauma centers, comparison of our results is challenging. Indeed, most studies in this field have been conducted in North America, where the organization of

emergency medical transport is somewhat different. Interestingly, a recent study described the development of trauma systems in four European countries (Germany, The Netherlands, England, and Spain) [7]. The authors highlighted the heterogeneity of practice from triage to rehabilitation, which makes difficult the establishment of common guidelines.

In the present study we found that children with severe trauma could be managed by adult physicians in most of the centers. Adult intensive care physicians and anesthesiologist have a large experience in trauma care, while pediatricians may be less familiar with these patients. However, adult physicians may be uncomfortable or inexperienced to care for young children. In those centers, collaboration between trauma-trained adult intensivists and pediatricians should be encouraged, given the specificities of children in terms of anatomy and physiology [8-10]. Recommendations for improvements in training, including simulation, are greatly needed.

Several limitations should be highlighted in this study. First, the sample is relatively small despite reaching all the French level-1 pediatric trauma centers. Second, we did not get detailed data regarding local algorithms and protocols for trauma care. Moreover, we did not collect data regarding the individual training of physicians, prehospital trauma management, and triage.

5. Conclusion

Although most of French level-1 pediatric trauma centers have a local protocol for pediatric trauma management, organization is very heterogeneous in France. Guidelines should focus on collaboration between professionals and hospital facilities in order to improve the outcomes of children with trauma.

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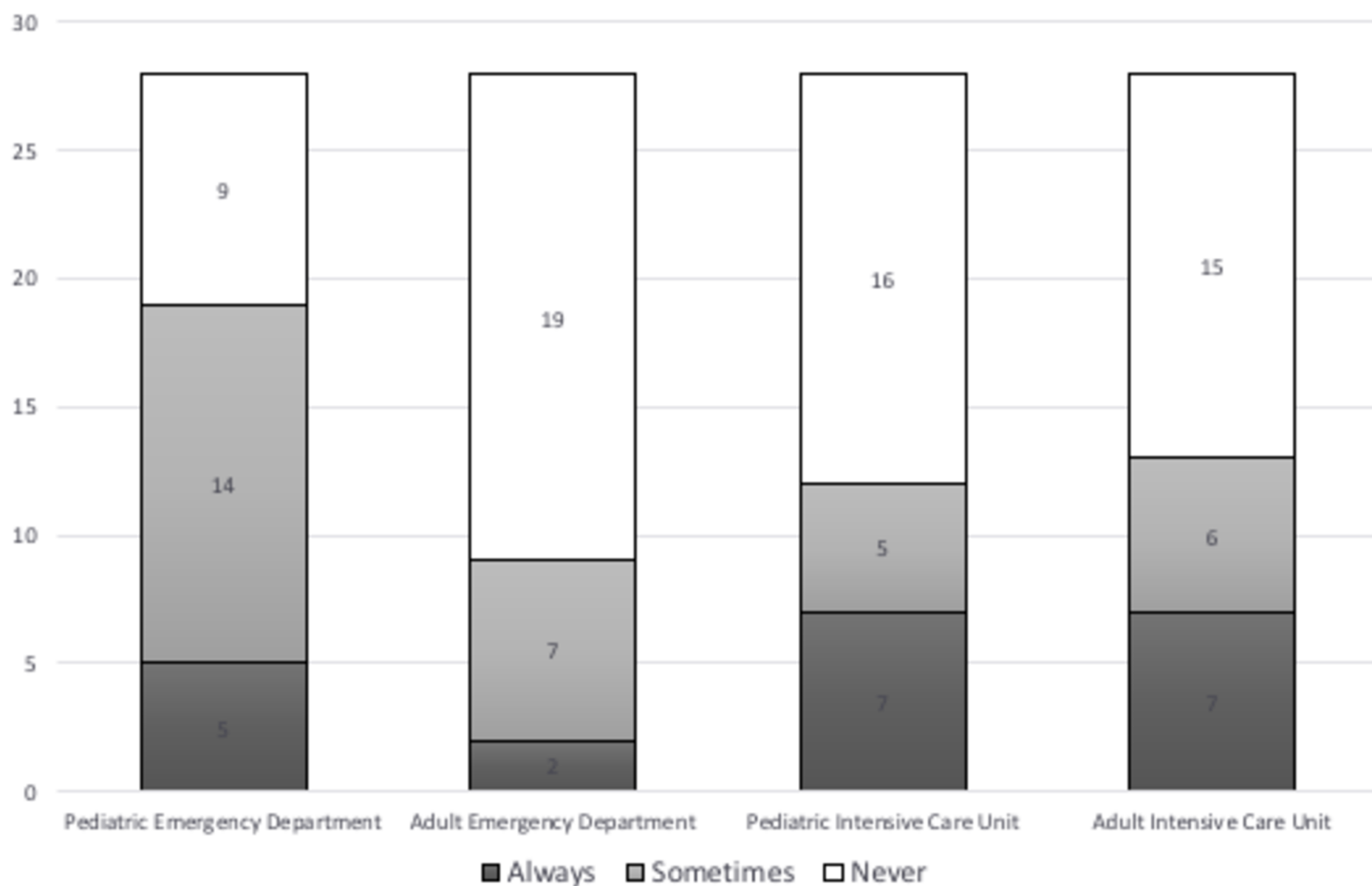
Figure legends

Figure 1: Location of trauma room

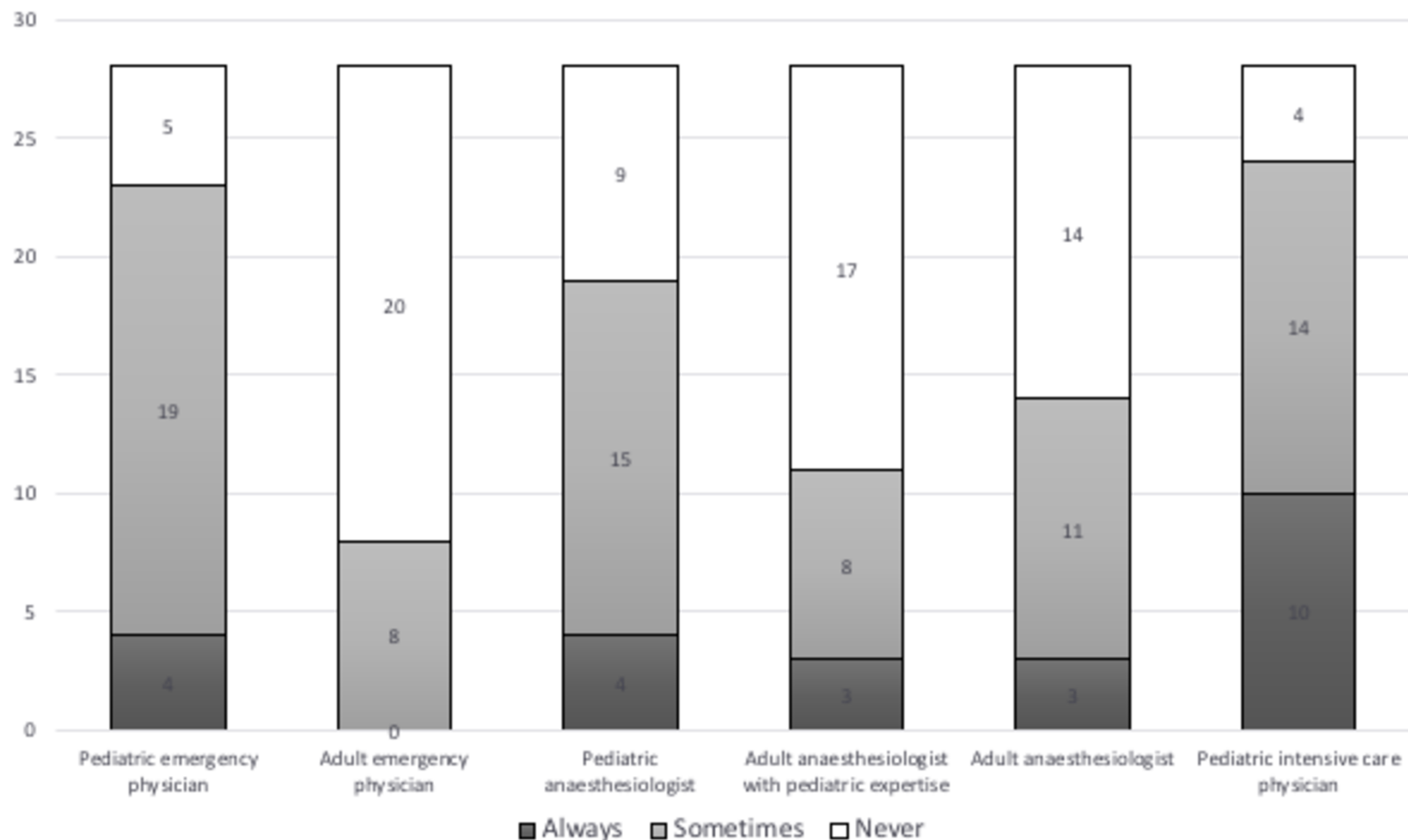
Figure 2: Leading physicians involved in trauma care management

Figure 3: Availability of subspecialist involved in trauma care management

Number of pediatric level-1 centers



Number of pediatric level-1 centers



Number of pediatric level-1 centers

