Comparing the emotional impact of the UK COVID-19 lockdown in very preterm and full-term born children

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Author contribution statement

ZS, LH, CN, LV have substantial contributions to the conception or design of the work as well as the acquisition, analysis, or interpretation of data for the work. All authors contributed to drafting the work or revising it critically for important intellectual content as well as the final approval of the version to be published. ZS, CN, LV agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Keywords

COVID-19, child mental health, Very preterm children, Internalizing symptoms, LockDown, Crisis

Abstract

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Introduction: The COVID-19 pandemic has caused a global mental health crisis, especially for those individuals who are vulnerable to stress and anxiety due to pre-existing mental health problems. This study aimed to understand the emotional impact of the COVID-19 lockdown on children who were born very preterm (VPT, <32 weeks' gestation), as they are vulnerable to mental health difficulties and are at increased risk of developing psychiatric problems during childhood compared to their full-term-born counterparts.

Methods: The parents of 32 VPT children (mean age=8.7) and 29 term-born controls (mean age=8.8) who had previously taken part in a study of brain development and psychopathology following VPT birth completed an online modified version of the Coronavirus Health and Impact Survey (CRISIS). The emotional impact of the COVID-19 lockdown on the child and the parent, measured by the CRISIS, was studied in relation to pre-existing mental health difficulties, assessed with the parent-rated Strengths and Difficulties Questionnaire (SDQ) evaluated before the CRISIS completion (mean time gap 15 months). T-tests, likelihood ratio F-tests, linear regression models and simple slope analyses were conducted to study the effects of COVID-19-related stressors on children's and parents' behavior, relationships and mental health.

Results: There were no significant group differences in pre-existing SDQ internalizing/externalizing symptoms, child's emotions or parent's emotions during the COVID-19 lockdown. However, higher pre-existing internalizing symptoms in VPT children were associated with greater lockdown-related emotional problems and worries (simple slope=1.95, $p<0.001$), whereas this was not observed in term-born children.

Conclusion: Our results suggest that VPT children with pre-existing internalizing problems may be more vulnerable to the negative impact of certain societal and familial stressors, such as social restrictions during the national COVID-19 lockdown periods. Effective intervention strategies are therefore needed to support this particularly vulnerable group in the context of potentially stressful life changes and adjustments.

Contribution to the field

Being born prematurely is associated with an increased risk for developmental psychiatric disorders and cognitive deficits. It is also well-reported that restrictions to daily life during the COVID-19 pandemic had profound effects on children's mental health. However, the effects of COVID-19-related stressors on preterm children's as well as their parents' relationships and mental health remains unclear. In order to address this question, we recruited 32 participants from a longitudinal study of children who were born very preterm (VPT) and matched them with 29 term-born peers. We tested associations between pre-existing mental issues with COVID-19 related child emotions in VPT and term-born children, while controlling for the impact on their parents' emotions. We found that the emotional impact of the COVID-19 lockdown did not differ between VPT children and their term-born peers as a whole; they also show comparable effects of lockdown-related stressors on emotions and worries of the parents of VPT and full-term children. However, results of this study indicate that specifically among VPT children, higher pre-existing internalising symptoms were associated with more COVID-19 related emotional problems and concerns during the lockdown. These findings not only show that pre-existing internalising symptoms were selectively associated with lockdown-related emotional problems in VPT children but suggest that VPT children with pre-existing internalising problems may be more vulnerable to the negative impact of societal and familial stressors in general. Our results highlight that very preterm children may be in need of more attention and care to reduce emotional impact when exposed to environmental change.

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Studies involving animal subjects

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Studies involving human subjects

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Hammersmith and Queen Charlotte's Research Ethics Committee
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Inclusion of identifiable human data

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Data availability statement

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Comparing the emotional impact of the UK COVID-19 lockdown in very preterm and full-term born children: a longitudinal study

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Key words: COVID-19, child mental health, very preterm children, internalizing symptoms, lockdown.

Abstract

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Results: There were no significant group differences in pre-existing SDQ internalizing/externalizing symptoms, child's emotions or parent's emotions during the COVID-19 lockdown. However, higher pre-existing internalizing symptoms in VPT children were associated with greater lockdown-related emotional problems and worries (simple slope=1.95, $p<0.001$), whereas this was not observed in term-born children.

Conclusion: Our results suggest that VPT children with pre-existing internalizing problems may be more vulnerable to the negative impact of certain societal and familial stressors, such as social restrictions during the national COVID-19 lockdown periods. Further rigorous studies are therefore needed to assess the severity of increased risks for this particularly vulnerable group in the context of potentially stressful life changes and adjustments.

1 Introduction

Restrictions to daily life during the COVID-19 pandemic had profound effects on children's well-being, friendships and mental abilities. Closure and reduction of access to academic settings and routine medical care resulted in decreased social support to children and young people, with likely adverse consequences for their mental health (Meherali et al., 2021, Panchal et al., 2021, Singh et al., 2020). In addition, the COVID-19 pandemic was associated with socioeconomic challenges for some families, due to increasing financial pressure, income decline and job loss (Fegert et al., 2020, Newlove-Delgado et al., 2021). Taken together, such factors contributed to changes in family dynamics during these uncertain times, in some instances exacerbating psychological stress for all family members (Ehrler et al., 2021).

Whilst it is now established that the COVID-19 pandemic has caused a global secondary mental health crisis (O'Connor et al., 2021, Kola et al., 2021), this appears to be especially true for those individuals who are vulnerable to stress and anxiety due to pre-existing mental health conditions (Stinson et al., 2021, Viner et al., 2022). In uncertain times and when facing stressful events, such individuals may be particularly worried about what is happening, become socially isolated and, at the extreme end, experience mental health problems (Griffiths et al., 2019, Garcini et al., 2017).

Here we studied the emotional impact of the COVID-19 lockdown on children who were born very preterm (VPT, <32 weeks' gestation) as they are vulnerable to stress and anxiety (Brummelte et al., 2012). Furthermore, VPT adolescents have also been found to show a more than twofold incidence of anxiety symptoms in the clinical range compared to their full-term born peers (Treyvaud et al., 2013, Johnson et al., 2010), including increased emotional and behavioral symptoms (Johnson et al., 2019) and attention-deficit/hyperactivity disorder (ADHD) (Rommel et al., 2017). They also have a doubled risk of developing clinically significant anxiety compared to full-term-born children (Somhovd et al., 2012).

Given the pre-existing vulnerability of VPT children to mental health difficulties, we investigated the effects of COVID-19-related stressors on children's and parents' behavior, relationships and mental health. We hypothesized that VPT children would be more negatively impacted than their term-born peers by lockdown-related stressors and that their pre-existing mental health would be associated with COVID-19 related emotional problems. Understanding the impact of COVID-19 on VPT children will help us understand what type of mental health support is needed, now and in the future.

2 Methods

This longitudinal study recruited parents of very preterm and full-term born children who had previously taken part in the ongoing Brain, Immunity and Psychopathology following very Preterm birth (BIPP) study.

2.1 Participants

This study recruited parents of very preterm and full-term children who had taken part in the Brain, Immunity and Psychopathology following very Preterm birth (BIPP) study. The BIPP study is currently ongoing, inviting consenting participants who previously took part in the 'Evaluation of MR imaging to predict neurodevelopmental impairment in the preterm infant' study (ePrime; EudraCT 2009-011602-42 (Edwards et al., 2018)) to complete a follow-up assessment between the ages of 8 and 10 years. Eligible participants were those who had previously taken part in a behavioral follow-up assessment at the age of 4-7(Vanes et al., 2021, Kanel et al., 2021). Infants recruited into ePrime had the following inclusion criteria: birth before 33 weeks of gestation, maternal age above 16 years, and mothers not being hospital inpatients. Exclusion criteria were major congenital malformations, contraindications to magnetic resonance imaging, parents not being able to speak English, or being subject to child protection proceedings. 511 very preterm infants delivered at 14 hospitals in the North and South-West London Perinatal Network were recruited at birth between April 2010 and July 2013 (Edwards et al., 2018).

Full-term (FT) born controls matched for sex and age are also currently being studied as part of the BIPP study. Controls were recruited via three strategies: asking parents of preterm children to invite a child of the same sex and similar in age within the same academic year to participate in the study, through recruitment letters to local schools and via internal advertisements to college staff and students. Inclusion criteria are full-term birth (38-42 weeks) and birth weight >2500 grams, the exclusion criteria are a history of neurological conditions (meningitis, head injury and cerebral infections) and contraindication for MRI. The BIPP study aims to recruit 240 VPT and 120 term-born participants by August 2024.

The parents of 134 BIPP participants (83 VPT children and 51 FT) who had already been assessed in person between October 2018 and July 2021 were contacted via email in September 2021 and asked to complete an online modified version of the Coronavirus Health and Impact Survey (Nikolaidis et al., 2021). The current study included 32 questionnaires completed by a parent of a VPT child and 29 questionnaires completed by a parent of a term-born child (Figure 1).

This study was conducted in accordance with the ethical standards of the 1964 Helsinki Declaration. The study was approved by the King's College London Ethics Committee (REC: LRS/DP-20/21-21931); ePrime by the Hammersmith and Queen Charlotte's Research Ethics Committee (REC: 09/H0707/98); BIPP by the South East Research Ethics Committee (REC: 19/LO/1940) and the Stanmore Research Ethics Committee (REC: 18/LO/0048).

2.2 Assessments

The SDQ parent report and the WISC child assessment were conducted in person between October 2018 and July 2021.

CRISIS Questionnaire

The Online Surveys platform (https://www.onlinesurveys.ac.uk) was used to obtain participants' informed consent and complete the CRISIS. The survey was completed by one of the child's legal guardians (97% birth mothers, 3% birth fathers). All the other assessments had already been collected as part of BIPP study prior to the CRISIS completion.

The CRISIS was created to assess the mental health impact of the COVID-19 pandemic, covering key domains relevant to mental distress and resilience (Nikolaidis et al., 2021). All three versions (for adults, parents/caregivers and youth) cover six domains, including COVID-19 exposure, COVID-19-related emotions/worries, life changes, mood states, substance use and daily behaviors. Our online survey used the parent/caregiver form to assess the impact of COVID-19 on children, and the adult self-report form to assess its impact on the responding parent (V1.0, http://www.crisissurvey.org/download/). Questions were rephrased to reflect the time during the UK's government-imposed COVID-19 lockdown period, rather than focusing only on the past two weeks, as in the original version. The varying degrees of national restrictions in the United Kingdom ranged from forced "stay at home measures" to eased "2m rules" and "Rule of six" .

For this study, we focused only on items in the "Emotions/Worries" sections pertaining to either the child or the parent (see Table 1 and Appendix). Responses to 13 items in the Emotions/Worries section of the parent/caregiver form were coded as 0 to 4 and the sum of scores was calculated to derive a continuous child emotions variable. The same coding was used for 10 questions in the "Emotions/Worries" section of the adult self-report form, and the sum of scores was calculated as a continuous variable to reflect parent emotions. Internal reliability of both the child and parent emotions subscales were found to be acceptable in our sample, with Cronbach's alpha for the child emotions subscale of 0.828, 95% CI [0.747, 0.880]; and for the parent emotions subscale of 0.735, 95% CI [0.622, 0.804].

Strengths and Difficulties Questionnaire (SDQ)

Parents had previously completed the Strengths and Difficulties Questionnaire (SDQ) (Goodman, 1997, Goodman et al., 2010) as part of the BIPP study. The SDQ is a 25-item questionnaire to assess behavioral and emotional symptoms used to evaluate mental health concerns in children and young people aged 4 to 17. The SDQ comprises five sub-scales of five items each: emotional symptoms; conduct problems, hyperactivity/inattention, peer relationship problems and prosocial behavior. For this study, the "Emotional Symptoms" and "Peer relationship" subscales were combined into an internalizing subscale, while the "Conduct problems" and "Hyperactivity/inattention" subscales were combined into an externalizing subscale (Goodman et al., 2010).

Internalizing and externalizing subscales were considered to reflect pre-existing

psychopathology in the children. However, given the between-participant variation in the amount of time elapsing between completion of the SDQ and the CRISIS, a time gap variable was calculated as the number of days between the SDQ assessments and CRISIS survey completion, which was used in all further analyses as a covariate of interest.

Wechsler Intelligence Scale for Children, Fourth Edition (WISC-IV)

The Wechsler Intelligence Scale for Children, Fourth Edition (WISC-IV) (Wechsler, 2003) was administered as part of the BIPP study. Full-scale intelligence quotient (IQ) scores were derived as a measure of children's cognitive abilities.

2.3 Statistical analysis

Statistical analyses were performed in R-4.2.1 and RStudio-1.4.1717. Independent samples t-tests were used to probe differences between the VPT and the full-term (FT) groups on continuous variables of interest. Separate linear regression models were run to test for the effects of pre-existing internalizing symptoms (or externalizing symptoms, respectively) and group (VPT vs FT) on children's emotions during the lockdown. These regression models controlled for sex, age, time interval (between SDQ and CRISIS assessments), and parent's emotions during the lockdown.

Each model was compared to a further model including the interaction between internalizing (or externalizing, respectively) and group using likelihood ratio F-tests, to determine whether the association between pre-existing mental health symptoms and children's emotions differed between groups. In the case of a significant interaction, simple slope analyses were conducted to quantify the effect. Due to group differences in IQ, we also reran these regression analyses after inclusion of IQ as an additional covariate of no interest in all models.

3 Results

3.1 Sample characteristics

Table 2 presents the characteristics of the study sample. There were more boys than girls in the VPT group and more girls than boys in the control group, but there was no group difference in age, internalizing, or externalizing symptoms. FT children had significantly higher IQ than VPT children. There were no significant differences between participants included in this study and the overall BIPP sample at time of study in terms of SDQ internalizing symptoms, externalizing symptoms, age, or sex distribution, all *p*s > .05.

3.2 COVID-19 related child and parent emotions

In order to explore differences between group in COVID-19 related child and parent's emotions (indexed by the CRISIS), univariate linear regressions were conducted with group, sex, age and time gap as predictors. There was no difference in COVID-19

related child emotions between the VPT (M = 16.97, SD = 9.16) and control (M = 15.66, SD = 5.84) groups, B=0.77 [-3.71,5.25], p=0.73; and no difference in parent emotions between the VPT (M = 19.75, SD = 6.48) and control (M = 19.13, SD = 6.17) groups, B=-0.10 [-184 3.63,3.41], p=0.95, after accounting for the aforementioned confounders.

3.3 Pre-existing internalizing and externalizing symptoms and COVID-19 related child emotions

A model comparison using likelihood ratio F-test demonstrated that the model predicting child emotions during the lockdown from pre-existing internalizing symptoms (and adjusting for age, sex, time gap, and parent's emotions) was significantly improved by the inclusion of an interaction between group and pre-existing internalizing symptoms (F=13.09, p<0.001). The results of this model are shown in Table 3 and Figure 2a. A simple slope analysis revealed that, while in FT children there was no significant association between pre-existing internalizing symptoms and lockdown-related emotional problems (simple slope=0.12, p=0.74), VPT children showed a significant positive association between the two (simple slope=1.95, p<0.001), suggesting that higher pre-existing internalizing symptoms were associated with greater emotional problems and worries during the COVID-19 lockdown. Interestingly, after including these effects of pre-existing internalizing symptoms and their interaction with group, the main effect of group on COVID-19 related child emotions also became significant, indicating increased emotional problems in VPT compared to FT children (see Table 3) when taking internalizing problems into account. Inclusion of IQ in both the simple and interaction model did not alter the results of the model comparison (F=12.89, p<0.001).

Another model comparison using the likelihood ratio F-test demonstrated that the fully adjusted model (age, sex, time gap, and parent emotions) predicting child emotions during the lockdown from pre-existing externalizing symptoms was not significantly improved by the inclusion of interaction between group and pre-existing externalizing symptoms (F=17.97, p=0.53). The results of this model are shown in Table 3 and Figure 2b. Results suggest that there was no association between externalizing symptoms and emotional problems and worries during the COVID-19 lockdown in either VPT or FT children. Inclusion of IQ in both the simple and interaction model did not alter the results of the model comparison (F=0.24, p=0.63).

4 Discussion

Results of this study indicate that the emotional impact of the COVID-19 lockdown did not differ between VPT children and their term-born peers as a whole; they also show comparable effects of lockdown-related stressors on emotions and worries of the parents of VPT and full-term children. However, results of this study indicate that specifically among VPT children, higher pre-existing internalizing symptoms were associated with more COVID-19 related emotional problems and concerns during the lockdown. Importantly, these findings control for key demographic variables as well as

the parents' own lockdown-related emotions and worries. The latter was indeed found to be significantly associated with children's emotions, which likely reflects both shared familial effects of the lockdown on parent and child, as well as potential rater bias given that all scales were completed by the parent.

Our findings are in line with a recent longitudinal study which showed that preterm birth and pre-existing mental health problems were associated with a greater risk for emotional and attention-deficit/hyperactivity disorder symptoms during lockdown (Bailhache et al., 2022). Another study comparing the impact of the COVID-19 lockdown on three groups of children found that the lockdown had a substantial influence on the entire family and added stress to families with children who were at risk for neurodevelopmental deficits (Ehrler et al., 2021). Evidence from two British cohorts also suggested that children with autism and their parents, who had experienced more pre-pandemic mental health symptoms, were more likely to have more pandemic-related mental health symptoms (Palmer et al., 2022).

In terms of the association between pre-existing psychiatric risk and the emotional impact of national lockdowns, findings to date have been inconsistent. A recent study indicated that the emotional impact of COVID-19 was not exacerbated in children with early brain injury or low IQ (Williams et al., 2022); another study showed a detrimental impact of lockdowns on mental well-being only in young people without pre-existing depressive symptoms (Joensen et al., 2022). However, other studies found that the lockdown had severely increased pre-existing stress and depression (Buneviciene et al., 2022, Palit et al., 2022), suggesting there is substantial heterogeneity in COVID-19 related emotional impact across different populations (Ma et al., 2021, Panchal et al., 2021, Lovato et al., 2022, Stinson et al., 2021, Viner et al., 2022). Our findings suggest that preterm children with pre-existing psychopathology represent a particularly vulnerable group in this context.

This study has several limitations. Firstly, the CRISIS questionnaire was administered only once and probed parents' and children's emotion during the course of COVID-19 lockdown, thus preventing a detailed evaluation of the timing and trajectories of lockdown effects on mental health. Some studies have in fact described gradually increasing symptom severity at the beginning of lockdown, which decreased after the lockdown ended (Castellini et al., 2021, Caldiroli et al., 2022), while others suggested that the most severe mental health symptoms occurred in the early stages of lockdown, but declined fairly rapidly afterwards (Fancourt et al., 2021). Secondly, our sample size is relatively small for both groups, and findings therefore may not be generalizable to all VPT and term children; however, the studied sample did not significantly differ from the overall sample in terms of key characteristics such as age, sex, and psychopathology, which have also been tested in other analysis based on the same sample (Leoni et al., 2022, Leoni et al., 2023). Our study is also limited by the non-random sampling method for term-born peers, although this approach may ensure greater similarity between control and preterm participants (Marlow et al., 2005). Thirdly, all assessments relied on parent-report, which could have led to measurement bias, although we included

parents' emotional problems as a confounding variable in our analyses to control for this. Finally, as our findings relate to a UK-based sample, their generalizability to other countries may be limited, given substantial differences in relevant variables such as healthcare or severity of nationally imposed COVID-related restrictions.

5. Conclusion

This study demonstrates that internalizing problems were associated with greater susceptibility to a negative emotional impact of the COVID-19 lockdown in VPT, but not term-born children. Our results suggest that VPT children with pre-existing internalizing problems may be more vulnerable to the negative impact of certain societal and familial stressors, such as social restrictions during the national COVID-19 lockdown periods. Further rigorous work is required to assess the severity of increased risks for this particularly vulnerable group in the context of potentially stressful life changes and adjustments.

Data Availability Statement

Datasets are available on request: The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author Contributions

ZS, LH, CN, LV have substantial contributions to the conception or design of the work as well as the acquisition, analysis, or interpretation of data for the work. All authors contributed to drafting the work or revising it critically for important intellectual content as well as the final approval of the version to be published. ZS, CN, LV agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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469 **Table 1** Adapted CRISIS questions for each item included in the primary outcome
470 variables (child's emotions and parent's emotions).

Variable	Item
Child emotions/worries (during the lockdown period):	1. How worried was your child generally? 2. How happy versus sad was your child? 3. How much was your child able to enjoy his/her usual activities? 4. How relaxed versus anxious was your child? 5. How fidgety or restless was your child? 6. How fatigued or tired was your child? 7. For their age, how well has your child been able to concentrate or focus? 8. How irritable or easily angered was your child? 9. How physically aggressive towards others was your child? 10. How physically aggressive have others been towards your child? 11. How lonely was your child? 12. How worried was your child about being infected? 13. How worried was your child about friends or family being infected?
Parent's emotions/worries (during the lockdown period):	1. How worried were you generally? 2. How happy versus sad were you? 3. How much were you able to enjoy your usual activities? 4. How relaxed versus anxious were you? 5. How fidgety or restless were you? 6. How fatigued or tired were you? 7. How well were you able to concentrate or focus? 8. How irritable or easily angered were you? 9. How lonely were you? 10. How worried were you that you or someone in your family would become infected?

471
472 **Table 2** Demographic, clinical, cognitive and pre-lockdown mental health
473 characteristics of the study participants.

	Variable	Full-term (n=29)	Preterm (n=32)	Statistics
Demographic and clinical measures	Sex n (number, %)			Chi-Square
	Male	8 (27.6)	20 (62.5)	X^2=6.13 *
	Female	21 (72.4)	12 (37.5)	
		Mean (SD)	Mean (SD)	t (95%CI)
	Age	8.8 (0.8)	8.7 (0.7)	0.58 (-0.27, 0.49)
	Gestational Weeks	39.9 (1.2)	29.8 (2.3)	22.08 (9.14, 10.97) ***
Pre-lockdown measures	IQ	112.1 (12.5)	104.0 (16.0)	2.19 (0.70, 15.45) *
	SDQ Externalising	4.9 (2.9)	6.3 (3.7)	-1.66 (-3.05, 0.28)
	SDQ Internalising	4.7 (3.0)	5.9 (2.7)	-1.57 (-2.62, 0.32)

*- p<0.05; **-p<0.01; ***-p<0.001*

SD- standard deviation; SDQ - Strengths and Difficulties Questionnaire.

Table 3 COVID-19 related child's emotions model predictors

Dependent variable: Child's emotions during lockdown		
Model 1 Predictors	B [95% CI]	p-value
Group: VPT	-10.28 [-16.53, -4.04]	0.002
Age	0.64 [-1.64, 2.92]	0.575
Sex: Male	0.63 [-2.63, 3.88]	0.702
Time gap	0.00 [-0.00, 0.00]	0.413
Pre-lockdown internalizing symptoms	0.12 [-0.59, 0.83]	0.740
Parent's emotions during lockdown	0.59 [0.35, 0.83]	<0.001
Interaction of group and internalizing symptoms	1.84 [0.81, 2.86]	<0.001
Model 2 Predictors	B [95% CI]	p-value
Group: VPT	0.63 [-3.15, 4.42]	0.346
Age	1.46 [-1.28, 4.21]	0.291
Sex: Male	-0.66 [-4.61, 3.27]	0.736
Time gap	0.00 [-0.00, 0.01]	0.223
Pre-lockdown externalizing symptoms	0.24 [-0.31, 0.79]	0.378
Parent's emotions during lockdown	0.69 [0.40, 0.98]	<0.001

Figure Caption

Figure 1: Flow chart of participants inclusion. For the follow-up at 4-7 years of age, a convenience sample (N=251) was recruited corresponding to 82% of 306 participants who were past their fourth birthday by the follow-up study end date (September 1st, 2019), and had consented to be contacted for future research.

Figure 2: Scatter linear regression plot describing associations between pre-existing internalizing (a) and externalizing (b) symptoms and emotions during lockdown in VPT and FT children.

Figure 1.JPEG

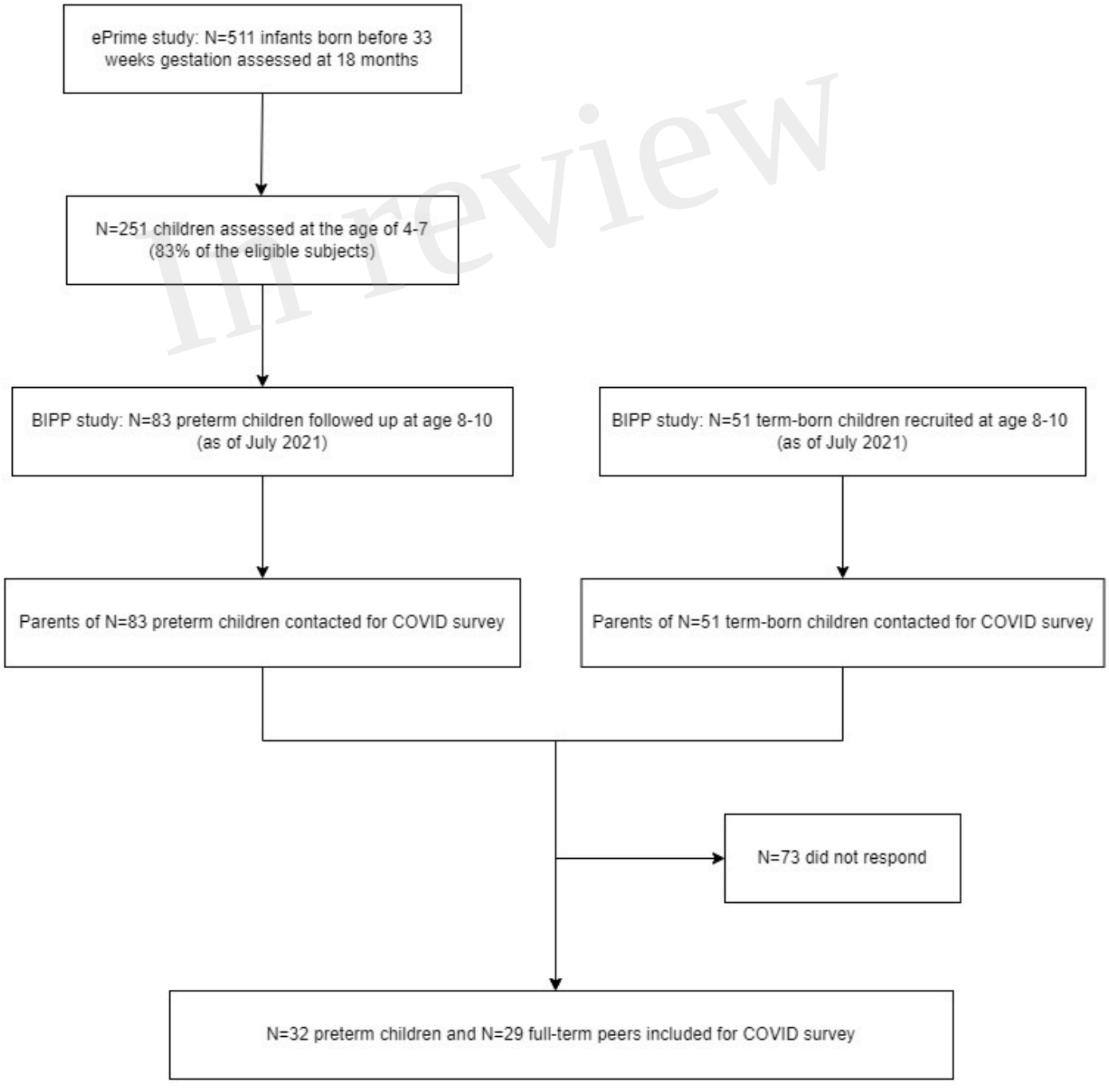

Figure 2.JPEG