NEW RESEARCH

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Child and Maternal Mental Health Before and During the COVID-19 Pandemic: Longitudinal Social Inequalities in a Brazilian Birth Cohort

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Objective: The coronavirus disease 2019 (COVID-19) pandemic has caused major stress for families and children, particularly in the context of prolonged school closures. Few longitudinal studies are available on young children's mental health, including data both before and during the pandemic. This study examined experiences that might increase risk for mental health problems among caregivers and young children during the COVID-19 pandemic and inequalities driven by pre-pandemic disadvantage.

Method: This prospective, population-based birth cohort study in Pelotas, Brazil, analyzed 2,083 children and caregivers with data from before the pandemic in 2019, when children were 4 years old, and again in 2020, when schools were closed for a long period during the pandemic. Child conduct problems, emotional problems, and hyperactivity-inattention problems were assessed using the Strengths and Difficulties Questionnaire. Family financial hardship, relationship difficulties, caregiver mental health, parenting practices, and child fears and isolation were considered as potential risk factors.

Results: Across the whole population, the only significant increase in mental health problems from before to during the pandemic was found for maternal depression. However, poorer families were at far greater risk of experiencing serious financial problems, food shortages, increased conflict in adult relationships, parenting problems, and child worries about food availability during the pandemic. In turn, these difficulties were associated with increases in multiple mental health problems for both caregivers and children. Increased child mental health problems were most strongly associated with concurrent maternal anxiety ($\beta > 0.20$, $p < .001$, for each of child conduct, emotional, and hyperactivity problems), maternal depression ($\beta = 0.26$, $p < .001$, for child emotional problems), partner criticism ($\beta = 0.21$, $p < .001$, for child conduct problems), and harsh parenting ($\beta > 0.20$, $p < .001$, for both child conduct and hyperactivity problems). Child worry about COVID-19 was associated with increased emotional problems ($\beta = 0.14$, $p < .001$), but children's isolation was not associated with their mental health.

Conclusion: Overall, the impact of the COVID-19 pandemic on mental health is a mixed picture, but for families in poverty, marked material and interpersonal difficulties were associated with increases in mental health problems among children and caregivers.

Key words: children; COVID-19 pandemic; inequality; mental health; parenting

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The coronavirus disease 2019 (COVID-19) pandemic has caused enormous psychosocial strain for families and individuals and highlighted the weaknesses of mental health systems worldwide.[1] In the first years of the pandemic, nearly every country imposed lockdowns, to varying degrees, to contain the virus. While such measures are vital public health strategies, they also represent major social upheavals with economic costs. Combined with fears about the virus itself and experiences of illness and loss, these social challenges carry profound implications for population mental health, with the largest and longest-lasting impacts most likely in underresourced settings.[1-3]

There are marked inequalities in COVID-19 illness and mortality, and financial impacts have been heavily socially concentrated during the pandemic.[4] Accordingly, mental health problems are likely to be most pronounced in families with preexisting income disadvantage, who are both more exposed and more vulnerable to the challenges caused by the pandemic.[5,6] For children, a major concern has been the effects of school closures during the pandemic, given the vital role schools play in learning,

socialization, mental health, protection, and, for many children, access to food. Although school closures were relatively brief for most children worldwide, for approximately 170 million children, schools were closed for at least half of the year from March 2020.[7] These difficulties may have particularly pronounced consequences for mental health among younger children and their parents, given young children's care needs, difficulties understanding changes caused by the pandemic, and challenges engaging young children in school remotely.[8]

To understand the effects of the pandemic on children's mental health, there is a critical need for longitudinal studies that include measures both before and during the pandemic and possible determinants of change.[3] Cross-sectional studies have reported high levels of stress, worry, and social and behavioral difficulties for children and adolescents during the pandemic,[9] but few longitudinal studies are available, especially regarding the experiences of young children. In a rare longitudinal study of 2- to 8-year-olds in the United States, levels of worry and uncooperative behavior did not change significantly from before to during the pandemic, but parental negative mood did decline, and family hardships during the pandemic were associated with both parent and child mental health outcomes.[10] Considering systems theories of development, it is likely that children's mental health during the pandemic can best be understood from the point of view of a cascading series of risk, including social upheaval and financial challenges, which impose on caregiver well-being, family relationships, and parenting.[11]

In the current study, we aimed to describe child and maternal mental health problems in a population-based study using longitudinal data collected in the year before the pandemic (2019) and during the pandemic (mid-2020) in a Brazilian city where nearly all schools remained closed for more than a year beginning in March 2020. Our focus was on the variation of experiences families had and their implications for child and maternal mental health. Brazil has been one of the worst hit countries in the pandemic, registering greater than 600,000 deaths caused by COVID-19 by the end of 2021. There has been a tragic lack of national coordination of public health and education policies and major income cuts for large segments of the population.[12] In this context, we examined inequalities in child and caregiver mental health symptoms according to both pre-pandemic family income and financial difficulties experienced during the pandemic. We further investigated the impact of social inequalities on adult relationships and parenting difficulties and whether these might explain why some individuals experienced increases in mental health problems from before to during the pandemic.

METHOD

Study Design and Sample

The 2015 Pelotas (Brazil) Birth Cohort Study is a population-based, prospective, longitudinal study including all children born in 2015 in Pelotas, a city of approximately 340,000 people in Southern Brazil. Data collection started in 2014 when pregnant women were invited to participate in the antenatal study. For the perinatal study, data were collected on 99.9% (N = 4,275) of all live births in the city from January to December 2015. Mothers and their children were assessed again at ages 3, 12, and 24 months in participants' homes and at 4 years in person at the university research clinic. More details on the cohort are described elsewhere.[13]

The last in-person follow-up included 4,010 children seen at age 4 years (mean [SD] = 45.5 [2.6] months), finalizing in September 2019. In 2020, we developed an online survey to examine family living conditions and health-related behaviors in the context of the COVID-19 pandemic. All live singletons and first-born twins in the cohort were eligible to participate (N = 4,158). Data collection took place between May and September 2020, when schools remained closed for the entire period due to the pandemic. Given the high rates of COVID-19 in Brazil and the closure of university buildings for research, mothers or caregivers were invited via social media and telephone to participate in a brief web-based survey. For mothers or caregivers without internet access, a telephone interview was offered, and 3% of respondents completed the questionnaire by this method. We considered the questionnaire complete if more than 80% of items were answered, partially complete if between 50% and 80% of items were answered, and incomplete if less than 50% of items were answered. Only participants with complete and partially complete questionnaires (ie, response items $\geq$50%) were included in the analysis. Children for whom this questionnaire was complete/partially complete had a mean (SD) age of 60.5 (3.6) months. The electronic questionnaire used during the in-person interview at age 4 years and the online questionnaire in 2020 were developed using REDCap.[14]

The following outcomes were analyzed in this study (measures are detailed below): mother–partner relationship (levels of criticism), maternal mental health (depression and anxiety), parenting practices (harsh and positive), child mental health (conduct problems, emotional problems, and hyperactivity-inattention problems). The 2015 cohort assessments were approved by the Research Ethics Committees of the Federal University of Pelotas (0–4 years: School of Physical Education #26746414.5.0000.5313; 4 years and COVID-19 pandemic follow-up: Faculty of Medicine

#03837318.6.0000.5317 and #31179020.7.0000.5313), and participants provided written informed consent.

Pandemic Events in Pelotas City

The first case of COVID-19 in Brazil was registered on February 26, 2020 in São Paulo, and the first case in Rio Grande do Sul state, where Pelotas city is located, was identified on March 10, 2020. In Pelotas, public sector schools and kindergartens were closed from March 17, 2020, and from May, a mandate required all private schools to close. In June 2020, the government began implementing some remote classes for children and adolescents in public schools. In July 2020, Pelotas experienced a large increase in COVID-19 cases, and a 1-week general lockdown was implemented, with subsequent high-risk periods occurring several more times until the end of August 2020. Strict lockdowns were not imposed; rather, some restrictions on activities were required, such as shopping centers functioning with 30% capacity, and gyms, beauty salons, and hairdressers functioning with social distancing of individual clients. Although many businesses continued to function, all public schools remained closed, even after the current study, until April 2021 (a year and a month after their closure), when in-person learning was slowly phased back in. Obligatory child attendance was not reinstated until October 2021. The key extra support provided to Brazilian families during the pandemic was emergency welfare, in terms of an income supplement for poorer families. Little was done to deal with growing concerns over other problems, such as domestic violence, and registering of violence against children reduced significantly from before to during the pandemic.[15]

Measures

Child Mental Health. We used the parent-reported Strengths and Difficulties Questionnaire (SDQ)[16] to measure child behavioral and emotional problems both before (at age 4 years in 2019) and during (May to September 2020) the pandemic. The Portuguese version of the SDQ has been validated for use in Brazil.[17,18] We examined 3 subscales of child mental health problems: conduct problems (eg, "Often fights with other children or bullies them"), emotional problems (eg, "Many worries, often seems worried"), and hyperactivity (eg, "Restless, overactive, cannot stay still for long"). Each subscale included 5 items, rated on a 3-point scale (0–2), yielding total scores from 0 to 10.

Maternal Mental Health. Maternal depression was assessed before (at age 4 years) and during the pandemic using items from the Edinburgh Postnatal Depression Scale (EPDS),[19] which has been validated for use in Brazil.[20] We used 3 items of this instrument that had the strongest associations with a total depression score and high prevalence rates at 4 years: "I have felt sad or unwell," "I have felt so sad that I have cried," and (reverse coded) "I have laughed and been able to look on the bright side of life." All 3 items are rated on a 4-point scale (0–3), yielding total scores ranging from 0 to 9. Maternal anxiety was measured in an earlier wave before the pandemic (when children were aged 12 months) and during the pandemic using the Generalized Anxiety Disorder (GAD-7) questionnaire,[21] which has been validated for use in Brazil.[22] The 7 items ask about general anxiety symptoms over the past 2 weeks (eg, "Feeling nervous, anxious or on edge"). All items are rated on a 4-point scale (0–3), from "not at all" to "several days," "more than half," and "nearly all days," with total scores ranging from 0 to 21.

Parenting. Both in 2019 before (at age 4 years) the pandemic and during the pandemic, parenting practices were measured using the Parenting and Family Adjustment Scales (PAFAS),[23] previously adapted for application in Brazil. Harsh parenting was assessed with the coercive parenting subscale (example item: "I spank (smack) my child when they misbehave"). Factor analysis in the current study at age 4 years and in a second Brazilian sample showed that one item ("I argue with my child about their behavior/attitude") should be removed from this subscale, as indicated by poor model fit, leaving 4 items, which are rated on a 4-point scale (0–3), from "not at all" to "a little," "quite a lot," and "very much" and summed to create total scores ranging from 0 to 12. Positive parenting was assessed using 2 items from the positive encouragement subscale: "I enjoy giving my child hugs, kisses and cuddles" and "I have a good relationship with my child." Each was rated on a 4-point scale (0–3), from "not at all" to "very much," and then summed to produce total scores between 0 and 6, with higher scores indicating higher levels of positive parenting.

Mother–Partner Relationship Criticism. Relationship criticism was measured before (at age 4 years) and during the pandemic using 2 questions shown in previous studies to associate strongly with depression[24,25] as well as intimate partner violence in our own sample.[26] The 2 items asked mothers or caregivers how critical they are of their partner and how critical their partner is of them. Both items were rated on a 10-point scale (0–10), giving total scores that ranged from 0 to 20.

Financial Problems During the Pandemic. Financial problems during the pandemic were measured with 3 items. To assess major income loss, participants were asked whether family income in the last month "got a lot worse," "got a little worse," "stayed the same," or "got better" (coded as "yes" ["got a lot worse"] or "no"). To assess food insecurity, participants were asked whether food availability worsened in the last month due to a lack of money (coded as "yes" or "no"). To assess emergency welfare receipt (only made to families with financial difficulties), participants were asked whether someone at home received this support during the pandemic (coded as "yes" or "no").

Child Isolation and Schoolwork During the Pandemic. Child isolation during the pandemic was measured by asking mothers or caregivers whether their child leaves the house "every day," "occasionally," or "only for essential activities," or "stays at home all the time." It was also reported whether children completed any school work in the past month (coded as "yes, school-organized, remote activities"; "no, but parents organized school-type activities"; or "no/not registered at school").

Child Fears During the Pandemic. To measure child fears during the pandemic, mothers or caregivers were asked whether their child was afraid of COVID-19 and whether their child was worried about lack of food and other resources (both coded as "disagree," "neither agree nor disagree," or "agree").

Other Measures Before the Pandemic. Family income was examined before the pandemic (at the age 4-year follow-up) to consider inequalities in outcomes during the pandemic. Total family monthly income was divided into quintiles, and we compared outcomes across 3 groups: low-income families (in the fifth quintile), middle-income families (in the second through fourth quintiles), and high-income families (in the first quintile). For the purposes of weighting the sample to better represent the whole cohort (representing the whole population of Pelotas), we also used measures of child sex, maternal skin color, maternal age, maternal schooling, family income, cohabiting household, and maternal smoking and alcohol consumption at birth and access to internet at home or on a cell phone measured at 24 months (see Table S1, available online).

Statistical Analyses

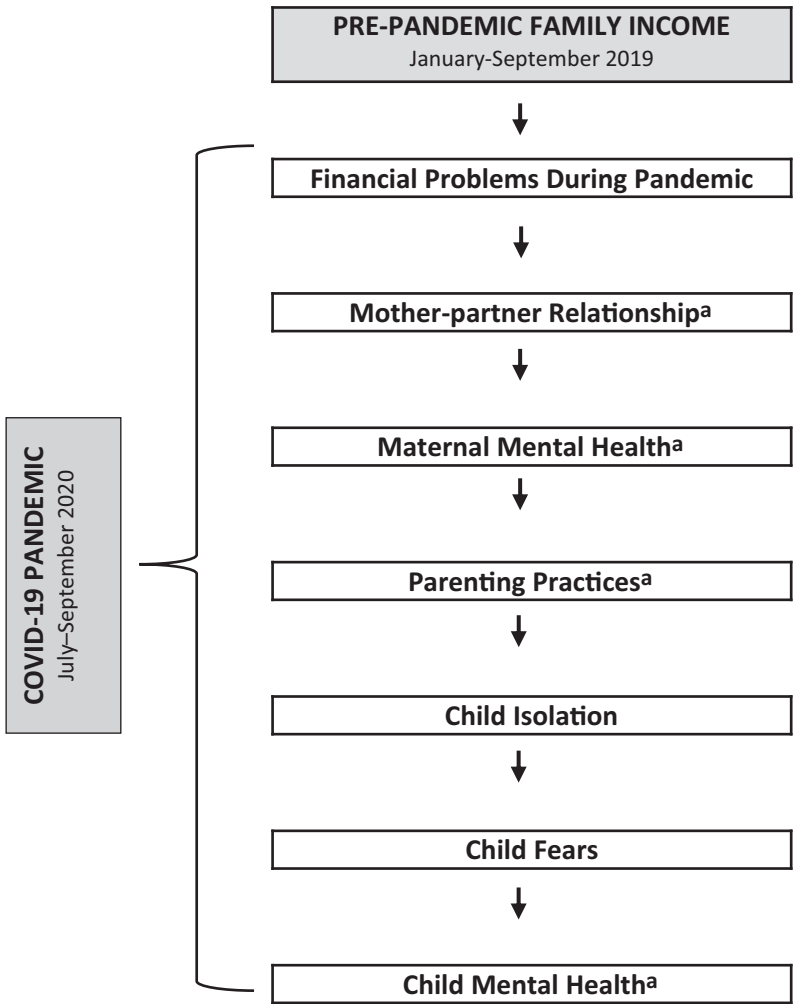
Analyses were conducted in 3 stages. First, to consider social inequalities in pandemic family living conditions, we examined family financial difficulties, child isolation, and child fears during the pandemic, stratified by family income (in the year before the pandemic) and maternal skin color. Second, we examined changes in mean levels of study outcomes from before to during the pandemic, using dependent t tests. Third, we examined associations between potential risk factors and study outcomes to consider possible determinants of change in each outcome from before to during the pandemic. We investigated risk factors occurring during the pandemic, assuming a theoretical causal order of the variables shown in Figure 1, reflecting a notion of cascading risk discussed by Prime *et al.*[11] We developed the models by first estimating bivariate associations between risk factors and outcomes as measured during the pandemic. Next, we built an adjusted model for each outcome (eg, child emotional problems) during the pandemic including the baseline measure of that outcome (ie, pre-pandemic child emotional problems, in this example) in the model to estimate a proxy of change and controlled for possible confounders (according to the hierarchal model shown in Figure 1). For each outcome, confounders included in the model were the risk factors in preceding levels that were associated with the outcome ($p < .20$). Thus, the final adjusted coefficients represent the association between each risk factor and a proxy of change in the outcome, from before to during the pandemic, adjusted for confounders based on the hierarchical model. These linear regression results are presented as standardized β coefficients with corresponding 95% CIs and p values. We used inverse probability weighting to address missing data in all analyses, which has been recommended when participants have missing data on entire assessment waves.[27] Supplement 1, available online, shows how weights were derived.

RESULTS

Characteristics of Participants Included in the Survey

Of 4,158 eligible participants, 2,183 (52.5%) mothers or caregivers completed the questionnaire during the pandemic, of which 2,083 (50.1%) were included in the analysis (see Supplement 1, available online, for full details). Based on data from before the pandemic, mothers and caregivers who were included in the analyses had higher levels of education and were more likely to be White and have higher family income compared with those who were not included. They were also more likely to live with their partners and have access to the internet at home or via a cell phone and were less likely to have smoked during pregnancy (see Table S1, available online). These differences were addressed using inverse probability weighting, for the results

FIGURE 1 Conceptual Model Guiding Analyses of Risk Factors and Maternal and Child Outcomes During the COVID-19 Pandemic



Note: [a]Study outcomes, which conceptually can also act as risk factors for other study outcomes.

to better represent the whole cohort population (details of the weighting are shown in Table S2, available online).

Extent of Financial Problems, Child Isolation, and Child Fears During the Pandemic

Table 1 shows caregiver-reported family financial difficulties, child isolation, and child fears during the pandemic, stratified by family income before the pandemic and by maternal skin color. Among families with a low income before the pandemic, 33.0% experienced major income loss during the pandemic, 43.1% experienced food insecurity, and 79.4% needed emergency welfare receipt (with significantly lower rates among medium-income families, and the lowest rates among the richest families). About two-fifths (42.4%) of children were not leaving their homes during the pandemic, regardless of family income. While schools were closed during the pandemic, many organized remote activities for children, but this provision varied substantially by family income: 70% of children in high-income families had remote school activities compared with 36% in low-income families. Nearly half of all caregivers (42.6%) reported that their child was afraid of COVID-19, and this varied little across income groups. However, children from low-income families were much more likely to be worried about a lack of food and other resources (30.0%) compared with children from medium-income (15.7%) and high-income families (5.7%; $p < .001$). These difficulties during the pandemic were also structured by maternal skin color, with all types of financial stresses more likely for mothers with Black/mixed skin color than mothers with White skin color. Also, children whose

TABLE 1 Financial Problems and Child Isolation and Fears During the COVID-19 Pandemic for the Total Sample and Stratified by Pre-Pandemic Family Income and Maternal Skin Color

	Total sample		Family income pre-pandemic			Maternal skin color	
	Unweighted n (%)	Weighted n (%)	High weighted %	Medium weighted %	Low weighted %	White weighted %	Black/mixed weighted %
Financial problems during pandemic							
Major income loss				$p < .001$		$p = .007$	
No	1,649 (79.2)	2,953 (78.2)	**87.1**	**78.6**	**67.0**	**79.8**	**74.4**
Yes	434 (20.8)	821 (21.8)	**12.9**	**21.4**	**33.0**	**20.2**	**25.6**
Food insecurity				$p < .001$		$p < .001$	
No	1,614 (77.5)	2,838 (75.2)	**93.8**	**74.4**	**56.9**	**78.6**	**66.6**
Yes	469 (22.5)	936 (24.8)	**6.2**	**25.6**	**43.1**	**21.4**	**33.4**
Emergency welfare receipt				$p < .001$		$p < .001$	
No	897 (43.1)	1,496 (39.6)	**67.4**	**36.0**	**20.5**	**43.5**	**29.8**
Yes	1,186 (56.9)	2,279 (60.4)	**32.6**	**64.0**	**79.4**	**56.5**	**70.2**
Child isolation							
Child leaves house				$p = .935$		$p = .210$	
Every day/occasionally	223 (10.7)	404 (10.7)	10.8	10.4	11.7	10.3	11.7
Only for essential activities	981 (47.1)	1,770 (46.9)	46.8	47.4	45.3	48.1	43.9
Stays at home all the time	879 (42.2)	1,601 (42.4)	42.4	42.3	42.9	41.6	44.4
School work at home in last month				$p < .001$		$p = .034$	
Yes: school-organized activities	1,064 (51.1)	1,846 (48.9)	**70.0**	**45.7**	**36.0**	**50.6**	**44.5**
Yes: parent-organized activities	453 (21.7)	841 (22.3)	**14.1**	**24.5**	**24.1**	**21.2**	**25.0**
No/not registered in school	566 (27.2)	1,087 (28.8)	**15.9**	**29.8**	**39.9**	**28.1**	**30.5**
Child fears							
Afraid of COVID-19				$p = .139$		$p = .480$	
Disagree	483 (23.2)	885 (23.4)	27.5	22.4	22.2	23.0	24.5
Neither agree nor disagree	708 (34.0)	1,281 (33.9)	34.0	34.5	32.1	34.7	32.0
Agree	892 (42.8)	1,608 (42.6)	38.5	43.1	45.7	42.3	43.5
Worried about food/other resources				$p < .001$		$p < .001$	
Disagree	1,226 (58.9)	2,162 (57.3)	**73.6**	56.4	**41.9**	**59.8**	**51.0**
Neither agree nor disagree	549 (26.4)	997 (26.4)	**20.7**	**27.9**	**28.1**	**26.4**	**26.6**
Agree	308 (14.8)	615 (16.3)	**5.7**	**15.7**	**30.0**	**13.9**	**22.5**
Total N	2,083	3,775	781	2,294	700	2,714	1,060

Note: *Boldface type indicates statistically significant group differences at $p < .05$. Low = lowest quintile; Medium = middle 3 quintiles; High = highest quintile.*

mothers had Black/mixed skin color were less likely to have engaged in school activities and were more likely to be worried about food availability than children whose mothers had White skin color.

Average Changes in Family Functioning and Maternal and Child Mental Health From Before to During the Pandemic

Table S3, available online, shows mean levels of maternal and child mental health and family functioning scores before and during the COVID-19 pandemic. The largest change was in terms of increases in maternal depression from before to during the pandemic ($d = 0.67$, $p < .001$), while maternal anxiety showed a very small decrease ($d = -0.08$, $p < .001$). There was no change in mother–partner relationship criticism from before to during the pandemic ($d = -0.04$, $p = .323$). Both harsh parenting ($d = -0.33$, $p < .001$) and positive parenting ($d = -0.25$, $p < .001$) decreased during this period. Finally, while child conduct problems and hyperactivity decreased ($d = -0.30$ and -0.13, respectively, both $p < .001$), mean levels of emotional problems were similar before and during the pandemic ($d = 0.05$, $p = .089$).

Risk Factors for Increases in Poor Family Functioning and Maternal Mental Health Problems During the Pandemic

Next, we examined possible risk factors explaining why some families, but not others, experienced worsened family functioning and mental health from before to during the pandemic. Pre-pandemic poverty was associated with increases in relationship criticism, maternal depression, and maternal anxiety during the pandemic, even after adjusting for baseline levels of these variables (Table 2). Income loss, food insecurity, and emergency welfare receipt during the pandemic were also associated with increases in mother–partner relationship criticism, maternal depression, and maternal anxiety, adjusting for both baseline levels of these variables and pre-pandemic family income (standardized regression coefficients ranging between 0.05 and 0.20).

Table 3 shows risk factors explaining changes in parenting practices from before to during the pandemic. Pre-pandemic low family income and financial problems during the pandemic were associated with a decrease in positive parenting (standardized coefficients ranging between 0.07 and 0.11), but were not associated with changes in harsh parenting. Relationship criticism and maternal depression and anxiety were associated with increases in harsh parenting and decreases in positive parenting, even after adjusting for baseline levels of these outcomes and family financial difficulties (standardized coefficients ranging between 0.09 and 0.28).

Risk Factors for Increases in Child Mental Health During the Pandemic

Table 4 presents risk factors for increases in child conduct problems, emotional problems, and hyperactivity-inattention symptoms from before to during the pandemic. Children in families with lower income before the pandemic showed increases in all types of mental health problems during the pandemic. Financial difficulties, mother–partner relationship criticism, maternal mental health, parenting, child isolation, and child fears during the pandemic all were associated with concurrent conduct problems, emotional problems, and hyperactivity in bivariate analyses. In adjusted analyses, increased child conduct problems were most strongly associated ($\beta > 0.20$) with high levels of mother–partner relationship criticism, maternal anxiety, and harsh parenting during the pandemic. The risk factors most strongly associated ($\beta > 0.20$ in adjusted analyses) with increases in emotional problems were maternal depression and anxiety. For hyperactivity problems, maternal anxiety and harsh parenting had the largest associations.

DISCUSSION

This population-based, longitudinal study in Brazil identified large inequalities in family difficulties and related child and maternal mental health during the COVID-19 pandemic. The pandemic has posed major challenges for entire populations, but low-income families and mothers of Black/mixed skin color in this study were at far greater risk of serious financial loss, food shortages, and children having no contact with school or school-organized activities. These difficulties were associated with increased conflict in adult relationships, parenting problems, and children's worries about food availability during the pandemic. In turn, these experiences were associated with increased mental health problems in children (conduct, emotional, and hyperactivity-inattention) and their caregivers (depression and anxiety), suggesting a cascade of risk from before to during the pandemic in terms of economic inequalities, family functioning, and mental health symptoms of both caregivers and children.

Across the entire sample, maternal depressive symptoms increased substantially, while there were small decreases in maternal anxiety. Another cohort in Brazil also highlighted particular increases in maternal depressive symptoms during the pandemic,[28] although data from Britain suggested anxiety was particularly pronounced.[29] In our Brazilian study, small decreases in symptoms of child conduct and hyperactivity-inattention from before to during the pandemic were found, while emotional problems were similar over this period. Other surveys of children and

TABLE 2 Risk Factors for Mother–Partner Relationship Criticism and Maternal Mental Health During the COVID-19 Pandemic, Adjusting for Pre-Pandemic Levels of Outcomes and Confounders

			Relationship criticism		Maternal depression		Maternal anxiety	
Timing of risk factor	**Model level**	**Risk factor**	**Crude β (95% CI)**	**Adjusted[a] β (95% CI)**	**Crude β (95% CI)**	**Adjusted[a] β (95% CI)**	**Crude β (95% CI)**	**Adjusted[a] β (95% CI)**
Before pandemic	0	Family income	$p = .079$		$p < .001$		$p < .001$	
		High	Reference		Reference		Reference	
		Medium	0.01 (−0.05, 0.07)		**0.11 (0.06, 0.17)**		**0.10 (0.04, 0.15)**	
		Low	**0.06 (0.00, 0.11)**		**0.14 (0.09, 0.19)**		**0.14 (0.09, 0.20)**	
During pandemic	1	**Financial problems**						
		Major income loss	$p < .001$	$p < .001$	$p < .001$	$p < .001$	$p < .001$	$p < .001$
		No	Reference	Reference	Reference	Reference	Reference	Reference
		Yes	**0.11 (0.07, 0.16)**	**0.09 (0.05, 0.13)**	**0.23 (0.19, 0.27)**	**0.20 (0.16, 0.24)**	**0.23 (0.18, 0.27)**	**0.17 (0.13, 0.21)**
		Food insecurity	$p < .001$	$p < .001$	$p < .001$	$p < .001$	$p < .001$	$p < .001$
		No	Reference	Reference	Reference	Reference	Reference	Reference
		Yes	**0.14 (0.09, 0.19)**	**0.10 (0.06, 0.14)**	**0.24 (0.20, 0.28)**	**0.19 (0.15, 0.23)**	**0.23 (0.19, 0.27)**	**0.18 (0.14, 0.22)**
		Emergency welfare receipt	$p = .001$	$p = .041$	$p < .001$	$p < .001$	$p < .001$	$p = .016$
		No	Reference	Reference	Reference	Reference	Reference	Reference
		Yes	**0.08 (0.03, 0.13)**	**0.05 (0.00, 0.09)**	**0.13 (0.08, 0.17)**	**0.07 (0.03, 0.12)**	**0.11 (0.07, 0.16)**	**0.05 (0.01, 0.10)**

Note: Results weighted to represent whole population, using N = 2,083 except for the outcome of relationship criticism, for which N = 1,598 (see Supplement 1, available online). Standardized coefficients with 95% CIs based on weighted data are shown. Boldface type values indicate statistically significant group differences at p < .05.

[a]*Results are adjusted for baseline (pre-pandemic) levels of the outcome variable (providing a proxy of change in the outcome associated with the risk factor) and pre-pandemic family income.*

TABLE 3 Risk Factors for Harsh Parenting and Positive Parenting During the COVID-19 Pandemic, Adjusting for Pre-Pandemic Levels of Outcomes and Confounders

			Harsh parenting		Positive parenting	
Timing of risk factor	**Model level**	**Risk factor**	**Crude β (95% CI)**	**Adjusted[a] β (95% CI)**	**Crude β (95% CI)**	**Adjusted[a] β (95% CI)**
Before pandemic	0	Family income	$p = .288$		$p < .001$	
		High	Reference		Reference	
		Medium	0.03 (−0.02, 0.09)		**−0.10 (−0.15, −0.05)**	
		Low	0.04 (−0.01, 0.09)		**−0.11 (−0.16, −0.06)**	
During Pandemic	1	**Financial problems**				
		Major income loss	$p = .093$	$p = .314$	$p < .001$	$p = .001$
		No	Reference	Reference	Reference	Reference
		Yes	0.04 (−0.01, 0.08)	0.02 (−0.02, 0.06)	**−0.10 (−0.14, −0.05)**	−0.07 (−0.11, −0.03)
		Food insecurity	$p = .087$	$p = .410$	$p < .001$	$p = .001$
		No	Reference	Reference	Reference	Reference
		Yes	0.04 (−0.01, 0.08)	0.02 (−0.02, 0.05)	**−0.11 (−0.15, −0.06)**	−0.07 (−0.11, −0.03)
		Emergency welfare receipt	$p = .068$	$p = .913$	$p < .001$	$p = .157$
		No	Reference	Reference	Reference	Reference
		Yes	0.04 (−0.00, 0.08)	−0.00 (−0.04, 0.04)	**−0.07 (−0.12, −0.03)**	−0.03 (−0.08, 0.01)
	2	Mother–partner relationship				
		Relationship criticism	$p < .001$	$p < .001$	$p < .001$	$p < .001$
			0.27 (0.23, 0.32)	**0.20 (0.15, 0.24)**	**−0.17 (−0.22, −0.13)**	**−0.15 (−0.19, −0.10)**
	3	Maternal mental health				
		Maternal depression	$p < .001$	$p < .001$	$p < .001$	$p < .001$
			0.24 (0.20, 0.28)	**0.19 (0.15, 0.23)**	**−0.17 (−0.21, −0.13)**	**−0.13 (−0.17, −0.09)**
		Maternal anxiety	$p < .001$	$p < .001$	$p < .001$	$p < .001$
			0.35 (0.31, 0.39)	**0.28 (0.24, 0.32)**	**−0.13 (−0.17, −0.09)**	**−0.09 (−0.13, −0.05)**

Note: *Results weighted to represent whole population, using N = 2,083. Standardized coefficients with 95% CIs based on weighted data are shown. Boldface type values indicate statistically significant group differences at $p < .05$.*

[a]*Results are adjusted for baseline (pre-pandemic) levels of the outcome variable (providing a proxy of change in the outcome associated with the risk factor) and variables with $p < .20$ in prior model level(s).*

TABLE 4 Risk Factors for Child Mental Health Outcomes During the COVID-19 Pandemic, Adjusting for Pre-Pandemic Outcome Levels and Confounders

			Conduct problems		Emotional problems		Hyperactivity-inattention	
Timing of risk factor	**Model level**	**Risk factor**	**Crude β (95% CI)**	**Adjusted[a] β (95% CI)**	**Crude β (95% CI)**	**Adjusted[a] β (95% CI)**	**Crude β (95% CI)**	**Adjusted[a] β (95% CI)**
Before pandemic	0	Family income	$p < .001$		$p < .001$		$p < .001$	
		High	Reference		Reference		Reference	
		Medium	0.10 (0.05, 0.16)		0.12 (0.06, 0.17)		0.09 (0.04, 0.14)	
		Low	0.18 (0.13, 0.23)		0.14 (0.09, 0.19)		0.15 (0.10, 0.20)	
During pandemic	1	**Financial problems**						
		Major income loss	$p < .001$	$p < .001$	$p < .001$	$p < .001$	$p < .001$	$p = .005$
		No	Reference	Reference	Reference	Reference	Reference	Reference
		Yes	0.12 (0.07, 0.16)	0.08 (0.04, 0.11)	0.11 (0.07, 0.16)	0.09 (0.05, 0.13)	0.10 (0.06, 0.14)	0.05 (0.02, 0.09)
		Food insecurity	$p < .001$	$p < .001$	$p < .001$	$p < .001$	$p < .001$	$p = .019$
		No	Reference	Reference	Reference	Reference	Reference	Reference
		Yes	0.15 (0.10, 0.19)	0.08 (0.04, 0.12)	0.19 (0.15, 0.23)	0.12 (0.09, 0.16)	0.12 (0.08, 0.16)	0.04 (0.01, 0.08)
		Emergency welfare receipt	$p < .001$	$p = .064$	$p < .001$	$p = .021$	$p < .001$	$p = .036$
		No	Reference	Reference	Reference	Reference	Reference	Reference
		Yes	0.12 (0.08, 0.16)	0.04 (−0.00, 0.08)	0.12 (0.07, 0.16)	0.05 (0.01, 0.09)	0.11 (0.07, 0.15)	0.04 (0.00, 0.08)
	2	Mother-partner relationship						
		Relationship criticism	$p < .001$	$p < .001$	$p < .001$	$p < .001$	$p < .001$	$p < .001$
			0.29 (0.25, 0.34)	0.21 (0.16, 0.25)	0.24 (0.19, 0.28)	0.16 (0.12, 0.20)	0.22 (0.17, 0.27)	0.14 (0.09, 0.18)
	3	Maternal mental health						
		Maternal depression	$p < .001$	$p < .001$	$p < .001$	$p < .001$	$p < .001$	$p < .001$
			0.30 (0.26, 0.34)	0.17 (0.12, 0.21)	0.37 (0.33, 0.41)	0.26 (0.21, 0.30)	0.26 (0.22, 0.30)	0.14 (0.10, 0.18)
		Maternal anxiety	$p < .001$	$p < .001$	$p < .001$	$p < .001$	$p < .001$	$p < .001$
			0.37 (0.33, 0.41)	0.24 (0.19, 0.28)	0.40 (0.36, 0.44)	0.30 (0.25, 0.34)	0.35 (0.31, 0.39)	0.22 (0.18, 0.26)
	4	Parenting						
		Harsh parenting	$p < .001$	$p < .001$	$p < .001$	$p < .001$	$p < .001$	$p < .001$
			0.48 (0.44, 0.52)	0.29 (0.24, 0.33)	0.30 (0.26, 0.34)	0.15 (0.11, 0.20)	0.41 (0.37, 0.45)	0.23 (0.19, 0.27)
		Positive parenting	$p < .001$	$p < .001$	$p < .001$	$p = .006$	$p < .001$	$p < .001$
			−0.28	−0.16	−0.15	−0.06	−0.19	−0.09
			(−0.32, −0.24)	(−0.20, −0.12)	(−0.19, −0.11)	(−0.10, −0.02)	(−0.24, −0.15)	(−0.13, −0.05)
	5	Child isolation						
		Child leaves house	$p < .001$	$p = .470$	$p = .068$	$p = .502$	$p = .084$	$p = .665$
		Every day/occasionally	Reference	Reference	Reference	Reference	Reference	Reference
		Only for essential activities	−0.14 (−0.21, −0.07)	−0.04 (−0.11, 0.03)	−0.07 (−0.14, 0.00)	−0.01 (−0.08, 0.06)	−0.06 (−0.13, 0.02)	−0.02 (−0.09, 0.04)
		Stays at home all the time	−0.14 (−0.21, −0.06)	−0.03 (−0.10, 0.04)	−0.09 (−0.16, −0.01)	−0.03 (−0.10, 0.04)	−0.08 (−0.15, −0.01)	−0.03 (−0.10, 0.04)

(*continued*)

TABLE 4 Continued

Timing of risk factor	Model level	Risk factor	Conduct problems		Emotional problems		Hyperactivity-inattention	
			Crude β (95% CI)	Adjusted[a] β (95% CI)	Crude β (95% CI)	Adjusted[a] β (95% CI)	Crude β (95% CI)	Adjusted[a] β (95% CI)
		School work at home in last month	$p < .001$	$p = .046$	$p = .089$	$p = .784$	$p < .001$	$p = .010$
		Yes: school-organized activities	Reference	Reference	Reference	Reference	Reference	Reference
		Yes: parent-organized activities	0.03 (−0.01, 0.08)	−0.00 (−0.04, 0.04)	0.02 (−0.02, 0.07)	−0.01 (−0.06, 0.03)	−0.02 (−0.06, 0.03)	**−0.06 (−0.10, −0.02)**
		No/Not registered in school	**0.13 (0.09, 0.18)**	**0.05 (0.01, 0.09)**	**0.05 (0.01, 0.10)**	−0.00 (−0.05, 0.04)	**0.10 (0.05, 0.14)**	−0.00 (−0.04, 0.04)
	6	**Child fears**						
		Afraid of COVID-19	$p = .003$	$p = .422$	$p < .001$	$p < .001$	$p = .062$	$p = .540$
		Disagree	Reference	Reference	Reference	Reference	Reference	Reference
		Neither agree nor disagree	**0.06 (0.00, 0.12)**	0.02 (−0.02, 0.07)	**0.09 (0.04, 0.15)**	0.04 (−0.01, 0.08)	0.01 (−0.05, 0.06)	−0.02 (−0.07, 0.02)
		Agree	0.10 (0.04, 0.15)	−0.00 (−0.05, 0.05)	0.27 (0.21, 0.32)	0.14 (0.09, 0.18)	0.06 (0.00, 0.11)	−0.02 (−0.05, 0.01)
		Worried about food/other resources	$p < .001$	$p = .007$	$p < .001$	$p < .001$	$p < .001$	$p = .148$
		Disagree	Reference	Reference	Reference	Reference	Reference	Reference
		Neither agree nor disagree	**0.07 (0.03, 0.12)**	0.02 (−0.02, 0.06)	**0.12 (0.08, 0.17)**	**0.05 (0.01, 0.09)**	0.01 (−0.03, 0.06)	−0.04 (−0.07, 0.00)
		Agree	**0.17 (0.13, 0.22)**	**0.06 (0.02, 0.10)**	**0.28 (0.24, 0.32)**	**0.13 (0.09, 0.17)**	**0.11 (0.06, 0.15)**	−0.01 (−0.05, 0.02)

Note: *Results weighted to represent whole population, using N = 2,083. Standardized coefficients with 95% CIs based on weighted data are shown. Boldface type values indicate statistically significant group differences at p < .05.*

[a]*Results are adjusted for baseline (pre-pandemic) levels of the outcome variable (providing a proxy of change in the outcome associated with the risk factor) and variables with p < .20 in prior model level(s).*

adolescents during the pandemic have also reported reduced child mental health symptoms and increases for only some specific types of problems, such as child depression.[10,30,31] The reduction in conduct and hyperactivity symptoms observed in our study might reflect naturally declining externalizing problems with age. It is also possible that some manifestations of conduct problems, such as fighting with other children, were reduced given social isolation of many children. This is consistent with bivariate results in the current study that children who were most isolated showed fewer conduct problems.

Income inequality has been a defining feature of illness and mortality during the COVID-19 pandemic and is also fundamental to understanding family functioning and maternal and child well-being in the current study. Poorer families in Pelotas lived in very disadvantaged circumstances before the pandemic, often in small, cramped homes, with unstable sources of income. The pandemic compounded such difficulties, with major income loss and food insecurity considerably more likely among poorer families and families of Black/mixed skin color, posing extreme hardship for many and need for emergency welfare. As a result, children in poorer families and of Black/mixed mothers were much more likely to be worried about food or other resources. These difficulties, both before and during the pandemic, were associated with increases in both maternal and child mental health difficulties compared with pre-pandemic levels. Thus, preexisting inequalities are not only limited to rates of COVID-19 illness and death, but also linked to new disparities emerging during the pandemic, such as increased material difficulties and consequent mental health problems for parents and children.

The closing of schools throughout the first year of the pandemic in Brazil was a major challenge for families with young children.[8,12] It was remarkable that the very prolonged closing of educational institutions was the main restriction imposed in Brazil, while restaurants, bars, shops, and other businesses remained open nearly the entire period of the study. School closures massively increase demands on parents as well as disrupting children's routines, their educational advancement, and removing other benefits of schools, such as mechanisms of protection and free meals provided to all children in public schools.[12] Pre-pandemic studies suggest that school is a critical source of structure for children's healthy behaviors, helping them maintain good diets, participate in physical activity, and maintain healthy sleep patterns.[32] Although about half of all children in the current study were involved in some form of remote school activity at the time of our survey, this varied widely according to family income (school-organized activities were being done by about 70% of children in rich families compared with 36% in poor families). Although remote schooling may not have been related to child mental health, the enormous educational divide during the pandemic is likely to contribute to increased social inequalities in years to come.[33] Given the importance of schools for child welfare, difficulties experienced by children and families in this study might have been mitigated by maintaining schools open whenever possible—rather than the policy of permanent school closures (while prioritizing opening of businesses and other institutions where possible) during 2020 and much of 2021.

In this highly challenging context, severe financial hardship experienced by many families in the pandemic was associated with relationship and parenting difficulties, and these were key risk factors for increases in children's mental health problems. High levels of adult relationship criticism (related to domestic violence in this population)[26] and maternal depression and anxiety during the pandemic were associated strongly with increases in children's own mental health problems. Also, harsh parenting practices and low parental warmth (themselves driven by relationship criticism and maternal mental health problems) were strongly associated with increases in children's mental health problems. Findings from this study are therefore consistent with other surveys highlighting the role of stress and family functioning in understanding mental health problems in the pandemic[8,31,34,35] and a theorical model of cascading social, economic, family, and psychological risk processes, particularly pronounced among already disadvantaged families.[10,11]

This study has several important strengths, including the large sample, population-based design, and longitudinal measures before and during the pandemic of several important possible explanatory factors for mental health problems. However, the following limitations also need to be considered. First, given the pandemic conditions, the assessment in 2020 was conducted via internet and phone, and, as with most such surveys, there was not a high response rate; the 52.5% response rate is usual for web-based surveys and similar to other internet surveys done during the pandemic in Brazil.[28] We handled the missing data, which were associated with several pre-pandemic variables, using inverse probability weighting, but this may not remove all differences in study results compared to if there had been no attrition. Second, the different methods used for data collection in 2019 (face-to-face interviews) and 2020 (internet/telephone-based survey) as well as naturally occurring changes in parenting and mental health as children age signify that average changes in outcomes between these 2 time points do not necessarily reflect pandemic effects. Although our focus was on risk factors associated with variation in this change, and the cascading risk model that organized the data analysis has plausibility, some of the associations (eg, between child adjustment and parenting) could reflect bidirectional effects and not only the influence of the hypothesized risk factor on the outcome. Third, some of the measures were not very

comprehensive, given the need for a brief internet survey during a stressful time for parents and families, and 2 questions about financial difficulties referred specifically to the last month and did not capture financial impacts of the pandemic that could have occurred beforehand. Fourth, in this study, we were unable to tease apart age (developmental change) and period (pandemic) effects, and so we caution against the interpretation that the pandemic caused child behavior to improve just because of average changes in the population from before to during the pandemic (our focus is on explaining variability in that change). Finally, this study examined family experiences during the initial, most difficult period of the pandemic, in 2020, but further research will be needed to investigate developmental effects later in the pandemic and through the life course.

In conclusion, some aspects of children's difficulties, such as fear about the virus and social isolation, varied little across income groups. However, other aspects of their difficulties were concentrated among economically disadvantaged children (eg, worry about food and family resources). In some domains, children's mental health improved, on average, across the whole population, while in others their difficulties got worse, and the same was true for mothers' mental health and parenting. Ultimately, the critical influences on children's adjustment during the COVID-19 pandemic were socioeconomic adversities, with specific family and parenting risk factors associated with increases in children's mental health problems in disadvantaged families.

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