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ORIGINAL ARTICLE

Injury before and during COVID-19 - consequences of quarantine in a pediatric emergency department

Trauma antes e durante a COVID-19 - consequências da quarentena num serviço de urgência pediátrica

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Keywords:
Poisoning,
Child,
Psychological Trauma,
Coronavirus Infections,
Multiple Trauma,
Child Abuse.

Abstract

Objectives: Evaluate the impact of confinement due to COVID-19 in pediatric emergency department (ED) visits due to injuries. **Methods:** Retrospective study performed in a Portuguese hospital. All ED visits from March 19 to May 19 2020 (pandemic confinement) were included and compared with ED visits of the same period in the previous years from 2012 to 2018 (pre-pandemic). **Results:** Between 19 March and 18 May 2020, 1,879 children attended the ED (mean 31 children per day), 19.3% due to injury (mean 6 injuries per day). The average per year in the pre-pandemic group was 10,042 visits (mean 167 children per day), 18.5% due to injuries (mean 30 injuries per day). In the pre-pandemic period 53.4% of injuries occurred in teenagers (>10 years old) and 21.7% in children under 6 years old. In 2020, 34% occurred in teenagers and 58.6% in children under 6 years old. Trauma was responsible for 92% of pre-pandemic admissions, followed by poisoning (5.6%) and child abuse (1.6%). During pandemic, trauma was still the most frequent cause of injury (82%), while the percentage of poisoning (14.4%) and child abuse (3.6%) increased. In 2012-2018, there was a clear difference in the weekly cycle of admissions attributed to injury in the ED, with a lower frequency on weekends. This difference was no longer seen during the pandemic, with a regular distribution by days of the week. **Conclusion:** Confinement has profoundly altered the activity of pediatric EDs and had serious consequences in children's lifestyle.

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Palavras-chave:
Envenenamento,
Criança,
Trauma Psicológico,
Infecções por Coronavirus,
Traumatismo Múltiplo,
Maus-Tratos Infantis.

Resumo

Objetivos: Avaliar o impacto do confinamento devido à COVID-19 nas visitas ao serviço de urgência pediátrica (SUP). **Métodos:** Estudo retrospectivo realizado em um hospital português. Foram incluídas todas as admissões no SUP entre 19 de março e 19 de maio de 2020 (período de confinamento) e comparadas com as visitas no mesmo período de tempo nos anos anteriores entre 2012 e 2018 (pré-pandemia). **Resultados:** Entre 19 de março e 18 de maio de 2020 foram admitidas 1.879 crianças (média de 31 crianças por dia), 19,3% devido a lesões traumáticas (média de 6 por dia). A média por ano no grupo pré-pandemia era de 10.042 visitas (média 167 crianças por dia), 18,5% devido à trauma (média 30 por dia). No grupo pré-pandemia 53,4% do trauma ocorria em adolescentes (>10 anos) e 21,7% em crianças abaixo dos 6 anos. Em 2020, 34% das lesões ocorreram em adolescentes e 58,6% em crianças abaixo dos 6 anos. O trauma foi responsável por 92% das admissões pré-pandemia, seguido do envenenamento (5,6%) e abuso (1.6%). Durante a pandemia, o trauma manteve-se a causa mais frequente (82%), aumentando a percentagem dos envenenamentos (14,4%) e abuso (3,6%). Em 2012-2018 existia uma clara diferença no ciclo semanal de admissões ao SUP devido a lesões traumáticas, com uma menor frequência aos finais de semana. Esta diferença deixou de ser observada durante a pandemia, com uma distribuição regular ao longo dos dias da semana. **Conclusão:** O confinamento alterou profundamente a atividade dos SUP e teve sérias consequências no estilo de vida das crianças.

INTRODUCTION

The traditional view of injuries as accidents, or random events, has resulted in the historical neglect of this area of public health. However, many epidemiological studies show that injuries are among the leading causes of death and disability in the world[1].

Children's mortality from trauma and unintentional injuries has been decreasing consistently in Portugal over the past 25 years. However, trauma and unintentional injuries, or accidents, still constitute an important cause of death in Portuguese children, being the most frequent cause of death from the age of 5. In addition, we know deaths are just the "tip of the iceberg" and for every child that dies many dozens are hospitalized and a few hundred are assisted[2].

Traumatic injuries can be accidental or intentional and range from minor isolated wounds to complex injuries involving multiple organ systems. All trauma patients require a systematic approach to optimize outcomes and reduce the risk of undiscovered injuries.

Pediatric patients with trauma have unique challenges, both practical and cognitive, to front-line care providers. The combination of anatomic, physiologic, and metabolic factors leads to unique injury patterns with different approaches and responses to treatment compared with adults.

External cause-of-injury matrices are an essential tool for standardizing the reporting of injuries by mechanism and intent of injury. The use of these matrices promotes consistency when monitoring injury events over time and across data sources. The external cause-of-injury matrices are based on external cause-of-injury codes from the International Classification of Diseases (ICD). ICD is a classification system developed and published by the World Health Organization to promote international comparability in the collection, classification, and presentation of mortality statistics. Injuries can be described in the ICD in two ways. The first as external cause which describes the cause or mechanism (e.g., cut or pierce, drowning, fall, struck by/against, suffocation, fire, burn or sunburn, poisoning) and intent of death (e.g., unintentional, suicide). The second way describes injuries according to nature of injury, which details the body region and nature of injury (e.g., open wound, superficial/contusion, fracture)[3,4].

Traumatic injuries are the second most frequent diagnosis in children attended in the pediatric emergency department (ED) of Hospital Professor Doutor Fernando Fonseca (HFF), a Portuguese level II hospital in Lisbon that receives a mean of 60,000 children under 18 years of age per year.

In 2020, the coronavirus disease 2019 (COVID-19) pandemic led to a quarantine period in almost every country with schools being closed, which significantly changed the flow to the ED and the causes that motivated their visit[5]. Some studies reported that domestic accidents and injuries resulting from them have increased in number and severity during quarantine[6].

This study aims to evaluate the impact of confinement due to COVID-19 in ED visits among children due to injuries, by comparing two data groups, the pre-pandemic injuries and those that occurred during the social confinement period. In this study, these two groups were compared in relation to raw numbers, type of injuries and their severity, daily and weekly distribution.

METHODS

All children under 18 years old who attended the pediatric ED of HFF with a diagnosis of injury were included. HFF is a level II Portuguese Hospital in the area of Lisbon, and is the third busiest pediatric urgency department in Portugal. Two time periods were considered: the period of social confinement due to the COVID-19 pandemic from March 19, 2020 to May 18, 2020 (pandemic group) and the same period in the previous years from 2012 to 2018 (pre-pandemic group). During the social confinement, schools and kindergartens were closed but outdoor activities were not restricted. Two sample groups were considered: the pre-pandemic (2012-2018) and the pandemic (2020) groups. Data was collected from the hospital's clinical informatics system. Demographic (gender and age), administrative (date and hour of the episode), and clinical data (triage level, complementary diagnostic tests, specialist emergency consultation and diagnosis) were collected.

For the 2020 group we used a more detailed classification based on ICD-10 matrices. We considered the mechanism of injury (cut or pierce, occupant in a transport accident in motor vehicles, pedestrian in a transport accident, pedal cyclist, fall, struck by/against, fire/burn or sunburn, poisoning, bite/sting, sexual abuse, physical aggression, aspiration or unspecified) and intent of injury (unintentional, homicide/assault, suicide/self-harm or undetermined). We also classified the body region (head & neck, thorax, abdomen & pelvis, spine & back, upper extremities, lower extremities, unspecified or multiple body regions), and nature of injury (open wound, superficial/contusion, fracture, dislocation, crushing, burn, foreign body, poisoning-improper use, toxic effects-proper use, sprain/strain, multiple injuries and unspecified).

We analyzed three mechanisms of injury in more detail: trauma, poisoning and child abuse. In poisoning, were included intoxications and foreign body aspiration. In child abuse, physical aggression and sexual abuse were considered.

To determine variations in injury severity, we used the Manchester Triage System that distributes the episodes in 5 severity levels.

This study consisted of a descriptive retrospective analysis. Data was analyzed in SPSS Statistics 23. A *p*-value≤ 0.05 was considered statistically significant.

Patients were unidentified and the study was approved by the hospital ethics committee.

RESULTS

Between 19 March and 18 May 2020, 1,879 children attended this ED (mean of 31 children per day), 19.3% (n=362) due to an injury (6 episodes of injury per day). Between 2012 and 2018, considering the same period of time (from 19 March to 18 May), on average per year, 10,042 children attended the ED (mean of 167 children per day), 18.5% (n=12775) due to injuries, with a mean of 1,825 injuries per year (mean of 30 per day). These results mean an 81% reduction in the total number of emergency episodes and an 80% reduction in the total number of injuries.

In 2012-2018, the weekly flow of admissions was characterized by a steep decrease on weekends attributed to injury in the ED (45% of the weekday episodes). This difference was no longer seen during the pandemic, with a similar daily frequency of admissions on different days of the week (Graphic 1A).

When comparing the attendance to the ED due to injuries over the hours of the day, there was no difference in the circadian pattern in the two groups with a higher affluence from 9 a.m. to 10 p.m. (92% of admissions in the pre-pandemic period; 90% of admissions in the pandemic group), and a lower affluence during the night, from 11 p.m. to 8 a.m. (8% in the pre-pandemic group; 10% in the pandemic group - Graphic1B).

The median age of the pandemic group was 51 month-old (standard deviation 63.7months) and 53% were males. The median age of the pre-pandemic group was 126 month-old (standard deviation 59,2months), being 51.7% female. The independent t-test showed that the 2012-2018 group had a higher mean age versus the group of 2020 (t(379)=12; *p=0.007*).

In the pre-pandemic data, the majority of injuries (53.4%) occurred in teenagers (>10 years old), with other age groups with a lower percentage: school age (6-10 years old) 24.9%, preschool age (2-5 years old) 13%, infants (1 month-2 years old) 8.5% and newborns (<1 month-old) with 0.2%. In 2020, this did not happen. Pre-school children were the predominant group (34.3%), followed by teenagers (26.8%), infants (24.3%), and school age (14.6%). There were no newborns that attended our ED due to injury in the pandemic period. Children under 6 years old corresponded to 21.7% of injury cases, in the pre-pandemic group, while in 2020 they accounted for 58.6% of cases (Table 1).

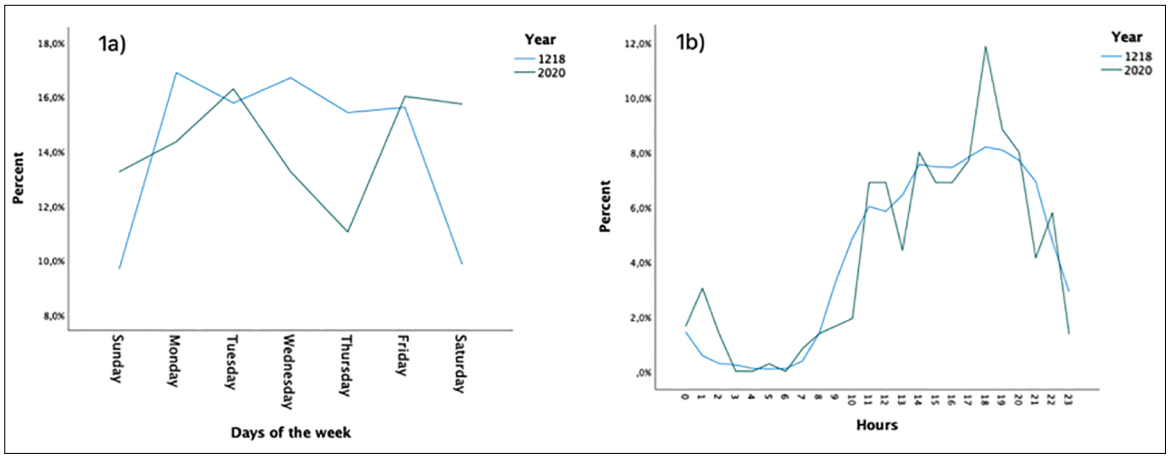
Considering the Manchester Triage System, the majority of admissions in both periods of time corresponded to "standard" category (79.6% in 2020; 68% in 2012-2018). The second most frequent category was "urgent" with 12.2% in 2020 and 23.8% in 2012-2018 (Table 1).

We analyzed injuries according to three mechanisms of injury: trauma, poisoning and child abuse. Trauma was the major category of injury, responsible for 92.9% (n=11863; average of 1,695 per year) of admissions between 2012-2018 and 82% (n=297) in 2020. Followed by poisoning with 5.6% (n=712; average of 102 per year during the period studied) in 2012-2018 and 14.4% (n=52) in 2020. Child abuse corresponded to 1.6% of injuries admitted (n=200; average of 29 per year during the period studied) and 3,6% (n=13) in 2020. It is important to emphasize that these changes in relative frequencies are mainly due to the reduction in the total number of cases in the trauma group (Graphic 2). Applying Pearson's chi-squared test, there is a significant correlation between the type of trauma and the year (*p-value*<0.001).

Calculating the relative frequency of child abuse taking into account the total number of children who attended the ED (not just due to injury), in the pre-pandemic group, abuse was reported in 0,3% (29 of 10,042) of the total episodes. In 2020, it represented 0.7% (13 of 1,879) of the total number of emergency episodes. Regarding poisoning, in the pre-pandemic group they represented only 1% (102 of 10,042) of the total ED visits, while during pandemic they represented 2.8% (52 of 1,879).

Regarding the mechanism of injury during the pandemic group, falls were by far the most frequent mechanism (37.8%, n=137), followed by struck (23.2%, n=84). The injuries were classified as unintentional in 96.1% (n=348), assault in 2.5% (n=9) and self-harm in 2.5% (n=9).

In relation to the affected body region, the most frequent was the head and neck (n=164, 45.3%), followed by the upper extremities (n=91, 25.1%). Concerning the nature of injury, 33.4% (n=121) were superficial or contusions, 30.7% (n=111) were open wounds and 10.8% (n=39) involved foreign



Graphic 1. Number of children attended in the pandemic (2020) and pre-pandemic group (12-18). A) Weekly pattern; B) Circadian pattern.

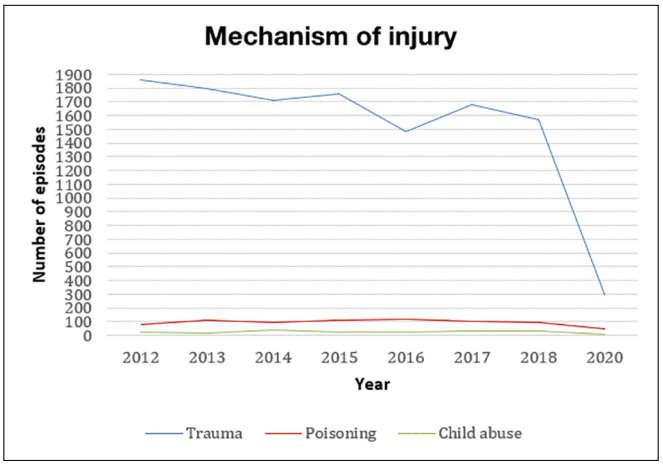
Table 1. Manchester triage system (MTS) and specialist emergency consultation during pandemic (2020) and pre-pandemic (2012-2018) periods.

	PRE-PANDEMIC (N=12775)	PANDEMIC (N=362)
Age group		
Newborn (≤1month-old)	0.2% (21)	0%
Infant (1month-2 years-old)	8.5% (1085)	24.3% (88)
Preschool age (2-5 years old)	13.0% (1666)	34.3% (124)
School age (6-10 years old)	24.9% (3182)	14.6% (53)
Teenager (>10 years old)	53.4% (6694)	26.8% (97)
MTS		
1 (immediate)	0.1% (8)	0
2 (very urgent)	4.8% (589)	5.8% (21)
3 (urgent)	23.8% (2906)	12.2% (44)
4 (standard)	68.0% (8299)	79.6% (288)
5 (non-urgent)	1.0% (122)	0.8% (3)
6 (referred to a medical specialist)	2.3% (276)	1.7% (6)
Total	100% (12200)	100% (362)
Specialist emergency consultation		
Surgery	30.5% (3892; average of 556 per year)	55.2% (200)
Orthopedics	57.3% (7324; average of 1046 per year)	17.7% (64)
Otorrinolaryngology	2.3% (295; average of 42 per year)	3.9% (14)
Ophthalmology	0.8% (106; average of 15 per year)	1.1% (4)
Total	90.9% (11617; average of 1660 per year)	77.9% (282)

bodies (Table 2). We do not have this information regarding the pre pandemic period.

Considering the total time spent in the ED (between admission and medical discharge), in 2020 the mean time was 88 minutes (minimum 6 minutes, maximum 486 minutes), compared to a mean of 98 minutes (minimum 4 minutes, maximum 736 minutes) in the pre-pandemic group. When comparing the time between triage and first medical observation, in 2020, we reported a mean of 9 minutes (standard deviation 19.5 minutes), while in 2012-2018, the mean was 25 minutes (standard deviation 108 minutes). The independent t-test showed that, on average, the 2012-2018 patient group had a bigger total time in the ED than the patient group of 2020 (t(10)=3; *p=0.004*). The independent t-test also showed that, on average, the 2012-2018 patient group presented a longer time between triage and the first medical observation compared to the 2020 group (t(1174)=11; *p<0.001*).

Considering medical observations by other specialties (in addition to pediatrics), in 2012-2018 90.9% of children were observed by other specialist, being the most frequent orthopedics (57.3%), compared to 77.9%, in 2020, with the majority corresponding to general surgery consultations (55.2%) (Table 1).



Graphic 2. Injuries distributed by mechanism (trauma, poisoning and child abuse) over the years. Number of episodes by year.

Thirty-eight percent (n=138) of patients performed an X-ray in 2020, while 62% (n=7977; average of 1140 per year) performed this exam between 2012-2018.

In 2020, 3.3% (n=12) of patients were hospitalized and 3.3% (n=12) were referred to a medical appointment in our hospital. In pre-pandemic period, 2.4% were hospitalized (n=311) and 8.5% (n=1,090) were referred to a medical appointment in the hospital.

DISCUSSION

The more evident difference between the pre-pandemic and pandemic years in the data presented is the significant lower number of children admissions in the pandemic period due to any cause, including injuries. This is evident through the direct comparison of the average number of children attended per day in our ED: mean of 167 per day in the pre-pandemic and of 31 admissions per day during the pandemic period (reduction of 81%). Regarding injuries, although the ratio of injuries remained almost the same, absolute numbers decreased by 80%. This is similar to other countries who went through mandatory curfew, as it is shown in a study about the COVID-19 lockdown in Montréal in which pediatric ED visits decreased by 72% and injury-related ED visits decreased by 62% compared to the previous 5 years[5,7]. These changes are most probably due to the closure of schools, an attempt to decrease the spreading of the disease in general. However, as during the pandemic, people were advised to go to emergency departments exclusively for urgent cases, parents may have decided not to consult, what may mean we are overestimating the reduction our results suggest.

There is a relevant difference when comparing the median age of children with injury (51 vs. 126 months-old) and the predominant age group (children under 6 years represented 58.6% compared with 21.7% and adolescents 34% vs. 54%), which is supported by data on other countries[7]. Apparently, adolescents stayed at home in front of computers or gadgets with no physical activity and consequently no injuries, in opposition to the pre-pandemic period, when adolescents

Table 2. Injury during pandemic. Distribution by mechanism, intent, body region, and nature of injury. Classification based on International Classification of Diseases matrices.

Injury during pandemic		
	n=362	%
Mechanism of injury		
Fall	137	37.8
Struck by/against	84	23.2
Unspecified	46	12.7
Poisoning	28	7.7
Cut/pierce	17	4.7
Pedal cyclist	14	3.9
Bite/sting	11	3.0
Physical aggression	7	1.9
Fire/burn/sunburn	6	1.7
Aspiration	6	1.7
Sexual abuse	2	0.6
Pedestrian in a transport accident (run over)	2	0.6
Occupant in a transport accident in motor vehicles	2	0.6
Intent		
Unintentional	348	96.1
Homicide/assault	9	2.5
Suicide/self-harm	5	1.4
Body region		
Head & neck	164	45.3
Upper extremities	91	25.1
Lower extremities	55	15.2
Multiple body regions	44	12.2
Thorax	5	1.4
Abdomen & pelvis	2	0.6
Unspecified	1	0.3
Nature of injury		
Superficial/contusion	121	33.4
Open wound	111	30.7
Foreign body	39	10.8
Fracture	30	8.3
Sprain/strain	20	5.5
Poisoning (improper use)	10	2.8
Multiple injuries	9	2.5
Burn	7	1.9
Crushing	6	1.7
Dislocation	5	1.4
Unspecified	3	0.8
Toxic effects (proper use)	1	0.3

had more physical activity probably related to their school activities. On the other hand, pre-school children, forced to stay inside their houses, kept their playfulness, leaving them more prone to injuries, leading to the rising percentage of accidents in this age group.

When we compare the relative frequencies in the injury group, and although trauma continues to be the major category of it, this percentage decreased by 10% during the pandemic period, with poisoning and child abuse not decreasing in the same ratio. As such, the percentage of poisoning became higher which suggests that even with the parents at home and their supposed surveillance, children still have domestic accidents, perhaps because they still have more than time to explore and to fuss around, leaving them more prone to domestic accidents.

In relation to child abuse, the percentage of abuses has doubled (from 1.6% in the pre-pandemic group to 3.6% in 2020) but the absolute number remained the same. We must be mindful of this phenomena because the quarantine may increase the risk for psychological and physical child abuse inside home as supported by Lawson et al. (2020)[8]. The numbers depicted in this study may suggest school may have a protective effect, signaling situations that are not detected when children are left at home with their families.

According to the Manchester Triage System, the priority of injuries also changed, during the pandemic group there was a tendency to decrease the percentage of urgent cases, with an increase of standard priority compared with the previous years. Children had less accident and less clinically relevant ones.

The difference between the pre-pandemic and pandemic temporal pattern in weekly cycles hospital admissions throughout the week is evident, showing that in our population, accidents happen mainly at school, where children seem to have their main physical activities - when schools close, the number of daily accidents on weekdays and weekends was similar, in opposition with the weekly pattern in the pre-pandemic years. The circadian distribution remained the same in the 2020 group and the pre-pandemic group, with an evident decrease of number of episodes at main meals hours and during the night. This may show our emergency department, not being referred, is used for convenience by families.

When we compare the time between triage and medical observation and total length of stay in the ED, both were significantly lower, which can be explained by the reduction of total hospital admissions, leading to a faster response by the nursing and medical staff of the ED.

In 2020, children were less assisted by other specialties, mainly orthopedics. The sharp decrease in observation by orthopedics may be due to the fact that trauma was the category that had the most reduction. In addition, it is necessary to bear in mind that face-to-face medical consultation decreased and phone assisted medicine raised during the quarantine as a mean to decrease risk of COVID-19 infection.

This study may prove the relevance of school activities in children's life and health in our country. In a previous study, it was shown that acute diseases in children (namely respiratory infections and trauma) are significantly related to the school calendar[9]. With this study we may conclude that trauma episodes in the ED changed significantly related to the closure of schools. Even though in Portugal children were permitted to play outdoors during quarantine, our study suggests that most of them stayed at home without physical activity during that period of time. This is a sign of a relevant role of schools in children's health in this region.

One limitation of our study is the fact that our hospital is not a pediatric trauma center and, for this reason, does not receive the polytraumatized seriously ill patient.

We also underscore the fact that this study relied on data from one specific region in the geographic Lisbon area and cannot be used to infer trends over the general population.

CONCLUSION

Confinement has profoundly altered the activity of pediatric EDs.

These changes may mean children during confinement performed very little physical activity, although there were no restrictions on going outside and outdoor activities in our country.

At home, accidents did not decrease in the same magnitude, showing that even with parents at home and more surveillance by family adults, children kept putting themselves at risk of domestic accidents. In relation to child abuse, we may also conclude that the protective role of school may be a very relevant one.

Confinement inevitably had serious consequences on children's quality of life, in many different unexpected aspects.

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