



# Paediatric Emergencies During the COVID-19 Pandemic

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María Isabel Lázaro Carreño<sup>1</sup> , Ana Barrés Fernández<sup>1</sup>,  
Diannet Quintero García<sup>1</sup>, Jesús Ferrer Ferrer<sup>1</sup>,  
Ignacio Fernández González<sup>1</sup> , Lucia Monfort Belenguer<sup>1</sup>,  
Sergio Iniesta González<sup>1</sup>, Angela Moreno Palomino<sup>1</sup>,  
Silvia Carbonell Sahuquillo<sup>1</sup>, and Francisco José Sebastián Cuevas<sup>1</sup>

## Abstract

The state of alarm decreed by the Spanish Government, due to the Coronavirus Disease-19 (COVID-19) pandemic, has demanded the lockdown of children and has conditioned a new organization of the Emergency Departments (ED). A pre-triage station and 2 independent circuits were established: *suspected COVID-19* and *not suspected COVID-19*. The ED visits decreased 84,5% from pre-alarm with no increase in the level of urgencies. During the alarm state, 40.97% of the children were classified as *suspected COVID-19*. Fever and respiratory symptoms, used as discriminators, generated 2 groups of patients with different characteristics. Although the interruption of sports activities and isolation of children at home contributed to the decrease in emergencies, it was also probably conditioned by adults' fear of contagion, who avoided going to the hospital in situations that would never have really required ED and resolved themselves in primary care or spontaneously.

## Keywords

paediatric, emergencies, lockdown, COVID-19

## Introduction

Pediatric Emergency Departments (EDs) are accustomed to treating patients with epidemic respiratory infections, usually with an overburden of the health service. However, the new and unknown SARS-CoV-2 pandemic (COVID-19)<sup>1</sup> has led to a substantial adjustment of the healthcare system throughout Spain. The state of alarm, first degree of state of emergency, decreed in Spain on 14 March 2020,<sup>2</sup> has mandated the lockdown of children changing the demand put upon emergency departments: a decrease in other viral infections or traumatic pathologies resulting from educational or sporting activities, leading to more domestic accidents or increased severity of other pathologies due to delays in receiving medical attention. The aim of the study is to describe the features of pediatric emergencies, including the changes in the work load and disease spectrum, before and during the state of alarm.

## Methods

A descriptive study was conducted regarding the pediatric emergency care in a tertiary hospital before and

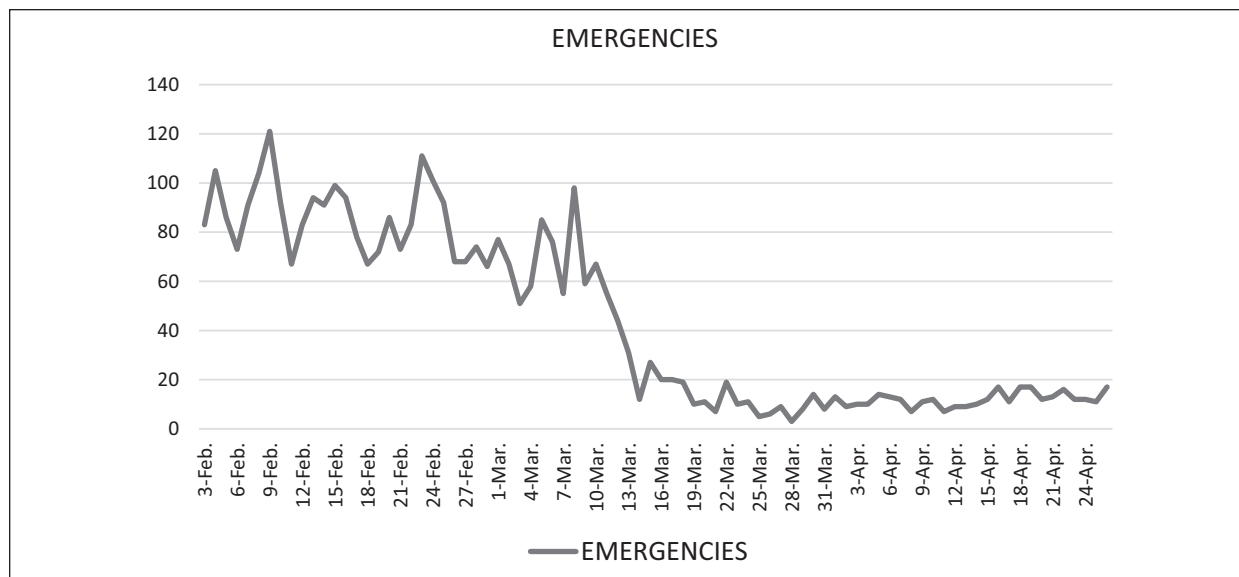
during home confinement conditioned by the state of alarm, declared in Spain on 14 March 2020 and came into force on 16 March 2020. Given the situation of community transmission in our country, according to the clinical characteristics initially described as a suspected case of SARS-CoV-2 infection, a pre-triage station and 2 independent patient circuits were established in the ED.<sup>3,4</sup> After an initial assessment, children were assigned an urgency category in pre-triage according to the Manchester Triage System (MTS) and were classified into 2 groups: *suspected COVID-19* for those with fever and/or symptoms of respiratory infection; and *not suspected COVID-19* for the rest of the patients. A waiting room, examination boxes, observation areas and separate critical boxes were established for each patient circuit. All pediatric emergency care was documented over the 6-week *alarm period*, from 16 March to 26

<sup>1</sup>Universitat de València, Valencia, Spain

### Corresponding Author:

María Isabel Lázaro Carreño, Hospital Clínico Universitario de Valencia, Av. de Blasco Ibáñez, 17, Valencia 46010, Spain.  
Email: m.isabel.lazaro@uv.es





**Figure 1.** Total number of patients attended in the *pre-alarm period* and *alarm period*.

April 2020. We compared it with retrospective data from the previous 6 weeks, from 3 February to 15 March 2020, *pre-alarm period*. The variables compared between both periods were the total number of visits, level of priority, age, sex, number of hospital admissions, and diagnoses. Clinical data of the children distributed in both *suspected* and *not suspected COVID-19* groups was also compared. Categorical variables were defined as percentages and analysed using the X2 test or Fisher's exact test. Continuous variables were described with mean and standard deviation or median with IQR (95% confidence intervals, minimum and maximum) and non-parametric tests were used for analysis (Mann-Whitney U). Statistical analysis was performed using Epidat 4.2.2®.

## Ethical Statements

**Conflict of Interest:** The authors declare that they have no conflict of interest.

**Funding:** There is no funding source.

**Ethical approval:** This is a retrospective study and did not require ethics approval according to the Medical Research Involving Human Subjects Act (WMO) (MEC-2016-467).

**Informed consent:** Not required. The project database is anonymous. The clinical/healthcare data are separated from the patient's identification data. The treatment of patient data generated in the study is in accordance with the Organic Law 3/2018, of 5 December, on the Protection of Personal Data and the guarantee of digital rights.

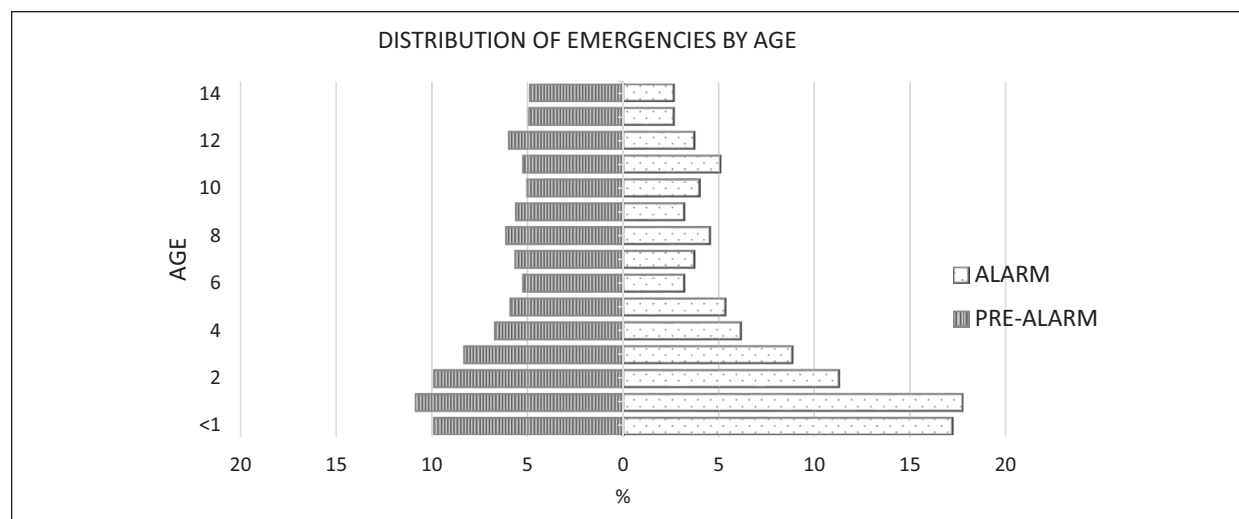
## Results

The healthcare department of the Hospital Clínico Universitario de Valencia (Spain) provides care to an estimated population of 341 951 people, 14.7% of whom are children under 15 years of age. The number of pediatric emergencies attended over the last 5 years in our health area ranges between 22 704 and 27 992 emergencies per year, with a hospital admission rate close to 4% (4.2-4.7%).

The epidemiological situation of COVID-19 differs among the Spanish Autonomous Communities, with different disease rates within the same region and also within each health departments. In particular, on 26 April, the 24 healthcare departments included in the Valencian Community registered between 108.8 and 858.4 cases of infection per 100 000 inhabitants.<sup>5,6</sup> In our department, 812 cases were declared with a rate of 238 per 100 000 inhabitants.

During the 6 weeks *pre-alarm period* 3,184 patients (45.4% girls and 54.5% boys) attended the ED, with a mean of 75.8 patients/day. During the first 6 weeks of the *alarm period* 493 patients (41% girls and 54.9% boys) attended the ED, with a mean of 11.7 patients/day. The number of visits decreased 84.5%. Despite the lockdown came into force on 16 March, this reduction started the same day the decree was announced on 14 March (Figure 1).

The mean age of the children treated during the *pre-alarm period* was 5.93 years (median 5, SD 4.41, IQR 2-10 years) versus 4.44 years (median 3, SD 4.24, IQR 1-8 years) during *alarm period* ( $P=.000$ ). The age distribution is presented in Figure 2.



**Figure 2.** Percentage of patients by age attended in the *pre-alarm period* and *alarm period*.

**Table 1.** Priority Levels of Paediatric Emergencies in Both Study Periods.

Triage	Pre-alarm period %	Alarm period %	P
I-Emergent	0.07	0	–
II-Very urgent	1.64	1.08	.414
III-Urgent	10.25	5.38	.003
IV-Standard	82.92	90.59	.000
V-Non-urgent	5.13	2.69	.040

Most children were assigned to standard urgency category in both periods. The number of patients with high triage levels did not increase during *alarm period* (Table 1). A decrease of 56.6% in urgent admissions was observed, with a significant difference in the percentage of admissions (3.39% in *pre-alarm* vs 9.3% in *alarm period*,  $P = .000$ ).

The general distribution of diagnoses in ED was similar during both periods, with respiratory diseases as the most frequent consultation (34% in *pre-alarm* vs 32.25% in *alarm period*). Common pathologies such as flu, acute otitis media, laryngitis and scarlet fever drastically decreased during *alarm period*. Trauma injuries decreased overall with the practical disappearance of ankle sprains and the increase in dog bites (Table 2).

During the state of alarm 202 children were classified as *suspected COVID-19* (40.97%) and 291 as *not suspected COVID-19* (59.03%). The most frequent diagnoses within the *suspected COVID-19* group were: 24.25% upper respiratory tract infections, 10.89% bronchospasms, 9.90% pneumonia, 7.92% fever <24h and 6.29% acute gastroenteritis. The most frequent diagnoses within the *not suspected COVID-19* group were:

32.3% traumatic pathologies, 6.52% foreign-body ingestion or insertion in orofacial regions, 5.49% skin lesions, 5.49% abdominal pain and 3.78% testicular pathologies. The characteristics of both groups of children are presented in Table 3.

The RT-PCR for SARS CoV-2 was performed in 58 patients out of 202 *suspected COVID-19* (30.85%). Only 2 patients were positive: an 11-year-old girl with alveolar consolidation pneumonia and a 3-year-old boy with exudative tonsillitis and basal peribronchial interstitial infiltrates. Both patients presented a good clinical evolution, without acute respiratory distress or need for supplemental oxygen. The characteristics of children from the *suspected COVID-19* group who underwent RT-PCR for SARS-CoV-2 are presented in Table 4.

## Discussion

In recent decades, the overload of EDs has become a major problem in every healthcare system.<sup>7</sup> The high uptake is mainly attributed to the lack of health education among the population, with an increase demand in prompt attention to any health problems, along with availability and easy access.<sup>8</sup>

The inappropriate use and the high seasonality of acute infectious diseases cause EDs to be often overburdened with banal pathologies.<sup>9</sup> The cyclical trends of the emergencies have been previously described in normal conditions,<sup>10</sup> but what would happen if children were isolated at home for many weeks? The lockdown imposed by the state of alarm has provided a unique opportunity to undertake a small experiment that otherwise would have never been possible.

**Table 2.** Diagnoses of Children During the *Pre-Alarm* and *Alarm* Period.

	<i>Pre-alarm period</i>		<i>Alarm period</i>	
	n	%	n	%
<b>Respiratory</b>				
Upper respiratory tract infection	372	11.68	49	9.93
Acute otitis media	164	5.15	19	3.85
Flu	131	4.11	1	0.20
Broncho-obstructive crises	101	3.17	22	4.46
Tonsillitis	62	1.94	9	1.82
Laryngitis	52	1.63	1	0.20
Atypical pneumonia	51	1.69	18	3.65
Acute bronchitis	44	1.38	6	1.21
Bronchiolitis	29	0.91	5	1.01
Cough	29	0.91	7	1.41
Scarlet fever	20	0.62	0	0
Other respiratory infections	19	0.59	5	1.01
Bacterial pneumonia	9	0.28	2	0.40
Suspected COVID-19	4	0.12	13	2.6
COVID-19	0	0	2	0.40
<b>Total</b>	<b>1087</b>	<b>34.13</b>	<b>159</b>	<b>32.25</b>
<b>Traumatism</b>				
Wounds and bruises	597	18.75	76	15.41
Fractures	127	2.48	20	3.44
Ankle sprains	76	2.38	1	0.20
Cranioencephalic trauma	45	1.41	12	2.43
Aggression	7	0.21	1	0.20
Dog bite	2	0.06	6	1.21
Burns	1	0.02	2	0.40
Polytraumatism	1	0.02	0	0
<b>Total</b>	<b>856</b>	<b>23.61</b>	<b>94</b>	<b>19.06</b>
<b>Gastrointestinal</b>				
Acute gastroenteritis	163	5.11	20	4.05
Abdominal pain	77	2.41	16	3.2
Vomiting	67	2.1	3	0.60
Constipation	12	0.37	1	0.20
Mesenteric adenitis	10	0.31	2	0.40
Acute appendicitis	8	0.25	3	0.60
<b>Total</b>	<b>337</b>	<b>10.58</b>	<b>45</b>	<b>9.1</b>
<b>Fever</b>				
Fever < 24 hours	119	3.73	16	3.2
Suspected viraemia	141	4.43	14	2.83
Febrile exanthema	30	0.94	3	0.60
Febrile seizure	10	0.31	4	0.81
<b>Total</b>	<b>300</b>	<b>9.4</b>	<b>37</b>	<b>7.5</b>
<b>Dermatology</b>	<b>129</b>	<b>4.05</b>	<b>16</b>	<b>3.2</b>
<b>Oftalmology</b>	<b>67</b>	<b>2.10</b>	<b>9</b>	<b>1.82</b>
<b>Neurological</b>				
<i>Afebrile seizure</i>	19	0.59	4	0.81
<i>Headaches</i>	25	0.78	3	0.60
<i>Others</i>	6		0	
<b>Total</b>	<b>50</b>	<b>1.57</b>	<b>7</b>	<b>1.41</b>

(continued)

**Table 2. (continued)**

	Pre-alarm period		Alarm period	
	n	%	n	%
Genito-urinary				
Urinary tract infection	17	0.53	6	1.21
Testicular pathology	23	0.72	11	2.23
Vulvovaginitis	7	0.21	1	0.20
Total	47	1.47	18	3.65
Strange body	22	0.69	19	3.85
Maxillofacial pathology	21	0.65	4	0.81
Toxic intake	11	0.34	1	0.20
Other	257		84	
Admissions	106	3.32	46	9.33
Total emergencies	3184		493	

**Table 3.** Characteristics of Children Suspected COVID-19 and Not Suspected-COVID-19.

	Suspected COVID-19 (n=202)	Not suspected COVID-19 (n=291)	P valor
Sex % (n)			
Female	44% (89)	46% (134)	
Male	56% (113)	53.9% (157)	
Age (years)	Average 3.8 (DE 4.05)	Average 5.08 (DE 4.39)	.001
	Medium 2	Medium 4	
	P25 1	P25 1	
	P75 7	P75 9	
Chronic illness % (n)	15.4% (31)	3.43% (10)	.000
Contact COVID-19 % (n)	21.7% (44)	0.34% (1)	.000
Chest X-ray % (n)	25.2% (51)	0.34% (1)	.000
Analytical % (n)	32.67% (66)	2.74% (8)	.000
RT-PCR SARS-CoV-2* % (n)	30.85% (58)	0.34% (1)	.000
Antibiotic % (n)	31.1% (63)	0.6% (2)	.000
Admission % (n)	20.29% (41)	1.71% (5)	.000
ICU admission % (n)	1.4% (3)	0	

Abbreviation: ICU, Intensive care unit.

\*Real-time reverse transcription polymerase chain reaction (RT-PCR) for SARS-CoV-2.

Since the announcement of the state of alarm and the need for home confinement in Spain, a very significant reduction in the number of pediatric emergencies has been observed in our health area, with no increase in the level of urgencies. The interruption of sports activities and the isolation of children at home may have contributed to both the total decrease in the number of consultations and the practical disappearance of common childhood infectious diseases, among others.

Much of the decrease in the visits was probably conditioned by the fear of adults of contagion, who avoided attending the hospital in situations that would never really have required an ED and were resolved at the primary care by telephone or spontaneously.

The low demand for health care at our ED made it easier to organise the 2 operating circuits of *suspected COVID-19* and *not suspected COVID-19* with different individual protection measures. Although a more responsible attitude toward the use of ED would be desirable after the return to the children's social activity, an increase in the demand and a new organisational approach is to be expected.

In our ED, fever and respiratory symptoms, used as discriminators, generated 2 groups of patients with different characteristics. However, a large systematic review in children suggests that both fever and respiratory symptoms should not be considered among the indicative symptoms of COVID-19 in pediatric patients.<sup>11</sup>

**Table 4.** Characteristics of Suspected-COVID Children with RT-PCR SARS-CoV-2.

	RT-PCR* SARS-CoV-2 (n = 58/202)
Sex % (n)	
Female	36.2% (21)
Male	63.7% (37)
Chronic illness % (n)	18.97% (11)
COVID contact % (n)	36.2% (21)
Chest X-ray % (n)	53.4% (31)
Pneumonia % (n)	34.4% (20)
Antibiotic % (n)	56.8% (33)
RT-PCR* SARS-CoV-2 positive % (n)	3.4% (2)
Admission % (n)	32.7% (19)

\*Real-time reverse transcription polymerase chain reaction (RT-PCR) for SARS-CoV-2.

Additionally, considering that children may present with a mild or asymptomatic disease compared with adults,<sup>12,13</sup> a new future strategy of pre-triage classification and individual protection should be contemplated.

Despite the similarities within the healthcare system organization of the different areas in our country, the findings of this single center study may not be extrapolated. The easy access to primary care and the possibility of follow-up telephone calls have probably contributed to avoid delay in attending potentially severe diseases.

Due to the COVID-19 pandemic, a large investment has been made in health education as well as an organizational effort. It is our hope that it will contribute to a better control, not only of new future pandemics, but also of usual seasonal infections, along with adequate material and human resource planning.

In conclusion, since the announcement of the state of alarm and home confinement in Spain, the number of pediatric emergencies has dropped considerably in our ED, without an increase in their level of urgency. These results highlight the inappropriate use of the health system and the urgent need for investment in social and health education. On the other hand, it is important to consider that children infected by SARS-CoV-2 may present a mild or asymptomatic disease, thus the use of fever and respiratory symptoms exclusively as discriminators might not be sufficient.

### Abbreviations

COVID-19: Coronavirus disease-19

ED: Paediatric emergency department

ICU: Intensive care unit

RT-PCR: Real-time reverse transcription polymerase chain reaction

### Author Contributions

MILC and ABF: study conception and design.

JFF, SIG, AMP, SCS and FSC: data collection.

MILC: analysis and interpretation of results.

MILC, ABF and DQG: draft manuscript preparation.

All authors reviewed the results and approved the final version of the manuscript.

### Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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### ORCID iDs

María isabel lázaro carreño  <https://orcid.org/0000-0002-2740-3489>

Ignacio fernández gonzález  <https://orcid.org/0000-0002-9816-5633>

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