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Research paper

# The psychological effects of COVID-19-related containment in children: The E-COCCON French study



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## ABSTRACT

The first containment of the Sars-Cov2 pandemic had the potential to generate posttraumatic stress (PTS) symptoms in children.

**Objective:** The main objective of the study was to determine the prevalence of PTS symptoms within 6 weeks of the end of lockdown, in children contained between March 17, 2020 and May 11, 2020 in France.

**Material and Methods:** This was a French prospective cross-sectional study between May 15 and July 2, 2020 conducted via telephone survey. Parents of children aged between 8 and 15 years were eligible. The invitation to participate was proposed through social networks (Instagram and Facebook), various local and national media, and by e-mail to the staff of our University Hospital Center. The PTS symptoms were assessed using the CRIES-13. A score of 30 and over has been confirmed as the cut-off for screening cases.

**Results:** During the study period, 379 children (male,  $n = 207$ ) were included, their mean age was  $10.8 \pm 2.1$  years. Symptoms of PTSD were identified in 17% of the children (girls 20.5%, boys 13.5%). These children were younger ( $p = 0.04$ ), lacked access to a private outdoor space ( $p < 0.0001$ ; OR: 7.8), had parents whose profession exposed them more to the coronavirus, and had parents who were more afraid of COVID-19.

**Conclusion:** After the first lockdown related to the pandemic crisis, children developed PTSD symptoms. The onset of such symptoms is correlated with gender, age, lockdown conditions, and parental perceptions. These last considerations were worse for pink- or blue-collar families, attesting to the subsequent intensification of health inequalities.

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## Abbreviations

COVID Coronavirus infectious disease

CRIES Child Revised Impact Event Scale

HCW Health-care workers

PTSD Posttraumatic stress disorders

## 1. Introduction

After a tragic event or disaster, and compared to adults, children are four times more likely to develop posttraumatic stress [1,2]. The current COVID-19 pandemic is an unprecedented event that has the

potential to cause lockdown-related stress. During the first lockdown, French policy included: school closures; the population was required to stay at home with the exception of daily exercise (1 h a day), grocery shopping (1 h a day), health emergencies or appointments, and other “essential” trips; bars, restaurants, museums, cinemas, theaters and all “non-essential” professional activities were closed; wearing a mask was mandatory in public areas. Following the first lockdown and closure of schools in several countries, children were exposed to significant amounts of anxiety-provoking information and a high level of stress from the adults around them [3–5]. The longer the lockdown, the more likely children are to develop symptoms of posttraumatic stress disorder (PTSD) [6,7]. At the time of the study, we had few pediatric data on this risk in relation to the pandemic containment. Without considering all the psychological consequences, the main objective of the present study was to determine the

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prevalence of signs of posttraumatic stress within 6 weeks of the end of lockdown in children aged 8–15 years who experienced lockdown between March 17, 2020 and May 11, 2020 in France. The secondary objectives were to assess the overall experience of lockdown in children and their parents as well as the influence of gender, age, and social and family environment.

## 2. Material and methods

Between May 15 and July 2, 2020, we performed a French cross-sectional study by telephone survey of person(s) with parental authority and their children aged 8–15 years. An invitation to participate in the study was proposed to parents of children aged 8–15 years via social networks (Instagram and Facebook) and various local and national media, and by e-mail to the staff of the Toulouse University Hospital Center (south-west of France). Parents called a dedicated number and were given a telephone appointment. One parent and each child aged 8–15.9 years were assessed. The parental responder and their child(ren) were assessed during the same appointment, they were not aware of the survey content. To minimize recall bias on the part of the children, the duration of the study was limited to 6 weeks after lifting of lockdown. The Child Revised Impact Event Scale (CRIES-13)<sup>1</sup>, which is validated in several languages including French [8], was used for the assessment of children aged 8 years or older who were survivors of traumatic events [1,9–11]. As the incidence of PTSD symptoms is influenced by age and gender, the score results were compared between girls and boys and between children aged 12 years or older versus younger ones.

### 2.1. Outcome

The CRIES-13 measures posttraumatic stress and is not a clinical diagnostic tool. It includes four items that measure Intrusion (sum of items 1, 4, 8, 9), four items that measure Avoidance (sum of items 2, 6, 7, 10) and five items that measure Arousal (3, 5, 11, 12, 13). Each item is rated on a four-point scale (*not at all, rarely, sometimes, often*) scored 0, 1, 3, and 5. The total score varies between 0 and 65. A score of 30 and over has been confirmed as the cut-off score for screening cases of PTSD symptoms that are denoted in the DSM-5 as acute stress disorder (acute stress disorder, *trouble stress aigu* (TSA)) [12]. When such symptoms have a duration exceeding 1 month, a diagnosis of PTSD is considered.

### 2.2. Covariates

The other data collected from the parents were: the sociodemographic profile (department of residence, gender, age, parent/caregiver status of the respondent [mother, father, other], socioprofessional category, total number of children); housing conditions (total number of people in the same home, type of home [house, apartment, other]; number of rooms; access to a private outdoor space [garden, balcony, terrace, other]); difficulties related to the lockdown (financial, switching to telework, presence of children and telework); overall feeling about the lockdown (scale from 1 = *very bad* to 10 = *very good*); comparison of the child's weight before and after lockdown; the notion of COVID-19 infection of a family member; the notion of risk factors for severe COVID-19 in the respondent and/or child(ren); and the notion of fear of the virus ("Are you afraid of COVID-19? If yes, are you afraid for yourself? For your children?").

The children were asked how they felt about the lockdown (scale from 1 = *very bad* to 10 = *very good*); about maintaining a mode of communication with friends; the notion of boredom and sadness

during the lockdown, measured on a Likert scale (*not at all, a little, occasionally, a lot*).

### 2.3. Statistical analysis

Data were entered in Microsoft Excel tables (Microsoft Corp., Redmond, WA). The analysis was performed with StatView 5.1 (SAS Institute Inc., Cary, NC) and EpiInfo 6.04fr (VF, ENSP-Epiconcept, Paris, France). In the descriptive analysis, data are presented as mean  $\pm$  SD, median with extreme values, or with 95% confidence intervals where appropriate, unless otherwise indicated. To compare qualitative variables, a chi-square test (Mantel–Haenszel) was used and a two-tailed Fischer's exact test if the expected value was  $<5$ . For independent quantitative variables, a paired Student's *t* test was used. A nonparametric Wilcoxon–Mann–Whitney *U* test was performed in the case of a non-normal distribution. Statistical significance was considered at  $p < 0.05$ . To analyze the correlation between parents and children's CRIES-13 score, we used a Bland–Altman comparison test.

### 2.4. Ethical and regulatory considerations

The research project was submitted to the appropriate ethics committee (CPP) for approval that was obtained on June 8, 2020 under reference 20.05.27.59425. The clinical trial is registered (clinicaltrials.gov) under the number NCT04615195.

## 3. Results

### 3.1. Sociodemographic characteristics

We received phone calls from 326 families, 12 families did not keep the phone appointment and thus 314 parents or legal caregivers and 379 children were included (Table 1). The phone calls came from 36 different French departments. A third of the parents belonged to a high socioprofessional category (white-collar, knowledge worker, i.e., engineer, doctor, university professor).

### 3.2. Lockdown conditions

The place of residence was a house in 75% of the cases with access to a private outdoor space for 95% of the families. The usual place of residence was the main lockdown space (97%). The ratio of the number of contained people to the number of rooms was more than 1:1 (over-occupancy) in 40% of the homes.

### 3.3. Parents' perceptions and difficulties

The principle of the lockdown was understood by 100% of the responders. The overall feeling about the lockdown was evaluated as good or very good (score  $> 5$ ) by 82% with no difference according to the responder's gender. The responder reported exercising an at-risk profession for infection in 44% of the cases, especially women (58% vs. 37%,  $p = 0.001$ , OR: 2.4 [1.2–4.8]); 39% of the parents switched to full-time ( $n = 82$ ) or partial ( $n = 41$ ) telework. During the lockdown, 57 families (18%) experienced financial difficulties.

### 3.4. Children's characteristics, perceptions, and difficulties

Data on 379 children were collected (207 males). The overall mean age was  $10.8 \pm 2.1$  years with no difference between boys and girls. Their overall perception of the lockdown was poor to very poor (score  $\leq 5$ ) for 31% of them with no gender difference but worse when compared to their parents (18%) ( $p = 0.0002$ , OR: 2.0 [1.4–2.8]). Overall, 15% of the children reported being very bored and/or sad (6%), especially the girls ( $p < 0.0001$ ) (Table 1). Communication with friends was maintained in the majority of cases (91%): phone calls

<sup>1</sup> [https://www.childrenandwar.org/wp-content/uploads/2019/06/cries\\_13\\_UK.pdf](https://www.childrenandwar.org/wp-content/uploads/2019/06/cries_13_UK.pdf)

**Table 1**  
Caregiver respondents and child characteristics by gender.

Variables	Girls (n = 171)	Boys (n = 207)	Total (n = 379)	p	OR (95% CI)
Mean age, years (SD)	10.9 (2.1)	10.6 (2.1)	10.8 (2.1)	0.25	
Age < 12 years, n (%)	102 (60)	132 (64)	234 (62)	0.41	
<b>Caregiver respondent, n</b>					
-Mother	116	143	259	0.10	1.7 (0.9–3.1)
-Father	16	34	505		
-Other primary caregivers	2	3			
<b>Mean age (years) (SD) of respondent</b>	42.1 (4.4)	42.3 (4.3)	42.2 (5.6)	0.84	
<b>Highest educational level, n caregivers (%)</b>	135	178	313		0.4 (0.2–0.8)
-University degree, technical degree, engineering or business school	102 (77.3)	140 (79.5)	242 (77.3)	0.009	
-High school diploma	11 (8.3)	26 (14.7)	37 (11.8)		
-Vocational certificate	9 (4.6)	6 (3.4)	15 (4.8)		
-None	13 (9.8)	4 (2.3)	17 (5.4)		
-Other		2 (0.1)	2 (0.7)		
<b>Socioprofessional level, n (%)</b>				0.33	
-White-collar <sup>1</sup> – Upper middle class	40 (30)	58 (33)	98 (32)		
-Interm. prof. <sup>2</sup> – Middle class	36 (27)	63 (36)	99 (32)	0.62	0.9 (0.5–1.4)
-Pink/Blue-collar <sup>3</sup> – Working class	32 (24)	37 (21)	69 (22)	0.11	0.7 (0.4–1.1)
-Unemployed	1 (2)	1 (0.)	2 (1)	0.50	
-Homemaker	12 (9)	9 (5)	21 (7)		
-Other	11 (8)	8 (5)	19 (6)		
<b>Type of residence, n (%)</b>					
-House	102 (60)	135 (65)	237 (75)	0.82	
-Apartment	32 (40)	45 (35)	77 (25)		
<b>Caregiver's perception of lockdown, n (1=poor to 10=excellent)</b>	134	180	314		1.4 (0.8–2.4)
-Score ≤ 5	28 (21)	29 (16)	57 (18)		
-Score > 5	106 (79)	151 (84)	257 (82)	0.28	
<b>Financial concerns, yes, n (%)</b>	22 (17)	35 (20)	57 (19)	0.43	0.8 (0.4–1.4)
<b>Transition to teleworking</b>					
-Yes/no	50 (37)/49 (36)	73 (41)/63 (35)	99 (32)/136 (43)	0.63	0.9 (0.5–1.5)
-Difficulties teleworking at home	29 over 56 (52)	47 over 79 (59)	76 over 135 (56)	0.37	0.7 (0.4–1.5)
<b>COVID-exposed profession</b>				0.31	
-Yes/no	65 (50)/43 (33)	74 (42)/72 (40)	139 (45)/115 (37)		
-Not applicable	22 (17)	32 (18)	54 (17)		
<b>Fear of COVID for their child(ren), n (%)</b>	57 (43)	78 (43)	135 (43)	0.41	0.8 (0.5–1.3)
<b>Child's previous chronic disease or condition<sup>4</sup></b>	20 (12)	22 (11)	42 (11)	0.74	
<b>Child's perception of lockdown</b>				0.91	
-Score ≤ 5	53 (31)	63 (30)	116 (31)		
-Score > 5	118 (69)	144 (70)	262 (69)		
<b>Boredom during lockdown</b>				0.79	
-Not at all	27 (16)	30 (14)	57 (15)		
-A bit	47 (27)	66 (32)	114 (30)		
-Sometimes	70 (41)	83 (40)	153 (40)		
-A lot	27 (16)	28 (14)	55 (15)		
<b>Feeling of sadness</b>				0.0001	3.2 (1.9–5.3)
-Not at all	68 (40)	117 (57)	186 (49)	<0.0001	
-A bit	46 (27)	62 (30)	108 (28)		
-Sometimes	40 (23)	23 (11)	63 (17)		
-A lot	17 (10)	5 (2)	22 (6)		
<b>Ability to communicate with classmates</b>					2.1 (0.97–4.52)
Yes/No	160 (94)/10 (6)	183 (88)/24 (12)	344 (91)	0.058	
<b>Number of communication methods</b>	n = 160	n = 183	n = 345	0.012	1.9 (1.1–3.2)
1 method	50 (31)	85 (46)	135 (39)	0.018	
2 methods	69 (43)	69 (38)	138 (40)		
≥ 3 methods	42 (26)	29 (16)	72 (21)		
<b>Child's weight variation, n (%)</b>				0.49	
-Weight gain	66 (39)	96 (46)	162 (43)	0.14	0.7 (0.4–1.1)
-Stable weight	50 (29)	51 (25)	102 (27)		
-Weight loss	10 (6)	10 (5)	20 (5)		
-ns	45 (26)	50 (24)	95 (25)		
<b>CRIES-13 / respondent</b>					
-Score ≥ 30	29 (17)	32 (15)	61 (16)	0.69	1.1 (0.6–1.9)
-Median [range]	15 [0–59]	13 [0–65]	13 [0–65]	0.23	
<b>CRIES-13 /child(ren)</b>					
-Score ≥ 30, n (%)	35 (20.5)	28 (13.5)	63 (17)	0.07	1.6 (0.95–2.8)
-Median [range]	16 [0–59]	14 [0–52]	15 [0–58]	0.32	

CI: confidence interval; CRIES: Child Revised Impact Event Scale; ns: not specified; OR: odds ratio; SD: standard deviation

<sup>1</sup> White-collar, knowledge worker, i.e., engineer, doctor, university professor, etc.<sup>2</sup> Intermediate professions, i.e., nurse, nursery nurse, storekeeper, police, etc.<sup>3</sup> Pink/blue-collar, working class, i.e., manual laborers, employees<sup>4</sup> Asthma, emphysema, cardiovascular disease, obesity, diabetes, cancer, epilepsy

**Table 2**  
Impact of the COVID-related lockdown on the psychological health of children: results of the CRIES-13.

Impact statements, %	Not at all	Rarely	Sometimes	Often
1-Do you think about it even when you don't mean to? <sup>*</sup>	34	29	28	9
2-Do you try to remove it from your memory? <sup>**</sup>	56	14	14	14
3-Do you have difficulties paying attention or concentrating? <sup>§</sup>	57	17	15	11
4-Do you have waves of strong feelings about it? <sup>*</sup>	61	19	13	7
5-Do you startle more easily or feel more nervous than you did before it happened? <sup>§</sup>	61	17	15	7
6-Do you stay away from reminders of it (e.g., places or situations)? <sup>**</sup>	59	13	17	11
7-Do you try not to talk about it? <sup>**</sup>	65	12	11	12
8-Do pictures about it pop into your mind? <sup>*</sup>	75	11	9	5
9- Do other things keep making you think about it? <sup>*</sup>	60	18	14	8
10-Do you try not to think about it? <sup>**</sup>	52	13	14	21
11-Do you get easily irritable? <sup>§</sup>	47	17	19	17
12-Are you alert and watchful even if there is no obvious need to? <sup>§</sup>	16	15	27	42
13-Do you have sleep problems? <sup>§</sup>	70	10	11	9

<sup>\*</sup> Intrusion items;  
<sup>\*\*</sup> Avoidance items;  
<sup>§</sup> Arousal items; CRIES: Child Revised Impact Event Scale

(59%), WhatsApp (43%), Instagram (15%) and SnapChat (14%) were the most widely used methods. The weight of each child before and after the lockdown was known for 292 children (77%): 55% of the children gained weight (mean gain 2.2±1.7 kg, range 1–10 kg). They differed from the others in that their parents reported more financial problems (25% vs. 13%,  $p = 0.02$ , OR: 2.3 [1.1–4.7]), they had a higher total median CRIES score (16 vs. 10,  $p = 0.014$ ), with no gender difference.

### 3.5. The psychological impact of COVID-19

The overall median CRIES-13 for children was 15 (range 0–58) with no influence of gender. Table 2 summarizes the distribution of answers to the 13 items. Table 3 describes the results of the total score and the subscores by age and gender. A high score over 30 was achieved by 17% of the children ( $n = 63$ ; girls 20.5%, boys 13.5%). Using a Bland–Altman test to compare the scores of parents and children, we found an average intraclass correlation of 0.70 (95% CI: 0.62–0.75); a significant proportion of scores equal to 0 contributed to a floor effect in the distribution of scores.

#### 3.5.1. Factors associated with psychological distress

**3.5.1.1. Child's age and gender.** Respondents for children under the age of 12 were more likely to be female (75% vs. 57%,  $p = 0.004$ , OR: 2.4 [1.3–4.3]), and more likely to report being inconvenienced by the presence of children at home in relation to teleworking (65% vs. 42%,  $p = 0.011$ , OR: 2.5 [1.2–5.2]). The median parental CRIES-13 score was higher (15 vs. 11,  $p = 0.01$ ) (Table 4). Children under 12 years of age felt worse overall about the lockdown ( $\leq$ score 5, 36% vs. 21%; OR: 2.1 [1.3–3.4]). There was an interaction effect of gender in the CRIES-13 score and age of children, this difference being more important in boys: young boys (age < 12 years) had significantly higher mean CRIES-13 total scores (17 vs. 11,  $p = 0.0001$ ) and subscores (intrusion

4.3 vs. 3.0,  $p = 0.008$ ; avoidance 6.0 vs. 3.4,  $p = 0.0015$ ; arousal 8.0 vs. 5.5,  $p = 0.0006$ ) than their older counterparts. Girls communicated through more methods, and expressed more sadness during the lockdown (33% vs. 13%,  $p < 0.0001$ , OR: 3.2 [1.9–5.3]).

**3.5.1.2. Social environment.** The group of children with a high CRIES-13 score was different because they were younger, lacked access to a private outdoor space, had parents whose profession exposed them more to the coronavirus, had parents who were more afraid of COVID-19, were more frequently bored during lockdown, and were sadder (Table 4).

**3.5.1.3. Overall experience of the lockdown. Parents' socioprofessional level and at-risk professions for infection:** A bad parental perception of lockdown was not a significant factor for a child CRIES-13 total score over 30 ( $p = 0.50$ ). Compared with white-collar and intermediate professions, more pink- and blue-collar workers lived in apartments (43% vs. 19%,  $p = 0.0001$ , OR: 3.2 [1.8–5.7]), considered lockdown to be less effective (90% vs. 97%,  $p = 0.016$ , OR: 3.9 [1.3–11.2–]), and expressed more financial difficulties (29% vs. 16%,  $p = 0.04$ , OR: 2.3 [1.2–4.2]). They were more afraid of the disease for themselves (65% vs. 51%,  $p = 0.01$ , OR: 2.1 [1.2–3.7]) and their child(ren) (59% vs. 39%,  $p < 0.0001$ , OR: 3.6 [2.1–6.2]). Their child(ren) had a worse experience of the lockdown (score  $\leq 5$ : 41% vs. 28%,  $p = 0.03$ , OR: 1.8 [1.1–3.0]), expressed more sadness (30% vs. 18%,  $p = 0.042$ ), had more chronic conditions (overweight, asthma, epilepsy, diabetes, etc.; 18% vs. 9%,  $p = 0.025$ , OR: 2.2 [1.1–4.4]) but did not score higher for PTSD symptoms ( $p = 0.76$ ).

Responders working in a profession at risk for contamination had more intermediate professions (i.e., nurse, nursery nurse, store-keeper, police, etc.; 46% vs. 21%,  $p < 0.0001$ , OR: 3.3 [2.0–5.4]), were more often female (88% vs. 78%,  $p = 0.018$ , OR: 2.2 [1.1–4.1]). Living predominantly in a house (80%) and a lower total number of children in the home ( $p = 0.04$ ) were associated with a better overall

**Table 3**  
Differences in the impact of the event on psychological health based on gender and age.

Impact of the event	Gender			Age (yrs.)		
	Girls (n = 171)	Boys (n = 207)	p	Age < 12 (n = 234)	Age $\geq$ 12 (n = 145)	p
<b>Intrusion subscale</b>	4.7 (4.6)	3.8 (3.8)	0.12	4.5 (4.3)	3.7 (3.9)	0.06
<b>Avoidance subscale</b>	5.3 (5.8)	5.1 (5.5)	0.98	5.9 (5.7)	3.9 (5.3)	0.0005
<b>Arousal subscale</b>	8.2 (5.9)	7.1 (4.9)	0.24	8.0 (5.4)	6.9 (5.3)	0.027
<b>CRIES-13 total</b>	18.3 (13.6)	16.2 (11.2)	0.32	18.5 (12.5)	14.8 (11.9)	0.0014
<b>CRIES-13 <math>\geq 30</math>, n (%)</b>	35 (20.5)	28 (13.5)	0.07	43 (18.4)	18 (12.4)	0.13

CRIES: Child Revised Impact Event Scale; SD: standard deviation; yrs: years.



**Table 4**  
Factors associated with a CRIES-13\* total score over 30 (cut-off for PTSD\*\* symptoms screening).

Factors		<i>p</i>	OR (95%CI)
<b>Children characteristics</b>			
Feeling of sadness during lockdown	49% vs. 17%	<0.0001	4.7 (2.6–8.3)
Poor perception of lockdown	57% vs. 25%	<0.0001	3.9 (2.2–6.9)
A lot of boredom during lockdown	25% vs. 12%	0.009	2.4 (1.3–4.7)
Lower mean age (years)	10.3±1.8 vs. 10.9±1.7	0.04	
Chronic disease or condition putting the child at risk for severe COVID-19 infection and/or decompensation***	17% vs. 9%	0.067	2.0 (0.95–4.3)
Being a girl	56% vs. 43%	0.07	1.6 (0.95–2.84)
<b>Parent's characteristics</b>			
Parent's profession exposed to COVID-19	43% vs. 35%	0.0005	3.5 (1.7–7.1)
Parental fear of COVID19 for			
-themselves	59% vs. 42%	0.025	2.1 (1.1–3.9)
-their child(ren)	52% vs. 32%	0.0007	2.6 (1.5–4.6)
<b>Shared family/social environment</b>			
Absence of access to an outdoor area (garden, balcony or terrace)	24% vs 3%	<0.0001	7.8(3.3-18.4)

\* Child Revised Impact Event Scale<

\*\* Posttraumatic stress disorder<

\*\*\* Asthma, emphysema, cardiovascular disease, obesity, diabetes, cancer, epilepsy.

experience for their child(ren) (75% vs. 62%,  $p = 0.018$ ) but there were more frequent CRIES scores for PTSD in the children (19% vs. 15%,  $p = 0.02$ , OR: 2.2 [1.1–4.1]).

### 3.6. Multivariate analysis

Factors independently associated with a child's score over 30 were identified using a multiple stepwise logistic regression model. All variables with a value of  $p < 0.2$  in the univariate analysis were entered into the model: absence of access to an outdoor area, feeling of sadness during lockdown, a poor perception of lockdown by children, parent's profession exposed to COVID-19, parental profession/pink- and blue-collar workers, parental fear of COVID-19 for themselves or their child(ren), extensive boredom during lockdown, age <12 years, being a girl, and the existence of a chronic disease or condition, weight gain or weight loss. In the final model, three variables continued to be associated with a CRIES-13 score  $\geq 30$ : a poor perception of lockdown by children ( $p < 0.0001$ , OR: 6.6 [2.9–15.1]), being a girl ( $p = 0.006$ , OR: 3.1 [1.4–7.1]), and parental fear of COVID-19 for their children ( $p = 0.038$ , OR: 3.2 [1.1–9.4]).

## 4. Discussion

No lockdown of such national scope and duration (8 weeks) had ever been applied before in France. While the rationale related to the epidemic was widely accepted, the long duration raises fears of a negative psychological impact, particularly among children. In fact, this lockdown has caused psychological and physical effects of varying nature and level depending on the country and on cultural considerations [4,13–19]. Published studies have focused on analyzing how people perceive the pandemic [20], the prevalence of depression and anxiety symptoms [18,21–23], posttraumatic stress symptoms [4], and sleep disorders in children [24,25]. Although our parent population had a rather high social status and more acceptable lockdown conditions, 17% of the children (girls 20.5%, boys 13.5%) reached or exceeded the cut-off for PTSD symptoms. This finding tends to confirm the results of previous studies [24,26] where the individual perception of such a situation by the parents, their level of difficulty managing it, and therefore the stress and anxiety generated, was associated with the level of psychological impact on their children, more than the quality of the social environment. The respective methods of assessment were: DMS-5 criteria for cross-cultural assessment of anxiety disorders [24], the Chinese version of the Generalized Anxiety Disorder Scale (GAD-7) [25], and the Depression Anxiety Stress Scale (DASS) short form in association with the Parenting Stress Index (PSI) short form [26].

Children's behavioral and emotional problems in this pandemic context are mediated by individual and dyadic parental stress [27]. The more stressed parents are, the more difficult it is for them to understand and respond to their child(ren)'s needs in a sensitive and caring way. Our results correspond to the prevalence of PTSD symptoms evaluated in the meta-analysis by Alisic et al. [2]. Davico et al. [4] in Italy showed that 31% of 786 children had a score cut-off for PTSD symptoms. Children in areas with high rates of infection had higher scores for fear, anxiety, and other related emotions [16,24]. Gender influences the incidence of PTSD. Davico et al. [4] demonstrated that girls as well as women reported higher distress levels than their male counterparts. Age is a risk factor for posttraumatic reactions. Younger children (age <12 years) scored higher than older children on the total score and on the two subscales (avoidance and arousal) (Table 3), which is consistent with the conclusions of Green et al. [28]. Other factors were described to have more problematic and enduring effects on children and adolescents (fear of infection, frustration or boredom, lack of contact with classmates/friends, lack of personal space at home and family financial loss) [14,29,30], which led to 22% of depressive symptoms among children in China [18].

Working class parents reported being more affected by a temporary loss of income. This financial aspect aggravated the feeling of confinement already altered by housing conditions and a greater fear of COVID-19 disease. Another factor of parental stress was substituting for teachers due to the closure of schools. This role was often challenged by social inequalities in terms of equipment, particularly computer equipment, Internet access, "overcrowding" at home, and by the need for many parents to telework. Children, especially the youngest, may have wanted to be closer to their parents and may have made more demands on them and some parents may have been under excessive pressure [31]. By generating more parental stress, such pressure at home contributed to more anxiety among children thereby creating a vicious circle [31].

During the lockdown, staying at home favored weight gain, as illustrated in this study where 57% of the children gained an average of  $2.2 \pm 1.7$  kg. It can also be assumed that the children ate more, or differently, or perhaps even better, since the families in the study were often well-off. Duan et al. [18] found that the proportion of daily screen time of 5 h or more tripled before and after lockdown. Time spent in front of a screen increased for different reasons. In school-aged children the main reason was the transition to e-learning. Children need a structured environment; during the day a planned and divided routine, and at night, strategies to promote sleep under the supervision of adults who play an overall protective and anxiolytic role [25,32].

#### 4.1. Bias and limitations

Although our study was widely disseminated on social networks, the number of parents and children was not representative of the French pediatric population. The telephone method of the survey may have limited the participation of some families. The presence of a parent when the child answered the questions could have also been a bias. Our distribution of socioeconomic classes was different from the national population by an over-representation of white-collar and knowledge workers (31.2% vs. 14.9%) and intermediate-level professions (31.5% vs. 14.1%). The proportion of pink- and blue-collar categories was comparable. Families who identified signs of stress and/or behavioral problems in their child(ren) may have been more likely to participate and may have been over-represented, but the level of scores at or above the cut-off for PTSD symptoms was comparable to similar studies in a recent meta-analysis [2].

#### 5. Conclusion

After the first lockdown related to the pandemic crisis, children developed PTSD symptoms. The onset of such symptoms is correlated with gender, age, lockdown conditions, and personal perceptions. These last two considerations were worse among children from pink- and blue-collar families, attesting to the subsequent intensification of health inequalities. Without questioning the need for a strict confinement, the observation of its effects on children requires the implementation of measures to mitigate the negative psychological impact: providing clear information about the disease in an age-appropriate language, having structured activities and a clear routine, maintaining indoor physical activities, as well as promoting virtual contact with family members, classmates, friends and teachers [3,13]. School closure should be weighed against the long-term risks of deepening socioeconomic and health inequities for children [6]. While children and adolescents have been exposed to other COVID-19-related lockdowns since this study, an increase in other psychological consequences (i.e., suicide attempt, child abuse) has been reported.

#### Conflict of interest

The authors have no conflicts of interests to disclose.

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