



A quasi-experimental study of parent and child well-being in families of color in the context of COVID-19 related school closure

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ABSTRACT

Families of color living in historically disinvested neighborhoods face a multitude of health disparities which have been exacerbated by COVID-19 and the resulting strategies to mitigate its transmission. School closure, which occurred with little warning and few, if any, resources for preparation, disrupted multiple aspects of families' lives; these disruptions are anticipated to adversely impact mental health and well-being. The current study aims to advance understanding of the experiences of families of young children of color during the pandemic by utilizing a natural experiment design to test impact on child and parent mental health and sleep in the context of COVID-19 related school closure among families in historically disinvested neighborhoods. Data from this study come from an ongoing study of 281 families of color enrolled in 41 pre-kindergarten (pre-K) programs in neighborhoods across New York City (NYC). In NYC, school closure occurred on March 16, 2020, during a data collection period involving phone surveys with parents; the quasi-experimental design allows for comparison of the 198 families who had completed the survey prior to March 16, and the 83 families who completed the survey after March 16, using identical protocols and procedures. Results demonstrate poorer mental health among parents surveyed after school closure as compared to before school closure. No differences were found for parent sleep, child mental health, or child sleep. Implications of this work highlight the need for structural and systemic supports for families faced with compounding stressors as a result of the COVID-19 pandemic and related school closure.

1. Introduction

The Social Determinants of Health framework (Marmot, 2005) outlines the important role of social and economic inequities and racism in causing health disparities among low-income families of color (National Academies of Sciences, 2017; Williams et al., 2016). COVID-19 and the resulting strategies to mitigate its transmission have likely exacerbated racial disparities in health both directly through COVID-19 infection and by disproportionately causing drastic changes in the lives of low-income families of color (Adhikari et al., 2020; Douglas et al., 2020; Lee, 2020; Hooper et al., 2020). In the US, Black and Latino adults disproportionately face conditions that increase their exposure to COVID-19, and make social distancing challenging, including employment in essential industries, crowded housing arrangements, and reliance on public transit (Anderson, 2016; Drew & Abu-Khalaf, 2020; NPR, 2020; Rimmer, 2020; Yancy, 2020; Yoshikawa et al., 2020). Moreover, low-income

families of color are more likely to experience traumatic and stressful events as a result of the pandemic such as job loss, pressure to work in unsafe conditions, food insecurity, severe illness or death of family and friends, and social isolation (Douglas et al., 2020; Lee, 2020), and more than two-thirds of Latino and Black households across the US report serious financial problems due to the pandemic, compared to one-third of white households (Garcia et al., 2020; NPR, 2020). As a result, child poverty rates during the pandemic have increased particularly among Latino and Black children (Chen & Thomson, 2021).

School closure, which occurred in NYC with little warning and few, if any, resources for preparation, disrupted multiple aspects of families' lives, forcing parents to provide or find child care, arrange access to food previously provided at schools, and manage virtual learning requirements (Douglas et al., 2020; Prime et al., 2020; Masten & Motti-Stefanidi, 2020). These disruptions were stressful for families and are anticipated to have adversely impacted mental health and

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well-being, in particular among families from historically and currently marginalized groups (Yip, 2020; Masten & Motti-Stefanidi, 2020). Sudden school closure was especially challenging for parents of young children given that young children need constant adult supervision and assistance with virtual learning platforms, and young children learn in the context of adult-child interactions (Ursache et al., 2020). These challenges were likely further compounded for parents who are not native English speakers as they likely experienced additional stress in helping their children navigate virtual learning (Latino Decisions & Abriendo Puertas/Opening Doors, 2020; López et al., 2020; Wakabayashi et al., 2020; Yip, 2020).

1.1. Sleep health and mental health among families of color living in disinvested neighborhoods

Families of color living in historically disinvested neighborhoods experience a disproportionate mental health burden and risk for sleep disturbances. Recent work extending the Social Determinants of Health framework to examine the social and economic factors impacting both mental health (Allen et al., 2014) and sleep health (Hale & Hale, 2010) provides a lens for understanding the drivers of these disparities. Historical and current structural racism create stark residential segregation in urban centers across the US, restricting low-income families of color to particular neighborhoods and disinvesting from those areas (Spilbury et al., 2006; Williams & Jackson, 2005). Further, structural racism manifests in a myriad of ways in these neighborhoods, including noise, environmental pollutants, access to physical activity amenities, lack of green space, high population density, violence, and safety concerns, all of which have been shown to increase risk for mental health and sleep disorders (Alegría et al., 2019; Diez Roux & Mair, 2010; Gilbert & Galea, 2014; Hale et al., 2019; Jackson et al., 2015; Koinis-Mitchell et al., 2019; Lawrence et al., 2018; Meldrum et al., 2018; Philbrook et al., 2020).

Understanding the extent to which COVID-19 and related school closures have further placed families of color at risk, above and beyond the aforementioned social and economic factors and structural racism, is of utmost importance for a number of reasons. First, theoretical and empirical research both suggest that poor health may disproportionately harm children of color and children from low-income families and the impacts of poor health on other developmental outcomes, such as achievement, may be more detrimental for these children (García Coll et al., 1996; Buckhalt, 2011; Buckhalt et al., 2009). In the context of the COVID-19 pandemic specifically, racism and marginalization have been identified as pre-existing vulnerabilities which may heighten the risk for declines in caregiver well-being and child adjustment (Prime et al., 2020). Second, low-income families of color have historically been excluded from research, and when research has been conducted in communities of color, it has often been used to tokenize or harm these communities, or blame lifestyle choices for negative health outcomes (Konkel, 2015; Kendi, 2020). In the context of COVID-19 school related closures, for example, parents have been blamed for child absenteeism or disengagement from virtual schooling without consideration of the structural barriers their families face, such as lack of high speed internet access, computers or time flexibility (Grench, 2020; Jacobson, 2021; Keierleber, 2021). Examining the impact of COVID-19 and related school closures among families of color is paramount for disrupting these historical trends and shifting beliefs about the level of engagement in distance learning among families of color. This may ultimately move the focus from family-level blame to a focused need for systemic supports to improve mental health and sleep so that children can thrive.

1.2. Theoretical perspectives on the COVID-19 pandemic and parent and child mental health and sleep

In New York City, school closure and the stay-at-home order occurred within a week of each other in mid-March 2020, during the early days of an acute surge in COVID-19 cases. For families with young

children, school closure disrupted nearly every aspect of daily life. Schools play a large role in structuring families' routines and in providing meals and care for a large portion of children's days. For families with young children then, the pathways to declines in well-being from pandemic related stressors and stay at home orders generally, as well as school closures specifically, are thus likely highly overlapping.

A recent conceptual model proposed by Prime et al., 2020 delineates the ways in which social disruptions of the COVID-19 pandemic, such as school closure, may pose acute risks to family, parent, and child well-being. Informed by the family stress model (Conger et al., 2002) and by family systems theory (Carr, 2015; Fiese et al., 2019), Prime and colleagues propose that the stress on parents to meet children's social and educational needs during school closures, and managing disruptive changes to family routines, can directly increase risk for parent mental health problems, especially among families enduring other stressors such as financial hardship and racism. Further, strained parent mental health is linked to family conflict and negative parent-child interactions which can have cascading effects on child emotional and behavioral functioning (Barajas-Gonzalez & Brooks-Gunn, 2014; Prime et al., 2020). Importantly, in the context of the COVID-19 pandemic in New York City, these stressors occurred alongside the direct biomedical and social threats of the virus itself including the fear and experience of illness and death at the personal, family, and community levels which were particularly acute in NYC as the early epicenter in the US (with hospitals at capacity and over 1000 COVID-19 deaths in NYC by March 31). These direct threats of the COVID-19 pandemic thus also likely increased risk for sleep and mental health problems among parents and children.

Moreover, given a wide literature demonstrating interrelations between mental health and sleep disturbances (Hale et al., 2020; Kelly & El-Sheikh, 2014), it is likely that declines in either mental health or sleep increased risk for disturbances in the other domain. Depression and anxiety in adults are associated with sleep disturbances such as insomnia and there is some evidence to suggest that these relations are bidirectional (Alvaro et al., 2013). Similarly, among children, reduced sleep duration and poor sleep quality longitudinally predict internalizing and externalizing symptoms and these adjustment difficulties also reciprocally predict sleep (Kelly & El-Sheikh, 2014). Furthermore, caregiver and child well-being are bidirectionally related (Prime et al., 2020). Children's sleep problems are associated with poor parent sleep quality and can influence parent well-being (El-Sheikh & Kelly, 2017; Meltzer & Mindell, 2007). Children who live in families with parental psychopathology, negative parent-child interactions or other forms of family risk tend to have less optimal sleep (El-Sheikh & Kelly, 2017) and parents' depressive symptoms in particular are associated with sleep problems among children (de Jong et al., 2016; El-Sheikh et al., 2012).

1.3. COVID-19 pandemic and parent health

Consistent with the theoretical approach outlined above, in the context of the COVID-19 pandemic and associated stay-at-home orders (encompassing a range of policies and referred to in some studies as lockdowns), emerging work suggests that there have been declines in parent mental health. In Italy, the prevalence of depression and anxiety was higher during the first weeks of lockdown than previously reported in the general population (Gualano et al., 2020). In a Southeastern United States (US) city, higher pandemic stress in the early months of the stay-at-home order was associated with decreased self-efficacy and increases in caregiver mental health symptoms (Davidson et al., 2021). Other work in the US has shown that over time, caregiver anxiety, depression and stress decreased from April 6, 2020 to June 8, 2020 during widespread stay-at-home orders, but, among lower income households, caregiver depression was higher across all time points, and anxiety began to increase again in mid-May after initial declines. African American caregivers also reported increasing depression and stress

beginning in mid-May, although anxiety and stress were consistently lower for African American households as compared to the overall sample (Center for Translational Neuroscience [CTN], 2020b).

Sleep health has also been reported to be compromised in the context of the COVID-19 pandemic and associated stay-at-home-orders. Adults in Italy reported later bedtimes and wake times, more time spent in bed, and lower sleep quality during lockdown as compared to pre lockdown (Gualano et al., 2020; Cellini et al., 2020); insomnia prevalence in Greek adults was found to be higher 3 weeks post lockdown than estimated prevalence prior to the pandemic (Votsidis et al., 2020). In the US, adults reported a greater prevalence of poor sleep duration (both shorter and longer than recommended) as well as a greater number of days in which they experienced sleep disturbances (Hisler & Twenge, 2021). Among mothers specifically, insomnia was reported to be higher during the COVID-19 pandemic than prior to it and severe insomnia symptoms were associated with higher levels of acute COVID-19 anxiety (Zreik et al., 2021).

1.4. COVID-19 pandemic and child health

Evidence that the COVID-19 pandemic and associated stay-at-home orders have impacted children's mental health is also growing. An unpublished review finds evidence that school closures and COVID-19 lockdowns more generally are associated with increases in emotional, behavioral and attention problems in children and youth as well as overall declines in psychological well-being across cultural contexts (Viner et al., 2021). Across Italy, Spain, Hong Kong, and Southern California in the US, studies reported increases in children's psychological difficulties including emotional, conduct, depressive, externalizing, and hyperactive symptoms in both preschool and school aged children (Cellini et al., 2021; Di Giorgio et al., 2020; Glynn et al., 2021; Romero et al., 2020; Tso et al., 2020). Furthermore, one longitudinal study in the US found that an initial increase in children's emotional and behavioral problems at the start of April 2020 was followed by a decrease in mid-May (CTN, 2020a). Importantly, among lower income and African American households, however, behavior problems began to decrease from April to mid-May, but then increased through June 2020 (CTN, 2020a).

Evidence regarding the impact of stay-at-home orders on children's sleep has been more mixed. Perhaps most consistently, several studies of young children found no change in sleep duration although bedtimes and wake times may have shifted later (Liu et al., 2021; Cellini et al., 2021; Di Giorgio et al., 2020; Lecuelle et al., 2020). Two studies in primarily European countries found that babies and young children had shorter sleep duration early on in the pandemic but these decreases stabilized (Dellagiulia et al., 2020) or rebounded after a period of weeks (Markovic et al., 2021). Findings with regard to sleep quality are more mixed. A study of Italian mothers found that young children had a decrease in sleep quality (Cellini et al., 2021; Dellagiulia et al., 2020) as did a study of young French children, which found increased difficulties initiating and maintaining sleep and parasomnia (Lecuelle et al., 2020), and a study of children primarily across Europe, which found acute decreases in sleep quality (Markovic et al., 2021). In contrast, one study of Chinese preschoolers found small improvements in sleep quality as evidenced by fewer caregiver-reported sleep disturbances (Liu et al., 2021). Yet others in Israel and Italy have found no overall change in sleep quality or increase in sleep disorders among young children (Zreik et al., 2021; Di Giorgio et al., 2020). Longitudinal findings have also been somewhat mixed with one study finding that initial declines in sleep quality at the beginning of April 2020 disappeared for the most part over the next two months (Markovic et al., 2021) whereas another small study found that quality stabilized but remained low (Dellagiulia et al., 2020).

1.5. Methodological limitations of studies to date

Despite some mixed findings, overall, these studies provide increasing evidence for a relation between the COVID-19 pandemic and associated stay-at-home orders and increases in mental health problems and sleep disturbances among both parents and children. These early studies, however, are limited in a number of ways. The majority of studies examining impacts of COVID-19 and associated stay-at-home orders are cross-sectional, with only a small number of longitudinal studies. Many of these studies compared mental health during stay-at-home orders to previously established national norms which may or may not reflect baseline levels in the samples being studied. Other studies utilized retrospective designs to ask parents about mental health and sleep health both in the present (during the COVID-19 stay-at-home orders) and in the past (several weeks prior to stay-at-home orders). These retrospective designs may be biased for a number of specific reasons in addition to general difficulties with retrospective recall: for example, the difference in time that parents and children spent together before and during school closures, parents' belief that school closures caused behavior problems in their children, and parents' increased sensitivity to their children's behaviors as a result of their own increased stress. No studies to our knowledge have employed quasi-experimental designs to examine the impact of COVID-19 and related stay-at-home orders or school closures on parent and child mental health and sleep. In this rapidly emerging literature, only a few studies have considered how impacts may differ by race, language, gender or other factors.

1.6. Current study

The current study aims to advance understanding of the experiences of families of young children of color during the pandemic by utilizing a natural experiment design to test the impact of COVID-19 and related school closure on child and parent mental health and sleep among families of color in historically disinvested neighborhoods. We hypothesize that parent and child mental health burden and sleep disturbance will increase in the context of COVID-19 related school closure. Moreover, we explore whether impacts differ by parent language, given the additional stressors experienced by parents who are not native English speakers in navigating their children's virtual learning (López et al., 2020; Wakabayashi et al., 2020), and by child gender, given some evidence of gender differences in response to disaster (Osofsky & Osofsky, 2018). The sample size does not allow for consideration of race as a moderator. However, to acknowledge the heterogeneity within historically disinvested neighborhoods, we consider differences in parent and child mental health and sleep prior to school closure by race, parent language, and child gender - differences which we understand as a reflection of a myriad of factors at the individual, family and community levels that interact with social determinants of health.

2. Methods

2.1. Sample

Data from this study come from an ongoing longitudinal study of families of color enrolled in 41 pre-kindergarten (pre-K) programs in historically disinvested neighborhoods across New York City. Demographic characteristics of these families ($n = 281$ parents and 285 children) are shown in Table 1. Children were on average 4.6 years old at the time of survey completion. Phone surveys were completed primarily by mothers (91%); 36% were completed in Spanish and 64% in English. Parents reported their race/ethnicity as 66% Latinx, 22% Non-Latinx Black, 5% Non-Latinx White and 2% Non-Latinx Asian. 24% of parents reported less than a high school diploma. Of the 168 parents who reported household income, 31% were below the federal poverty line and 67% were low-income (less than 200% federal poverty line). Fifty-three percent of parents were married or living with a partner and

Table 1
Descriptive statistics before (n = 198 families, 202 children) and after (n = 83 families and children) school closure.

	Before School Closure	After School Closure	p value*
Parent Race/Ethnicity, [n]			
Latinx	133	46	0.16
White	7	7	
Black	41	20	
Asian	2	3	
Other	9	4	
Language of Survey, [n]			
English	121	58	0.21
Spanish	77	25	
Parent Education, [n]			
Less than High School Degree	48	16	0.04
High School Degree	65	19	
Some College	42	17	
College Degree or more	37	28	
Family Income, [n]			
In Poverty ¹	39	13	0.62
Low Income ²	82	31	0.77
Child Gender, [n]			
Boy	93	35	0.64
Girl	109	48	
Child Age in Months [Mean(SD)]	n = 283 54.20 (3.78)	n = 83 57.12 (4.25)	< 0.001
Parent mental health standardized score [Mean(SD)]	n = 274 -0.09 (0.90)	n = 83 0.21 (1.00)	0.02
CESD [Mean(SD)]	n = 274 -0.10 (0.96)	n = 83 0.23 (1.09)	0.01
PHQ4 [Mean(SD)]	n = 276 -0.08 (0.97)	n = 83 0.20 (1.07)	0.04
Parent sleep t-score [Mean(SD)]	n = 270 46.48 (9.26)	n = 83 47.8 (10.00)	0.30
Child internalizing t-score [Mean(SD)]	n = 268 55.10 (8.01)	n = 83 56.12 (8.41)	0.36
Fear anxiety [Mean(SD)]	n = 278 56.40 (9.80)	n = 83 58.73 (9.79)	0.07
Fear of separation [Mean(SD)]	n = 277 58.92 (11.44)	n = 83 58.87 (13.45)	0.97
Sadness [Mean(SD)]	n = 275 50.13 (9.41)	n = 83 51.79 (10.44)	0.20
Child externalizing standardized score [Mean(SD)]	n = 274 -0.03 (0.81)	n = 83 0.08 (0.89)	0.30
Attention [Mean(SD)]	n = 279 -0.01 (1.00)	n = 83 0.03 (1.02)	0.75
Anger [Mean(SD)]	n = 276 -0.06 (0.99)	n = 83 0.15 (1.02)	0.12
Child sleep t-score [Mean(SD)]	n = 273 51.10 (8.93)	n = 83 50.95 (9.26)	0.90

Notes: * p-values are from chi-squared tests for categorical variables to compare proportions and t-tests for continuous variables to compare means, and unadjusted for multiple tests. ¹Less than or equal to 100% Federal Poverty line. ²Less than or equal to 200% Federal Poverty line.

total household size ranged from 2 to 11 individuals including both adults and children with most households containing 3 (11%), 4 (36%), 5 (23%), or 6 (11%) individuals. Among the 176 parents who reported on essential worker status, 48% indicated that there was an essential worker in their household.

To assess the need for sensitivity analyses as a result of the possibility of confounders, we examined the demographic characteristics for the subsamples of families surveyed prior to and during COVID-19 related school closure. T-tests and chi-squared tests were used as appropriate. We found that there were differences in education between the two subsamples (see Table 1). There were not significant differences for race, parent language, income or child gender.

2.2. Procedures

2.2.1. Sample selection

Data for this study come from the baseline data collection for a longitudinal school-based RCT. As part of the larger study, participants were recruited from participating schools on a rolling basis during November 2019–March 2020. Timing of parent recruitment was largely related to the timing of onboarding schools to the study. All parents consented to the study prior to school closure. After parents consented to the study, the research team began contacting parents (also on a rolling basis) to schedule the phone survey. The current study leverages a natural experiment created by COVID-19 related school closure for all pre-K programs in NYC in the middle of data collection. Phone surveys took place between November 2019 and June 2020. In NYC, school closure occurred on March 16, 2020; 202 families had completed the survey prior to March 16, and 83 families completed the survey after March 16, using identical protocols and procedures. For parents surveyed after March 16 in the early months of the pandemic, however, we offered resources and counseling support following data collection.

2.2.2. Survey procedures

During phone surveys, parents reported on their own mental health and sleep, their children’s mental health and sleep, and demographics. Phone surveys were conducted in English or Spanish, as determined by the parent. Surveys in Spanish were conducted by bilingual staff (including native and non-native Spanish speakers). All measures were validated in both languages, and the developers’ Spanish translation was used.

2.3. Measures

2.3.1. Parent mental health

Parent mental health was assessed with two self-report measures—the *Patient Health Questionnaire* (PHQ-4; Kroenke et al., 2009), and the *Center for Epidemiological Studies – Short Depression Scale* (CESD-10; Andresen et al., 1994). The PHQ-4 is a four item questionnaire asking caregivers to report on symptoms of depression and anxiety over the last two weeks. Caregivers reported on items such as, “Not being able to stop or control worrying” and “Feeling down, depressed, or hopeless” on a four point Likert-type scale ranging from “Not at all” to “Nearly every day.” Its purpose is to allow for ultra brief and accurate measurement of core symptoms and signs of depression and anxiety. An elevated PHQ-4 score is an indicator for further inquiry to establish the presence or absence of a clinical disorder warranting treatment. (Cronbach’s alpha = 0.83). The CESD-10 is a 10-item self-report measure of the frequency of depressive symptoms in the past week, with participants rating items such as “I was bothered by things that don’t usually bother me” and “I felt hopeful” on a scale from 0 (Rarely or none of the time [less than 1 day]) to 3 (All of the time [5–7 days]). It includes eight items on negative affect, and two on positive affect (Cronbach’s alpha = 0.73). The CESD-10 can be used to classify participants with clinically elevated symptoms of depression. A composite measure of parent mental health was created by standardizing and averaging scores on these two scales.

2.3.2. Parent sleep health

Parent sleep health was assessed using the *Patient-Reported Outcomes Measurement Information System -4 (PROMIS - 4) Sleep Disturbance* (Yu et al., 2012). This is a 4-item questionnaire assessing self-reported perceptions of sleep quality, sleep depth, and restoration associated with sleep over the past seven days (Cronbach’s alpha = 0.79). Raw scores were converted to t scores for analysis.

2.3.3. Child internalizing behaviors

Child internalizing behaviors were assessed via parent report on three scales from the *NIH Toolbox Emotion Battery: Fear-Over Anxious, Fear-Separation Anxiety, and Sadness* (Salsman et al., 2013). The NIH

Toolbox Fear-Over Anxious Parent Report - includes 6 items measuring symptoms of anxiety that reflect autonomic arousal and perceptions of threat including fear, worry, and hyperarousal (e.g. "Needs to be told over and over that things are okay") (Cronbach's alpha = 0.63). The NIH Toolbox Fear-Separation Anxiety Parent Report - includes 7 items measuring symptoms of anxiety that reflect autonomic arousal and perceptions of threat including being separated from home and from loved ones (e.g. "Worries about being separated from loved ones") (Cronbach's alpha = 0.71). The NIH Toolbox Sadness Parent Report includes 7 items measuring low levels of positive affect including negative mood, negative views of the self, and negative social cognition (e.g. "Doesn't smile or laugh much") (Cronbach's alpha = 0.60). Caregivers rate how well the behavior describes their child on a 3-point scale ranging from "Never true" to "Often true". Raw scores were converted to t scores for analysis. A composite measure of child internalizing behaviors was created by averaging across these three scales.

2.3.4. Child externalizing behaviors

Child externalizing behaviors were assessed via parent report on two scales including the *NIH Toolbox Emotion Battery: Anger* (Salsman et al., 2013) and the *Pediatric Symptom Checklist Attention Problems subscale (PSC; Gardner et al., 1999; Murphy et al., 2016)*. The Anger Parent Report includes 9 items measuring angry mood and verbal aggression (e.g. "Has temper tantrums or a hot temper") (Cronbach's alpha = 0.74). Raw scores on the Anger Parent Report were converted to t scores. The PSC Attention Problems Subscale includes 5 items assessing fidgeting, daydreaming, distraction, concentration, and hyperactivity (Cronbach's alpha = 0.70). A composite measure of child externalizing behaviors was created by standardizing and averaging across these two scales.

2.3.5. Child sleep health

Child sleep health was assessed by parent report on the *PROMIS-4 Sleep Disturbance Questionnaire* (Bevans et al., 2019). This is a 4-item questionnaire assessing parent-reported perceptions of children's sleep quality over the past seven days (Cronbach's alpha = 0.78). Raw scores were converted to t scores for analysis.

2.4. Statistical approach

Descriptive analyses examined the percentage of parents and children exhibiting clinical levels of mental health and sleep health symptoms prior to COVID-19 related school closure. We also examined differences in the level of mental health and sleep health symptoms prior to school closure by gender, parent language, and between the two largest racial/ethnic groups in the sample - non-Latinx Black parents and Latinx parents. Chi-squared tests were used to compare the proportions of categorical variables and t-tests were used for continuous variables.

Primary analyses included comparisons of parent mental health and sleep as well as child externalizing, internalizing, and sleep between families who completed surveys before and after school closure. Outcome measures that deviated from normality were logarithmically transformed. T-tests were used to compare average scores before and after school closure. Non-parametric Wilcoxon tests were used as a sensitivity analysis, in particular when distribution of the measures deviated from normality. To further assess whether the impact varied over time, the average scores before school closure were compared with the average within the first 2 months of school closure and within the second 2 months (ie. months 3 and 4) of school closure. As a secondary analysis, we compared individual domains (i.e. scales) within each composite measure before and after school closure. As noted above, there were some demographic differences between the sub-samples surveyed prior to and during COVID-19 related school closure (Table 1). To account for potential confounding, we ran linear regression analyses with pre-post school closure as the primary exposure variable and parent education, parent race, child age, and interview language as covariates. To explore heterogeneity in impacts, moderation analyses

examined parent language preference as a moderator for parent and child outcomes, and child gender as a moderator for child outcomes. As described above, the sample size does not allow for consideration of race as a moderator. Appendix A contains regression equations used in analysis.

3. Results

3.1. Descriptive analyses - mental health and sleep health prior to school closure

A high percentage of parents reported elevated mental health symptoms for themselves and their children prior to COVID-19 and related school closure. Among adults, 18% of parents surveyed before school closure were at risk for depression on the CESD and 19% reported elevated levels of anxiety or depression on the PHQ-4. Among children, a substantial portion of parents rated their children as exhibiting behaviors in the elevated range on all measures: 50% for separation anxiety, 36% for fear-over anxious behaviors, 27% for anger, 18% for attention problems, and 17% for sadness. Sleep disturbances were also prevalent with elevated levels of sleep disturbance reported among 7% of parents and 18% of children.

Analyses examining racial group differences in pre-closure mental health and sleep health demonstrated that non-Latinx Black parents reported on average higher burden of mental health problems (mean(sd) composite score: 0.20(1.02) vs -0.21(0.79), $p = 0.006$) and greater child sleep disturbance (mean(sd) t score: 53.61(9.43) vs 50.27(8.72), $p = 0.036$) than Latinx parents. Analyses examining differences in pre-closure mental health and sleep health by parent language demonstrated that Spanish speaking parents reported lower mental health problems (mean(sd) composite score: -0.27(0.83) vs 0.03(0.92), $p = 0.022$), lower sleep disturbance (mean(sd): 43.92(7.99) vs 47.97(9.64), $p = 0.003$), higher child internalizing (mean(sd) composite: 57.49(7.52) vs 53.71(7.98), $p = 0.001$), higher child externalizing (mean(sd) composite: 0.24(0.76) vs -0.21(0.80), $p < .001$), and marginally lower child sleep disturbance (mean(sd): 49.73(8.31) vs 51.96(9.23), $p = 0.090$) than English speaking parents. There were no gender differences in child externalizing, internalizing, or sleep disturbance.

3.2. Primary analyses - impact of COVID-19 and related school closure

COVID-19 and related school closure significantly impacted parent mental health with an effect size in the low to medium range (Table 1). Standardized composite measures of parent mental health problems were on average 0.30 points higher after school closure compared to before, ($t(272) = -2.44$, $p = 0.015$). Secondary analysis further confirmed that scores on individual measures of mental health were both higher after school closure (CESD 0.23 vs -0.10, $t(272) = -2.46$, $p = 0.014$; PHQ-4 0.20 vs -0.08, $t(274) = -2.11$, $p = 0.035$). Importantly, the difference for parent mental health remained significant after accounting for possible confounders (i.e., parent education, race, child age, parent language; see Table 2) in regression analyses with log transformed outcomes (b [95%CI] = 0.15 [0.04, 0.26], $p = 0.007$). For parent sleep disturbance, and parent-reported child internalizing, externalizing, and sleep disturbance, there were no significant differences between those who completed the surveys prior to versus following school closure. When the impact was compared over time, possible heterogeneity in impact over time was observed only for parent mental health. Notably for parent mental health, while the mean composite scores within the first 2 months post school closure and prior to school closure were not different (0.05 vs -0.08, $t(df) = -1.05(89.4)$, $p = 0.29$), the mean score in the second 2 months was significantly higher compared to prior to school closure (0.54 vs -0.08, $t(df) = -2.5(29.9)$, $p = 0.017$).

Table 2
Comparison of outcomes before and after school closure from adjusted regression models.

	Parent mental health (log scale)		Parent Sleep		Child internalizing		Child externalizing		Child sleep	
	Adjusted* b [95% CI]	p value	Adjusted* b [95% CI]	p value	Adjusted* b [95% CI]	p value	Adjusted* b [95% CI]	p value	Adjusted* b [95% CI]	p value
Before school closure	Reference		Reference		Reference		Reference		Reference	
After school closure	0.15 [0.04, 0.26]	0.007	0.89 [-1.80, 3.58]	0.518	1.72 [-0.64, 4.07]	0.153	0.16 [-0.08, 0.39]	0.189	0.20 [-2.45, 2.85]	0.882

Notes: *Regression models are adjusted for main effects of parent education, parent race, child age, and interview language.

3.3. Moderation analyses - differences in impact by gender and language

Moderation analyses (Table 3) indicated no significant differences in the association between COVID-19 and related school closure and parent mental health by parent language (b[95%CI] = -0.15 [-0.37, 0.06], p = 0.156), indicating that the impact on parent mental health was comparable for Spanish- and English-speaking parents. Additionally, there were no significant moderation effects for any of the other parent or child outcomes.

4. Discussion

This is the first study to use quasi-experimental methods to investigate the impact of COVID-19 and related school closure on parent and child mental health and sleep. In line with the Social Determinants of Health framework, our findings highlight how symptoms of anxiety and depression increased among a health disparate population during the COVID-19 pandemic and related school closure. Specifically, we found that parent mental health burden was higher among those who were surveyed following school closure than among those who were surveyed prior to school closure. This finding adds to a growing body of work which has found declines in mental health in the context of the COVID-19 pandemic and associated stay-at-home orders. Furthermore, the current study strengthens this body of work by utilizing quasi-experimental methods to move closer to making causal claims about the impact of COVID-19 and related school closures on parent mental health in the early months of the pandemic in the US. We place these findings in context of substantial overall burden of mental health and sleep problems for parents and children prior to COVID-19, and the heterogeneity found within this sample of families of color living in historically disinvested neighborhoods: on average, Black parents reported higher mental health problems for themselves and more sleep problems for their children, relative to Latinx parents; whereas Spanish-speaking parents reported lower mental health and sleep problems for themselves and higher mental health problems for their children, relative to English-speaking parents (50% of whom identified as Latinx, 33% as Black). We understand these differences as a complex reflection of the myriad of individual, family and community-level factors that interact with social determinants of health, and interpret this quasi-experimental result as demonstrating a unique main effect of COVID-19 and related school closure on parent mental health on top of the substantial burden already disproportionately experienced by Black parents. Moreover,

results exploring heterogeneity in the timing of impacts suggested that parent mental health may have declined over time, with stronger impact among parents surveyed in the 2–4 months after school closure than in the first 2 months of closure. The small sample sizes in each group, however, make it difficult to draw definitive conclusions, and further research is needed to understand the impact on parent mental health over time.

Contrary to hypotheses, we did not find impacts on parents' sleep health or on children's mental health and sleep health. Our findings largely contrast with prior work which has found some evidence of relations of COVID-19 and related stay-at-home orders to these health outcomes. Importantly, our study examined these health outcomes in a population already burdened with higher prevalence of poor mental health and sleep health. It may be that additional changes in health among this group are more nuanced and require detection by more precise methods. Another possibility is that estimates of effects in prior work are biased because of methodological limitations. For example, several studies asked parents to retrospectively report on their own or their children's health. Given that parents were reporting on pre pandemic health while experiencing the stress of the pandemic, these retrospective estimates may have been overly positive recalls of their own or their children's health status which would then have inflated estimates of the difference in health status before and during the pandemic.

Although we did not find significant impacts of school closure on children's mental health and sleep, it may be that impacts on children occur later in time. For example, as parent mental health burden increases, positive interactions with children may deteriorate, ultimately resulting in child sleep and mental health problems (Prime et al., 2020). In line with this hypothesis, some work has found that increased maternal perceived stress and depressive symptoms were related to internalizing and externalizing problems in children (Glynn et al., 2021). Moreover, while children may initially see school closure as a break or vacation from school, the cumulative impact of disrupted routines and social isolation may lead to increased mental health burden for children. As mental health burden increases for parents and children, sleep disruptions may increase as well; increased caregiver stress has been associated with multiple aspects of sleep disturbance in young children (Markovic et al., 2021). Future work will follow this sample longitudinally to examine longer term impacts on both children and parents.

Alternatively, families' strengths and protective strategies in which

Table 3
Interaction effects from two separate adjusted regression models for moderation analyses.

	Parent mental health (log scale)		Parent Sleep		Child internalizing		Child externalizing		Child sleep	
	Adjusted* b [95% CI]	p value	Adjusted* b [95% CI]	p value	Adjusted* b [95% CI]	p value	Adjusted* b [95% CI]	p value	Adjusted* b [95% CI]	p value
School closure * child gender					-1.54 [-5.97, 2.89]	0.496	-0.24 [-0.67, 0.20]	0.293	-3.09 [-8.04, 1.86]	0.222
School closure * parent language	-0.15 [-0.37, 0.06]	0.156	-1.98 [-7.36, 3.40]	0.472	0.72 [-4.05, 5.49]	0.768	-0.08 [-0.55, 0.39]	0.741	-3.75 [-8.98, 1.48]	0.161

*Each regression model is adjusted for main effects of parent education, parent race, child age, and parent interview language in addition to the interaction effect.

they engage may have buffered their children from acute negative impacts of COVID-19 and related school closure. Within the family context, psychosocial resilience in times of disaster is supported through a number of pathways including nurturing relationships, family cohesion, family problem solving and planning, active coping, hope, a sense of family meaning, positive views of family, and family routines, traditions, and celebrations (Masten & Motti-Stefanidi, 2020; Prime et al., 2020). Families' cultural context is infused throughout these resilience factors as culture influences how each of these factors is expressed as well as provides many guidelines for child rearing as well as traditions and rituals for making meaning of and responding to adversities (Masten & Motti-Stefanidi, 2020). Prior work specifically in the context of COVID-19 has identified a number of factors, including mindfulness, presence of siblings in the household, and time caregivers spend with their children, which had positive impact on sleep during confinement (Markovic et al., 2021). Similarly, family routines during the stay at home order predicted better child mental health even after accounting for household characteristics including income, food security, dual parent status and maternal stress and depressive symptoms (Glynn et al., 2021). More work is needed to understand whether these or other family level strengths helped to buffer negative impacts within this sample of families of color living in historically disinvested neighborhoods. Furthermore, understanding the factors that may attenuate negative impacts of COVID-19 and related school closures is important for planning programs and policies to support families burdened with long term impacts on sleep health and mental health and as prevention strategies in future public health crises.

4.1. Limitations

Although the findings of this study are strengthened by the use of quasi-experimental methods, there are a number of limitations. Most prominently, school closure occurred at about the same time as the stay-at-home order, business closures and the escalation of pandemic-related illness, hospitalization and death when NYC was the early epicenter of the pandemic in the US. Furthermore, the killing of George Floyd in police custody on May 25th led to protests across the US during this time and has been linked to increased depression and anxiety, particularly for Black Americans (Eichstaedt et al., 2021). Thus, we cannot disentangle the impacts of school closure specifically from the host of stressors and trauma during this acute phase of the COVID-19 pandemic. Additionally, surveys conducted before school closure were carried out over a period of 4 months with the later surveys being conducted as concern about COVID-19 grew, but prior to school closure. As is common in many quasi-experimental designs, the possibility remains that there is some systematic difference between those families that we were able to survey after versus prior to school closures, leading to selection bias. If this is the case, the most probable scenario is that we were unable to schedule surveys with participants experiencing the highest levels of hardship as a result of the pandemic and thus our results may be underestimating impacts of COVID-19 and related school closures. Furthermore, our measurement of mental health and sleep health was limited in that we relied on parent reports of both their own and their

children's health. Finally, low statistical power given the small sample size post school closure may be one reason why we found limited statistically significant effects.

4.2. Conclusion

Overall, this study demonstrates that COVID-19 and related school closure had negative impacts on mental health among parents of color living in historically disinvested neighborhoods. As such, these findings help to shed light on the ways in which the COVID-19 pandemic has impacted families of color, potentially exacerbating existing health disparities. Furthermore, these findings point to the need for structural and systemic supports for family health in order to not only ameliorate this burden of parent mental health but to prevent longer term increases in poor health as well as subsequent emergence of downstream health disparities in both parents and their children.

Author statement

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The authors have no competing interests to declare.

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Appendix A

A. 1. Regression equations corresponding to the results in Table 1:

$$Y_i = \beta_0 + \beta_1 T_i + \beta_2 Edu_i + \beta_3 Race_i + \beta_4 Age_i + \beta_5 Language_i + \varepsilon_i$$

where, Y_i denotes the outcome for parent i , T_i denotes the exposure variable which is 1 if the outcome was observed for parent i after school closure and 0 otherwise, ε_i is the normally distributed residual. β_0 is the intercept, β_1 is the slope coefficient denoting the association of school closure with the outcome, and our main effect of interest as reported in Table 1. Regression equations are similar for child outcomes as well.

A. 2. Regression equations corresponding to the results in Table 2: Moderation by child gender

$$Y_i = \beta_0 + \beta_1 T_i + \beta_2 Edu_i + \beta_3 Race_i + \beta_4 Age_i + \beta_5 Language_i + \beta_6 Gender_i + \beta_7 T_i * Gender_i + \varepsilon_i$$

where, Y_i denotes the outcome for parent i , T_i denotes the exposure variable which is 1 if the outcome was observed for parent i after school closure and 0 otherwise, ε_i is the normally distributed residual. β_1 is the slope coefficient relating the association of the school closure with the outcome, and β_7 is the interaction effect of interest as reported in Table 2 for moderation by child's gender. Regression equations are similar for child outcomes as well.

A. 3. Regression equations corresponding to the results in Table 2: Moderation by parent language

$$Y_i = \beta_0 + \beta_1 T_i + \beta_2 Edu_i + \beta_3 Race_i + \beta_4 Age_i + \beta_5 Language_i + \beta_6 T_i * Language_i + \varepsilon_i$$

where, Y_i denotes the outcome for parent i , T_i denotes the exposure variable which is 1 if the outcome was observed for parent i after school closure and 0 otherwise, ε_i is the normally distributed residual. β_1 is the slope coefficient relating the association of the school closure with the outcome, and β_6 is the interaction effect of interest as reported in Table 2 for moderation by parent's language. Regression equations are similar for child outcomes as well.

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