Attendance to the pediatric emergency department during COVID-19 lockdown

Natacha Loumaye [a], Julia Bokias [b], Mohamed H. Iraki [b], Michele Dramaix [c], Tessa Goetghebuer [a], Elisabeth Rebuffat [a]

[a] CHU Saint-Pierre, Department of Pediatrics, Brussels, Belgium
[b] Erasme Brussels University Hospital, Department of Pediatrics, Université libre de Bruxelles, Brussels, Belgium
[c] Research Center of Health Policy and Systems-International Health, School of Public Health, Université Libre de Bruxelles, Brussels, Belgium
NL, TG an ER contributed equally to this work and share senior authorship

natacha.loumaye@outlook.fr

Keywords

SARS-CoV-2 ; COVID-19 ; pediatric emergency ; collateral damage ; delayed attendance ; diagnoses ; outcome ; side effect.

Abstract

Objectives: SARS-CoV-2 started during the winter of 2019-2020. In Belgium, the first lockdown was instituted between March 18th and May 4th. The attendance to the pediatric emergency department (PED) decreased drastically during this period.

Our study aimed to assess the repercussions of the lockdown on the rate of attendance, evaluate the delay between the onset of symptoms and admission to the PED and the cause of admission in 2020 and 2019.

Methods: This is a retrospective study in a public university hospital in Brussels (CHU Saint-Pierre).

Attendance to the PED during the study period in 2020 (March 18th - May 4th) was compared to the same period in 2019. Chi² test and Mann-Whitney tests were applied and prevalence ratios (PR) with 95% CI were computed. The median of the delay was derived from a survival analysis (Kaplan-Meier) and a log-rank test was used to compare this delay between 2019 and 2020.

Results: During the study period, the number of admissions to PED decreased from 3,087 in 2019 to 783 in 2020 (IR 2020/2019: 0.25, 95%CI: 0.23-0.27). The median delay between the onset of symptoms and the admission to the PED was longer in 2020 than in 2019 (3 days and 2 respectively ($p<0.001$). Children with comorbidities were 1.33 times more likely to attend the PED in 2020 (95%CI: 1.08-1.63).

Intoxication, burns, urogenital and neurological conditions were relatively more frequent, while there were fewer diagnoses of gastrointestinal conditions and fractures in 2020 compared to 2019.

Conclusion: The rate of attendance in PED decreased during the lockdown in 2020 compared to 2019, with a longer delay between the onset of symptoms and the admission to the PED during the lockdown. There is a difference in the distribution of diagnoses in 2020 compared to 2019. This study does not allow us to conclude to any increased morbidity rate but the collateral damage on children should not be overlooked.

Introduction

SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus 2) appeared during the winter of 2019-2020. The number of people infected and the severity of the disease have led to a saturation of the global health care system. Infected patients present with cough, dyspnea, fever, sore throat, rhinorrhea, anosmia, and gastrointestinal symptoms. During the first phase (March to May 2020), children accounted for less than 2% of the positive tests performed globally (1–3). Children were more often asymptomatic or paucisymptomatic compared to adults.(4–7).

To minimize the circulation of the SARS-CoV-2 virus, the government imposed a lockdown. In Belgium, a lockdown was instituted between March 18th and May 4th. The lockdown and its economic consequences limited the access to hospitals and healthcare in general. Most hospital activities were reduced except those in the emergency ward. Many human and material resources were deployed to provide COVID-19 care. It has been already stated elsewhere that non-emergency conditions were delayed (8).

A reduction in the attendance in the pediatric emergency department (PED) was described in many settings (1,9–11). Lazzerini was one of the first to highlight a fall in the attendance in PED in Europe. For example, in Italy, Lazzerini showed a decrease of 73% in the attendance rate in 2020 compared to the same period in 2019 (1). In UK, Isba showed a decrease of 33.8% in the attendance rate in PED in February and March 2020 compared to the same period in 2019 (10).

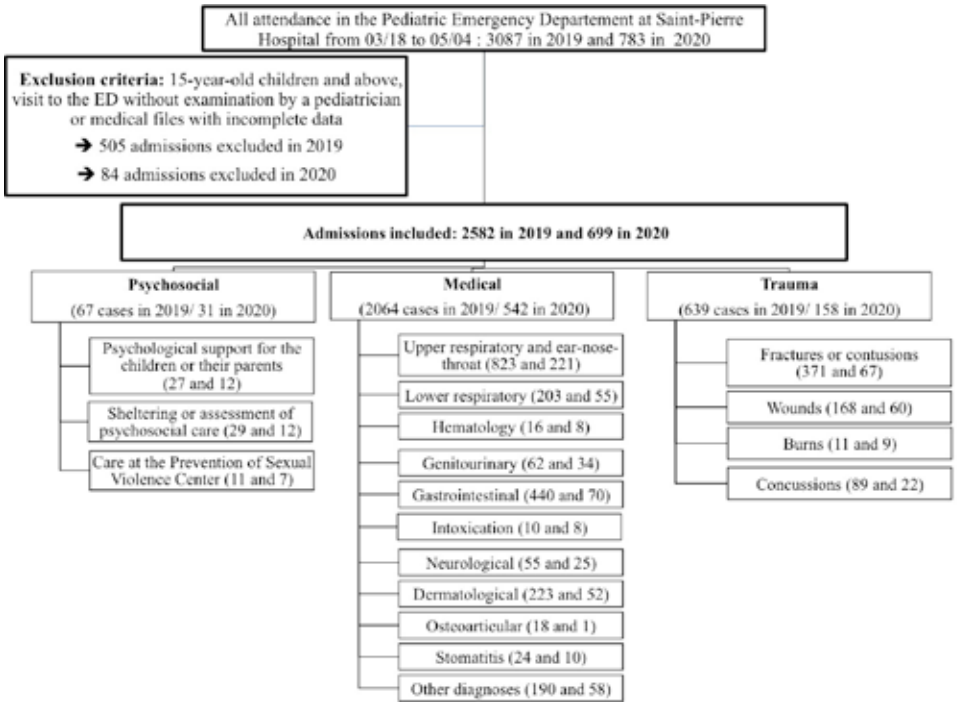
Feral et al. alerted to possible collateral damage leading to lack of diagnostic and care (12). Increased rate of severe pathologies (like urinary tractus, abdominal emergency, stroke, heart disease) has been demonstrated in the adult population during the lockdown period compared to March and April 2019 (13,14). Disruption of childhood vaccination campaigns raised the fear of resurgence of other vaccine preventable infectious diseases (8).

This lockdown had an impact on the circulation of other viruses involved in respiratory or gastrointestinal pathologies. The political measures prohibited the practice of sports in clubs and closed schools, which could have modified the traumatology encountered in pediatric emergencies.

Our study aimed to observe changes in incidences of PED visits in CHU Saint-Pierre between 2020 and 2019. The primary objective is to assess the repercussions of the lockdown in 2020 on the rate of attendance to PED. In secondary objectives, we aimed to evaluate the delay between the onset of symptoms and admission to the PED and the cause of admission in 2020 and 2019.

Figure 1:
Flow chart of medical file selection.

All causes of admission to pediatric emergency department were classified in psychosocial, medical and trauma categories. The subcategories of diagnoses are presented in this figure.



Materials and methods

We conducted a retrospective cohort study in the PED of CHU Saint-Pierre, the national reference center for the management of highly contagious respiratory viruses. This public university hospital is located in Brussels downtown.

In Belgium, the lockdown was instituted between March 18th and May 4th which is the study period. All attendance data to the PED during the study period in 2020 and 2019 were reviewed. Exclusion criteria were: children older than 15-years, visit to the PED without examination by a pediatrician and medical file with incomplete notes. The number of admissions was counted after applying these exclusion criteria. In our hospital, children can receive nursing care in the pediatric emergency room every morning for 2 hours. These admissions of children without a consultation by a pediatrician were not counted as emergency room visits. Some patients with pediatric chronic diseases are seen in the PED after they turn 15 years old. These patients older than 15 years were not counted as emergency room visits in PED (age limit of 15 years based in Belgium on the Royal Decree of 13 July 2006).

The flow chart of the medical file selection is shown in Figure 1.

The first author, NL, collected the data with the help of co-authors JB and MI. The information was stored in a coded Excel file. The following data were extracted from the medical file on the computer system Xperia: age, sex, comorbidity, date of attendance, date of the onset of symptoms, date of the admission to the PED, additional laboratory and radiologic investigations, diagnosis at discharge, discharge disposition (return home; hospitalization; transferred to Intensive Care Unit (ICU); death). In each patient's file, the date of onset of symptoms was recorded as reported by the child caregiver. The delay between the onset of symptoms and the admission to the PED was the difference in days between the date of symptom onset and the date of admission to the PED.

For our secondary objective, the cause of admission to the PED was classified into psychosocial, medical or trauma categories. Each category was divided into diagnostic subcategories according to a classification created for this study (Figure 1). Comorbidities were classified as allergy, respiratory disease, genetic disease, renal disease, hematologic disease, cardio-vascular disease, premature birth and neurological disease. Comorbidities included those identified in previous visit notes and those highlighted in the emergency department visit during the study period.

The classification system used to categorize reasons for admission was established at the time of application to the ethics committee. The subcategory for stomatitis was added after the first two weeks of coding. Previous records were reanalyzed with this new category.

A composite marker was used to determine appropriate visits to the PED, including children needing further examinations or surgical advice, children referred to the PED by a physician and children requiring hospitalization (15).

The institutional ethics committee approved this study on May 14th 2020.

Statistical analysis

The study focuses on the analysis of the year 2020 compared to 2019. To ensure that 2019 was representative of years prior to COVID-19, the PED attendance rates in 2020 were also compared to PED attendance in 2017 and 2018. The number of PED admissions was compared over the same period between 2017 and 2020. With the exception of the PED attendance rate, no further analysis was done on the patients included in 2017 and 2018.

Attendance rate ratios, exact 95% confidence intervals (95% CI) and mid p-values were computed.

Comparison of the admissions to the PED between 2019 and 2020 was performed after exclusion of the children older than 15 years or with missing data (Figure 1). Chi-square test and Mann-Whitney tests were used to calculate prevalence ratios (PR) with 95% CI.

The median of the delay between the onset of symptoms and admission was derived from a survival analysis (Kaplan-Meier) and a log-rank test was used to compare this delay between 2019 and 2020.

All tests were two-tailed and the significance level was set at alpha = 0.05. Statistical analysis was performed with Stata/IC15.0 and Jamovi 1.1.9.0. The graphics were generated with GraphPad Prism 8.4.3.

Results

Between March 18th and May 4th, the incidence of PED visits was 783 in 2020 compared to 3,087 in 2019, representing a decrease of 75% in 2020. The daily incidence decreased from 66 patients in 2019 to 17 patients in 2020. The daily incidence during the study period was similar in 2017, 2018 and 2019. The attendance rate in 2020 compared to 2019 showed an IR (incidence ratio) = 0.25 (95%CI: 0.23-0.27). The attendance rate was also significantly lower in 2020 compared to 2018

and 2020 compared to 2017 IR=0.26 (95%CI: 0.24-0.28) and IR =0.26 (95%CI: 0.24-0.28) respectively.

Table 1 shows the number of attendance to PED in 2019 and 2020, globally and in each diagnostic category. We can see that the absolute numbers of admissions in each category (psychosocial, medical or trauma category) were lower in 2020 compared to 2019. However the relative rate in attendance for a psychosocial condition was higher in 2020 than in 2019 (4.4% versus 2.6%, 95%CI: 1.13-2.59).

Table 1: Comparison of admission to PED from 03/18/2019 to 5/04/2019 and from 03/18/2020 to 5/04/2020.

The absolute number of admissions in each category was lower in 2020. In proportion, it appeared that psychosocial condition was more frequent in 2020 compared to 2019 while trauma and medical conditions were less frequent.

	Cohort 2019 n (%)	Cohort 201920 n (%)	Prevalence Ratio (95% CI)
Admission to the PED (n)	2,582	699	
Patients (n)	2,422	639	
Number of visits to PED [a]			
1	2,282 (94.2%)	587 (91.9%)	0.69 (0.54-0.88)
2	122 (5.0%)	47 (7.4%)	1.45 (1.03-2.06)
>2	18 (0.7%)	5 (0.8%)	1.03 (0.38-2.77)
Admission for psycho-social condition	67 (2.6%)	31 (4.4%)	1.71 (1.13-2.59)
Admission for medical condition	2,064 (79.9%)	542 (77.5%)	0.97 (0.93-1.01)
Admission for trauma condition	639 (24.8%)	158 (22.6%)	0.91 (0.78-1.06)

a p=0.073 (Chi²)

Table 2: Characteristics of the study population attending Pediatric Emergency in 2019 and 2020.

Comorbidities were classified in allergy, respiratory disease, genetic disease, renal disease, hematologic disease, cardio-vascular disease, preterm and neurological disease categories.

	Cohort 2019 2,422 patients	Cohort 2020 639 patients	p–value	Prevalence Ratio (95% CI)
Median age (P25-P75) (years)	3.1 (1.1-7.7)	2.7 (1.1-7.0)	0.188	
Gender M (n, %)	1,346 (55.6%)	335 (52.4%)	0.155	0.94 (0.87-1.02)
Comorbidities (n, %)	294 (12.1%)	103 (16.1%)	0.008	1.33 (1.08-1.63)
Median* delay between the onset of symptoms and the admission to the PED (P25-P75) (days)	2 (1-4)	3 (1-5)	<0.001	

* Survival analysis (K-M); log-rank test.

The characteristics of children attending PED in 2020 and 2019 were compared (Table 2). The presence of comorbidities was proportionally 1.33 times more frequent in 2020 than in 2019 (95%CI: 1.08-1.63). The median delay between the symptom onset and the admission to the PED was longer in 2020 than in 2019 (3 days and 2 days respectively (p<0.001). Figure 2 shows the difference in delay between the symptom onset and the admission in 2020 and 2019 by admission category. The increase in delay in 2020 is statistically significant for global admission, upper respiratory infections and gastrointestinal conditions.

The ratio of proportions of admission for each category in 2020 versus 2019 is presented in a Volcano Plot in Figure 3. Urogenital, neurological conditions, intoxication and burns were relatively more frequent in 2020 compared to 2019, while the gastrointestinal conditions and fractures were relatively less frequent in 2020 than in 2019. There were no statistically significant differences for the other conditions.

Details of additional investigations performed at the PED are shown in Table 3. The proportions of blood test, urinalysis, and nasopharyngeal swabs were higher in 2020 than in 2019 but the proportion of imaging was not significantly different.

The rate of appropriate emergency visits as defined by Ben Ahmed was similar in 2019 and 2020 (54% and 58% respectively; PR= 1.07; 95%CI: 0.99-1.15) but PED discharge was more often followed by a pediatric visit in 2020 than in 2019. (15) Moreover the proportion of patients hospitalized was higher (16.2% in 2020 versus 9.4% in 2019; PR=1.72; 95%CI: 1.40-2.11), except to the ICU (0.4% and 0.5%; PR=0.85; 95%CI: 0.24-2.98), the median length of hospitalization was similar in 2020 and in 2019 (2 days in 2019 and 2 days in 2020, p-value<0,001).

PCR for identification of SARS-CoV-2 was performed only in children who were hospitalized (n=113). Ten (8.8%) swabs were positive, with only 3 patients presenting upper or lower respiratory symptoms.

No diagnosis of Multisystem Inflammatory Syndrome in Children (MIS-C) was made during the study period.

Discussion

This study compares the rate of attendance to PED in 2020 and 2019. We report that the number of pediatric admissions was 4 times lower in 2020 compared to the years 2017, 2018 and 2019, similarly to reports from Italy, Ireland, USA and United Kingdom (1,9,10,11,16). Prior to the pandemic, a decrease in ED attendance was described in the literature following natural disasters and during the financial crisis (17–19). Although the daily number of patients attending the ward in 2020 is small, the difference with 2019 undoubtedly reflects the situation in 2020. Comparisons in terms of diagnoses and time from symptom onset to consultation are impacted by the small size of the 2020 cohort. The statistical power is dependent on the sample size.

When comparing the characteristics of children attending PED in 2020 and 2019, those attending in 2020 have higher rates of comorbidities, probably because parents of children with comorbidities are more prompt in seeking medical care and would be less likely to postpone medical visits. Vulnerable children were more affected. Patients with chronic conditions accounted for 27.8% of PED visits in 2020 compared with 23.7% in 2017, 2018 and 2019 (16).

The delay between symptom onset and ward attendance was longer in 2020 than in 2019. Mc Donnel has suggested that some hospitalizations can be avoided if patients are admitted to the ED without delay (11). We observed an increase in the hospitalization rate. Possible causes are: parental fear of nosocomial SARS-CoV-2 infections, the difficulty in accessing hospital care due to lockdown measures and the closure of hospital beds. Indeed, one of the two pediatric hospitalization units has been converted into an adult ICU unit. The closure of the temporary hospitalization room in the PED also had an impact on the hospitalization rate in 2020 for inpatient care of less than 24 hours.

During the 2020 study period, more follow-up visits were scheduled after hospitalization. The hypothesis of increased follow-up is related to the shorter hospital stay in 2020. Additional pediatric follow-up appointments were scheduled to prevent clinical deterioration at home.

Finkelstein et al compared PED attendance in Canadian tertiary hospitals in a 2018-2020 cohort and during the first wave. Finkelstein showed an increase in the proportion of children hospitalized in ICU and non-ICU

Figure 2:
The difference of the mean number of days between the onset of symptoms and the admission in 2020 and 2019 was reported by subcategories.

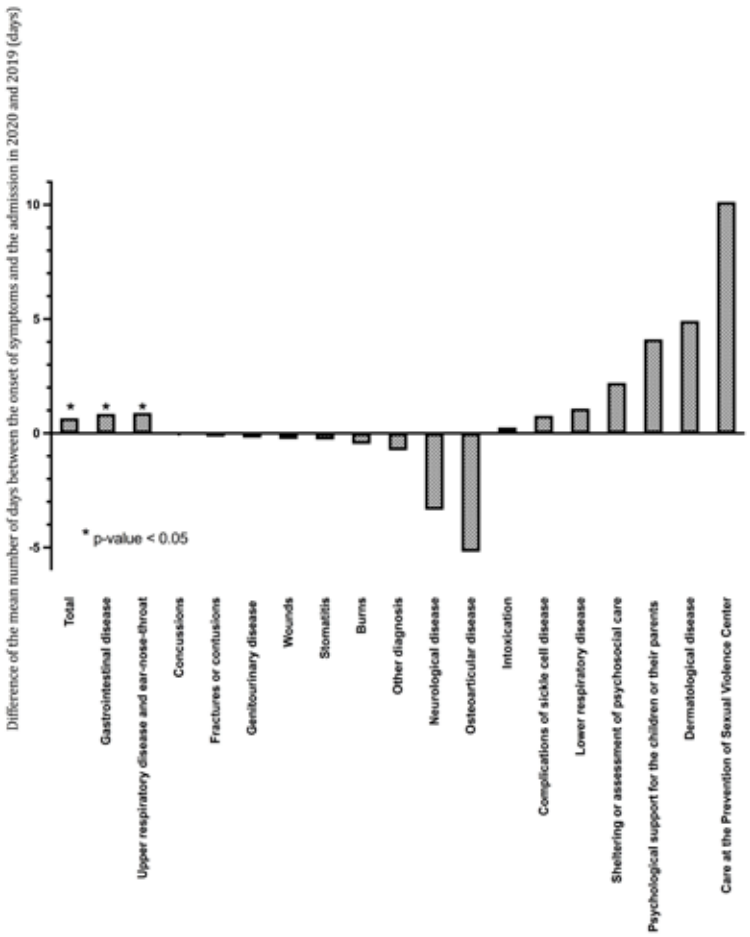


Table 3: Comparison of investigations performed in the emergency department in 2019 and 2020.

	Cohort 2019 N= 2,582 admissions	Cohort 2020 N= 699 admissions	Prevalence Ratio (95% CI)
Nasopharyngeal swabs (n, %)	268 (10.4%)	128 (18.3%)	1.76 (1.45-2.14)
SARS-CoV2 positive swabs (n, %)	NA*	10 (1.4%)	-
Blood test (n, %)	399 (15.5%)	147 (21.0%)	1.36 (1.15-1.61)
Urine test (n, %)	237 (9.2%)	93 (13.3%)	1.45 (1.16-1.81)
Chest imaging (n, %)	145 (5.6%)	42 (6.0%)	1.07 (0.77-1.49)
Other imaging (n, %)	328 (12.7%)	82 (11.7%)	0.92 (0.74-1.16)
Referred by a physician to the PED (n, %)**	340 (13.2%)	105 (15.0%)	1.14 (0.93-1.40)
Hospitalization rate (n, %)	243 (9.4%)	113 (16.2%)	1.72 (1.40-2.11)
ICU* transfers (n,%)**	13 (0.5%)	3 (0.4%)	0.85 (0.24-2.98)
Pediatric follow-up medical appointments (n, %)	511 (19.8%)	208 (29.8%)	1.50 (1.31-1.73)
Appropriate visits in PED (n, %) #	1,395 (54.0%)	403 (57.7%)	1.07 (0.99-1.15)

* NA= Not applicable **PED = Pediatric Emergency Department *** ICU = Intensive Care Unit

This marker included children who had been referred by a physician to the PED and those who needed additional examinations, surgical advice (wound, fracture) or hospitalization.

during the first wave but with a similar lengths of stay. There were no differences in mortality between two groups. This author concluded that Canadian children were sicker during the early-pandemic period, even though there were no differences in mortality or length of stay (20). The results of our study must be put into perspective with this Canadian study. The absence of deaths and the stable proportion of ICU admissions do not allow us to conclude that there is a higher morbidity and mortality rate during our study period.

The parents had the possibility to call the PED for a telephone advice during the different years studied. The number of telephone calls did not increase significantly (personal communication).

General practitioners were mainly overwhelmed by the adult patient population. Private pediatricians continued their practices and helped to filter out visits to the PED. Although, the population attending the Saint-Pierre public hospital is not used to going to see a pediatrician or a general practitioner before going to the emergency room.

Walk-in consultations were maintained during the pandemic but the number of regular pediatric consultations was reduced. Our hospital's pediatricians have been working as part of the adult emergency team.

The rate of appropriate emergency department visits was about 50% in 2019 and 2020. However, this rate is lower than that found in a Belgian study carried out in 2010 (60%), but higher than in the USA (42%) or in Italy in 2010-2011 (43%) (15,21–24).

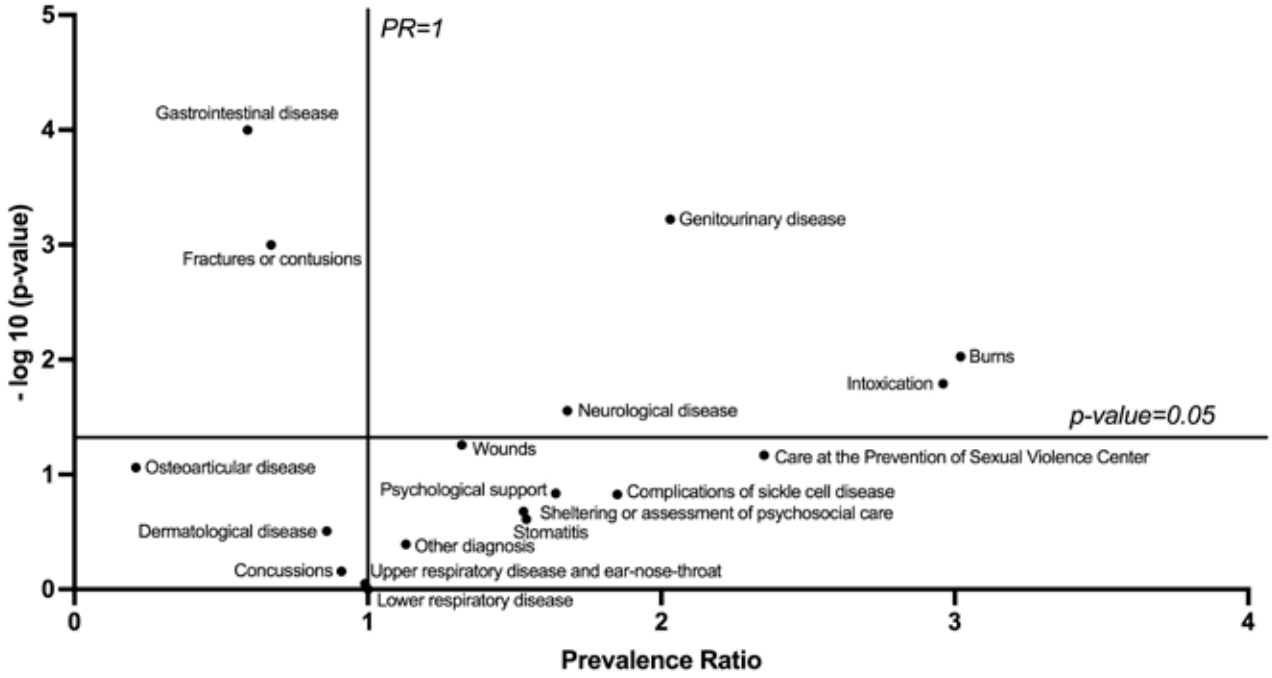
Despite a decrease in the absolute number of visits for PED, the proportion of diagnosis categories changed in 2020. It appears that the proportion of admission for burns was higher in 2020 than in 2019 but the absolute number of burns was similar. However, in Ireland, the proportion of injuries and intoxications was similar in 2018, 2019 and 2020 (25). The lower rate of fractures and contusions is probably due to the cessation of sports practice, school closures, playground closures, but also a reduction in road traffic accidents due to teleworking (9,11). Urogenital conditions were relatively more frequent, while gastrointestinal conditions were less frequent. This is probably related to the restriction of contacts due to confinement, which may affect the rate of gastroenteritis but not urinary tract infections. In adults, one study reported more severe urinary tractus infection but fewer ED visits in 2020 compared to 2019 (13). A Canadian multicenter study reached the same conclusions regarding the significant decrease in gastroenteritis diagnoses. This study included cohorts with larger daily visits than our study (22,654 admissions in 2019 and 7,535 in 2020) (26).

The COVID-19 crisis and its impact on the economy led to an increased risk of mental illness, domestic violence and child abuse (27–31).

While admissions for psychosocial conditions were relatively more frequent in 2020 than in 2019, it is likely that the real number of cases of child abuse or psychological distress in 2020 was even higher (32). The number of traumatic injuries caused by physical child abuse in 2020 is twice to the number in 2019 and 2018 (8, 4, and 3 cases respectively) (33). The Centers for Disease Control and Prevention showed that the proportion of mental health–related visits in PED increased in 2020 compared to 2019 (+24% for children aged 5-11 years, and +31% for children aged

Figure 3: Volcano plot of Prevalence ratio to Pediatric Emergency Department by clinical categories in 2020/2019.

The dots in the upper left side show a significant decreased in proportions (PR <1 and p-value <0.05) for gastro-intestinal conditions and fractures in 2020. The dots in the upper right side show a significant increase in proportions in 2020 (PR >1 and p-value <0.05). Urogenital, neurological conditions, intoxication and burns were relatively more frequent in 2020 compared to 2019. The dots below the horizontal row are not significant; there were no significant differences for the other conditions.



12-17 years) (34). During this pandemic, the overloaded medical teams, the reduced number of pediatric consultations, as well as the modified calendar of medical appointments, compromised good support for patients. School closures also reduced the number of alerts for child abuse alerts by teachers (35,36). CHU Saint-Pierre hospital is a reference center for sexual violence in Brussels and is one of the two reference centers for child abuse. During the lockdown period, the number of child abuse reports was much lower than in the previous year (141 versus 215) (Vanthournout, SOS enfant, personal communication). The number of calls to the dedicated crisis line to help children in the French-speaking region of Belgium was similar. (6,668 during the period studied in 2020 and 6673 in 2019). However, the proportion of calls for maltreatment has almost doubled (18.8% for the whole of 2020 versus 10.8% in 2019). (Courtoy, Ligne écoute téléphonique 103 Ecoute Enfant, personal communication).

Finally, we have identified few COVID-19 patients in our study. According to the guidelines of the Belgian Health Care , nasopharyngeal swabs for SARS-CoV-2 PCR were performed only in case of hospitalization. Indeed, the COVID-19 cases were underestimated, we see only the tip of the iceberg. In a Greek study, no SARS-CoV-2 was detected in PED during the first wave (0/60 tests). However, during the second containment, the positivity rate increased to 23% (69 positives out of 299 tests) (37). According to Belgian data , there were 600 cases of COVID-19 in children under 19 years of ages during the period between March 18th and May 4th, including 233 cases were in children under 10 years of age. In the Brussels region, there were 65 cases of COVID-19 in children under 19 years of age from March 18th to April 5th, 2020.

To our knowledge, there is no Belgian publication on PED attendance during COVID-19.

The children suffered more from the collateral damage and other pathologies than from COVID-19 in 2020. One of the lessons of our study is to better understand what diagnoses are encountered in the event of a lockdown and how to improve the management and referral of these patients in the future. Targeted prevention campaigns could be disseminated during a future pandemic. Knowing the type and proportion of diagnoses will allow better allocation of personnel and resources in the event of a future health crisis.

This study has some limitations. Data were collected retrospectively for both years. This mono-centric study took place in the national reference center for the management of highly contagious respiratory viruses in Belgium. Therefore, due to the fear of SARS-CoV2, attendance at this hospital cannot reflect the attendance at another hospital. The number of patients attending the ward every day in 2020 is small, but it reflects the situation in 2020. The difference is undoubtedly statistically significant between the number of attendance in 2020 compared to 2019 or 2020/2018 or 2020/2017. Changes have been observed, but a causal link could not be formally demonstrated. This study does not allow us to conclude an increased morbidity rate due to the lockdown. Furthermore, an assessment of long-term morbidity in the post-COVID period cannot be derived from an analysis of emergency department admissions in 2020. To better assess the long-term impact of this pandemic, epidemiological studies on the health of children attending schools and health prevention centers are needed.

Pediatric studies are a small part of the scientific literature. All of the studies used in the discussion were small and of short duration in 2020. The SARS-CoV-2 virus had different variants over the next two years. The mutations have resulted in a variety of COVID-19 impairments and severities. Most of the studies that contribute to this discussion are focused on the first wave.

Moreover, we may have missed some relevant studies by including only English language publications.

Conclusion

In conclusion, as observed in many other countries, the rate of attendance at the PED of CHU Saint-Pierre decreased during the lockdown in 2020 compared to the same study period in 2019. The delay between the onset of symptoms and the admission to the PED was longer, and the hospitalization rate was higher during the lockdown. There is a difference in the distribution of diagnoses in 2020 compared to 2019.

This study highlights the implications of the lockdown on various aspects of the pediatric care.

Conflict of interest

The authors have no conflict of interest to declare.

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