



Material hardship level and unpredictability in relation to U.S. households' family interactions and emotional well-being: Insights from the COVID-19 pandemic

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ABSTRACT

Background: The COVID-19 pandemic has been recognized to provide rare insight to advance the scientific understanding of early life adversity, such as material hardship. During the COVID-19 pandemic, material hardship (i.e., difficulty paying for basic needs) in families of young children has had detrimental effects on caregivers' and children's well-being. In addition to the degree of material hardship, the week-to-week and month-to-month unpredictability of hardship status may add to families' stress and worsen well-being. This study examined the magnitude of and mechanisms underlying the effects of material hardship level and unpredictability on the well-being of U.S. households with young children during the pandemic.

Methods: Data were drawn from the RAPID project, a large ongoing national study that used weekly/biweekly online surveys to investigate the pandemic impact on U.S. households with young children. The current study leveraged data from 4621 families who provided at least three responses between April 2020 and October 2021.

Results: Findings indicated that racial/ethnic minorities and lower-income households experienced higher levels of material hardship and unpredictability during the pandemic, compared to their White or higher-income counterparts. Levels of pandemic-related material hardship and hardship unpredictability were both significantly associated with worsened well-being among caregivers and children. Finally, the effects of hardship level and unpredictability on well-being outcomes were partially mediated through disrupted family routines.

Conclusions: The findings from this study highlight that ensuring equal and adequate access to financial resources, as well as promoting financial stability for households with young children are both critical for maintaining functional family dynamics and promoting caregivers' and children's optimal well-being.

1. Introduction

Material hardship, defined as the difficulty paying for basic needs (Beverly, 2001), has been documented as a major stressor that takes tolls on caregivers and children's well-being (French and Vigne, 2019). Most existing studies focus on how the level of material hardship affects well-being outcomes (French and Vigne, 2019). However, recent research highlights unpredictability as another core but understudied dimension of life stressors (Baram et al., 2012; Ellis et al., 2009a; Nelson III & Gabard-Durnam, 2020; Smith and Pollak, 2021b). The COVID-19

pandemic has abruptly and unprecedentedly exposed families to widespread material hardship and financial unpredictability (Center on Budget and Policy Priorities, 2020). Racial/ethnic minorities and low socioeconomic status (SES) households, in particular, were disproportionately affected by the pandemic (Abedi et al., 2021). The current study employed data from the Rapid Assessment of Pandemic Impact on Development (RAPID) project to investigate how pandemic-induced material hardship level and unpredictability were associated with the well-being of U.S. households with young children. We also examined changes in family conflict and routines as mechanisms underlying these

Abbreviations: RAPID, Rapid Assessment of Pandemic Impact on Development; SES, Socio-economic status; COVID-19, Coronavirus disease of 2019.

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associations.

2. Material hardship level & unpredictability during the pandemic

During the COVID-19 pandemic, U.S. households have been facing acute and severe financial strain (Center on Budget and Policy Priorities, 2020). Unemployment related to the stay-at-home orders and shutdowns led to immediate financial losses and posed challenges to families' abilities to pay for basic needs. Households with young children were especially vulnerable to these financial impacts because of the lack of childcare assistance and increased caregiving responsibilities (Godinic et al., 2020). As such, many families with young children experienced high levels of material hardship since the pandemic.

Beyond the magnitude/level of hardship that has been broadly investigated (Cooney and Schaefer, 2021; Memmott et al., 2021), emerging research highlights unpredictability as a core experience underlying life stressors (e.g., Gee and Cohodes, 2021; Glynn et al., 2021). In the context of the pandemic, families experienced employment uncertainty and financial instability because of the fast transmission and limited knowledge about the virus, the frequent policy changes regarding stay-at-home orders, public health guidelines, and financial assistance, as well as the uncertainty about childcare options (Godinic et al., 2020; Smith and Pollak, 2021a). Employment and financial instability exposed caregivers of young children to week-to-week or month-to-month uncertainty in their abilities paying for basic needs (i.e., the unpredictability of material hardship status).

2.1. The influence of material hardship level & unpredictability on well-being

The current study focused on the significance of material hardship level and unpredictability in families' well-being. Material hardship is a major source of stress that detrimentally affects caregivers' and children's emotional well-being (Cooney and Schaefer, 2021; Gershoff et al., 2007). Zilanawala and Pilkauskas (2012) report a linear relationship between the number of experienced hardships and internalizing & externalizing symptoms among children at 3 and 5 years old, respectively. Most studies assess material hardship as a static state (measured at one time-point or as an average of multiple time-points) and have rarely accounted for the repeated and unpredictable changes in hardship status. Thus, studies that examine the link between hardship unpredictability and well-being outcomes are still lacking.

Relatedly, research on income volatility (i.e., year-to-year changes of income) sheds light on the potential mechanisms underlying the associations between hardship unpredictability and well-being. Leveraging Bronfenbrenner's bioecological systems theory (Bronfenbrenner, 1979; Bronfenbrenner and Ceci, 1994; Bronfenbrenner and Evans, 2000), the influences of income volatility on caregivers' (Hill et al., 2013) and children's (e.g., Cheng et al., 2020) well-being have been suggested to be mediated through disrupted proximal processes (i.e., engagement in complex interpersonal interactions; Hill et al., 2013) in the family context. With unstable household income, caregivers' challenges with financial management and difficult decision-making about spending on their children may increase their stress level and conflict with other family members, reduce their energy to consistently and warmly interact with their children and disrupt regular family routines (Hill et al., 2013). When caregivers experience varying numbers of hardships from time to time (i.e., hardship unpredictability), they may also face similar financial management and decision-making challenges and experience similar disruptions in family routines and increased conflict. These financial challenges and disrupted family processes have been shown to directly affect caregivers' mental health (Gershoff et al., 2007). Meanwhile, children reared in disrupted family environments may have difficulty meeting their emotional needs and developing effective self-regulation skills, which put them at elevated risk for behavioral

problems and worsened well-being (Crespo et al., 2019; Glynn et al., 2021).

2.2. The current study

From the authors' knowledge, this is the first study to investigate the pandemic influence on families' psychological well-being by focusing on both the level and unpredictability dimensions of material hardship. The frequent assessment of hardship status in the RAPID study enabled us to accurately capture hardship unpredictability using repeated measures obtained at multiple time points. Given the widening structural inequalities during the pandemic (Abedi et al., 2021), we first hypothesized that families of racial/ethnic minorities or lower-SES would experience higher levels of material hardship and unpredictability compared to White or higher-SES households (Hypothesis 1). Second, we hypothesized that the level and unpredictability of material hardship would both be negatively associated with well-being among caregivers and children (Hypothesis 2). Lastly, we hypothesized that increased family conflict and disrupted family routines would serve as intermediate factors on the associations between hardship level & unpredictability and well-being among caregivers and children (Hypothesis 3).

3. Methods and materials

3.1. Procedures

Data used in the current study were drawn from RAPID, an ongoing national study that started in April 2020 and used weekly/bi-weekly surveys to assess the influence of the COVID-19 pandemic on households with young children. All study procedures were reviewed and approved by the institutional review boards at the University of Oregon and Stanford University. Participant recruitment methods included Facebook Ads, community or family-facing organization email listservs, and panel services. On Facebook Ads, we target individuals who 1) live in the U.S., 2) are above 18 years old, and 3) identify as being parents or present interest in parenting, motherhood, or fatherhood. Community or family-facing organizations we collaborate with for recruitment include ParentsTogether, Acelero Learning, and Educare[®] schools (e.g., Milwaukee, Chicago, New Orleans, Atlanta, etc.). We also recruited participants through panel services such as Amazon Mechanical Turk and the Kinedo child development app, targeting parents of young children who live in the U.S.

The RAPID sampling strategy included initial recruitment (i.e., baseline) and ongoing survey assessments (i.e., follow-up), which were distributed on a weekly basis at the beginning and then switched to an alternating bi-weekly basis (see Supplemental Table 1 for details). During each baseline recruitment assessment, caregivers who were interested in participation first completed an eligibility survey. To be eligible for the ongoing survey assessments, respondents must be: 1) 18 years or older, 2) the primary caregiver of a child aged 0–5 years old, 3) fluent in English and/or Spanish, and 4) living in the U.S. Eligible caregivers provided consent to recontact for ongoing follow-up assessments, answered a series of core survey questions (e.g., demographics, material hardship, well-being), and were entered into the participant pool. RAPID recruited widely for the initial assessment using convenience sampling. Thus, the participant pool was not intended to be nationally representative.

During ongoing follow-up assessments, caregivers were invited by email to complete follow-up surveys that included core questions and special modules (e.g., family conflict and routines; varied by survey). For each follow-up assessment, we invited 2000 caregivers who were randomly selected from the participant pool (following a stratified sampling strategy), with an anticipated response rate of 50% (i.e., obtaining approximately 1000 responses per follow-up survey). After completing each survey, the family received \$5 as an incentive. The study team made extensive efforts to include more racially/ethnically

diverse and low-income households in the ongoing follow-up assessments. Each follow-up survey was stratified based on participants' race and poverty level (i.e., the percentage of the U.S. federal poverty level; FPL), to reach national representativeness regarding these demographic characteristics (See [Supplemental Table 2](#) for sampling stratification). The stratification strategy also accounted for participants' geographic distribution in the U.S. Following this sampling strategy, the frequency of follow-up survey invitations as well as the number and date of follow-up responses varied by family. We provided the distribution and descriptive statistics of time intervals between respondents' follow-up responses and the total responses numbers in [Supplemental Figure 1](#).

In the context of the pandemic, survey fraud (i.e., some participants fraudulently gain access to the survey and/or complete the survey multiple times for incentives) has become a severe issue as many in-person surveys move to online venues ([Palamar and Acosta, 2020](#)). Our research team has made extensive efforts to manually and systematically inspect all baseline and follow-up surveys based on I.P. address, attention check questions, and inconsistent data patterns to detect and remove fraudulent responses. Simple math questions (e.g., "What year is 10 years in the future [2022 + 10]?") and questions confirming the participant's date of birth were used for attention check. Responses were identified as fraudulent if 1) duplicated I.P., email address, or other identifiable information were found in previous baseline surveys; 2) I.P. address was identified as "survey farms" using an external online tool; 3) failure to answer the attention check questions correctly (within 1 digit error margin); and 4) inconsistent data pattern (e.g., reported child age in baseline survey did not match responses in the eligibility survey; reported caregiver gender did not match reported relationship to the child). These strategies were formed based on a series of recently developed fraud detection protocols that had been proven effective (e.g., [Ballard et al., 2019](#); [Pozzar et al., 2020](#); [Storozuk et al., 2020](#)).

3.2. Participants

This used RAPID data collected from April 6th, 2020 to October 1st, 2021. During this time frame, 54,929 responses from 14,630 participants were collected, of which 22.34% ($n = 12,271$) responses from 3025 participants were identified as fraudulent and removed from analyses. This procedure resulted in 42,658 valid responses from 11,605 families of young children. Recruitment sources of these participants included 59.88% from Facebook Ads, 32.65% from the community or family-facing organization email listservs, and 7.47% from panel services. To obtain a reliable estimate of hardship unpredictability overtime during the pandemic, we only included families who provided at least three survey responses ($N = 4621$) in this study. The number of responses for each family ranged from 3 to 38, with a mean of 7.44 ($SD = 4.86$). This sample of 4621 participants was used to test the first and second study hypotheses because variables involved in these two hypotheses (i.e., material hardship and well-being) were assessed in every baseline and follow-up survey, and thus were available for all participants in this sample.

For the third hypothesis testing, variables of family conflict and family routines were considered as special modules and only assessed during one follow-up survey in late April 2021 (between April 28th, 2021 and May 1st, 2021). Participants who have responded to this particular follow-up survey (in late April 2, 0221) and have provided at least three survey responses in total during the study timeframe (from April 2020 to October 2021) formed a subsample of 644 families. This subsample was used to test the roles of family conflict and routines in the associations between hardship level & unpredictability and well-being outcomes. For this subsample, the number of responses for each family ranged from 3 to 27, with a mean of 8.03 ($SD = 4.94$). The demographic information of the full ($N = 4621$) and subsample ($n = 644$) is comparable (see [Table 1](#)).

Table 1
Demographic characteristics of the study sample.

Demographic Characteristics		Full sample for the first & second ($N = 4621$)		Subsample for the third hypothesis testing ($n = 644$)		
		<i>n</i>	Percentage	<i>n</i>	Percentage	
Caregivers' Race	American Indian/Alaska Native	42	0.91%	5	0.78%	
	Asian	165	3.57%	31	4.81%	
	Black/African American	274	5.93%	52	8.07%	
	Native Hawaiian/Pacific Islander	1	0.02%	1	0.16%	
	White	3762	81.41%	509	79.04%	
	Bi-Racial/Multi-Racial	151	3.27%	29	4.50%	
	Others	219	4.74%	17	2.64%	
	Caregivers' Ethnicity	Hispanic/Latino (a)	676	14.65%	95	14.77%
		Non-Hispanic/Latino(a)	3939	85.35%	548	85.23%
	Caregivers' Gender	Male/Transgender	141	3.05%	22	3.42%
Female/Transgender		4456	96.43%	621	96.43%	
Female						
Gender Variant/Non-Conforming		3	0.06%	0	0.00%	
Prefer not to answer		9	0.19%	1	0.16%	
Other		12	0.26%	0	0.00%	
Pre-Pandemic Poverty Level	At or below 200% FPL	1874	41.06%	244	37.89%	
	200%–400% FPL	1561	34.20%	213	33.07%	
	Above 400% FPL	1129	24.74%	187	29.04%	
Caregivers' Age Group	18–24 years old	167	3.64%	18	2.80%	
	25–34 years old	2875	62.61%	405	62.89%	
	35–44 years old	1469	31.99%	215	33.39%	
	45–54 years old	60	1.31%	3	0.47%	
	55+ years old	21	0.46%	3	0.47%	
Caregivers' Employment Status	Pre-Pandemic Employed	2064	78.36%	280	76.29%	
	Pre-Pandemic Not Employed	570	21.64%	87	23.71%	
	During Pandemic Employed	2990	70.67%	409	68.86%	
Family Structure	During Pandemic Not Employed	1241	29.33%	185	31.14%	
	Dual-Parent Household	4231	91.58%	587	91.15%	
Geographic Region	Non-Dual-Parent Household	389	8.42%	57	8.85%	
	Northeast	816	17.66%	156	24.22%	
	Midwest	1215	26.29%	166	25.78%	
	South	1388	30.04%	164	25.47%	
Distribution in U.S.	West	1202	26.01%	158	24.53%	

Note. FPL = federal poverty level; pre-pandemic poverty level was calculated based on 2019 annual income and household size. Valid percentages (i.e., percentages calculated after excluding missing data) are presented in this table.

3.3. Measures

Given the RAPID's nature of frequent and brief online surveys that captured numerous domains, we used shortened or trimmed measurement tools to reduce survey length and avoid participants' fatigue. When validated measures were available, we selected questions that were most

relevant to families' experiences during the COVID-19 pandemic. For domains with no validated or appropriate measures, questions were developed by the research team.

3.4. Hypothesis 1&2 full sample

Material hardship level and unpredictability. In analyses for hypotheses 1 & 2, the level and unpredictability of material hardship were obtained based on responses provided by families during the full timeframe (April 6th, 2020–October 1st, 2021). Material hardship was assessed in all baseline and follow-up surveys with one item adapted from the Institute of Medicine financial strain scale (IOM, 2014): "Which of these needs have been hard to pay for in the past month? Select all that apply". Responses included "Food," "Housing," "Utilities (electric, water, trash, etc.)," "Healthcare," "Childcare," and "Social and Emotional." Responses included "1 – Yes" and "0 – No". For each family's each survey response, material hardship level was indicated by the number of basic needs that families had difficulty paying for (ranged 0 to 6). Then, for each family, the average material hardship level was calculated by taking the mean score of their hardship levels during the multiple responses and used in analyses. The material hardship unpredictability was obtained using the coefficient of variance (CV), which was the standard deviation divided by the mean of their hardship levels during the multiple responses. CV is a commonly used method to assess unpredictability (e.g., Key et al., 2017), with higher scores indicating more unpredictability.

Well-being outcomes. Pre-pandemic well-being outcomes were retrospectively reported by caregivers during the baseline surveys. Caregivers also reflected on their emotional distress and their children's behavioral problems during the pandemic in both baseline and follow-up surveys. To establish temporal precedence in study models while maintaining the benefits of the large RAPID sample size, each caregivers' latest response to the follow-up surveys was used to indicate well-being during the pandemic.

Caregivers' emotional distress was captured by a composite of depressive symptoms, anxiety symptoms, perceived stress, and loneliness. Depressive symptoms were measured using two items from the Patient Health Questionnaire-2 (Kroenke and Spitzer, 2002), including "little interest or pleasure in doing things" and "feeling down, depressed, or hopeless". Anxiety symptoms were assessed via the Generalized Anxiety Disorder (GAD) 2-item Scale (Kroenke et al., 2007), including "feeling nervous, anxious, or on edge" and "not being able to stop or control worrying". GAD-2 is a short form of GAD-7 (Spitzer et al., 2006) and has been shown to perform well as a screening tool for anxiety disorders (Kroenke et al., 2007). Responses for the depression and anxiety questions ranged from "0 – Not at all" to "3 – Nearly every day". Perceived stress symptoms were captured by one item, "stress means a situation in which a person feels tense, restless, nervous, or anxious, or is unable to sleep at night because his/her mind is troubled all the time. Did you feel this kind of stress?", developed by Elo et al. (2003). Responses for the stress question ranged from "0 – Not at all" to "4 – Very much". Lastly, caregivers' loneliness was measured by one item, "I feel lonely", from the NIH Toolbox item bank version 2.0 (Gershon et al., 2013), with responses ranging from "0 – Never" to "4 – Always". These four measures were moderately to highly correlated, $0.49 \leq r \leq 0.74$, $p < .001$, and had acceptable internal consistency, $\alpha_{pre} = .77$, $\alpha_{during} = 0.86$. The total score of each of the four constructs was first transformed to a range of 0–100. Then, the average scores of pre- and during-pandemic composite emotional distress were calculated respectively.

Caregivers reported child symptoms of fear/anxiety and fussiness/defiance on each of their children aged between 0 and 5 years old in the household, using two items selected from the Child Behavioral Checklist (Achenbach and Rescorla, 2001), on a 3-point scale of "0 – Not true", "1 – Somewhat/sometimes true", and "2 – Often true/very true". Child fear/anxiety symptoms were assessed via the item "Too fearful or

anxious", and fussiness/defiance symptoms were measured using the item "Fussy or defiant". When multiple children within the age range presented in the household, caregivers separately reported on each child, and the average scores across all reported children were calculated to reflect the overall children's fear/anxiety and fussiness/defiance symptoms at the household level. The scores of these two symptoms were moderately correlated, $r_{pre} = .49$, $r_{during} = 0.56$, $p < .001$. Scores were transformed to a range of 0–100, and the average of fear/anxiety and fussiness/defiance symptoms across all reported children in each household was calculated to indicate children's total behavioral problems.

3.5. Hypothesis 3 subsample

Family conflict and routines. Family conflict and routines were assessed as two special modules in a follow-up survey during late April 2021 (between April 28th, 2021 and May 1st, 2021). In this special module, caregivers were asked to retrospectively reflect on their pre-pandemic experiences of family conflict and routines. They were also instructed to report on their current (during pandemic) family conflict and routine levels. Family conflict was assessed via seven items, with three items from a short form of the revised Conflict Tactics Scale (Straus and Douglas, 2004) to capture spousal conflict and four items from the Parent-Child Conflict Tactics Scale (Straus et al., 1998) to indicate parent-child conflict in the past week (for a full list of selected items, see the Supplemental Table 3). Responses ranged from "0 – this has not happened" to "5 – more than 10 times per week". Mean scores of the seven items were computed to indicate overall pre-pandemic and during-pandemic family conflict levels, respectively, with higher scores suggesting more conflict. This family conflict scale had excellent internal consistency, $\alpha_{pre} = .94$, $\alpha_{during} = 0.95$.

Family routines were measured through five items modified on the Questionnaire of Unpredictability in Childhood (QUIC; Glynn et al., 2019), and a full list is presented in Supplemental Table 3. QUIC was originally developed to assess adult experiences of unpredictability during their own childhood (Glynn et al., 2019). Our research team selected items from the Parental Monitoring and Involvement subscale that were applicable for young children's experiences during the pandemic and modified the items for caregivers' reports on family routines with their children. Responses ranged from "1 – almost never" to "4 – almost every day". Mean scores of the five items were calculated to indicate overall family routine levels. This family routine scale had acceptable internal consistency, $\alpha_{pre} = .67$, $\alpha_{during} = 0.74$. Higher scores suggested more regular family routines.

Material hardship level, unpredictability, and well-being outcomes. Household material hardship level and unpredictability, caregivers' emotional distress, and children's behavioral outcomes were measured in the same way as described above and obtained among the subsample of 644 families to establish temporal precedence for hypothesis 3 testing. In particular, material hardship level and unpredictability (CV) used in the mediation model were calculated based on families' multiple responses between April 6th, 2020 and April 28th, 2021. Additionally, we obtained each family's well-being outcomes during their first follow-up response after late April 2021 as the dependent variables in the mediation model. We also included families' well-being variables assessed concurrently with family conflict and routines (i.e., in late April 2021) as a covariate to examine changes in caregivers' and children's emotional well-being.

3.6. Demographics and socioeconomic characteristics

Households' pre-pandemic (i.e., 2019) annual household income was collected in the baseline survey. Families' pre-pandemic FPL was further obtained based on 2019 income and household size. Caregivers also indicated their race/ethnicity in the baseline survey. In analyses models, race/ethnicity was coded into three binary (0/1) variables,

including Black, Hispanic/Latino(a), and other minorities.

3.7. Analysis

First, zero-order correlations were conducted to examine associations among study variables. To test hypothesis 1, families' material hardship level and unpredictability were compared among different race/ethnicity and FPL groups using ANOVA and LSD posthoc analyses. Then, structural equation models (SEM) were constructed in Mplus Version 8.3 (Muthén and Muthén, 2017) to investigate the associations among the level and unpredictability of material hardship, well-being, and family interaction outcomes. All SEM models used maximum likelihood estimation with robust standard errors (Yuan and Bentler, 2000). Missing data were minimal (0%–1.6%) and addressed using the full information maximum likelihood (FIML) algorithm. Model fit was assessed through the chi-square, the comparative fit index (CFI), and the standardized root mean residual (SRMR; Hu and Bentler, 1999). To test the second study hypothesis, a direct effect model was analyzed using the full sample, $N = 4,621$, to examine the effects of material hardship level and unpredictability on the changes in caregivers' and children's well-being outcomes since the pandemic, accounting for the effect of pre-pandemic household income, race/ethnicity, and corresponding pre-pandemic well-being outcomes. To test the third hypothesis, the indirect effects of material hardship level and unpredictability (before late April 2021) on changes in caregivers' and children's well-being outcomes (from late April 2021 to the first follow-up response after) via family interactions (assessed during late April 2021) were examined using the subsample, $n = 644$, accounting for the effects of pre-pandemic household income and race/ethnicity. To assess changes in the mediator and dependent variables, path a of this mediation model (i.e., material hardship level & unpredictability → family conflict & routines) controlled for corresponding pre-pandemic family interaction variables. Similarly, path b of this mediation model (i.e., family conflict & routines → follow-up well-being outcomes) controlled for corresponding well-being variables assessed concurrently with family conflict & routines during late April 2021. The R-Mediation procedure was employed to estimate the indirect effect coefficients and confidence intervals (Tofighi and MacKinnon, 2011).

4. Results

The descriptive statistics and correlation coefficients of study variables in the two samples are presented in Tables 2 and 3, respectively. Study variables were correlated in expected directions. In the full sample of 4621 participants, material hardship level and unpredictability were significantly correlated with each other with a small effect size, $r = .06$,

$p < .01$. Caregivers' emotional distress and children's behavioral problems were positively correlated (r ranged from 0.18 to 0.48, $p < .01$). Participants' total number of survey responses was correlated with higher levels of material hardship unpredictability, $r = 0.14$, $p < .01$, lower average hardship levels, $r = -0.05$, $p < .01$, lower levels of caregiver emotional distress during the pandemic, $r = 0.14$, $p < .01$, and higher levels of child behavioral problems before the pandemic, $r = 0.03$, $p < .05$ (all with small effect sizes). Additionally, Black ($r = 0.09$, $p < .01$) and other minority ($r = 0.05$, $p < .01$) racial groups had higher numbers of survey responses.

In the subsample of 644 families, material hardship level was linked to poorer caregiver well-being (r from .31 to .40, $p < .01$), more behavioral problems among children ($r = 0.26$, $p < .01$), less regular family routines, $r = -0.26$, $p < .01$, and more family conflict, $r = 0.11$, $p < .05$. Hardship unpredictability was significantly related to more irregular family routines, $r = -.13$, $p < .01$. Higher levels of family conflict (r between 0.20 and 0.26, $p < .01$) and less regular family routines (r between -0.26 and -0.22 , $p < .01$) were also connected with worse well-being among caregivers and children. Participants' total number of survey responses was correlated with higher levels of material hardship unpredictability, $r = 0.14$, $p < .01$. Additionally, Black ($r = 0.14$, $p < .01$) and other minority ($r = 0.13$, $p < .01$) racial groups had higher numbers of survey responses.

The ANOVA results supported the first study hypothesis (Table 4). Compared to White families, Black/African American, Hispanic/Latino (a), and other minorities experienced significantly higher material hardship level and unpredictability. Black/African American and Hispanic/Latino(a) caregivers reported further elevated hardship levels than other minority groups. Lower-income households experienced heightened hardship level and unpredictability compared to higher-income families. These findings revealed severe structural inequalities of families' financial situations based on race/ethnicity and SES during the pandemic.

The model testing the direct associations between material hardship level & unpredictability and well-being outcomes is presented in Fig. 1 & Table 5. This model indicated that both pandemic-related material hardship level and unpredictability were significantly and negatively associated with caregivers' and children's well-being after controlling for pre-pandemic income. Accordingly, pandemic-related material hardship level was related to significant increases of caregivers' emotional distress, $\beta = .218$, $p < .001$, and children's behavioral problems, $\beta = 0.177$, $p < .001$. Hardship unpredictability was also significantly linked to increases in caregivers' emotional distress, $\beta = .037$, $p < .01$, and children's behavioral problems, $\beta = 0.040$, $p < .01$, with smaller effect sizes. Pre-pandemic income was positively and significantly associated with child behavioral problems, $\beta = 0.020$, $p < .05$, but not

Table 2
Correlation Coefficients and Descriptive Statistics of Full Sample Study Variables (for Hypotheses 1&2, $N = 4621$).

	1	2	3	4	5	6	7	8	9	10	11
1. MH unpredictability (during)	–										
2. MH level (during)	.06**	–									
3. Income (pre)	-.09**	-.12**	–								
4. Caregiver distress (during)	.07**	.34**	-.06**	–							
5. Caregiver distress (pre)	.08**	.26**	-.09**	.48**	–						
6. Child problems (during)	.06**	.24**	-.02	.43**	.25**	–					
7. Child problems (pre)	.05**	.11**	-.03	.18**	.29**	.33**	–				
8. Black	.03*	.10**	-.04**	-.03**	.03*	-.01	.02	–			
9. Hispanic/Latino(a)	.05**	.12**	-.06**	.02	-.01	.04**	.03*	-.05**	–		
10. Other minorities	.06**	.07**	.00	-.01	-.02	.03*	.04**	-.08**	.36**	–	
11. Number of responses	.14**	-.07**	-.01	-.05**	-.02	-.03	.03*	.09**	.02	.05**	–
Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maximum	5.39	5.75	5,517 k	100.00	100.00	100.00	100.00	1.00	1.00	1.00	38.00
Mean	.54	.76	82.88 k	38.79	26.41	35.46	22.01	.06	.15	.15	7.44
Standard Deviation	.85	1.13	145.67 k	23.15	17.93	24.52	20.48	.24	.35	.36	4.86

Note. Hypotheses 1 & 2 testing used the full sample of 4621 participants. MH = Material hardship; during = during COVID-19 pandemic; pre = pre-COVID-19 pandemic; Caregiver distress = Caregiver emotional distress; Child problems = Child behavioral problems; k = \$1000. * $p < .05$, ** $p < .01$.

Table 3
Correlation Coefficients and Descriptive Statistics of Subsample Study Variables (for Hypotheses 3, n = 644).

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. MH unpredictability (pre-Apr21)	-.07														
2. MH level (pre-Apr21)	-.10*	-.19**													
3. Income (pre-pandemic)	.00	.08	.00												
4. Fam. conflict (Apr21)	.02	.11*	-.07	.64**											
5. Fam. conflict (pre-pandemic)	-.13**	-.26**	.02	-.16**	-.10*										
6. Fam. routine (Apr21)	-.05	-.13**	.04	-.20**	-.20**	-.50**									
7. Fam. routine (pre-pandemic)	.03	.31**	-.07	.26**	.23**	-.25**	-.14**								
8. Caregiver distress (post-Apr21)	.05	.40**	-.11**	.32**	.18**	-.22**	-.13**	.75**							
9. Caregiver distress (Apr21)	.07	.26**	-.11*	.20**	.18**	-.26**	-.19**	.36**	.34**						
10. Child problems (post-Apr21)	.05	.26**	-.03	.25**	.21**	-.24**	-.17**	.32**	.40**	.66**					
11. Child problems (Apr21)	.06	-.02	-.03	.05	.13**	-.15**	-.09*	-.08	-.09*	.03	.07				
12. Black	.12**	.15**	-.07	-.13	-.17**	-.04	-.02	.03	.02	.06	.04	-.04			
13. Hispanic/Latino(a)	.13**	.08*	-.05	-.09*	-.10*	-.07	.00	-.01	-.02	.06	.03	-.09*	-.36**		
14. Other minorities	.14**	-.03	-.02	.04	.03	-.02	.07	.03	-.04	.05	.02	.14**	.03	.13**	
15. Number of responses	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.00
Minimum	4.24	5.33	2,640 k	5.00	5.00	4.00	4.00	100.00	100.00	100.00	100.00	1.00	1.00	1.00	27.00
Maximum	.52	.68	85.94 k	1.89	1.62	3.34	3.24	36.81	40.06	36.68	37.78	.08	.15	.17	8.03
Standard Deviation	.86	1.08	123.38 k	.86	.79	.60	.67	21.91	23.19	25.19	23.82	.27	.36	.37	4.94

Note. For hypothesis 3 testing, variables of family conflict and family routines were only assessed during one follow-up survey in late April 2021 (i.e., Apr21). Participants who have responded to this particular follow-up survey and have provided at least three survey responses in total during the study timeframe (from April 2020 to October 2021) formed a subsample of 644 families. In this table, MH = Material hardship; Fam. = Family; Caregiver distress = Caregiver emotional distress; Child problems = Child behavioral problems; k = \$1000. * $p < .05$, ** $p < .01$.

linked to caregivers' emotional distress, $\beta = 0.008, p = .423$. Overall, these findings supported hypothesis 2 by suggesting that both the level of difficulty paying for basic needs and the instability/uncertainty of families' financial situations during the pandemic were related to worsened caregiver and child well-being, compared to pre-pandemic situations.

Fig. 2 and Table 6 present the findings of the model that test the indirect associations between material hardship level & unpredictability and well-being outcomes through family conflict & routines. Pandemic-related material hardship level and hardship unpredictability were both significantly related to fewer regular family routines (level: $\beta = -.173, p < .01$; unpredictability: $\beta = -.098, p < .01$) but not associated with changes in family conflict (level: $\beta = 0.010, p = .816$; unpredictability: $\beta = -.0006, p = .842$) assessed during late April 2021. Further, higher levels of family conflict during late April 2021 were related to increases in caregivers' emotional distress, $\beta = 0.071, p < .05$, but not significantly linked to changes in children's behavioral problems, $\beta = 0.058, p = .140$, during the follow-up assessment. Reduced family routines were significantly linked to increases in both caregivers' emotional distress, $\beta = -.094, p < .01$, and children's behavioral problems, $\beta = -.091, p < .05$, during the follow-up survey. Significant indirect effects were found on the associations between hardship level and well-being outcomes via reduced family routines (caregiver: $\alpha \times \beta = .016, p < .01$; children: $\alpha \times \beta = 0.016, p < .05$) but not via family conflict (caregiver: $\alpha \times \beta = 0.001, p > .05$; children: $\alpha \times \beta = 0.001, p > .05$). Similarly, we found significant indirect effects on the associations between hardship unpredictability and well-being outcomes through reduced family routines (caregiver: $\alpha \times \beta = .009, p < .05$; children: $\alpha \times \beta = 0.009, p < .05$) but not through increased family conflict (caregiver: $\alpha \times \beta = -.00004, p > .05$; children: $\alpha \times \beta = -.00003, p > .05$). These findings partially supported hypothesis 3 and suggested that hardship level and unpredictability might influence families' well-being through changing disrupting daily routine activities.

5. Discussion

This study examined the magnitude of and mechanisms underlying the associations between the level and unpredictability of material hardship and the well-being of U.S. households with young children during the pandemic. First, we found that racial/ethnic minorities or lower-SES households experienced significantly higher material hardship level and unpredictability compared to White or higher-SES families. Second, material hardship level and unpredictability were both found to be significantly and negatively associated with caregivers' and children's well-being. Lastly, disrupted family routines were found to be a significant intermediate factor on the links between the level and unpredictability dimensions of material hardship and well-being among caregivers and young children.

5.1. Interpretation of the study findings

The findings of this study first demonstrated the expected severe inequalities in U.S. households' financial situations based on race/ethnicity and SES during the pandemic. Households of racial/ethnic minorities (such as Black and Hispanic/Latino[a] families) and lower-income families were especially likely to face the double risk of high financial instability and the lack of financial resources. One possible explanation is wealth gaps, as families from marginalized groups have fewer savings and overall wealth cumulated before the pandemic compared to their White or higher-income counterparts (Burton, 2018). Another cause of the financial disparities might be the systemic inequalities in employment opportunities, as Black, Hispanic/Latino(a), and low-income caregivers had disproportionately higher unemployment rates during the pandemic (Kantamneni, 2020). Additionally, Black, Hispanic/Latino(a), and low-income individuals had higher infection, hospitalization, and mortality rates as a result of COVID-19

Table 4
ANOVA Results of Material Hardship Unpredictability Differences by Groups (N = 4621).

Dependent Variable	Grouping	ANOVA Results						LSD Post-Hoc Comparisons		
		SS _{total}	SS _{within}	SS _{between}	df _{within}	df _{between}	F	Comparison	M _{difference}	95%CI of M _{difference}
MH Level	Race/Ethnicity	5870.176	5740.049	130.128	4612	3	34.852***	Black vs. White	.452	[.307, .597]***
								Hispanic/Latino(a) vs. White	.412	[.320, .505]***
								Other minorities vs. White	.140	[.022, .259]*
								Black vs. Hispanic/Latino (a)	.040	[-.123, .203]
								Black vs. Other minorities	.312	[.133, .491]**
								Hispanic/Latino(a) vs. Other minorities	.272	[.132, .412]***
								Below 200%FPL vs. 200%-400%FPL	.676	[.589, .764]***
								Below 200%FPL vs. Above 400%FPL	1.268	[1.169, 1.368]***
								200%-400%FPL vs. Above 400%FPL	.592	[.519, .666]***
								MH Unpredictability	Race/Ethnicity	3323.756
Hispanic/Latino(a) vs. White	.142	[.072, .212]***								
Other minorities vs. White	.111	[.022, .201]*								
Black vs. Hispanic/Latino (a)	-.003	[-.127, .121]								
Black vs. Other minorities	.028	[-.108, .164]								
Hispanic/Latino(a) vs. Other minorities	.031	[-.075, .137]								
Below 200%FPL vs. 200%-400%FPL	.060	[-.009, .129]‡								
Below 200%FPL vs. Above 400%FPL	.407	[.328, .485]***								
200%-400%FPL vs. Above 400%FPL	.346	[.288, .404]***								
MH Level	Pre-Pandemic Poverty Level	5823.956	5110.164	713.792	4561	2	318.542***			
								Below 200%FPL vs. Above 400%FPL	1.268	[1.169, 1.368]***
								200%-400%FPL vs. Above 400%FPL	.592	[.519, .666]***

Note. MH = Material hardship; SS = Sum of squares; df = Degree of freedom; M_{difference} = mean difference (for comparison x vs. y, mean difference was calculated as x - y); CI = Confidence interval. ‡p < .10 (marginally significant), *p < .05, **p < .01, ***p < .001.

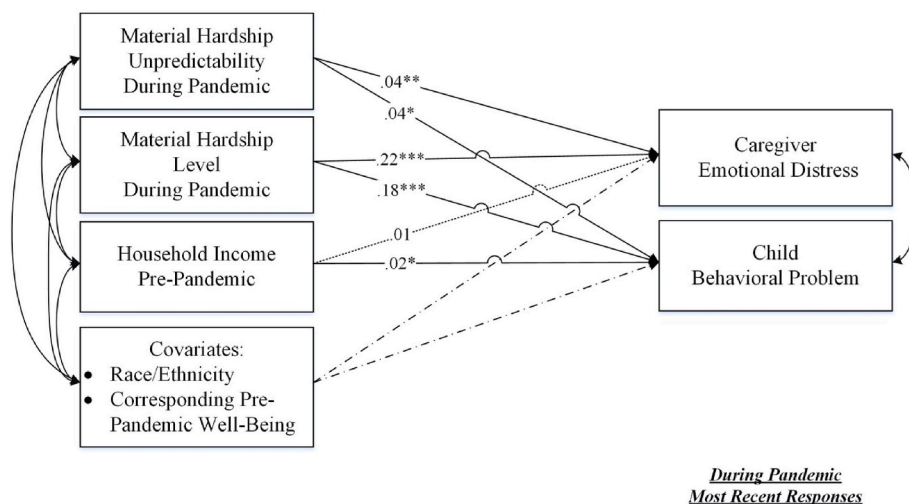


Fig. 1. Visual Presentation of the Structural Equation Model that Examined the Effects of Material Hardship Level and Unpredictability on Well-Being Outcomes (N = 4621). Note. Standardized coefficients β are presented in the figure. Solid lines indicate significant paths, dotted lines represent non-significant paths, and dash-dotted lines represent controlled variables (coefficients not presented in the figure for clarity). Model fit was excellent: $\chi^2(2) = 105.032$ ($p < .001$), CFI = 0.960, SRMR = 0.020. *p < .05, **p < .01, ***p < .001.

(Abedi et al., 2021; Azar et al., 2020), causing even heavier financial burdens on these marginalized households.

The finding on the associations between higher material hardship levels and worsened well-being outcomes corroborate the existing poverty literature (French and Vigne, 2019). As a major source of stress, experiences of struggles paying for basic needs took tolls on caregivers' mental health, especially during the pandemic when income and employment losses occurred more frequently and the need to socially

distance reduced opportunities for social support. Households' financial strain was also directly and indirectly (through disrupted/inconsistent parenting behaviors) related to increased risk for developing symptoms of fear/anxiety and/or fussiness/defiance problems among young children (Crnic et al., 2005). Beyond hardship level, hardship unpredictability had weaker yet still significant connections with caregivers' emotional distress and children's behavioral problems, indicating that financial instability was a unique risk factor for poor well-being.

Table 5
Structural Equation Models Examining the Associations between Material Hardship Level & Unpredictability and Well-Being Outcomes (N = 4621).

Paths	B (S.E.)	β	95%CI of B
Direct Associations			
MH Unpredictability (during) → Caregiver distress (during)	.135 (.048)	.037	[.040, .229] **
MH Unpredictability (during) → Child problems (during)	.188 (.071)	.040	[.049, .327] **
MH Level (during) → Caregiver distress (during)	.397 (.026)	.218	[.347, .447] ***
MH Level (during) → Child problems (during)	.421 (.033)	.177	[.357, .485] ***
Income (pre) → Caregiver distress (during)	.000 (.000)	.008	[.000, .000]
Income (pre) → Child problems (during)	.000 (.000)	.020	[.0001, .001] *
Covariates			
Caregiver distress (pre) → Caregiver distress (during)	.420 (.015)	.399	[.390, .450] ***
Child problems (pre) → Child problems (during)	.269 (.013)	.281	[.242, .295] ***
Black → Caregiver distress (during)	-.689 (.122)	-.079	[-.928, -.451] ***
Black → Cd BP (during)	-.482 (.173)	-.042	[-.822, -.143] *
Hispanic/Latino(a) → Caregiver distress (during)	-.061 (.087)	-.011	[-.231, .108]
Hispanic/Latino(a) → Child problems (during)	-.049 (.118)	-.006	[-.280, .182]
Other Minorities → Caregiver distress (during)	-.141 (.081)	-.025	[-.300, .017]
Other Minorities → Child problems (during)	-.038 (.116)	-.005	[-.266, .190]
Model Fit Indices			
	$\chi^2(2) = 105.032$ ($p < .001$), CFI = .960, SRMR = .020		

Note. This table presents findings for hypothesis 2 testing, using the full sample of 4621 families. Caregivers' emotional distress and children's behavioral problems during the pandemic were obtained during each family's latest responses. Material hardship level and unpredictability data were computed using all responses provided by families during the full timeframe (April 6th 2020–October 1st 2021). Material hardship level was indicated by taking the mean score of their hardship levels during the multiple responses and used in analyses. The material hardship unpredictability was obtained using the coefficient of variance (CV), which was the standard deviation divided by the mean of their hardship levels during the multiple responses. MH = Material hardship; during = during COVID-19 pandemic; pre = pre-COVID-19 pandemic; Caregiver distress = Caregiver emotional distress; Child problems = Child behavioral problems. * $p < .05$, ** $p < .01$, *** $p < .001$.

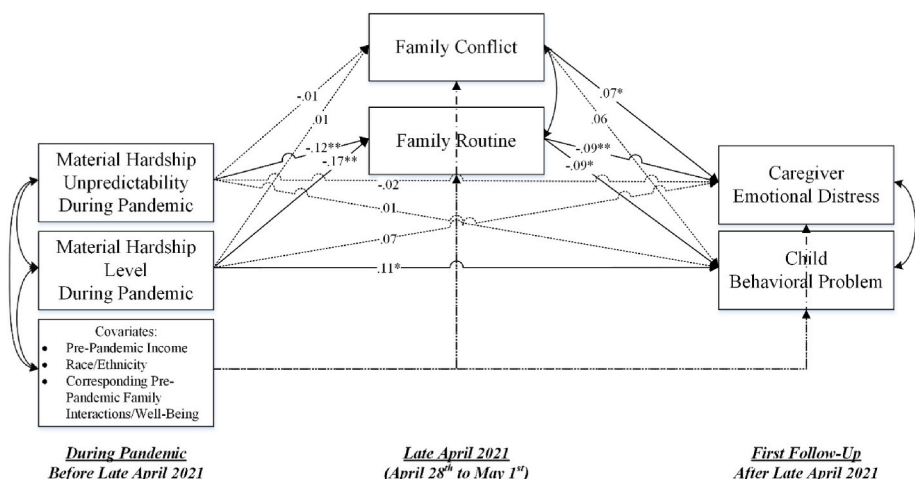


Fig. 2. Visual Presentation of the Structural Equation Model that Examined the Indirect Effects of Material Hardship Level and Unpredictability on Well-Being Outcomes Through Family Conflict and Family Routines (N = 644). Note. Standardized coefficients β are presented in the figure. Solid lines indicate significant paths, dotted lines represent non-significant paths, and dash-dotted lines represent controlled variables (coefficients not presented in the figure for clarity). Model fit was excellent: $\chi^2(10) = 44.951$ ($p < .001$), CFI = 0.969, SRMR = 0.021. * $p < .05$, ** $p < .01$, *** $p < .001$.

Disrupted family routines served as an intermediate factor on the negative associations between material hardship (both level and unpredictability) and well-being. This finding corroborates with Bronfenbrenner's bioecological systems theory and highlights the key role of proximal family processes in caregivers' and children's mental health. For caregivers, struggles with irregular routines in addition to managing difficult and inconsistent financial status considerably increased parenting stress, which naturally posed them at elevated risk for anxiety, depression, and stress symptoms (Crnic et al., 2005). Social isolation related to stay-at-home orders during the pandemic also exposed caregivers to a social context with reduced support, increasing their loneliness symptoms (Saltzman et al., 2020). For young children, early childhood is a sensitive period when typical neural development relies on predictable caregiving signals as an external regulatory sources (Gee and Cohodes, 2021). Therefore, unpredictability factors of financial instability and irregular family routines may disrupt the predictability of caregiving signals, induce more inconsistent and harsh parenting behaviors, and further increase young children's risk for increased behavioral problems (Crnic et al., 2005).

In addition to the bioecological systems theory, the life history theory adopts the evolutionary developmental framework and provides an alternative explanation about the associations between hardship unpredictability and children's well-being. Although not tested in this study, the unique perspective of the life history theory is worth noting. This theory suggests that young children reared in highly unpredictable environments tend to exhibit faster life history strategies characterized by early maturation to preserve energy and achieve evolutionary fitness (i.e., survival and reproduction; Ellis et al., 2009b). Shaped by natural selection through evolution, the human brain may detect environmental unpredictability via "ancestor cues" (i.e., cues of unpredictability in the surrounding environment) and enact corresponding developmental adjustment quickly and effectively (Ellis et al., 2009a; Young et al., 2020). In the context of the COVID-19 pandemic, unpredictability factors of hardship unpredictability and disrupted family routines may serve as such "ancestor cues" of potential unpredictability and promote children to adopt faster life strategies. Despite being evolutionarily or biologically adaptive, faster life-history strategies were also found to be related to socially undesirable and dysfunctional traits and behaviors, such as aggression, reduced empathy, self-harm behaviors, as well as behavioral symptoms (Hurst and Kavanagh, 2017).

5.2. In the broad context of unpredictability research

The current study focused on the unpredictability of material hardship in the family context. Meanwhile, emerging research has identified unpredictability factors of various formats (e.g., household chaos,

Table 6
The Indirect Effects of Material Hardship Level and Unpredictability on Well-Being Outcomes Through Family Conflict and Family Routines (N = 664).

Paths	B (S.E.)	β	95%CI of B
Path a			
MH Unpredictability (pre-Apr21) → Fam. Conflict (Apr21)	-.010 (.049)	-.006	[-.105, .086]
MH Unpredictability (pre-Apr21) → Fam. Routine (Apr21)	-.115 (.043)	-.098	[-.199, -.032]**
MH Level (pre-Apr21) → Fam. Conflict (Apr21)	.008 (.035)	.010	[-.060, .076]
MH Level (pre-Apr21) → Fam. Routine (Apr21)	-.108 (.031)	-.173	[-.169, -.046]**
Path b			
Fam. Conflict (Apr21) → Caregiver Distress (post-Apr21)	.161 (.073)	.071	[.018, .304] *
Fam. Conflict (Apr21) → Child Problems (post-Apr21)	.178 (.121)	.058	[-.059, .414]
Fam. Routine (Apr21) → Caregiver Distress (post-Apr21)	-.274 (.100)	-.094	[-.471, -.077]**
Fam. Routine (Apr21) → Child Problems (post-Apr21)	-.359 (.146)	-.091	[-.644, -.073]*
Path c'			
MH Unpredictability (pre-Apr21) → Caregiver Distress (post-Apr21)	-.060 (.100)	-.017	[-.256, .137]
MH Unpredictability (pre-Apr21) → Child Problems (post-Apr21)	.039 (.159)	.008	[-.272, .350]
MH Level (pre-Apr21) → Caregiver Distress (post-Apr21)	.122 (.086)	.067	[-.046, .290]
MH Level (pre-Apr21) → Child Problems (post-Apr21)	.265 (.095)	.108	[.079, .452] **
Indirect Effects			
MH Unpredictability (pre-Apr21) → Fam. Conflict (Apr21) → Caregiver Distress (post-Apr21)	-.002 (.009)	-.0004	[-.020, .016]
MH Unpredictability (pre-Apr21) → Fam. Conflict (Apr21) → Child Problems (post-Apr21)	-.002 (.001)	-.0003	[-.028, .022]
MH Unpredictability (pre-Apr21) → Fam. Routine (Apr21) → Caregiver Distress (post-Apr21)	.032 (.017)	.009	[.004, .070] *
MH Unpredictability (pre-Apr21) → Fam. Routine (Apr21) → Child Problems (post-Apr21)	.041 (.024)	.009	[.005, .095] *
MH Level (pre-Apr21) → Fam. Conflict (Apr21) → Caregiver Distress (post-Apr21)	.001 (.006)	.001	[-.011, .015]
MH Level (pre-Apr21) → Fam. Conflict (Apr21) → Child Problems (post-Apr21)	.001 (.008)	.001	[-.014, .019]
MH Level (pre-Apr21) → Fam. Routine (Apr21) → Caregiver Distress (post-Apr21)	.030 (.014)	.016	[.006, .061] **
MH Level (pre-Apr21) → Fam. Routine (Apr21) → Child Problems (post-Apr21)	.039 (.020)	.016	[.006, .083] *
Covariates			
Income (pre-pandemic) → Fam. Conflict (Apr21)	.001 (.010)	.003	[-.019, .791]
Income (pre-pandemic) → Fam. Routine (Apr21)	-.005 (.007)	-.028	[-.019, .009]
Income (pre-pandemic) → Caregiver Distress (post-Apr21)	.041 (.017)	.078	[.008, .075] *
Income (pre-pandemic) → Child Problems (post-Apr21)	.012 (.025)	.017	[-.037, .062]
Fam. Conflict (pre-pandemic) → Fam. Conflict (Apr21)	.717 (.038)	.659	[.643, .791] ***
Fam. Routine (pre-pandemic) → Fam. Routine (Apr21)	.509 (.046)	.459	[.419, .599] ***
Caregiver Distress (Apr21) → Caregiver Distress (post-Apr21)	1.698 (.107)	.684	[1.488, 1.909]***
Child Problems (Apr21) → Child Problems (post-Apr21)	1.213 (.090)	.564	[1.037, 1.389]***
Black → Fam. Conflict (Apr21)	-.168 (.102)	-.053	[-.367, .032]
Black → Fam. Routine (Apr21)	-.278 (.094)	-.113	[-.461, -.094]**

Table 6 (continued)

Paths	B (S.E.)	β	95%CI of B
Black → Caregiver Distress (post-Apr21)	-.147 (.184)	-.020	[-.508, .215]
Black → Child Problems (FL post-Apr21)	-.091 (.337)	-.009	[-.752, .569]
Hispanic/Latino(a) → Fam. Conflict (Apr21)	-.035 (.090)	-.014	[-.212, .141]
Hispanic/Latino(a) → Fam. Routine (Apr21)	.059 (.069)	.031	[-.076, .194]
Hispanic/Latino(a) → Caregiver Distress (post-Apr21)	.021 (.193)	.004	[-.357, .399]
Hispanic/Latino(a) → Child Problems (post-Apr21)	-.028 (.279)	-.004	[-.576, .519]
Other minorities → Fam. Conflict (Apr21)	-.039 (.081)	-.017	[-.197, .119]
Other minorities → Fam. Routine (Apr21)	-.120 (.066)	-.066	[-.249, .010]
Other minorities → Caregiver Distress (post-Apr21)	-.157 (.161)	-.030	[-.473, .158]
Other minorities → Child Problems (post-Apr21)	.071 (.282)	.010	[-.481, .624]
Model Fit Indices			
	$\chi^2(10) = 44.951 (p < .001)$, CFI = .969, SRMR = .022		

Note. This table presents findings for hypothesis 3 testing, using a subsample of 644 families. This subsample is selected because variables of family conflict and family routines were only assessed during one follow-up survey in late April 2021 (i.e., Apr21). Participants who have responded to this particular follow-up survey and have provided at least three survey responses in total during the study timeframe (from April 2020 to October 2021) formed a subsample of 644 families. To establish temporal precedence, material hardship level and unpredictability were assessed using participants' responses before this April 2021 survey (i.e., pre-Apr21), family routine and family conflict were assessed at April 2021 survey (i.e., Apr21), and well-being outcomes were obtained at their first follow-up response after this survey (i.e., post-Apr21). The mediation model also controlled for family conflict & routines during pre-pandemic, as well as well-being outcomes assessed during this April 2021 survey. In this table, MH = Material hardship; Fam. = Family; Caregiver distress = Caregiver emotional distress; Child problems = Child behavioral problems. * $p < .05$, ** $p < .01$, *** $p < .001$.

physical environment changes, unpredictable caregiving) and embedded in multi-level social contexts (e.g., family, community, and sociocultural contexts; Young et al., 2020). As indicated by Nelson III and Gabard-Durnam (2020), adversity is reflected by “deviations in or disruptions of the expectable environments”. Cross-species evidence further highlights the common neurobehavioral alterations induced by fragmented, unpredictable caregiving signals (e.g., Baram et al., 2012; Davis et al., 2017) that is particularly salient among young children (Gee and Cohodes, 2021). Thus, environmental unpredictability may serve as a core dimension of adverse experiences and potentially unite the neurobehavioral pathways after exposure to early adversity. Further discussion of the broad literature on unpredictability is beyond the scope of the current study but can be found in Liu and Fisher (in press). Due to the early stage of unpredictability research, the unifying role of environmental unpredictability as a core dimension of early adversity remains to be tested.

5.3. Limitations

This study has several limitations. First, there might be reporting biases because all the survey questions were answered by caregivers, and only retrospective reports were available to measure pre-pandemic situations of family conflict, routines, and well-being outcomes. However, given empirical evidence supporting the accuracy of retrospective reports across time (Bell and Bell, 2018; Little et al., 2020), we believe that our assessment of pre-pandemic situations is valid. Second, due to the nature of the weekly large-sample data collection, we utilized some trimmed questionnaires and team-developed questions whose validity and reliability had not been fully established. Relatedly, child

behavioral problems were only limited to fear/anxiety and fussiness/defiance symptoms. Future studies that examine broader child behavioral problems (e.g., problems assessed through the full CBCL scale) in relation to material hardship level, unpredictability, and family interactions are still needed. Third, despite the extensive effort to recruit families from diverse backgrounds, RAPID is a convenience sample, and the number of participants from racial minority groups of American Indian/Alaska Native, Asian, Black/African American, and Native Hawaiian/Pacific Islander is relatively small. Although families' access to technology continues increasing during the pandemic, digital inequality persists (Zheng and Walsham, 2021), and participants' digital capabilities (i.e., access to the Internet and digital equipment) and interest in parenting may affect the representativeness of the current sample (Denissen et al., 2010; McInroy, 2016). Thus, the generalizability of study findings is limited. Despite these limitations, RAPID is a rare dataset with a large sample across the U.S. and time-intensive assessments of households' material hardship status, which enabled us to capture the frequent changes of families' financial situations and investigate their impact on well-being during the pandemic.

6. Conclusions

Both the level and unpredictability of material hardship were significantly associated with worsened emotional well-being in families with young children during the COVID-19 pandemic, and these associations were partly mediated through disrupted family routines. The global pandemic and other large-scale socio-historical events are frequently approached as natural experiments because they are imposed on a broad swath of the population independent of the actions of the individual (e.g., Ahmed et al., 2021; Zahran et al., 2014). Consistent with the "natural experiment" framework of the pandemic, these findings can be leveraged to advance the scientific understanding of early adversity (Roubinov et al., 2020; Thomson, 2020). Although the generalizability of study findings to non-pandemic situations remains to be tested, this study highlighted the potential importance of hardship unpredictability in shaping caregivers' and children's well-being. Future early adversity research could benefit from studies that investigate both the intensity and unpredictability of adverse experiences in relation to well-being outcomes.

This study suggests that stable financial conditions, in addition to adequate financial resources, are critical for supporting caregivers' and children's well-being, which has important implications for family intervention programs, policymakers, as well as economic policy research. For family intervention programs targeting at-risk households, taking both income levels and stability into consideration during risk screening could ensure inclusive program dissemination that benefits all families in need. These programs could also benefit from adding content that helps caregivers cope with income unpredictability and maintain regular family routines, as well as distributing resources that help enhance families' financial stability. Regarding policymaking, addressing disparities in financial difficulties and unpredictability based on racial/ethnic and SES should still be a high priority. Policies that increase equal employment opportunities, protect workers' job security, safety, and health, expand unemployment insurance eligibility, and enhance unemployment benefits may help reduce the existing financial disparities and promote economic stability among racial/ethnic minority and low-SES households. Lastly, the findings of the current study may inform economic policy studies that compare the effects of different types of financial support on mental health. Policy analysis studies are needed to test whether distributing the same total amount of financial assistance/relief proportionally, frequently, and regularly (e.g., the Child Tax Credit payments) versus at once sporadically (e.g., the stimulus checks) differentially affect families' well-being, which can further inform financial assistance policy design.

Author Contributions

Dr. Sihong Liu was involved in the conceptualization and design of this study, carried out data analyses, and drafted the manuscript. Drs. Maureen Zalewski, Liliana Lengua, Megan R. Gunnar, and Nicole Giuliani were provided constructional directions on the conceptualization and design of this study, reviewed and revised the manuscript, and provided input from theoretical and methodological perspectives. Dr. Philip Fisher is the primary investigator of the Rapid Assessment of Pandemic Impact on Development (RAPID) project, who was involved in the conceptualization and design of the study, directed the design of data collection instruments, and reviewed and revised the manuscript.

Declaration of competing interest

None.

Data availability

Data will be made available on request.

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Appendix A. Supplementary data

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