



## Original Research

## Evaluation of changes in pediatric healthcare activity during the Covid-19 state of alarm in the Canary Islands

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## ABSTRACT

**Objective:** During the SARS-CoV-2 state of alarm (SoA), a 30–70% reduction was observed in the number of visits to Pediatric Emergency Departments (ED), as well as frequent delay in diagnosis or difficulty accessing healthcare services. Here we evaluate modifications observed in pediatric healthcare activity during the SoA.

**Study design:** Descriptive retrospective observational study of the hospital pediatric activity.

**Method:** We compared the use of pediatric healthcare services during the SoA (March 11th – June 25th, 2020) versus the use during the equivalent periods of years 2018 and 2019, in the “Complejo Hospitalario Universitario Insular Materno Infantil de Canarias” (Mother and Child University Hospital of the Canary Islands).

**Results:** The number of patients visiting the pediatric ED decreased by 66.75% on average (95%CI: -65.6; -67.7;  $p < 0.001$ ), with a peak reduction (70.4%; 95%CI: -69.0; -71.7;  $p < 0.001$ ) during the lockdown. We observed an increase in the number of cases of psychiatric disorders, foreign body ingestions and intoxications, as well as a decrease in respiratory conditions. Hospital admissions decreased by 45.5% (95%CI: -38.9; -51.3;  $p < 0.001$ ), while the ratio and duration of hospital stay increased. A proportion of 3.95% of admitted patients experienced complications caused by delayed visit to the ED.

**Conclusions:** The study shows that more patient education campaigns are needed to improve the efficiency of emergency services. It is important to reinforce the message that adequate healthcare service management is necessary.

### 1. Introduction

The outbreak of the SARS-CoV-2 infection that emerged in December 2019 in Wuhan, China, had unprecedented consequences worldwide. A major impact on hospitals and a significant reduction in patient flow to the emergency services were evident after Covid-19 was declared a pandemic [1] and the state of alarm (SoA) was established in Spain [2]. This epidemiological catastrophe altered the work of Emergency Departments (ED) and healthcare system in general. Besides the virus's direct morbidity and mortality effects, the lockdown strategy had evident consequences on the population's health, as well as in their use of healthcare services.

Children, unlike adults, seem less likely to be infected by SARS-CoV-

2 and consequently, they need less medical care for this disease [3]. Published studies show a worldwide 30–70% reduction in the number of visits to pediatric EDs, as well as frequent diagnosis delays or difficulty accessing health services during the SARS-CoV-2 SoA [4–7]. In many cases, all of this led to increased morbidity and mortality rates [8,9].

Surveys filled by pediatricians evidenced great concern for the generalized delay in visiting the ED observed in patients with serious conditions, with 32% of the surveyed subjects reporting a delay in care, referring that 1 in 3 patients presented with advanced conditions [10]. A further remarkable change in pediatric healthcare concerned the decline in vaccination rates during the pandemic, which seems to reflect the reduction in doctor-patient contact [11].

Overcrowding of the emergency services is a well-known problem

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affecting hospitals all over the world [12]. Understanding the concerns that lead patients and caregivers to seek emergency medical care, as well as the changes occurred during the pandemic, may help us understand what people consider to be a medical emergency today. This study evaluated the changes in the demand for pediatric care in a third-level Spanish hospital during the SARS-CoV-2 SoA.

## 2. Method

### 2.1. Design

Descriptive retrospective observational study of the pediatric healthcare activity in the “Complejo Hospitalario Universitario Insular Materno-Infantil” (Mother and Child University Hospital of the Canary Islands), during the SARS-CoV-2 SoA. This hospital is the only public third-level pediatric hospital in Gran Canaria, Spain. It covers an area with a pediatric population of approximately 109,000 children younger than 15 years (in 2019). A mean of 45,000 visits per year are recorded at the pediatric ED.

The Canary Islands were among the least affected regions in Spain, in terms of COVID-19 infection. Actually, no pediatric COVID-19 patient required admission in the Grand Canary Island during the SoA.

In this study, we analyzed the number of visits to the ED throughout the SoA (March 11th - June 25th, 2020). Based on the information on the Official Bulletin of the State and the WHO declaration of COVID-19 as a pandemic, the following relevant dates were considered: declaration of COVID-19 as a pandemic on March 11th [1]; lockdown March 14th - May 10th [2]; de-escalation phase 1 May 11th-24th; de-escalation phase 2 May 25th - June 7th; de-escalation phase 3 June 8th - 20th; end of the SoA June 21st - 25th [13–15]. The information collected included the following clinical and demographic data (anonymous) from the electronic records of patients visiting the hospital ED during the mentioned periods: date of visit to the ED, age, triage level (Andorran triage model, Spanish pediatric triage system MAT/SET, web\_e-PAT software) [16], disease group and destination (hospitalization/discharge). These data were compared with data from patients managed during the equivalent periods (March 11th-June 25th) of 2018 plus 2019.

The Andorran triage system (MAT) and its subsequent Spanish adaptation (SET) are 5-level triage systems based on: reasons for visiting the doctor, vital signs, symptom category and care needs. Level 1 corresponds to patients that need resuscitation i.e. immediate treatment; Level 2 “emergency” corresponds to patients at imminent life risk who need treatment in less than 15 min; Level 3 includes emergency patients at life risk who need treatment in less than 30 min; Level 4 includes patients who need less urgent care with potentially serious situations (less than 60–90 min); Level 5 includes non-emergency patients who can be managed in less than 120 min. The system is applied through a computer program that establishes a systematic protocol for each symptom category [16].

Hospital admissions during the SoA were also analyzed in terms of admission rate, hospital stay, disease group and complications due to delay in diagnosis.

### 2.2. Statistical analysis

For every studied variable (age, lockdown or de-escalation phase, triage level and disease group) data were classified according to level and year. Variables were expressed as frequencies and percentages; ad-hoc Poisson regression models were used to compare the expected number of events (patient flow, hospital admissions, disease groups) in 2020 versus 2018–2019. Results were summarized as percent variation between the mean of values expected in 2020 versus those expected in 2018–2019 (95%CI). To analyze the evolution of the number of visits, a binomial negative regression (MT) model was used, with the assumption that the trend for 2018–2019 may differ from that of 2020. This model provided a trend in the number of events for each period and an

expected value. The rate of hospital admission was calculated as the ratio between the total number of patients managed in a certain period and the number of patients admitted to hospital in the same period. The percent difference between the rates of admissions in 2020 versus 2018–2019 was calculated with 95%CI. Data were analyzed using the R software package, version 3.6.1 (development Core team, 2019) [17].

Given that the study was retrospective and involved anonymity of patients’ data, approval by the Ethics Committee was not necessary, in accordance with the local policy. The study was conducted in conformity with the Declaration of Helsinki under the terms of the relevant local regulations.

## 3. Results

An evaluation of a 29,598 visits sample revealed 66.75% reduction in patient flow to the hospital ED (95%CI: -65.6; - 67.7;  $p < 0.001$ ) after the onset of the SoA. Table 1 shows the number of events and distributions in each year of the different analyzed variables (age, lockdown or de-escalation phase and triage level), as well as the ratios between the values expected for 2020 and those expected for 2018–2019. Regarding age, the largest reduction was observed in preschool children (69.4%, 95%CI: - 67.7; -71.1;  $p < 0.001$ ); regarding the SoA timeline, the largest reduction (70.4%, 95%CI: -69.0; -71.7  $p < 0.001$ ) occurred during the lockdown (Table 1); regarding triage level, the level of severity increased as compared with the total number of patients assessed (ratio rate of 1.27 for triage level 1 and 2; 95% CI: 1.085; 1.487;  $p 0.0034$ ) (Table 2).

A nadir was observed in the patient flow during the second week of lockdown, with an 84% reduction in the number of managed patients (163 patients in 2020 versus 989 in 2018 and 1056 in 2019). Fig. 1 shows the number of visits expected per week of the studied period, on every year. On the first week, 938.8 (95%CI: 829.0–1029.5) visits were expected in 2018, 906.9 (95%CI: 815.8–1010.7) in 2019, and 521.0 (95%CI: 395.3–68.7) in 2020. Notice that the number expected visits in 2018 did not differ significantly from that of 2019, and that the trend in those two years was of a gradual weekly reduction at a rate of 1.14% (95%CI: 0.01%–2.96%). However, in 2020 the visits markedly dropped in the first week and gradually increased afterwards at a rate of 7.2% (95%CI: 5.1%–9.3%). In the last week, the adjusted number of visits was 786.9 (95%CI: 706.2–877.0) in 2018, 772.5 (95%CI: 693.2–860.9) in 2019 and 429.3 (95%CI: 373.2–493.9) in 2020, thus showing a large difference between 2018 and 2019 and 2020.

Table 3 shows patient flow classified into the studied years and disease groups, as well as the corresponding percent changes. Regarding disease groups, an increase was observed in the number of psychiatric disorders (164.5%, 95%CI: 83.9; 280.4;  $p < 0.001$ ), foreign body ingestions and intoxications (125.4%, 95%CI: 65.7; 206.7;  $p < 0.001$ ), as well as a decrease in the number of respiratory conditions (-48.1%, 95%CI: -52.5; -43.2;  $p < 0.001$ ).

Regarding hospital admissions, the number of admitted patients decreased by 45.5% (95%CI: - 38.9; -51.3;  $p < 0.001$ ) (354 patients admitted in 2020 versus 661 in 2018 and 718 in 2019) (Table 4). However, their ratio of admissions and the duration of hospital stay increased (7.9 days in 2020; 6.95 days in 2018 and 6.2 days in 2019) (Tables 4 and 5).

Complications produced by the delay in seeking emergency pediatric care (14 cases; 3.95% of hospital admissions) included: 7/14 cases of complicated acute appendicitis, 1/14 case of urinary tract infection with bacteremia, 2/14 cases of acute gastroenteritis with moderate dehydration and 3/14 cases of pneumonia with pleural effusion, 1/14 displaced phalanx fracture; 42.8% of patients presenting such complications were preschoolers. The average hospital stay duration of patients with complications was 12.9 days, which corresponded to an increase of 63.2%.

**Table 1**

Number of events in relation to affluence, hospital admissions, age groups, lockdown, and triage level. The net reduction in the total number of patients is assessed, in age group and phase. By triage and admissions, the proportional reduction is assessed.

	2018	2019	2020	Percentage variation in the mean <sup>b</sup> (95% CI)	P-value <sup>c</sup>
<b>Patient flow</b> (admissions to the ED)	12.791	12.578	4.229	-66.7 [-65.6; -67.7]	<0.001
<b>By age group</b>					
Infants 0–24 m	3963 (31.0)	3758 (29.9)	1372 (32.4)	-64.5 [-62.4; -66.4]	<0.001
Preschoolers 2- 6a	4748 (37.1)	4735 (37.6)	1450 (34.3)	-69.4 [-67.7; -71.1]	<0.001
Schoolchildren 7a- 10a	2350 (18.4)	2313 (18.4)	769 (18.2)	-67.0 [-64.4; -69.4]	<0.001
Younger teenagers 11- 14a	1703 (13.3)	1759 (14.0)	618 (14.6)	-64.3 [-61.1; -67.2]	<0.001
Older teenagers 15-17a	27 (0.2)	13 (0.1)	20 (0.5)	-	-
<b>By phase</b>					
lockdown	7501 (58.6)	7459 (59.3)	2215 (46.9)	-70.4 [-69.0; -71.7]	<0.001
Phase 1	1597 (12.5)	1584 (12.6)	570 (12.1)	-64.2 [-60.8; -67.2]	<0.001
Phase 2	1454 (11.4)	1559 (12.4)	726 (15.4)	-51.8 [-47.7; -55.6]	<0.001
Phase 3	1440 (11.3)	1399 (11.1)	632 (13.4)	-55.5 [-51.5; -59.2]	<0.001
End of AS <sup>b</sup>	801 (6.3)	582 (4.6)	582 (12.3)	-47.5 [-41.1; -53.2]	<0.001
<b>By triage<sup>a</sup></b>					
Level 1	2 (0.0)	2 (0.0)	3 (0.1)	250 [-]	0.006 <sup>d</sup>
Level 2	383 (3.0)	421 (3.4)	179 (4.0)	25.5 [6.8; 47.6]	
Level 3	2750 (21.7)	2586 (20.7)	898 (20.1)	-5.18 [-11.6; 1.8]	
Level 4	8908 (70.2)	8769 (70.2)	3135 (70.2)	-0.12 [-3.7; 3.9]	
Level 5	655 (5.2)	718 (5.7)	253 (5.7)	3.9 [-9.1; 18.8]	
<b>Hospital admissions</b>	N = 661	N = 718	N = 376	-45.5 [-38.9; -51.3]	<0.001
<b>By age group</b>					
Infants 0–24 m	304 (46.0)	313 (43.7)	147 (41.5)	-7.3 [-22.5; 10]	0.309 <sup>d</sup>
Preschoolers 2- 6a	170 (25.7)	191 (26.6)	87 (24.6)	-6.2 [-25.8; 18.6]	
Schoolchildren 7a- 10a	95 (14.4)	105 (14.6)	56 (15.8)	9 [-19; 46.6]	
Younger Teenagers 11- 14a	85 (12.9)	102 (14.2)	62 (17.5)	29.1 [-3.2; 72]	
Older teenagers 15-17a	7 (1.1)	6 (0.8)	2 (0.6)	-	

<sup>a</sup> Missing information, patients without triage level: 2018: 97 (0.76), 2019: 87 (0.69), 2020: 38 (0.84).

<sup>b</sup> SoA: State of alarm.

<sup>c</sup> Poisson regression.

<sup>d</sup> Pearson's Chi-square. Percentage distribution in 2020 relative to the 2018–2019 biennium. Frequencies lower than 30 are not assessable.

**Table 2**

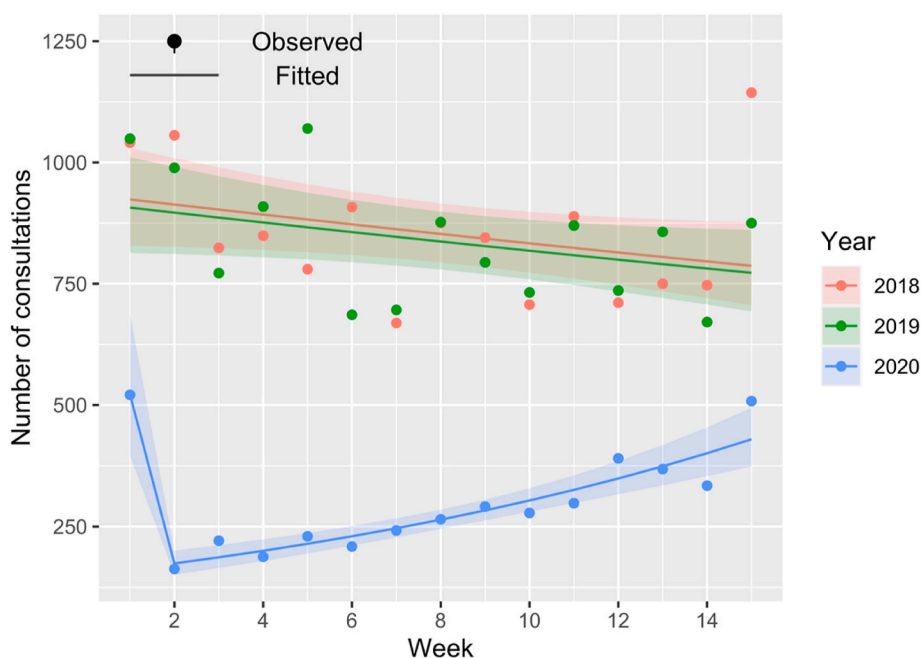
Triage level and its variation between 2020 studied period and 2018–2019..

	2018–2019	2020	P-value	Ratio rate (95% CI)
Triage level 1–2	808 (3.2)	182 (4.1)	0.003434	1.27 (1.085; 1.487)
Triage level > 2	24386 (96.8)	4286 (95.9)		

#### 4. Discussion

In a normal situation, patient flow to the pediatric emergency services often includes a large proportion of low-severity cases, which rarely require advanced emergency care. About 37–47% of patients visiting the ED present with non-emergency afflictions [18,19]. The reasons behind such visits include: high level of parental anxiety, poor social or healthcare education, difficulty accessing primary care or a desire to get answers quickly.

The SARS-CoV-2 pandemic produced a radical change in the



**Fig. 1.** Evolution of the total number of expected visits on each week of the studied period in the different years. The shadowed area corresponds to 95%CI. The data were obtained with the [MT] model.

**Table 3**  
Number of patients attended according to the pathology group and year.

	2018 <sup>a</sup>	2019 <sup>a</sup>	2020 <sup>a</sup>	Percentage variation (95% CI) <sup>b</sup>	P-value <sup>d</sup>
<b>Accident</b>	2614 (21.4)	2518 (21.0)	1065 (24.4)	14.9 [ 7.6; 22.7]	<0.001
<b>Digestive cause</b>	2111 (16.5)	2180 (18.2)	708 (16.2)	-6.5 [ -13.6; 1.3]	0.794
<b>Endocrine cause</b>	22 (0.2)	24 (0.2)	17 (0.4)	104.6 [ 17.3; 256.9]	0.161
<b>Respiratory cause</b>	2971 (24.3)	2640 (22.0)	526 (12.0)	-48.1 [ -52.5; -43.2]	<0.001
<b>CNS cause<sup>c</sup></b>	318 (2.6)	327 (2.7)	150 (3.4)	28.8 [ 7.8; 53.8]	0.076
<b>Infectious cause</b>	2251 (18.4)	2329 (19.4)	939 (21.5)	13.5 [ 5.8; 21.8]	0.006
<b>Drug intake or foreign body</b>	75 (0.6)	65 (0.5)	57 (1.3)	125.4 [ 65.7; 206.7]	<0.001
<b>Onco/haematological</b>	48 (0.4)	47 (0.4)	29 (0.7)	69.0 [ 11.5; 156.2]	0.183
<b>Others</b>	1054 (8.6)	1004 (8.4)	445 (10.2)	19.7 [ 8.1; 32.6]	0.009
<b>Surgical</b>	104 (0.9)	193 (1.6)	97 (2.2)	80.8 [ 43.8; 127.4]	<0.001
<b>Mental health</b>	37 (0.3)	53 (0.4)	43 (1.0)	164.5 [ 83.9; 280.4]	<0.001
<b>Social</b>	9 (0.1)	11 (0.1)	7 (0.2)	93.8 [ -18.1; 358.3]	0.880
<b>Non-accidental trauma</b>	304 (2.5)	289 (2.4)	94 (2.2)	-12.2 [ -29.4; 9.1]	0.984
<b>Cardiological cause</b>	127 (1.0)	100 (0.8)	61 (1.4)	48.8 [ 12.2; 97.4]	0.084
<b>Non-emergency pathology</b>	260 (2.1)	200 (1.7)	130 (3.0)	56.5 [ 28.8; 90.1]	<0.001

<sup>a</sup> Frequencies and percentages corresponding to the distribution of visits to the ED on the studied period each year.

<sup>b</sup> Variations in the weight of the 2018–2019 studied period as compared to the 2020 one (95%CI).

<sup>c</sup> CNS cause: Central Nervous System cause.

<sup>d</sup> Poisson regression.

**Table 4**  
Number of Hospital admissions and its variation between the 2020 studied period and the 2018–2019 one. Hospital stay in days, and its variation between the 2020 studied period and the 2018–2019 one.

	2018	2019	2020	Variation	P-value <sup>b</sup>
<b>Hospital admissions</b>	661	718	376	-45.5 [ -38.9; -51.3] <sup>a</sup>	<0.001
<b>Hospital stay</b>	6.95 days	6.2 days	7.9 days	+20%; +1.3 days	

<sup>a</sup> Reduction (%) in 2020 in relation to 2018–2019 biennium (CI - 95%).

<sup>b</sup> Poisson regression.

organization of healthcare activity. Our data evidenced a marked 66.75% reduction of ED care (95%CI: -65.6; -67.7);  $p < 0.001$ ) in Gran Canaria, much like in other regions of Spain (35.3–65.4% in Madrid; 83.7% in Mallorca) [20–22] and the world: (66.7–76% in Italy, 50–46% in Ireland, 5.6–30.4% in the United Kingdom, 42% in the United States) [4–7,23,24]. The pattern of ED use observed in our study during the pandemic was different from the usual pattern – which slowly decreases from the end of the winter to the spring/summer season and raises again during the autumn/winter season.

The outstanding drop in the number of patients visiting the pediatric ED may be accounted for by several factors such as reluctance to visit the hospital for fear of the pandemic or government advice to stay home. This change is consistent with the observed variation in severity levels, with a ratio rate of 1.27 for triage level 1 and 2 in 2020 compared to 2018–2019 (95% CI: 1.085; 1.487;  $p < 0.0034$ ) and a 25% increase in the

**Table 5**  
Rate of hospital admissions by phase (ratio between total number of patients attended and number of admissions in each phase).

	2018	2019	2020	Percentage variation (95% CI) <sup>a</sup>	P-value <sup>b</sup>
<b>Lockdown</b>	402/ 7501 (5.36)	427/ 7459 (5.72)	221/ 2215 (9.98)	80.1 [ 55.2; 108.9]	<.001
<b>Phase 1</b>	84/1597 (5.26)	110/ 1584 (6.94)	44/570 (7.72)	26.6 [ -8.8; 75.6]	0.1582
<b>Phase 2</b>	59/1454 (4.06)	95/1559 (6.09)	39/726 (5.37)	5.1 [ -26.0; 49.3]	0.7814
<b>Phase 3</b>	82/1440 (5.69)	61/1399 (4.36)	47/632 (7.44)	47.6 [ 6.2; 105.3]	0.0205
<b>End of SoA</b>	34/801 (4.24)	25/582 (4.30)	25/363 (6.89)	61.4 [ 1.1; 157.7]	0.0448

Data are hospital admissions/patients attended (%).

<sup>a</sup> Growth in 2020 compared to 2018–2019.

<sup>b</sup> Poisson regression.

proportion of triage level 2 (95%CI: 6.8–47.6;  $p < 0.006$ ). It can be speculated that these findings may be a result of increased users' awareness of the need of making a proper use of emergency services.

Similar changes in triage levels were also observed in other regions of Spain (e.g. in Madrid, triage levels I and II increased from 21.9% to 33.4% in 2019 to 31.2% and 39.9% in 2020) [20,22]. In Italy the white code fell from 65.8% to 57.9%, while emergency cases rose from 46.3% to 48.9% and resuscitation was 7.1% in 2020 versus 4.7% in 2019 [6,25,26]. In the United States the proportions of patients in triage levels I, II and III were 59.4% in 2020 versus 49.6% in the three-year period 2017–2019 [27] with a reduction of less severe triage levels and a proportional increase in emergency ones. However, data published in Ireland revealed less changes in triage (level I remained stable at 0.7–0.8% in 2020 and 2018, level II was 20.3% in 2020 versus 18.4% in 2018 and 17.9% in 2019, and emergency level scores 1 and 2 corresponded to about 20% of visits both in 2020 and 2019) [4,7]. Such differences could be due to differences in the used triage system.

A further possible cause of decrease in the ED patient flow may reside in mobility restrictions which, together with the closure of schools and nurseries, might have led to significant lifestyle modifications with the consequent reduction in seasonal infections spread. Actually, our data evidenced a 48.1% decrease in visits for respiratory conditions (95%CI: -52.5; -43.2  $p < 0.001$ ). This result is in line with other published series showing up to 90% fall in asthma attacks because of a reduced amount of upper respiratory tract infections [28], or a 70–90% fall in the number of visits for infections [24,29].

In our study a 125.4% increase was found in the number of visits for foreign body ingestion or intoxication during the SoA (95%CI: 65.7–206.7;  $p < 0.001$ ). This was also reported in Ireland, with a 40% increase in intoxication cases [7], or in the United States with 16.4%–20.4% increase in emergency calls to intoxication control centers [30]. These findings suggest that the lifestyle changes derived from measures such as the lockdown or de-escalation phases during the pandemic, might have increased household risks to children. We propose that adequate health and risk-prevention education to families should be reinforced in periods of potentially reduced contact between the population and the healthcare system.

The observed 164.5% (95%CI: 83.9–280.4;  $p < 0.001$ ) raise in the number of psychiatric cases is a matter of concern. Similar results were reported in Ireland (23% increase in the mean number of visits for psychosocial issues) [7]; as well as in China (Hubei), where high levels of children anxiety and depression were observed during the lockdown (anxiety 21.68 in children and 25.56 in adolescents, as measured through the “Spence Child Anxiety Scale”; prevalence in depressive symptoms 6.8% in children and 22.28% in adolescents) [31]. In the

United Kingdom, a questionnaire administered during the lockdown to parents of children and young people with neurodevelopmental disorders, revealed higher prevalence of emotional symptoms (42% vs. 15%) and conduct problems (28% vs. 9%), and fewer prosocial behaviors (54% vs. 22%) as compared to neurotypical controls [32].

A raise in the number of visits to the ED due to psychiatric causes in the pediatric population is a phenomenon repeatedly noticed in recent years (60% increase of visits for general mental health reasons) [33], which seems to have exacerbated during the lockdown. The lack of access to community services specialized in mental health or to psychiatrists or psychologists during the lockdown may have triggered imbalances in a population that is highly vulnerable to changes. On this basis, we propose that the network of pediatric mental healthcare should be strengthened in terms of efficiency and effectiveness and that specific interventions aimed at relieving pediatric emotional distress should be implemented. Similarly, optimizing ED care for this group of patients should be a priority.

In parallel with the decrease in patient flow to the ED, the number of patients admitted to hospital wards decreased by 45.5% (95%CI: -38.9; -51.3;  $p < 0.001$ ), which can be accounted for by the overall decrease in patient flow, lower number of patients presenting with infectious diseases or asthma exacerbation – usually the majority of short-stay admissions – and to the fact that scheduled admissions were postponed.

Although the number of hospitalizations decreased, the rate of patient admission increased (Table 5), a phenomenon also observed in ED services around Spain, the United Kingdom, the United States and Germany, where higher probability of admission (OR 1.2 in the UK and 1.6 in the US) [34] and higher rate of admission (hospitalization rate increasing from 4.8% to 9.7% in Madrid, 8–13% in the US and 13.6%–26.6% in Germany, in 2019 vs. 2020 [22,35,36]) were reported in the times of the pandemic. Such an increase could be due to an increase in the severity of managed cases, to a reduction of hospital visits for mild afflictions or to organizational changes in the EDs.

The duration of hospital stay was also observed to increase as compared to previous years (7.9 days in 2020 versus 6.95 in 2018 and 6.2 in 2019); this finding is potentially related to the causes of increased admission rate.

Regarding the number of complications (affecting 3.9% of hospital admissions), our results were similar to those reported in the United Kingdom, where a 3% delay in seeking pediatric emergency care was estimated [9]. None of the cases in our study had a fatal outcome, differently from the results reported for a small patient series in Italy, where half of the children were admitted to the (PICU) or died [8].

We postulate that the general population should be provided with better health education, especially concerning the warning signs that should lead them to seek emergency care, and with high quality coordinated healthcare services with minimal delays in the management of high priority or complex patients.

## 5. Conclusion

Overcrowding and collapse of hospital emergency services is a global problem with a considerable organizational and financial impact, which may hinder the health system's capacity to provide adequate services to patients with emergency medical problems in a timely manner [12].

The experience gained in recent months should promote a more efficient use of emergency services. In addition, it provides a good starting point for reorganizing hospital pediatric services, with the aim of adjusting them to the actual needs of the population, while preventing abuse or misuse. Possible solutions to ED collapse include providing education on the use of health services, strengthening the role of primary care and improving accessibility of the general population to healthcare services.

It is important to reinforce the message that an adequate management of health services should be granted, providing immediate medical care to patients with severe symptoms or diseases, prioritizing them over

cases that may be deferred for later management, either in-person or through telematic applications. Learning from the changes observed in care services provides us with an opportunity to enhance support to families within and outside the hospital healthcare system.

## 6. Strength and limitations

A strong point of this study is the demonstration of a reduction in patient flow to the ED during the SoA, with a proportional raise in triage level severity, a finding that may reflect an increase in population's awareness about a proper use of emergency services.

Changes in the reasons for visiting the ED were also observed, with an increase in psychiatric disorders – a trend already observed in the last few years that seems to have exacerbated during the SoA – increased numbers of intoxications and foreign body ingestions, proposedly related to the fact that children stayed at home for longer time, and reduced number of patients presenting with respiratory conditions, proposedly due to mobility restrictions and lifestyle changes that reduced seasonal infections spread.

Among the limitations of this study, we include the lack of standardization or codification of the reasons for visiting the ED, which hinders comparability with other studies; the retrospective design; the fact that complications due to delayed ED care were established *a posteriori* by external assessment instead of through direct questions to caregivers; and that severity was established only on the basis of triage level and need for hospital admission, instead of on clinical data.

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## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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