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**Assessment of general emergency medicine physicians' medical education regarding
management of pediatric emergencies in western Normandy, France**

Short title: Emergency medicine physicians' medical education regarding management of
children

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Informed Consent

All procedures were in accordance with the ethical standards of the responsible committee on
human experimentation (institutional and national) and with the Helsinki Declaration of 1975,
as revised in 2000.

Conflict of interest

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Abstract

Objectives: General emergency medicine physicians sometimes have to deal with acute management of pediatric emergencies. The objectives of this study were to assess the pediatric medical education background of emergency physicians, how often they encounter pediatric emergencies, as well as the knowledge and organizational gaps regarding the management of children in general emergency departments.

Methods: A survey was conducted from March 25 to June 25, 2017, by emailing an anonymized questionnaire to all senior emergency physicians of the 22 general emergency departments of western Normandy public hospitals.

Results: A total of 81 responses were analyzed. In all, 83% percent of respondents had previously worked in a pediatric department. In total, 90% of the respondents reported caring for children within their emergency department and 93% out-of-hospital (100% of them during primary interventions and 39% during secondary interventions such as inter-hospital transfers). Fourteen percent of the respondents considered that the pediatric medical education they received was adapted to their current practice, while 73% reported experiencing difficulties during management of pediatric emergencies (technical difficulties, unsuitable material and therapeutics, relational problems, personal apprehension, disease- or age-specific difficulties, especially with children under the age of 2–3 years).

Conclusion: Most general emergency physicians report caring for children despite a lack of medical education in pediatrics. Pediatric medical education as well as collaborations between general practitioners and specialized pediatric teams should be enhanced to better match the needs of general emergency departments and improve the quality of primary and acute care for children.

Keywords: Emergency medicine, pediatrics, medical education.

1. Introduction

In France, out-of-hospital emergency management depends on the Urgent Medical Aid Service (UMAS; *Service d'Aide Médicale Urgente* = SAMU). A call to the UMAS can trigger two levels of intervention: primary level provided by first response teams composed of fire department ambulances, or secondary level advanced life support provided by mobile intensive care units (MICUs) including a physician (*Service Mobile d'Urgences et de Réanimation* – SMUR) [1-3]. Specialized pediatric MICU teams exist but availability and organizational aspects vary widely across the country [2,3].

Organizational aspects in the management of acute pediatric emergencies vary from one hospital to another. In major hospitals with a high influx of patients and in university health centers (UHC), general emergency departments (EDs) are usually separated from pediatric EDs [4]. General EDs are managed by emergency physicians and usually take care of patients aged 16–18 years or older whereas pediatric EDs are managed by pediatricians and care for patients aged 18 years or younger [4]. In smaller peripheral hospitals, general ED teams care for patients of all ages and all types of needs. They provide in-hospital management as well as out-of-hospital primary interventions (UMAS and MICU services) for all types of patients including children [5,6].

However, pediatric diagnoses and therapeutic management differ from adult patients and require a specific skillset as well as a specialized pediatric medical formation. Today, general emergency physicians are considered sufficiently qualified to manage pediatric emergencies despite infrequent encounters of these situations and a lack of specific medical education, which both give rise to medical team apprehension and other types of difficulties [7].

The objectives of this study were to assess the medical education of general emergency physicians concerning pediatric emergencies, how often they encounter children in

their daily ED practice, as well as the knowledge, organizational, or other types of gaps and difficulties regarding the specific management of children in their ED.

2. Materials and Methods

A survey was conducted from March 25 to June 25, 2017, in EDs of western Normandy. Western Normandy is located in northwestern France and has about 1.5 million inhabitants. The survey was conducted within urban and rural public hospital' EDs, UMAs, or MICUs or primary care center.

2.1. Study population

All senior physicians working in any of the 22 public hospital EDs, UMAs, or MICUs or primary care center of western Normandy were included. Medical interns were not included and physicians who reported never taking care of children were excluded, as were incomplete responses.

2.2. Settings and questionnaire

The survey was conducted through an online questionnaire that was created with the *eval and go*[®] software (Montpellier, France, 2009). The questionnaire included 46 questions regarding the following topics: acquired academic degrees and competencies, type of hospital (UHC, peripheral), emergency medicine activities (ED, UMa, MICU), pediatric activities in- and out-of-hospital, types of difficulties encountered when taking care of children, as well as level of interest regarding pediatric emergencies. The questionnaire was developed by the study team especially for this survey and was inspired from a previously published questionnaire [8]. The complete questionnaire is available in the supplemental material section. Respondents had to answer questions according to 5-point Likert-type scales (*strongly agree, agree, neutral, disagree, or strongly disagree*). The survey technique was an adapted form of respondent-driven sampling. One physician was asked to serve as a node to recruit additional study participants. The chair of the ED was contacted by email in March 2017 and was asked

to transfer this email to all of their senior physician colleagues working for the ED. The email contained a brief description of the study objectives and a web link to the online questionnaire. Each participant received a reminder of the study twice by email. All of the questionnaires were anonymized once received by the research team. Answers were collected and analyzed in June 2017 with Excel[®] software.

The respondents were divided into two groups according to their answer to question 19 (“As part of your daily medical activities, do you encounter difficulties when taking care of children?”): group 1 reporting difficulties (*strongly agree* or *agree*) vs. group 2 reporting no difficulty (*neutral*, *disagree* or *strongly disagree*).

2.3. Statistical analysis

According to the distribution of variables (Shapiro–Wilk test), continuous variables are expressed as medians [interquartile range] and categorical variables as numbers (percentage). Results are presented for the whole study population and per group. Comparisons between groups 1 and 2 were made using the Mann–Whitney *U* test for continuous variables and Fisher’s exact test or chi-square test for categorical variables, as appropriate.

A *p* value of 0.05 or less was considered statistically significant. Statistical analyses were performed using open access R[®] software version 3.3.1 (<http://cran.r-project.org> Vienna, Austria).

3. Results

Over the 2-month-long course of the study, 93 questionnaires were returned (Fig. 1) and 81 (87%) complete responses were included. Study population characteristics are shown in Table 1. ED physicians mostly had an initial general medicine education background and had been working in the ED for a median of 6 years. In total, 67 respondents (83%) reported having previously worked in a pediatric care unit, most commonly for a very short period of less than 1 year and for 97% of them during their residency. Only three (4%) respondents declared

having worked in pediatric surgery, and each one of them had also reported a clinical activity within one or several others pediatric units such as intensive care or emergency. Eleven respondents (14%) considered that the medical education they received regarding pediatrics meets their daily practice needs and 78 (96%) reported that it should be improved, for example, by making the pediatric emergency medicine complementary degree mandatory for all ED physicians. A total of 73 respondents (90%) reported taking care of children within their ED and 75 (93%) reported managing children out-of-hospital (75 of them [100%] for primary interventions and 29 [39%] for secondary interventions such as inter-hospital patient transfers).

Of the respondents who reported taking care of pediatric emergencies (whether in- or out-of-hospital), 73% also reported facing at least one type of difficulty (group 1) (Fig. 2). Difficulties were reported with the use of invasive techniques (vascular access, airway management, and intubation) and therapeutics (drugs and dosing regimens). Difficulties were also reported regarding specific relational challenges with pediatric patients, or their family, as well as personal apprehensions in dealing with children (transposition phenomenon, unusual personal implication). From group 1, 38 respondents (64%) reported having difficulties in dealing with specific types of pediatric emergencies, for example, respiratory or neurologic diseases, or resuscitation situations. Also from group 1, 45 respondents (76%) reported having difficulties when taking care of young children, especially under the age of 2–3 years. Physicians from group 1 were younger, less experienced, and more frequently reported having multiple medical activities (e.g., ED and UMAS) than physicians from group 2 (Table 1).

It was agreed by 32% of respondents that only pediatricians should provide pediatric MICU services. This proportion reached 54% when respondents were asked about MICU services for children under the age of 2–3 years. According to 62% of the respondents, only pediatricians

should provide secondary interventions (inter-hospital patient transfer or transportation) for children.

4. Discussion

This work highlights the fact that most general emergency physicians care for pediatric patients despite generally feeling that the medical education they received is insufficient in this field, and this delicate situation causes apprehension. Physicians who reported having difficulties or apprehension in dealing with pediatric emergencies seem to be younger and less experienced. Physician working exclusively in UMAS or in the ED seem to be less affected than physicians having multiple medical activities.

In France, the specialized education program for emergency physicians was updated in 2004. With this update, a pediatric clinical rotation of 6 months minimum, either in a pediatric ED or a pediatric medicine ward, became a prerequisite for getting the new emergency medicine diploma (*Diplôme d'Études Spécialisées Complémentaires* – DESC). Further improvements were made in terms of minimum essential pediatric training with the revision of the emergency medicine diploma in 2017 [9]. Even with the help of these new education guidelines in terms of minimal pediatric knowledge and competencies to be acquired [10], the exact pediatric components of educational programs and teaching methods still vary widely across UHCs [11]. In this survey, 14% of the respondents considered that the medical education program they graduated from was suited to their current daily practice needs regarding pediatrics. Specific pediatric competencies are known to develop with time, experience, and exposure to pediatric patients [12] but emergency physicians reported having a total clinical experience of less than 1 year in pediatrics. This experience gap is commonly filled with continuous education activities (training or simulation sessions) once the official emergency medicine education program is over [13]. Continuous education sessions have become a key element for physicians to remain up-to-date or for them to acquire

complementary knowledge or techniques with the help of specialized professionals and simulation-based training, especially for management pediatric emergencies [12,14]. Simulation-based training programs have become increasingly popular in France with the support of the French Health Authorities (*Haute Autorité de santé* – HAS) urging universities across the country to develop these structures for the initial education of medical students as well as continuous education of professionals [15]. Approximately 30 simulation-based training structures currently exist in France, but not all of these include a pediatric emergency training program.

The 2017 emergency medicine program revision included new options such as specialized complementary training (*Formations Spécialisées Transversales* – FSTs) to promote acquisition of specialized competencies throughout general medical programs [16]. At the time of this survey, no pediatric emergency FST was offered during the general emergency medicine program [16]. A pediatric emergency FST has just been created for the general pediatric medicine program. This two-semester FST will consist in acquiring clinical, technical, and behavioral skills, including child emergency medicine organization and pediatric emergency medicine performance. Before graduation, the students will be assessed on theoretical knowledge and practical skills [17].

This survey shows that the majority of ED physicians report being in charge of children, despite their infrequent encounters with pediatric emergency situations [7]. In 2016, the UMAS of Caen UHC, the largest western Normandy hospital, reported 4,150 interventions with only 12% of these involving children. In total, 60% of the reported pediatric interventions were inter-hospital transfers and were managed by the specialized Caen UHC pediatric MICU (personal communication). The number of inter-hospital transportation cases of pediatric patients should keep increasing given the centralization of specialized technical services toward the larger hospitals [18]. Thus, most UMASs have already delegated pediatric

patient transportation services to specialized pediatric MICUs [2]. This survey showed that 62% of the respondents agreed with the fact that pediatric patient transfers should be managed by pediatric medical teams instead of general ED teams. Indeed, pediatric patient transfers could be managed by specialized medical transportation teams including trained pediatric nursing staff with or without a pediatrician depending on the clinical situation [19]. Specialized pediatric transportation teams with child-adapted materials and drugs are more competent and better prepared for management of pediatric emergencies [20,21].

Very few detailed information is available in the medical literature regarding the difficulties encountered by general ED physicians when caring for children. A survey was conducted in 2012 with intensivists across lower Normandy regarding management of critically ill children in adult ICUs [8]. Our results are similar to those of that survey: 67% of the intensivists reported encountering difficulties when managing children within their ICU (technical difficulties [57%], therapeutic difficulties [39%], relational problems with the child [39%] or their family [33%], and personal/emotional difficulties [44%]). With our questionnaire, we can add pediatric pathology-specific difficulties (64%), especially with acute respiratory (bronchiolitis, laryngitis) or neurological disorders and resuscitation situations (shock, for example). We also highlighted age-specific difficulties, with 76% of the respondents reporting apprehension especially when taking care of young children (under 2–3 years of age).

Management of pediatric emergency situations, especially with very young children, warrants thorough collaboration between specialized pediatric teams and the general ED team in charge. Proximal general ED teams can allow for rapid and efficient medical management of acute pediatric situations based on previously established child-specific protocols [22,23] while waiting for a relay by a specialized pediatric team [3]. Moreover, modern communication tools and telemedicine could be of great interest for specialized teams to communicate specific and adapted instructions to general ED teams [24,25].

The first limitation of our study resides in the response rate. According to the most recent inquiry made in 2015, there would be approximately 211 emergency physicians working in EDs throughout lower Normandy (personal communication). Given this denominator, our true response rate could be estimated at approximately 44%. Furthermore, even if our work was a multicenter study, our survey was not sent to all of France EDs but only to the EDs of a specific region. Since medical education programs can vary across UHCs of different regions, data collected with this survey should not be extrapolated nationwide. This extrapolation should be all the more disregarded since our questionnaire was not previously validated but was especially created for the purpose of the study [26]. Last, due to its declarative nature, this self-assessment failed to provide information on the real practice performances, and hetero-evaluation should be considered.

5.Conclusion

Most general emergency physicians report caring for children as part of their daily practice. They often encounter difficulties or apprehension regarding pediatric emergencies, probably due to a lack of specific pediatric medical education. Pediatric medical education for emergency physicians should be enhanced as well as collaborations and communication with specialized pediatric teams to better match the needs of general EDs and improve the quality of primary and acute care for children.

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328 **Tables**

329 **Table 1: Responder characteristics**

330 Results in numbers (percentages) or medians [interquartile range]

331 * CAMU: Capacité de Médecine d’Urgence (title of the emergency medicine diploma
332 obtained prior to 2004)

333 £ DESC: Diplôme d’Études Spécialisées Complémentaires (title of the emergency medicine
334 diploma obtained after the 2004 update)

335 ¥ DU or DIU: Diplôme Universitaire ou Diplôme Inter Universitaire (complementary
336 university degree)

337 § RANP: Cours de Réanimation Avancée Néonatale et Pédiatrique (Pediatric Advanced Life
338 Support (PALS) course in Europe)

339 ¤UMAS/MICU: Urgent Medical Aid Service/Mobile Intensive Care Unit service

340 ¶ UHC: University Health Center

Characteristics	Total <i>n</i> = 81	Group 1 (difficulties) <i>n</i> = 59	Group 2 (no difficulty) <i>n</i> = 22	<i>p</i>
Gender (male/female)	46 (57 % [46–67])/ 35 (43% [33–54]))	27 (46% [34–58]) / 32 (54% [42–66])	19 (86% [66–96]) / 3 (14% [4–34]))	0.001
Age (years)	37 [32–47]	34 [31–44]	44 [38–52]	0.02
Years of experience	6 [4–15]	5 [3–12]	14 [8–24]	0.001
<u>Initial medical education program</u>				
General medicine		79 (98 % [91–100])		
Other		2 (2 % [0,1–9])		
<u>Emergency medicine education program</u>				
CAMU [*]	36 (44 % [34–55])	22 (37% [26–50])	14 (64% [43–80])	0.01
DESC [‡]	36 (44 % [34–55])	32(54% [42–66])	4 (18% [7–39])	
None	9 (11% [6–20])	5 (8% [3–19])	4 (18% [7–39])	
<u>Complementary degree (emergency/critical care)</u>	22 (27% [19–38])	12 (20% [12–32])	10 (45% [27–65])	0.05
Emergency DU/DIU [¥]	4 (5 % (2–12))	3 (5% [1–14])	1 (5% [0–24])	0.6
Critical care DU/DIU [¥]	8 (10 % [5–19])	2 (3% [0–12])	6 (27% [13–48])	0.07
<u>Complementary degree (pediatrics)</u>				
Pediatric emergency DU/DIU [¥]	20 (25 % [17–35])	15 (25% [16–38])	5 (23% [10–44])	0.8
<u>Complementary training (pediatrics)</u>				
Simulation-based training	44 (54 % [44–65])	32(54% [42–66])	12 (55% [35–73])	0.9
RANP/PALS [§]	7 (9 % [4–17])	6 (10% [4–21])	1 (5% [0–24])	0.7
<u>Clinical experience (pediatrics)</u>	67 (83% [73–90])	51 (86% [75–93])	16 (73% [52–87])	0.2
Pediatric emergency	57 (70 % [60–79])	43 (73% [60–83])	14 (64% [43–80])	0.9
General pediatric medicine	56 (69 % [58–78])	45 (76% [64–85])	11 (50% [31–69])	0.1
Pediatric critical care	7 (9 % [4–17])	4 (7% [2–17])	3 (14% [4–34]))	0.3
Pediatric surgery	3 (4 % [1–11])	1 (2% [0–10])	2 (9% [1–29])	0.1
<u>Length of pediatric clinical experience (years)</u>				
< 1	65 (65 % [70–88])	50 (85% [73–92])	15 (68% [47–84])	0.4
1–5	2 (2 % [0,1–9])	1 (2% [0–10])	1 (5% [0–24])	
> 5	0	0	0	
<u>Current medical activity</u>				
UMAS and/or MICU ^{‡‡}	5 (6 % [2–14])	1 (2% [0–10])	4 (18% [7–39])	0.01
Emergency department	4 (5 % (2–12))	2 (3% [0–12])	2 (9% [1–29])	
Both	72 (89 % [80–94])	56 (95% [86–99])	16 (73% [52–87])	0.9
UHC [¶]	17 (21 % [13–31])	13 (22% [13–34])	4 (18% [7–39])	
<u>Pediatric emergency management situations</u>				
In-hospital	73 (90 % [81–95])	54 (92% [81–97])	19 (86% [66–96])	0.7
Out-of-hospital	75 (93 % [84–97])	56 (95% [86–99])	19 (86% [66–96])	0.3

342 **Figures**

343 **Figure 1:** Flowchart

344 [§] ED : Emergency department

345 **Figure 2:** Types of difficulties encountered with management of pediatric emergency

346 situations

22 ED^s approached
211 expected responses

93 responses received
44%

7 responses excluded: incomplete

86 fully completed questionnaires

5 responses excluded: respondents
reported never taking care of children

81 analyzed responses

