J Pediatr (Rio J). 2017;93(s1):68–74

Jornal de Pediatria
www.jped.com.br

REVIEW ARTICLE

Pediatric emergency in Brazil: the consolidation of an area in the pediatric field☆

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Received 23 June 2017; accepted 5 July 2017
Available online 1 September 2017

KEYWORDS
Emergency;
Pediatrics;
Medical residency;
Teaching program

Abstract
Objective: The aim of this study was to present a review on the evolution, development, and consolidation of the pediatric emergency abroad and in Brazil, as well as to discuss the residency program in this key area for pediatricians.
Data sources: This was a narrative review, in which the authors used pre-selected documents utilized as the minimum requirements for the Residency Program in Pediatric Emergency Medicine and articles selected by interest for the theme development, at the SciELO and Medline databases, between 2000 and 2017.
Data synthesis: The historical antecedents and the initial evolution of pediatric emergency in Brazil, as well as several challenges were described, regarding the organization, the size, the training of professionals, and also the regulation of the professional practice in this new specialty. Additionally, a new pediatric emergency residency program to be implemented in Brazil is described.
Conclusions: Pediatric emergency training will be a powerful stimulus to attract talented individuals, to establish them in this key area of medicine, where they can exercise their leadership by promoting care qualification, research, and teaching, as well as acting decisively in their management.

☆ Please cite this article as: Piva JP, Lago PM, Garcia PC. Pediatric emergency in Brazil: the consolidation of an area in the pediatric field. J Pediatr (Rio J). 2017;93:68–74.

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https://doi.org/10.1016/j.jped.2017.07.005

PALAVRAS-CHAVE
Emergência;
Pediatria;
Residência médica;
Programa de ensino

Emergência pediátrica no Brasil: a consolidação da área de atuação para o pediatra

Resumo
Objetivo: O estudo teve como objetivo apresentar uma revisão sobre a evolução, desenvolvimento e consolidação da Emergência Pediátrica no exterior e no Brasil assim como discutir o programa de residência nesta importante área de atuação para o pediatra.
Fontes dos dados: Trata-se de uma revisão do tipo narrativa, em que os autores utilizaram documentos pré-selecionados empregados nos requisitos mínimos para o programa em Residência de Medicina de Emergência Pediátrica e artigos selecionando por interesse para desenvolvimento do tema utilizaram as bases de dados SciELO e Medline entre 2000 e 2017.
Síntese dos dados: Foram descritos os antecedentes históricos e a evolução inicial da Emergência Pediátrica no Brasil e diversos desafios, na organização, no dimensionamento, na formação de profissionais e, também, na regulamentação do exercício profissional desta nova especialidade. Também se descreve um novo programa de residência em Emergência Pediátrica a ser implementado no Brasil.
Conclusões: A formação em emergência pediátrica será um poderoso estímulo para atrair indivíduos talentosos, fixá-los nesta importante área da medicina, onde poderão exercer sua liderança promovendo qualificação na assistência, na pesquisa e no ensino, assim como atuando decisivamente no seu gerenciamento.

Introduction

Starting in the second half of the last century, emergency services in most countries have experienced a substantial increase in their volume of care. The reasons for this increase in demand include rapid access to diagnostic and therapeutic resources; the complexity and resolutiveness of the sector, being an alternative and facilitated route for hospital admission; and, in some cases, access to medical care without costs to the user.

It is estimated that in the United States, over 115 million visits to emergency services are made annually; 10%–12% of them are transported by ambulance. Of this total, 18% are intended for the care of children and adolescents under 15 years of age, and 75% of these services are provided in emergency services located in general hospitals. It is also estimated that 40% of hospital admissions of pediatric patients occur through emergency services.[1,2] In Brazil, there is little data available, but according to the portal of the Ministry of Health, over 300,000 calls were received from patients with some type of urgency between January 2016 and March 2015, during which 72,000 patients were treated in specialized emergency units and 81,000 in emergency units. Around 10% of the total number of visits (approximately 30,000 visits) required observation for more than 24 h in a specialized unit. The heterogeneity of prehospital care in Brazil is also noteworthy, as in 6900 cases the care was provided through boats.[3]

Obviously, this complex system, which has become increasingly overloaded, has brought several challenges: organization, size, training of professionals, as well as the regulation of professional practice.

The development of the emergency specialty is very recent in most countries, with a very similar history of development and recognition among them. In 1968, in the United States, the American College of Emergency Physicians (ACEP) was founded; the specialty was recognized in 1979 and issued its first certificate in 1980. After 1982, the minimum requirements for the Residency Program in Emergency Medicine were approved, followed by the first annual fellowship program in 1989. After 2000, emergency medical residency training and the certificate issued by ACEP became prerequisites for clinical practice in emergency services. Even with this recent history, emergency is now one of the largest medical specialties in the United States, with over 25,000 active professionals.[1,4]

From the recognition of the specialty, the search for emergency care standardization directed to the pediatric range was natural and obligatory. The death of an 18-year-old adolescent in New York attributed to the lack of adequate emergency care was the trigger for the creation, in 1984, of the Emergency Medical Services for children, aiming to ensure treatment for children and adolescents with severe diseases or victims of trauma, reduce their dysfunctions, prevent death, and promote rehabilitation.[5] In the first decade of its implementation, operating norms were defined, funding was allocated to specific projects, and epidemiological knowledge and information were distributed to the entire system. At the end of the first decade, pediatric emergency training programs aimed at medical and non-medical professionals were instituted, including pediatric basic and advanced life support (PALS). In the second decade, protocols for prehospital care were developed, minimum pediatric equipment in the emergency services were defined, and the emergency care was regionalized, with patient referral and transfer, following a logical pattern of increasing complexity.[4]

In Canada, the pediatric emergency field was acknowledged in 1980, while in the United States the training of these professionals became regular and frequent in the 1980s, but it was only defined, regulated, and certified as subspecialty in 1991.[5,6]

After its recognition, pediatric emergency became the fastest growing area in the United States – approximately 500% in the period between 1992 and 1999 – and is the second most sought specialty by pediatricians who completed the basic residence, second only to neonatology.[1,4] After an accelerated growth phase in the pediatric emergency residency programs in the United States, a natural stabilization and consolidation was observed, with a reduction in the proliferation of new training programs. Since then, the goal has been to standardize training in the several services and to look forward to the future challenges for the new millennium. In the early 1990s, there was great disparity in training provided by the programs. It was observed that 75% of the first-year residents worked without adequate supervision in the different programs, a percentage that was reduced to less than 20% in 2000. At the end of the first decade of the new millennium, most pediatric emergency residency programs became a three-year program with a minimum-curriculum definition, as well as skills and competences to be achieved.[1,2,4–6]

Evolution of pediatric emergency in Brazil

In the 1970s and 1980s, Brazil still suffered from the consequences of major and severe epidemics due to the lack of vaccine coverage and, especially, basic sanitation. Even with advances in these areas, pediatric emergency services were still overloaded, as they represented (and still represent) the best option for healthcare access.

Since the 1990s, the Brazilian Society of Pediatrics (Sociedade Brasileira de Pediatria [SBP]) has started a movement to stimulate and regulate training in pediatric areas, such as pediatric intensive medicine, neonatology, pneumology, pediatric nephrology, and pediatric neurology. To meet this demand, it was decided together with the National Commission of Medical Residency (Comissão Nacional de Residência Médica [CNRM]) to accredit some residence programs to offer the optional third year of the residency program in pediatrics for training in the specific area. Within this context, the third optional year in the pediatric residency program, aimed at pediatric emergency, was established in several services and persisted until 2002. In that year, a significant change occurred with the unification of Specialties and Areas of Practice defined by the Brazilian Medical Association (Associação Médica Brasileira [AMB]), CNRM, and the Federal Council of Medicine (Conselho Federal de Medicina [CFM]). For reasons unknown to date, urgency and emergency became an area linked to the internal medicine practice.[7] From that moment on, pediatric emergency ceased to be an area of action of pediatrics; this program was no longer recognized by the CNRM and thus the formation of pediatricians with training and qualification in pediatric emergency activity was suspended for over a decade. Evidently, this impossibility in the formation of qualified professionals in pediatric emergency was very harmful to the Brazilian population, to pediatricians, and to teaching and research activities in this country.

Despite the repeated requests by the SBP to the CNRM and AMB, this illogical situation persisted until 2015, when a decisive fact took place that changed the direction and the history of the emergency specialty in Brazil. In June 2015, twenty renowned Brazilian institutions (medical schools and teaching hospitals) met with the CNRM and presented proposals for residency programs in adult emergency (three years) and pediatric emergency area (one year), with detailed programmatic content, as well as skills and competences to be acquired up to the completion of training (Fig. 1). The CNRM, in an innovative and ground-breaking attitude, decided to approve the application for accreditation of 22 residency programs proposed by these entities. Thereafter, the specialty and the area of action were recognized by the scientific council of AMB in August 2015 and formally homologated with the publication of CFM resolution No. 2.149/2016.[8,9]

Figure 1 Meeting held at the Federal Medical Council (Conselho Federal de Medicina [CFM]) with representatives of the National Medical Residency Commission (Comissão Nacional de Residência Médica [CNRM]) and representatives of 20 Brazilian institutions (medical schools and teaching hospitals),[a] where the residency programs in emergency (adults) and pediatric emergency were defined and approved. (June 2015).
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A pediatric emergency residency program for Brazil

When proposing a residency program in pediatric emergency to be implemented in Brazil, some guiding assumptions were chosen for the creation of the program content, skills, and competences, as well as training time, among which the following stand out:

> ''To preview, prepare, and enable their graduates to face the challenges anticipated for the next decades in the services of Pediatric Emergency.''

In this context, it should be emphasized that pediatricians who are now entering these programs will be working in the care of children and adolescents with acute diseases in the next 30–35 years (*i.e.*, between 2020 and 2050). Therefore, they will face challenges in care that are very different from those experienced to this day. Some of these future challenges have already been well identified. Studies that analyzed the changes in disease profiles over the last few years suggest that the greatest challenges for pediatricians in the coming decades will be related to adolescent pregnancy, perinatal mortality, urgency medicine, infections (sepsis), external causes (including accidents, alcohol and drug use), chronic diseases, and children with ''medical complexity.''[10] Thus, differently from what occurred 20 years ago, there is a growing contingent of pediatric patients with chronic diseases, and even at the final stages of life, being treated in pediatric emergency services. The ability to treat these patients and their families is a priority in the teaching goals of the new programs.[11]

Not only the disease profile tends to change, but also the diagnostic features. Almost all areas of modern medicine incorporate routine echocardiography performed at the bedside, increasing both diagnostic sensitivity and specificity. Specifically, in the emergency service, this possibility has found great applicability.[12,13] Of course, this skill becomes an essential requirement for the new pediatricians working in emergency care, representing a great challenge in their formation, because few chief residents currently dominate this technique. Programs should establish partnerships with radiology services or other services so that their residents have a minimum and sufficient training to deal with the most prevalent situations in pediatric emergency.

Model and resources for learning and acquiring skills

As in several countries, the acquisition of knowledge, skills, and competence in pediatric emergency should follow a model based on daily practice, through the discussion and review of more prevalent cases with a preceptor actively involved in the teaching process. The less frequent situations must be experienced through a simulation laboratory or other teaching practices such as films and dramatizations, among others.[14]

It has been observed that residency programs in pediatrics, neonatology, and pediatric emergency, among others, expose residents to a small number of more complex procedures, less that the amount proposed and considered as the minimum desirable.[14–17] In the proposed program, residents to prove their participation and performance with adequate supervision in a minimum of these more complex procedures.

Training leaders to work in pediatric emergency services

In addition to the knowledge, skills, and competences, the graduates of these new programs must be trained to assume the status of leaders of their services, coordinating care and administrative activities.

A question could be raised on whether the adoption of the pediatric residency program in three years would not be sufficient to enable professionals to act as medical leaders at several levels (care, teaching, research, and management) in emergency settings. Even considering that 20–25% of the workload of the three-year general pediatric residency programs occurs in the emergency department, this training is incomplete for what is expected of a professional who leads the process in this important area.

International studies evaluating the abilities and experience of pediatric residence programs (three to four years) developed in large hospitals show that, at the end of the residency, these pediatricians have insufficient exposure to the minimum recommended pediatric emergency situations. In a study evaluating the pediatric residency program (four years) at a large referral center in the United States, it was observed that 89% of pediatric residents were not exposed to the minimum situations recommended by the CNRM in that coutry.[16] Another study showed that pediatric residents in their regular emergency department training are exposed to a small number of critical patients (~14 severe pediatric patients per resident during the training period).[17] These same shortcomings in training and skill acquisition by emergency pediatric residents were also observed in Brazil,[15] as well as through the analysis of their performance at the board certification test promoted by SBP.

These results do not necessarily mean that pediatricians are not capable of working in pediatric emergency services. However, it is imperative to recognize that they prevent these professionals from being a reference, a leader, and an innovative element in this area. The gaps in their skills and abilities in this area require an adequately trained and qualified professional to support and improve their performance while working in a pediatric emergency.

In Brazil, the need for a vocational and acknowledged speaker in this area has been observed, to be an interlocutor in both the intra-hospital and extra-hospital discussions aimed at the implementation of management policies and care in pediatric emergency.

To expand the offer of emergency pediatricians in the short-term

After more than a decade without providing residency programs in pediatric emergency, qualified professionals are needed in all regions of the country. Even considering the most optimistic calculations, there will be a great gap to be filled in the several services of the country. In this context, the proposal for the next years is that the residence programs in emergency pediatrics will be conducted over

the course of one year, complementing the three years of residence in pediatrics. It was understood at the time of the proposal presentation that this policy would allow the fulfillment, in a maximum of one decade, of the main positions of leadership and coordination of pediatric emergency in Brazil. Thereafter, a new level will be established, developing the program into a two-year training period, as in other pediatric areas (pediatric intensive medicine and neonatology, among others).

Development of pediatric emergency research

In an attempt to prepare themselves for this new scenario, the US National Health Institute (NHI) has recently chosen three priority fields for the development and stimulation of pediatric research: pediatric intensive care, pediatric emergency and rehabilitation of children suffering from acute or chronic diseases. Research in the pediatric emergency area has been relegated and poorly developed, requiring, in addition to research resources, the training of skilled researchers with interest and knowledge in this area.[18,19] Therefore, among the challenges for the next decades, emergency medicine should be considered as a priority in research on children and adolescents' health.[20]

Due to the aforementioned reasons, the authors believe that pediatric emergency training will be a powerful stimulus to attract skilled individuals, to establish them in this important area of medicine, where they can exercise their leadership by promoting qualification in care, research, and teaching, as well as decisively working in its management.

Residency program in emergency and pediatric emergency area

Approved by CNRM in August 2015:

1- Duration: one year
2- Number of openings: the minimum opening number was defined as two per service, while the maximum number of residents will be defined according to the volume and facilities offered by the service
3- Workload: 60 h per week according to CNRM recommendations, including 30-day vacations.
4- Objectives of the professional to be trained:
   - To deepen the knowledge, skills, and competences in the area of pediatric emergency in its several scenarios.
   - To develop the capacity to generate knowledge within four components: clinical skills, research, education, and management.
   - To train leaders who can influence and have an impact on the care, management and planning of the sector, including leadership roles in multiprofessional teams.
   - Training of professionals who are able to contribute to the creation of solutions aligned with the healthcare policy needs of their region.
5- Training sites
   - Pediatric Emergency Service with a minimum of 50,000 annual outpatient visits.
   - The care complexity should ensure a minimum demand close to 10% of patients classified as up to second level on the priority scale (five levels)
   - Intra and extra-hospital transportation
   - Pediatric intensive care unit (at least ten beds).
   - Anesthesiology and surgery (imaging services with anesthetic procedures/surgical center/anesthetic recovery).
   - Trauma service.
   - Imaging area (radiology and ultrasound)
   - Complementary options (*e.g.*, otorhinolaryngology, cardiology, pneumology, burn unit, poisoning, accidents with venomous animals, among others)
6- Cognitive goals of the program

   A minimum of 10% of the workload should be allocated to theoretical activities, either as classes, seminars, clinical discussions, and article reviews, among others. The theoretical-practical basis should cover the main acute situations in Pediatrics, such as those listed below, but not restricted only to these:
   a. Cardiopulmonary resuscitation.
   b. Rapid sequence intubation.
   c. Shock (septic, hypovolemic, cardiogenic).
   d. Acute respiratory failure.
   e. Severe acute asthma
   f. Basic notions o mechanical ventilation.
   g. Upper airways emergencies.
   h. Meningoencephalitis.
   i. Status epilepticus
   j. Sedation and analgesia.
   k. Diabetic ketoacidosis.
   l. Initial care to the polytraumatized and cranial trauma.
   m. Exogenous poisoning.
   n. Accidents with venomous animals.
   o. Anaphylaxis.
   p. Hypertensive urgencies.
   q. Syncope and coma
   r. Congestive heart failure and cyanosis crisis.
   s. Heart rhythm disturbances.
   t. Hydroelectrolytic and acid-base disorders.
   u. Ethical and legal aspects of care in emergency services
   v. Basic concepts in management and administration of emergency services.
   w. Notions in scientific methodology for research in emergency.
   x. Catastrophe care.
   y. Emergency surgical pathologies
   z. Ultrasound at the bedside (point of care).
7- Competences
   a. To recognize signs of severity and the acute diseases in children and adolescents treated at emergency/urgency units and the adequate implementation of the respective protocols.
   b. To promptly establish urgency lines of care.
   c. To assist in the care of patients with specific needs and dependent on technology.
   d. Capacity for autonomy and leadership

e. To propose and develop a research project (monograph)
f. To demonstrate the ability to manage the unit's administrative processes (cost management, human resources allocation and flows) and the relationship with municipal and state health networks.
g. To participate in the management tool implementation (care protocols and quality indicators, among others)
h. To be familiar with the priorities and national/regional healthcare policies with emphasis in the area of pediatric emergency.

8- Skills

A minimum set of skills will be required, as follows:

a. Peripheral and central venous access (including umbilical catheter) – minimum of six accesses each; arterial access (minimum six);
b. Intraosseous access – minimum of four accesses;
c. Airway access – minimum of twelve;
d. Invasive and non-invasive ventilatory support;
e. PALS or equivalente;
f. Minimum of invasive procedures: lumbar (twelve), suprapubic (twelve), thoracic (four) punctures;
g. Identification of alterations and major acute diseases in imaging tests (echography, radiography, CT, and/or MRI);
h. Experience in applying priority care classification systems (''risk classification'');
i. Presentation of a free theme or submission of an article to a journal

9- Description of activities

The activities will be carried out in the unit itself and other places (Table 1).

10- Assessment

Residents will be assessed on the following aspects every six months:

Attitudes

- Posture, communication, and integration, among others

Knowledge and skills

- Domain of contents of the area and protocols, among others
- Research project (Term Paper)

Skills

- Check list of acquired skills

11- At the end of the internship, the professional should be able to:

a. Identify, diagnose, and treat the main acute situations in Pediatrics according to the best scientific evidence (protocols).
b. Identify, diagnose, and start treatment based on the best scientific evidence (protocols) of the main emergency situations in the pediatric specialties (*e.g.*, otorhinolaryngology, ophthalmology, orthopedics, neurology, and neurosurgery, among others).
c. Correctly interpret the usual imaging tests in the main pediatric emergency situations.
d. Perform key emergency procedures.
e. Lead the medical and multiprofessional team in the area of pediatric urgency and emergency.
f. Understand regional health policies and the hospital referral system;
g. Lead and organize a pediatric emergency care service.

Table 1 Description of activities.

Location	Workload (%)
Pediatric emergency service/unit	50%–70%
Pediatric intensive care unit	5%–10%
Transportation	5%–10%
Imaging	5%–10%
Trauma	5%–10%
Surgery and anesthesia	5%–10%
Optional	5%–10%

This distribution does not necessarily imply a fixed division into blocks.

Conflicts of interest

The authors declare no conflicts of interest.

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