



## Incidence of child abuse with subdural hemorrhage during the first year of the COVID-19 pandemic: a nationwide study in France

Fiorella Caron, Pierre Tourneux, Hyppolite Kuekou Tchidjou, Ariski Taleb, Richard Gouron, Michel Panuel, Céline Klein

### ► To cite this version:

Fiorella Caron, Pierre Tourneux, Hyppolite Kuekou Tchidjou, Ariski Taleb, Richard Gouron, et al.. Incidence of child abuse with subdural hemorrhage during the first year of the COVID-19 pandemic: a nationwide study in France. *European Journal of Pediatrics*, 2022, 181 (6), pp.2433-2438. 10.1007/s00431-022-04387-x . hal-04009307

**HAL Id: hal-04009307**

**<https://u-picardie.hal.science/hal-04009307>**

Submitted on 9 Oct 2023

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution 4.0 International License



# Incidence of child abuse with subdural hemorrhage during the first year of the COVID-19 pandemic: a nationwide study in France

Fiorella Caron<sup>1</sup> · Pierre Tourneux<sup>1,2</sup> · Hyppolite Kuekou Tchidjou<sup>3</sup> · Ariski Taleb<sup>4</sup> · Richard Gouron<sup>5</sup> · Michel Panuel<sup>6</sup> · Céline Klein<sup>5,7</sup>

Received: 15 October 2021 / Revised: 20 January 2022 / Accepted: 21 January 2022 / Published online: 17 March 2022  
© The Author(s), under exclusive licence to Springer-Verlag GmbH Germany, part of Springer Nature 2022, corrected publication 2022

## Abstract

The global COVID-19 pandemic prompted governments to impose unprecedented sanitary measures, such as social distancing, curfews, and lockdowns. In France and other countries, the first COVID-19 lockdown raised concerns about an increased risk of child abuse. Abusive head trauma (AHT) is one of the most serious forms of child abuse in children aged 0–24 months and constitutes the leading cause of death in children under 2 years of age. Subdural hemorrhage (SDH) is present in 89% of cases of AHT and constitutes one of the most specific, objective clinical presentations in the diagnosis of child abuse. In a French nationwide study, we sought to evaluate the potential impact of the first year of the COVID-19 pandemic on the incidence of hospital admissions for child abuse with SDH, relative to the two previous years. We conducted a nationwide, retrospective study of data in the French national hospital discharge summary database by applying the International Classification of Diseases (10th Revision) codes for SDH and for child abuse. After including children aged up to 24 months with a diagnosis of child abuse and/or SDH following hospital admission anywhere in France between January 1, 2018, and December 31, 2020, we compared the incidence of child abuse, the incidence of SDH + child abuse, and the demographic data for 2020 with the corresponding values for 2018 and 2019. There were no significant differences in the number of hospital admissions due to child abuse or SDH + child abuse between 2020 and the 2018/2019 control years. The incidence of SDH + child abuse was higher among boys than among girls. There were significantly fewer hospital admissions in May 2020 ( $p = 0.01$ ) and significantly more in December 2020 ( $p = 0.03$ ), relative to the same months in the two preceding years. There was a nonsignificant trend toward a lower incidence of hospital admission for child abuse in 2020, relative to 2019 (decrease: 6.4%) and 2018 (decrease: 7.6%).

**Conclusion:** When considering children under the age of 24 months in France, the incidence of hospital admission for SDH in the context of child abuse was not significantly higher in 2020 than in the two previous years.

## What is Known:

- The impact of COVID-19 lockdown on child abuse and more specifically on subdural hemorrhage remains unknown.

## What is New:

- There was no increase in hospitalizations for child abuse and AHT.
- We found that boys are more often victims of child abuse and subdural hemorrhage among children aged less than 12 months.

**Keywords** Child abuse · COVID-19 · Subdural hemorrhage

## Abbreviations

AHT	Abusive head trauma
COVID-19	coronavirus disease 19
SDH	Subdural hemorrhage

Communicated by Gregorio Paolo

✉ Céline Klein  
celinekleinfr@yahoo.fr

Extended author information available on the last page of the article

## Introduction

During the COVID-19 pandemic, the announcement of France's first period of lockdown (on March 14, 2020) raised concerns about a possible increase in the risk of child abuse [1]. Family relationships were inevitably modified by the almost permanent presence of all family members under the same roof (due to the closure of daycare centers, and with parents teleworking from home), the associated climate of

fear, social isolation, and (in some cases) the financial consequences of COVID-19.

In France and some other developed countries, the numbers of reports to child welfare services and emergency department visits for child abuse started to fall when lockdown was introduced [2, 3]. Since levels of domestic violence were unlikely to fall during this uncertain period, the observed decreases led to concerns that abused children were not being identified and cared for [1, 4]. One of the most serious forms of abuse in children aged 0 to 24 months is abusive head trauma (AHT), which can result in severe injury or death [5, 6]. Subdural hemorrhage (SDH) is present in 89% of cases of AHT [7, 8]. Although some recent studies have identified increased child abuse during lockdown as a major public health concern, this phenomenon has not previously been quantified [1, 3, 4]. In view of the results of the above-cited studies, we decided to conduct a nationwide study of data in the French national hospital discharge database (*Programme de médicalisation des systèmes d'information*, PMSI) and focused on cases of subdural hematoma (SDH) in a context of ATH.

The primary objective of the present study was to compare the incidence of hospital admissions in France for child abuse with SDH during 2020 (the first year of the COVID-19 pandemic), relative to the previous two years. To further analyze the potential impact of lockdowns, we evaluated the incidences of SDH and child abuse for each calendar month.

## Methods

We performed a retrospective observational study of data in the PMSI database. Children aged up to 24 months with a diagnosis of child abuse and/or SDH following hospital admission anywhere in France between January 1, 2018 and December 31, 2020 were included in the study. The PMSI database was searched with specific International Classification of Diseases, 10th Revision (ICD-10) diagnostic codes (Supplementary Data 1). For 2018, 2019, and 2020, we collected data on the total number of children aged up to 24 months admitted to hospital in France, the number of children admitted for child abuse, and the number of hospital admissions for child abuse + SDH. To better characterize the children hospitalized for child abuse + SDH, we examined the month-by-month number of hospital admissions for the three study years. We chose both 2018 and 2019 as comparator years because (in contrast to 2020) they did not include any periods of lockdown or travel restrictions (Supplementary Data 2). We noted the median age at the time of hospital admission, the child's sex, the length of hospital

stay, the number of admissions to an intensive care unit, and the number of deaths.

The year 2020 was considered to be the first year of exposure to COVID-19, and so the 2020 data were compared with control data from 2018 and 2019. The main exclusion criterion was hospital admission for SDH associated with a code for accidental trauma.

## Statistical analysis

Data were expressed as the median (range) or the frequency (percentage). Intergroup differences in qualitative variables were probed using the chi-squared test. The threshold for statistical significance was set to  $p < 0.05$ . All statistical analyses were performed using GraphPad Prism 8 software (version 8.4.3 (471), GraphPad Software Inc., La Jolla, CA, USA). In order to maintain the patients' anonymity, exact (individual) data were not available on the length of stay (for all patients) or the age (for patients aged 12–24 months); only median values could be extracted from the national database. Hence, we could not apply chi-squared tests to these two variables.

## Results

The numbers of hospital admissions of children under the age of 24 months, admissions for child abuse, and admissions with SDH + child abuse codes in 2018, 2019 and 2020 are given in Table 1. There was a nonsignificant trend toward a lower total number of hospital admissions per year for the 2020 (COVID-19) group, relative to the 2019 group (decrease: 6.4%) and the 2018 group (decrease: 7.6%) groups.

Of the 913,623 children under the age of 24 months hospitalized in 2018, 1137 were admitted for child abuse and 154 were admitted for SDH + child abuse at least once. In 2019, 902,556 children were hospitalized, 1184 were admitted for child abuse, and 150 were admitted for SDH + child abuse. In 2020 (the COVID-19 year), 844,509 children were hospitalized, 1131 were admitted for child abuse, and 138 were admitted for SDH + child abuse.

There were no significant differences in hospital admissions with codes for child abuse or for SDH + child abuse between the 2020 COVID-19 group and the 2019 and 2018 control groups (Table 1). The SDH + child abuse population (Table 2) showed male predominance in all three years. In all years, most of the children were aged below 12 months. There were significantly fewer hospital admissions in May 2020 than in May 2019 or May 2018, whereas there were significantly more hospital admissions

**Table 1** Hospital admissions in France for child abuse with or without subdural hemorrhage in children under 24 months of age, 2018–2020

	2018 (controls)	*%	2019 (controls)	%*	2020 (COVID-19)	%*	<i>p</i> value in a chi-squared test
Hospital admissions of children under 24 months of age	n = 913,623		n = 902,556		n = 844,509		
Hospital admissions with child abuse codes per year	1,137	0.12%	1,184	0.13%	1,131	0.13%	0.19
Hospital admissions for SDH per year	334	0.037%	360	0.040%	332	0.039%	0.47
Hospitalizations with SDH + child abuse codes per year	154	0.017%	150	0.017%	138	0.016%	0.96

SDH subdural hemorrhage

\*Percent of the total number of hospital admissions per year

**Table 2** Characteristics of children with SDH + child abuse codes recorded during their hospital stay

	2018 (controls)		2019 (controls)		2020 (COVID-19)		<i>p</i> value in a chi-squared test
	<i>n</i>	% (males)	<i>n</i>	% (males)	<i>n</i>	% (males)	
	(total = 154)		(total = 150)		(total = 138)		
<b>Males/females</b>	87/67	56.5	106/44	70.7	90/48	65.2	0.034
<b>Sex ratio (males/females)</b>	1.3		2.4		1.9		
<b>Age (years)</b>							
<b>0</b>	141	91.6	145	96.7	128	92.8	0.16
<b>1</b>	13	8.4	5	3.3	10	7.2	NA
<b>Age, median (range) (days)</b>	121 (50–359)		108 (14–365)		107 (25–360)		NA
<b>Length of stay, median (days)</b>	13.9		14.1		15.6		NA
<b>Admission to an intensive care unit</b>	34	22.1	37	24.7	31	22.5	0.08
<b>Mortality</b>	7	4.5	6	4	5	3.6	0.9

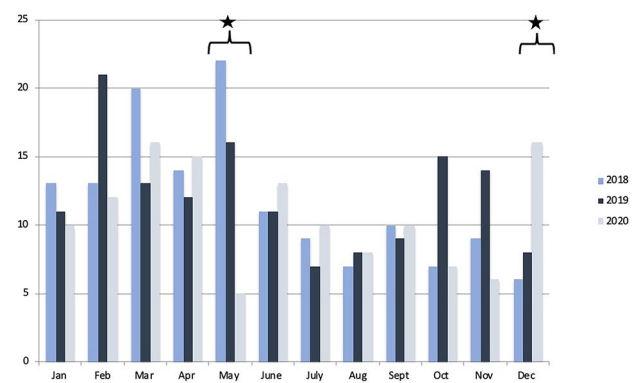
Number of boys was significantly higher in all years. Data on the age in children older than 12 months and length of stay were not available. Exact data on age were only available for patients aged between 0 and 12 months

NA non-applicable

in December 2020 than in December 2019 or December 2018 (Fig. 1).

The median age of the children hospitalized in the 2020 COVID-19 group was 107 days; this was lower (albeit not significantly) than the value for 2018 (121 days) or 2019 (108 days). The hospital stay was longer (albeit not significantly) in the COVID-19 group (15.6 days) than in the 2018 group (13.9 days) or the 2019 group (14.1 days). The proportion of children with SDH + child abuse codes requiring admission to an intensive care unit was 22.1% in 2018, 24.7% in 2019, and 22.5% in 2020; the inter-year difference was not statistically significant.

The mortality rate for children with SDH related to child abuse was 0.8% lower in 2020 than in 2018 but this difference was not statistically significant ( $p = 0.9$ ).

**Fig. 1** The monthly distribution of the incidence of SDH + child abuse codes, showing a significant decrease in May 2020 and a significant increase in December 2020 (marked by an asterisk)

## Discussion

The present study focused on severe forms of child abuse — forms that are frequently associated with AHT and sequelae like SDH [7]. Our nationwide study showed that the number of children aged 0 to 24 months hospitalized for SDH in the context of child abuse was no higher in 2020 than in 2018 or 2019. The demographic profile of our “SDH + child abuse” group was in line with the literature data [8]. Recently, Maassel et al. analyzed the number of hospital admissions for AHT during the COVID-19 period recorded in a US nationwide database; their results were similar to ours [9]. We were surprised not to find an increase in 2020, given the presence of all the risk factors for domestic violence and child abuse during this period of uncertainty [10].

In the literature, a number of studies have highlighted the considerable psychological and psychosocial repercussions of pandemics or other major humanitarian crises, including greater child abuse [11, 12]. In contrast to our present results, Sidpra et al.’s single-center study found a 1493% increase in hospital admissions for AHT in 2020, relative to the three previous years [13]. Several other studies have evidenced increases in the number of hospital admissions for child abuse [14, 15]. The COVID-19 crisis has accentuated tensions between family members; due to confinement and other restrictions, exasperated and/or exhausted adults might be more likely to shake and injure a crying infant. Furthermore, a recent study found that children under the age of two were more likely to be abused when they were cared for at home [16].

Our present results are especially surprising when viewed against the sharp increase in calls to the national abuse hotline (an increase of 56.2% between March 18 and May 10, 2020, relative to the same period in 2019) [17]. This increase prompted the French government to quickly issue media alerts about the increased risk of domestic and child abuse (on television, in newspapers, on radio stations, on social networks, and in shopping malls, together with the implementation of additional national help lines).

However, there are several possible explanations for our present results. Firstly, severe injuries (including SDH) are usually easy to observe clinically and will always require hospitalization; in contrast, bruising, burns, and general violence may go unnoticed. The curfew and lockdowns may have had an impact on the number of consultations with healthcare professionals in general. Indeed, we observed a decrease in all-cause hospital admissions of children aged under 24 months in 2020. Hence, under-reporting might have masked an overall increase in child abuse [3, 9, 18]. Furthermore, some children admitted for SDH might not have been recognized as having suffered AHT. Secondly, the French government’s media campaign

might have raised awareness of the risk of AHT among the population. Thirdly, the permanent presence of all family members might have prevented some acts; it is known that AHT is most often perpetrated by an adult alone with the child. This might also explain the decrease in ATH in May (when many adults were working from home) and the increase in ATH in December 2020 (corresponding to the end of the second lockdown and a decrease in working from home) [19]. Lastly, the closure of daycare centers and child care facilities might have reduced the number of reports of abuse and contributed to under-reporting. In Rey-Salmon et al.’s study in 2020, 317 cases of abuse (98.5%) occurred in a private home and only one occurred in a daycare center; the risk of abuse is higher when children are kept at home, as was the case during lockdown. The results of Rey-Salmon et al.’s study contributed to the concern about an increase in child abuse during the COVID pandemic [16].

A better understanding and early identification of risk factors and families’ personal and social resources are essential for avoiding the recurrence of abuse. This is shown by the fact that shaking was repeated (from 2 to 30 times, with an average of 10 times) in 55% of situations in which parents admitted to shaking their infant [20]. In 20% of cases in which an infant cried repeatedly, shaking occurred every days for several weeks [20].

The present study had several limitations, including reporting bias. The study required specific, accurate ICD-10-CM coding for physical child abuse, with a combination of a “child abuse code” and an “SDH code.” Even though healthcare professionals dealing with child abuse victims were especially aware of the need to detect cases of abuse and thus code them accurately, we did not observe an increase in the frequency of SDH codes. It was not possible to identify all the paraclinical examinations (e.g., imaging) performed during the stay. Furthermore, the month-on-month differences between the 2020 COVID-19 group and the 2018 and 2019 groups might have been due to chance. Lastly, the diagnosis of AHT is complex; this might explain the contradictory literature data [14, 21, 22].

## Conclusion

Reassuringly, we did not observe a greater risk of hospital admissions for SDH in a context of child abuse during the first year of the COVID-19 epidemic in France (i.e., 2020). Our present data and other studies indicate that the early identification of risk factors (age, sex, etc.) might facilitate the early detection of at-risk situations for child abuse and that could result in SDH.



**Supplementary information** The online version contains supplementary material available at <https://doi.org/10.1007/s00431-022-04387-x>.

**Authors' contributions** Fiorella Caron and Céline Klein designed the study, collected data and wrote the manuscript. Pierre Tourneux and Michel Panuel corrected the manuscript. Ariski Taleb studied the methodology and collected data. Richard Gouron performed the statistical analysis.

**Availability of data and material** Original data available from the authors upon request.

## Declarations

**Ethics approval** Approval by the local Medical Research Ethics Committee and the national commission for informatic and liberties (PI2020\_843\_0064).

**Consent for publication** All authors consent to publication.

**Conflict of interest** The authors declare no competing interests.

## References

- Guen CG-L, Hentgen V, Dubos F et al (2021) French pediatric societies call for school to stay open amid the coronavirus disease 2019 Pandemic. *J Pediatr* 234:293–295.e2. <https://doi.org/10.1016/j.jpeds.2021.04.001>
- Caron F, Plancq M-C, Tourneux P et al (2020) Was child abuse underdetected during the COVID-19 lockdown? *Arch Pédiatrie* 27:399–400. <https://doi.org/10.1016/j.arcped.2020.07.010>
- Kaiser SV, Kornblith AE, Richardson T et al (2021) Emergency visits and hospitalizations for child abuse during the COVID-19 pandemic. *Pediatrics* 147. <https://doi.org/10.1542/peds.2020-038489>
- Martinkevich P, Larsen LL, Græsholt-Knudsen T et al (2020) Physical child abuse demands increased awareness during health and socioeconomic crises like COVID-19. *Acta Orthop* 91:527–533. <https://doi.org/10.1080/17453674.2020.1782012>
- Keenan HT (2003) A population-based study of inflicted traumatic brain injury in young children. *JAMA* 290:621. <https://doi.org/10.1001/jama.290.5.621>
- Maguire SA, Williams B, Naughton AM et al (2015) A systematic review of the emotional, behavioural and cognitive features exhibited by school-aged children experiencing neglect or emotional abuse: systematic review of school-aged neglect/emotional abuse. *Child Care Health Dev* 41:641–653. <https://doi.org/10.1111/cch.12227>
- Kelly P, John S, Vincent AL, Reed P (2015) Abusive head trauma and accidental head injury: a 20-year comparative study of referrals to a hospital child protection team. *Arch Dis Child* 100:1123–1130. <https://doi.org/10.1136/archdischild-2014-306960>
- Laurent-Vannier A, Bernard JY, Cheignard M (2020) High frequency of previous abuse and missed diagnoses prior to abusive head trauma: a consecutive case series of 100 forensic examinations. *Child Abuse Rev* 29:231–241. <https://doi.org/10.1002/car.2638>
- Maassel NL, Asnes AG, Leventhal JM, Solomon DG (2021) Hospital admissions for abusive head trauma at children's hospitals during COVID-19. *Pediatrics* 148. <https://doi.org/10.1542/peds.2021-050361>
- Lawson M, Piel MH, Simon M (2020) Child maltreatment during the COVID-19 pandemic: consequences of parental job loss on psychological and physical abuse towards children. *Child Abuse Negl* 110:104709. <https://doi.org/10.1016/j.chiabu.2020.104709>
- Rubenstein BL, Stark L (2017) The impact of humanitarian emergencies on the prevalence of violence against children: an evidence-based ecological framework. *Psychol Health Med* 22:58–66. <https://doi.org/10.1080/13548506.2016.1271949>
- Brooks SK, Webster RK, Smith LE et al (2020) The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *Lancet Lond Engl* 395:912–920. [https://doi.org/10.1016/S0140-6736\(20\)30460-8](https://doi.org/10.1016/S0140-6736(20)30460-8)
- Sidpra J, Abomeli D, Hameed B et al (2021) Rise in the incidence of abusive head trauma during the COVID-19 pandemic. *Arch Dis Child* 106:e14–e14. <https://doi.org/10.1136/archdischild-2020-319872>
- Hughes Garza H, Piper KE, Barczyk AN et al (2021) Accuracy of ICD-10-CM coding for physical child abuse in a paediatric level I trauma centre. *Inj Prev* 27:i71–i74. <https://doi.org/10.1136/injuryprev-2019-043513>
- Ebert C, Steinert JI (2021) Prevalence and risk factors of violence against women and children during COVID-19, Germany. *Bull World Health Organ* 99:429–438. <https://doi.org/10.2471/BLT.20.270983>
- Rey-Salmon C, De Boissieu P, Teglas JP, Adamsbaum C (2020) Abusive head trauma in day care centers. *Pediatrics* 146. <https://doi.org/10.1542/peds.2020-013771>
- Dicom Océane D, Dicom Océane D (2021) Reconfinement : une nouvelle campagne de sensibilisation du numéro 119 Allô Enfance en Danger pour lutter contre les violences faites aux enfants. In: Ministère Solidar. Santé. <https://solidarites-sante.gouv.fr/affaires-sociales/familles-enfance/pacte-pour-l-enfance/lutte-contre-les-violences-faites-aux-enfants/reconfinement-campagne-119-allo-enfance-en-danger>. Accessed 31 May 2021
- Markham JL, Richardson T, DePorre A et al (2021) Inpatient use and outcomes at children's hospitals during the early COVID-19 pandemic. *Pediatrics* 147. <https://doi.org/10.1542/peds.2020-044735>
- Laurent-Vannier A, Bernard JY, Cheignard M (2021) Abusive Head Trauma through Shaking: Examination of the Perpetrators According to Dating of the Traumatic Event. *Child Abuse Rev* <https://doi.org/10.1002/car.2694>
- Adamsbaum C, Grabar S, Mejean N, Rey-Salmon C (2010) Abusive head trauma: judicial admissions highlight violent and repetitive shaking. *Pediatrics* 126:546–555. <https://doi.org/10.1542/peds.2009-3647>
- Högberg U, Squier W, Andersson J et al (2020) Do inter-country differences in the frequency of abusive head trauma reflect different proportions of overdiagnosis of abuse or true differences in abuse? *J Epidemiol* 30:276–277. <https://doi.org/10.2188/jea.JE20190066>
- Cowley LE, Adesman A (2021) The challenge of identifying pediatric abusive head trauma during the COVID-19 pandemic. *Pediatrics* e2021050612. <https://doi.org/10.1542/peds.2021-050612>

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

## Authors and Affiliations

Fiorella Caron<sup>1</sup> · Pierre Tourneux<sup>1,2</sup> · Hyppolite Tchidjou Kuekou<sup>3</sup> · Ariski Taleb<sup>4</sup> · Richard Gouron<sup>5</sup> · Michel Panuel<sup>6</sup> · Céline Klein<sup>5,7</sup> 

Fiorella Caron  
caron.fiorella@chu-amiens.fr

Pierre Tourneux  
tourneux.pierre@chu-amiens.fr

Hyppolite Tchidjou Kuekou  
ippolito6@yahoo.it

Ariski Taleb  
taleb.ariski@chu-amiens.fr

Richard Gouron  
gouron.richard@chu-amiens.fr

Michel Panuel  
michel.panuel@ap-hm.fr

<sup>1</sup> Pediatric Intensive Care Unit, Amiens University Medical Center, Amiens, France

<sup>2</sup> PériTox Laboratory UMR\_I 01, UFR de Médecine, University of Picardie Jules Verne, Amiens, France

<sup>3</sup> Department of Pediatric Emergency, Amiens University Medical Center, Amiens, France

<sup>4</sup> Department of Medical Information, Montreuil-sur-Mer Medical Center, Montreuil-sur-Mer, France

<sup>5</sup> Department of Pediatric Orthopedics, University of Picardie Jules Verne and Amiens Picardie University Medical Center, Amiens, France

<sup>6</sup> Department of Medical Imaging Hôpital Nord, Hôpitaux de Marseille, Assistance Publique, Marseille, France

<sup>7</sup> Service d'Orthopédie Pédiatrique, CHU Amiens-Picardie, 1 rue du Professeur Cabrol, 80054 Amiens Cedex 1, France