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Author(s)	Yang Yang, Jallene Chua, Kiat Hui Khng and Yue Yu
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How did COVID-19 Impact the Lives and Perceived Well-being of Parents?

Using the Case of Singapore to Investigate the Mechanisms

Yang Yang<sup>1</sup> (yang.yang@nie.edu.sg), Jallene Jia En Chua<sup>1</sup> (jallene.chua@nie.edu.sg),

Kiat Hui Khng<sup>1</sup> (kiathui.khng@nie.edu.sg) & Yue Yu<sup>1</sup> (yue.yu@nie.edu.sg)

<sup>1</sup>Centre for Research in Child Development,

National Institute of Education, Nanyang Technological University

#### Author Note

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## Abstract

The COVID-19 pandemic presents a significant challenge to the lives and well-being of families with underaged children. Although previous studies have documented COVID-related deterioration in well-being and identified protective and risk factors, the mechanisms under which the pandemic leads to worsened well-being remain unclear. In addition, from a policymaker's perspective, it is important to differentiate between the effects of government-issued infection control measures (such as lockdown) and families' voluntary responses when facing the coronavirus (such as self-quarantine) on well-being. Using Singapore as an example, we collected retrospective self-reports on the everyday activities, stressors, and well-being of parents and other caregivers at three timepoints: before local transmission (Pre-pandemic), after local transmission but before the "circuit breaker" (Pandemic), and during the "circuit breaker" (Lockdown). We estimated the effects of the pandemic itself and families' voluntary responses to it by contrasting Pandemic against Pre-pandemic, and we estimated the additional effects of imposed lockdown measures by contrasting Lockdown against Pandemic. Results showed significant changes in jobs and income, childcare arrangement, family dynamics, and parents' emotional well-being throughout the three timepoints. Both mothers and fathers reported to worry most about the health and safety of family members and self. Mothers' time spent on housework partially mediated the effect of lockdown on their emotional well-being, and parents' conflict with other adults in the household partially mediated the effects of both pandemic and lockdown on their emotional well-being. The effects of pandemic and lockdown were also moderated by parents' age, education level, and fathers' authoritarian values.

*Keywords:* COVID-19, lockdown, emotional well-being, family dynamics, authoritarian values, Singapore.

## How did COVID-19 Impact the Lives and Perceived Well-being of Parents?

### Using the Case of Singapore to Investigate the Mechanisms

The COVID-19 pandemic presents a significant challenge to the well-being of people around the world, especially for families with underaged children. What are the major stressors faced by parents? How did COVID-19 change family dynamics and childcare arrangements? What are factors that influence parents' emotional well-being during this difficult period? Above all, how much of the COVID-related impact can be attributed to families' voluntary responses to the threat of the coronavirus (e.g., self-quarantine), and how much can be attributed to measures imposed by authority (e.g., school closures and stay-at-home orders)? Answers to these questions have important implications for researchers and policymakers when weighing the advantages and disadvantages of different infection control policies and support programs. Using Singapore as an example, we investigated these questions by collecting families' retrospective self-reports on their everyday activities, stressors and well-being throughout the COVID-19 period. By comparing their responses across different timepoints, we hope to shed light on how parents' well-being is affected by voluntary and imposed measures related to COVID-19, and identify potential mediators and moderators.

### **COVID-19 affects families' well-being**

COVID-19 started as an outbreak in Hubei, China, and escalated quickly into a global pandemic. This galvanized the implementation of institutional measures to curb its spread, such as employing physical distancing and social isolation measures. These measures in turn brought about major disruptions to people's daily functioning, routines, and behavior, which may have profound impact on their well-being. A survey by Ipsos MORI, a UK-based market research

company, indicated that social and psychological problems brought by the pandemic ranked higher as a concern to people than the prospect of contracting COVID-19. These problems included increased anxiety and depression, a lack of social contact and loneliness, as well as negative feelings related to practical aspects like finance and employment (Ipsos MORI, 2020). A systematic review with studies in China, Spain, Italy, Iran, US, Turkey, Nepal, and Denmark showed that people reported high rates of symptoms of anxiety, depression, post-traumatic stress disorder, stress, and psychological distress during the COVID-19 pandemic (Xiong et al., 2020).

The impact of COVID-19 on well-being is particularly noteworthy for families with children, especially with work and school shifting to being home-based in many societies (Fontanesi et al., 2020). National surveys distributed in the US showed that almost all families reported significant disruption in their daily life and routines due to school and business closures (Pew Research Center, 2020a). Over one-third (35%) of parents who continued to work during the pandemic reported having difficulties in handling childcare responsibilities (Pew Research Center, 2020b). Almost a quarter (24%) of parents reported a loss of regular childcare, and the majority of parents reported that their child needs to be watched by a parent (Patrick et al., 2020). These stressors bring significant challenges to parents' mental health. Over a quarter (27%) of US parents reported worsening mental health (Patrick et al., 2020). Surveys from Singapore also suggest that there is a significant increase in people's anxiety level due to COVID-19, and that married people with children tend to worry more (Awang, 2020).

Extensive research has shown relations between parents' mental health and children's cognitive and socioemotional development (Lau et al., 2018; McLaughlin et al., 2012; Reupert & Maybery, 2016). Particularly, parents' mental health may impact children's development by reducing parental sensitivity to children that lead to inadequate support or comforting (Apter-

Levy, Feldman, Vakart, Ebstein, & Feldman, 2013), increasing harsh parenting (Wolford, Cooper, & McWey, 2019) and resulting in parenting stress that makes them feel hard to fulfil the parenting role (Tsotsi et al., 2019). COVID-19 may have long-term consequences on child development through increased parental mental health problems.

Some individuals are more resilient than others when facing a crisis like COVID-19. Xiong and colleagues (2020) reviewed studies on the impact of COVID-19 on mental health that was available before May 2020. The risk factors identified in these studies include female gender, younger age group, chronic/psychiatric illnesses, unemployment, student status, and exposure to media about COVID-19. Studies focusing on families showed that a higher proportion of parents with younger children reported declines of their mental health compared to parents with older children (Patrick et al., 2020; Wu et al., 2020). Female and unmarried parents reported higher rates of worsening mental health (Patrick et al., 2020). In the US, parents who perceived more support from others experienced lower stress (Brown, Doom, Lechuga-Peña, Watamura, & Koppels, 2020). Additionally, the more difficulties Italian parents perceived regarding quarantine (e.g., difficulties in finding a relaxing space alone, time for the partner and for kids, and to do leisure activities), the more their well-being was undermined (Spinelli, Lionetti, Pastore, & Fasolo, 2020). A survey on Chinese parents showed that their mental health and well-being during the pandemic were affected by perceived stress, marital satisfaction, social support, family conflict, parents' history of mental illness, and parenting styles. In particular, authoritative parents reported a lower level of depression than authoritarian parents, and families with more conflict reported more issues on mental health than harmonious families (Wu et al., 2020).

Though much research has documented the impact of COVID-19 on parents' well-being and identified potential protective and risk factors, the mechanisms underlying such impact remain

unclear. For example, it is unclear whether the negative impact of COVID-19 on parents' mental health is mediated by financial difficulties, childcare burden, conflicts within families, or a combination of multiple factors. Another important distinction yet to be explored is whether families *chose* to change their lifestyles when facing the threat of coronavirus, or whether they were *forced* to make changes because of infection control measures imposed on them. This raises the question of whether the voluntary and enforced measures impacted well-being differently. Empirical evidence on these issues is important for policymakers when they weigh the benefit of lockdown measures on curtailing transmission against potential social, psychological, and financial burdens on families. Such evidence could also help direct relief resources to where they are most needed, such as establishing a baseline for the need for financial support, childcare, and family counselling.

### **The case of Singapore**

Singapore provides a unique opportunity to examine the mechanisms underlying COVID-19's impact on family life and well-being. Firstly, the island nation experienced a relatively well-defined period of pandemic and lockdown, and policies like school closures and gathering bans were applied consistently nationwide. This allowed us to find a large sample of families who faced similar challenges at similar timepoints, so that the differences found between families were less likely to be confounded by varied conditions and policies in local communities. Secondly, Singapore underwent a long period of time (February to March 2020) when there was persistent local transmission and heightened awareness to the threat of the coronavirus, yet the government posed minimal mandatory restrictions on people's everyday lives. Contrasting this period with the "circuit breaker" period (April to May 2020) that followed, when extensive lockdown measures were enforced, can help separate the effects of voluntary vs. imposed

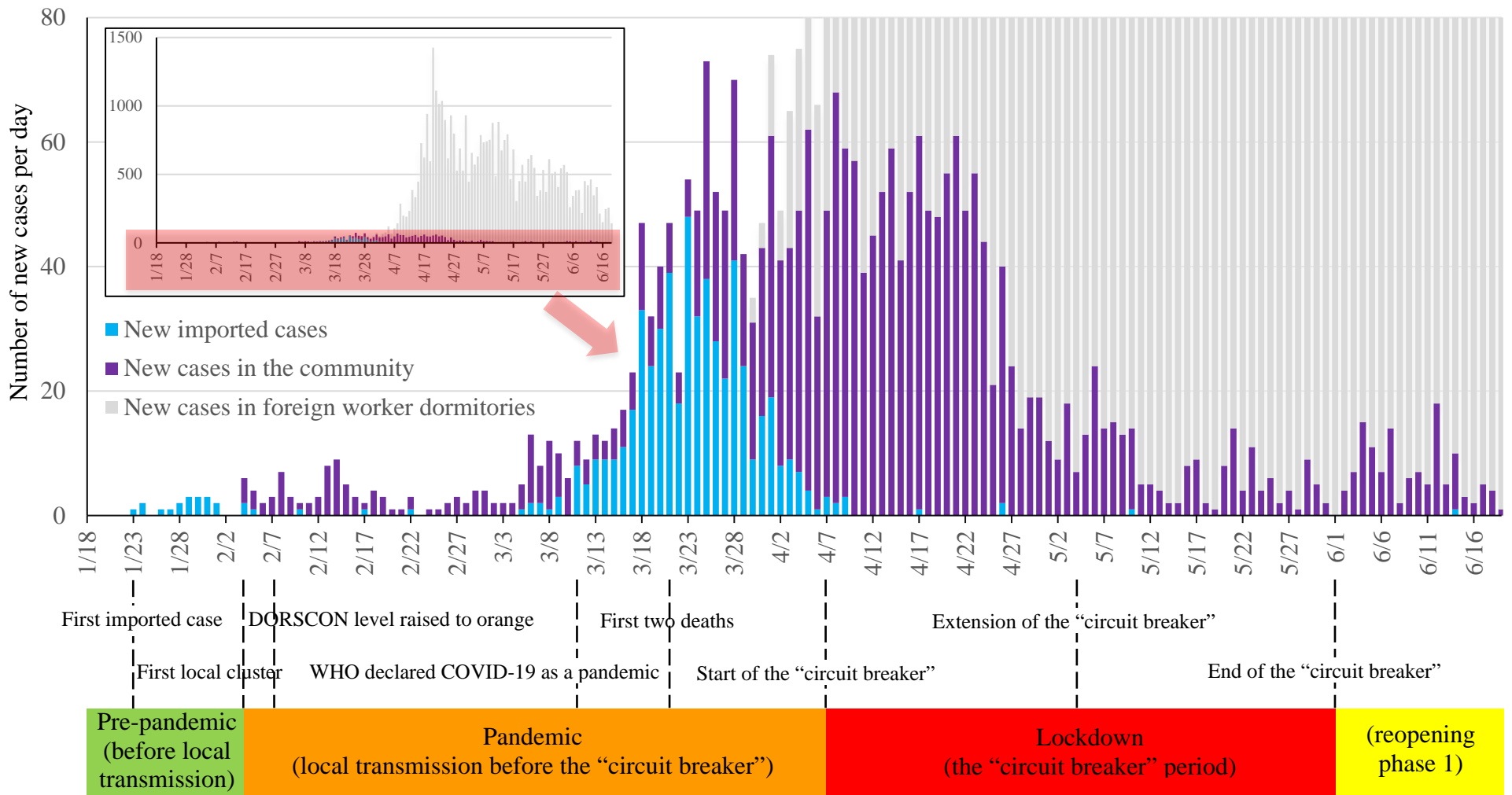
measures on well-being. Lastly, compared to most countries in the world, Singapore suffered a milder impact in terms of loss of lives caused by the coronavirus. The nation recorded 27 deaths, or 4.8 deaths per million people as of September 2020, which is among the lowest in the world (World Health Organization, 2020). On the other hand, the impact on economy has been detrimental: Singapore's gross domestic product (GDP) shrank by 41.2% in the second quarter of 2020 compared to the first quarter (Lee, 2020). Therefore, Singapore provides an ideal ground to study the indirect impact of COVID-19 on people's mental health, with little confounding effect from its direct impact on people's physical health.

Figure 1 shows the timeline of the COVID-19 pandemic in Singapore. The first imported COVID-19 case was confirmed on January 23, 2020, and local transmission in Singapore was first reported on February 3. The government raised the Disease Outbreak Response System Condition (DORSCON) to orange on February 7 to alert the possibility of a local pandemic. Throughout February and early March, the number of new cases remained low. The situation changed with a sharp increase in imported cases occurred in late March when many Singaporeans abroad returned home, which was followed by an outbreak in foreign workers' dormitories. In response to the fast-increasing number of new and unlinked cases, the Singapore government carried out a stringent set of lockdown measures from April 7 to June 1, officially known as the "circuit breaker".

### **Figure 1**

*Timeline of the COVID-19 Pandemic in Singapore*





- Safe distancing at workplaces
- Closure of all non-essential workplaces
- Closure of all tuition and enrichment centers
- Closure of all schools, full-time home-based learning
- Safe distancing at entertainment venues
- Closure of all entertainment venues
- Congregational worship and religious services suspended
- Closure of all places of worship
- Gatherings of more than 10 people prohibited
- Gatherings between people not living together prohibited
- Safe distancing at food establishments
- No dine-in allowed for food establishments
- Unwell persons to wear masks
- Mask wearing mandatory for all above 2 years of age

Comparing the period of local transmission before the “circuit breaker” (February 4 to April 6) and the “circuit breaker” period (April 7 to June 1), the number of new local cases (imported cases plus cases in the community) did not differ significantly. On average there were 18.9 new cases daily ( $SD = 21.0$ ) during local transmission prior to the “circuit breaker”, and there were 23.7 new cases daily ( $SD = 21.5$ ) during the “circuit breaker”,  $t(117) = 1.24, p > .2$ . There was also large amount of cases in foreign workers’ dormitories during the “circuit breaker”, though most cases were mild, and the dormitories were largely isolated from the rest of Singapore. The main contrast was in lockdown measures (bottom of Figure 1): Before the “circuit breaker”, Singapore government’s infection control endeavors focused on boarder control and contact tracing, and the measures that applied to the general public were mainly precautionary, such as social distancing, hand washing, and wearing masks if unwell. It was not until the end of March when more stringent measures started to take effect, such as entertainment venues and tuition centers being closed, and large gatherings being banned. This quickly transitioned to a full-scale lockdown in early April, when all schools, non-essential workplaces, and places of worship were closed, and food establishments were only allowed to offer take-away (Cheong, 2020). The numbers of essential workers who continued to commute to work was restricted to no more than 20% of the entire workforce at the beginning of the “circuit breaker”, and that proportion was further reduced to 15% on April 21 (Ministry of Health, 2020). All gatherings with family or friends who do not live together were banned, and all residents were strongly encouraged to stay at home (Gov.sg, 2020b). In sum, whereas the threat of the coronavirus was acute both before and during the “circuit breaker”, the restrictions forced upon families were significantly more extensive in the latter period.

### **The Present Study**

Taking advantage of the naturally occurring contrast between these different periods, we aim to use Singapore as an example to examine the effects of the pandemic and lockdown on parents' lifestyle and well-being. Our research questions are:

- 1) What were the effects of the pandemic on Singapore families' household composition, jobs and income, childcare arrangement, family dynamics, and parents' emotional well-being? Were there additional effects that can be attributed to the imposed lockdown measures, above and beyond the effects of families' voluntary responses to the pandemic?
- 2) What were the major stressors parents faced during the pandemic and lockdown?
- 3) What were the factors that (partially) mediated the effects of the pandemic and lockdown on parents' emotional well-being? What were the factors that moderated these effects?

To address these questions, we collected families' self-reports on their lifestyle and well-being at three timepoints: Pre-pandemic (before local transmission), Pandemic (during local transmission but before the "circuit breaker"), and Lockdown (during the "circuit breaker"). By comparing their responses between Pandemic and Pre-pandemic, we can estimate the effect of the pandemic itself as well as families' voluntary responses to it. By comparing their responses between Lockdown and Pandemic, we can estimate the additional effect of government-imposed lockdown measures.

### **Method**

We designed a survey to distribute to families who had at least one child under the age of 18 living in their household during the COVID-19 period. The survey was sent as a part of a larger package of surveys. Our items mainly focused on the everyday activities and well-being of parents and adult caregivers, whereas other surveys in the package also included items about other aspects of adults' and children's lives and opinions. Because this survey was listed first in

the package, it was unlikely for the answers to be subject to carry-over or fatigue effects due to filling out other surveys. The whole package was approved by the NTU Institutional Review Board, and was distributed by email lists and social media. Each family filled out one package after signing a consent form, and received an eVoucher worth SGD\$10 afterwards.

### Participants

Complete responses were collected from 198 families residing in Singapore. An additional 25 responses were excluded because they were either incomplete or failed a basic quality check (e.g., indicated <3 hours of sleep per day). Our sample was 505 adults (above 21 years of age) living in these 198 families, including 180 mothers, 166 fathers, 39 grandparents, 15 full-time domestic helpers, 24 other adult relatives (e.g., aunts and uncles), and 81 adult children. They provided care for 235 children (under 18 years of age) living in their households. Table 1 lists the demographic information of the sample in comparison with the Singapore population. Median monthly household income for the sample in January 2020 (SGD\$6,500) was significantly lower than the 2019 national median (SGD\$7,981),  $\chi^2(1) = 10.3, p = .001$ . Singaporean citizens were overrepresented,  $\chi^2(1) = 67.9, p < .001$ .

**Table 1**

*Demographic Information of Participating Families*

Survey item	Categories	Sample			Singapore population	
		No. of families	Percentage	Cumulative percentage	Percentage	Cumulative percentage
Citizenship	Singapore citizen	178	89.9%	89.9%	61.4%	61.4%
	Permanent residents	15	7.6%	97.5%	9.2%	70.6%
	Long-term pass holders	5	2.5%	100.0%	29.4%	100.0%
Ethnicity <sup>a</sup>	Chinese	155	78.3%	78.3%	74.4%	74.4%
	Malay	13	6.6%	84.8%	13.4%	87.8%

	Indian	27	13.6%	98.5%	9.0%	96.8%
	Mixed or others	3	1.5%	100.0%	3.2%	100.0%
Monthly household income before COVID-19 <sup>a,b</sup>	0 - 1,999	17	8.6%	8.6%	20.3%	20.3%
	2,000 - 3,999	32	15.2%	23.9%	10.1%	30.4%
	4,000 - 5,999	37	19.3%	43.1%	10.3%	40.7%
	6,000 - 7,999	35	18.3%	61.4%	9.5%	50.2%
	8,000 - 9,999	18	9.1%	70.6%	8.7%	58.9%
	10,000 - 11,999	22	10.7%	81.2%	8.0%	66.9%
	12,000 - 14,999	17	8.6%	89.8%	9.2%	76.1%
	15,000 - 19,999	10	5.6%	95.4%	9.5%	85.6%
	20,000 & Over	9	4.6%	100.0%	14.4%	100.0%
	Mother's education level <sup>a,c</sup>	Secondary or lower	33	19.2%	19.2%	36.0%
Post-secondary		58	33.7%	52.9%	26.3%	62.3%
University		81	47.1%	100.0%	37.7%	100.0%
Housing <sup>a</sup>	1 or 2 room HDB	5	2.5%	2.5%	6.2%	6.2%
	3 room HDB	23	11.6%	14.1%	17.5%	23.7%
	4 room HDB	53	26.8%	40.9%	31.8%	55.5%
	5 room HDB	62	31.3%	72.2%	23.1%	78.6%
	Condominium	45	22.7%	94.9%	16.2%	94.8%
	Landed property	10	5.1%	100.0%	5.0%	99.8%

*Note.* Information for Singapore population was retrieved from 2019 data published by the Singapore Department of Statistics. HDB = Public housing managed by the state Housing and Development Board.

<sup>a</sup> For these items, “Singapore population” refers to Singaporean citizens and permanent residents (PRs) only.

<sup>b</sup> Monthly household income for the sample was calculated by summing up all adult family members’ January 2020 income (including commissions, allowances, bonuses, and government subsidies), except for foreign domestic helpers (FDH). Monthly household income for the Singapore population was based on 2019 data, and included income from work and employer contributions to the Central Provident Fund (CPF).

<sup>c</sup> Mother’s education level for the Singapore population is estimated based on the education level of all women between 25 and 64 years of age.

**Instruments**

The survey was constructed using Qualtrics survey software, and comprised of questions about the whole family, as well as each adult in the family. Respondents who filled out the survey were asked to consult their family members on questions regarding them, to ensure everyone's opinions were accurately represented. Autosave features were enabled to allow the survey to be filled out across multiple sessions. For measures that may change because of COVID-19, we asked participants to report answers regarding three timepoints: Pre-pandemic (January 2020), Pandemic (February to March 2020), and Lockdown (April to May 2020). Note that in Singapore the school year starts on January 2, so for most families with children their schedules during January should represent a typical schedule during the school year.

Respondents who experienced unusual events during January 2020 were asked to use a different month as a pre-pandemic baseline. All data was collected in June 2020. We used a 11-point scale (0-10) for all Likert items because it has superior psychometric properties and normality compared to scales with fewer points (Leung, 2011), and is also easy to comprehend. Having a consistent scale could also help minimize confusions and errors due to changes in scales. The full survey is listed in the Appendix.

***Measures for family***

Measures for family included demographic information (citizenship, ethnicity, language spoken at home, type of housing), number of adults and children living in the household at each of the three timepoints, as well as whether anyone in the family had been diagnosed with COVID-19 or received a Quarantine Order (QO), a Leave of Absence notice (LOA), or a Stay-Home Notice (SHN).

***Measures for adults***

Adults first reported basic information (gender, age, relationship to children, education level, existing disabilities or mental health conditions) and their authoritarian values. For each timepoint, adults also reported their job situation, monthly income, time schedule, emotional well-being, family dynamics, and major stressors they faced.

Authoritarian values were measured by the Child-rearing Values Questionnaire (Feldman & Stenner, 1997; Tagar, Federico, Lyons, Ludeke, & Koenig, 2014). Adults were asked to choose one quality out of each pair that they thought is more important for a child: respect for elders or independence, curiosity or good manners, obedience or self-reliance, being considerate or being well-behaved. An authoritarianism score (0-4) was calculated by counting how many times respect for elders, good manners, obedience, and being well-behaved were chosen.

Emotional well-being was measured by the Patient Health Questionnaire-4 (PHQ-4, Kroenke, Spitzer, Williams, & Löwe, 2009). It included two questions on anxiety, and two questions on depression. We used a 11-point Likert scale (0: never, 10: always) instead of the original 4 point scale to increase sensibility in our non-patient sample (Leung, 2011). Higher scores indicated more mental health issues and worse emotional well-being.

Family dynamics were measured by a set of frequency measures (0: never, 10: always) on how adults interacted with other family members living in the same household, including rule setting (setting up rules for children to follow without explaining why), autonomy granting (allowing children to make decisions for themselves), conflicts with children, and conflicts with adults. Note that unlike authoritarian values which were relatively stable across time, family dynamics could change based on what the family was experiencing, and therefore was measured at each timepoint.

Questions about time schedule and major stressors were developed by the authors to capture the most time-consuming and stressful responsibilities adults typically face, such as work, housework, and childcare. We also included activities that can be affected by the pandemic and lockdown, such as socializing and travelling. We asked adults to report how many hours they engaged in each of these activities every week, the responses were then divided by seven to get the number of hours per day, averaged across weekdays and weekends. Adults also reported how much stress they felt from these activities, as well as from COVID-19-related stressors such as health concerns, concerns about jobs and finances, inconveniences in working or getting necessities, and reading negative news (see Appendix for a complete list).

### **Data analysis**

The data analysis plan was preregistered on the Open Science Framework (<https://osf.io/9rkta>). All data were entered and analyzed in Excel, IBM SPSS 22, and R. An  $\alpha$  level of .05 (two-tailed) was used for all tests. Given the multilevel structure of our sample (timepoints were nested under individuals, and individuals were nested under families), we used multilevel mixed-effects linear regression models as the analytical tool for the omnibus tests. Timepoint was treated as an independent variable with fixed effects. It was dummy coded with Pandemic as the reference group, so that the  $\beta$  coefficients reflected the differences between Pre-pandemic and Pandemic, and between Pandemic and Lockdown. The models were implemented using the lme4 package in R. We used type II Wald Chi-Square tests to examine the significance of the fixed-effect variables. All models were fitted using the maximum likelihood (ML) estimation instead of restricted maximum likelihood (REML) to facilitate model comparison. All  $\beta$ s reported were estimates of unstandardized coefficients. Significant tests for  $\beta$ s were performed by the lmerTest package in R, and used Satterthwaite's degrees of freedom method.



Mediation analyses were performed by the `bmlm` package in R, which is suitable for multilevel data with a within-subject design (Vuorre & Bolger, 2018).

### **Results**

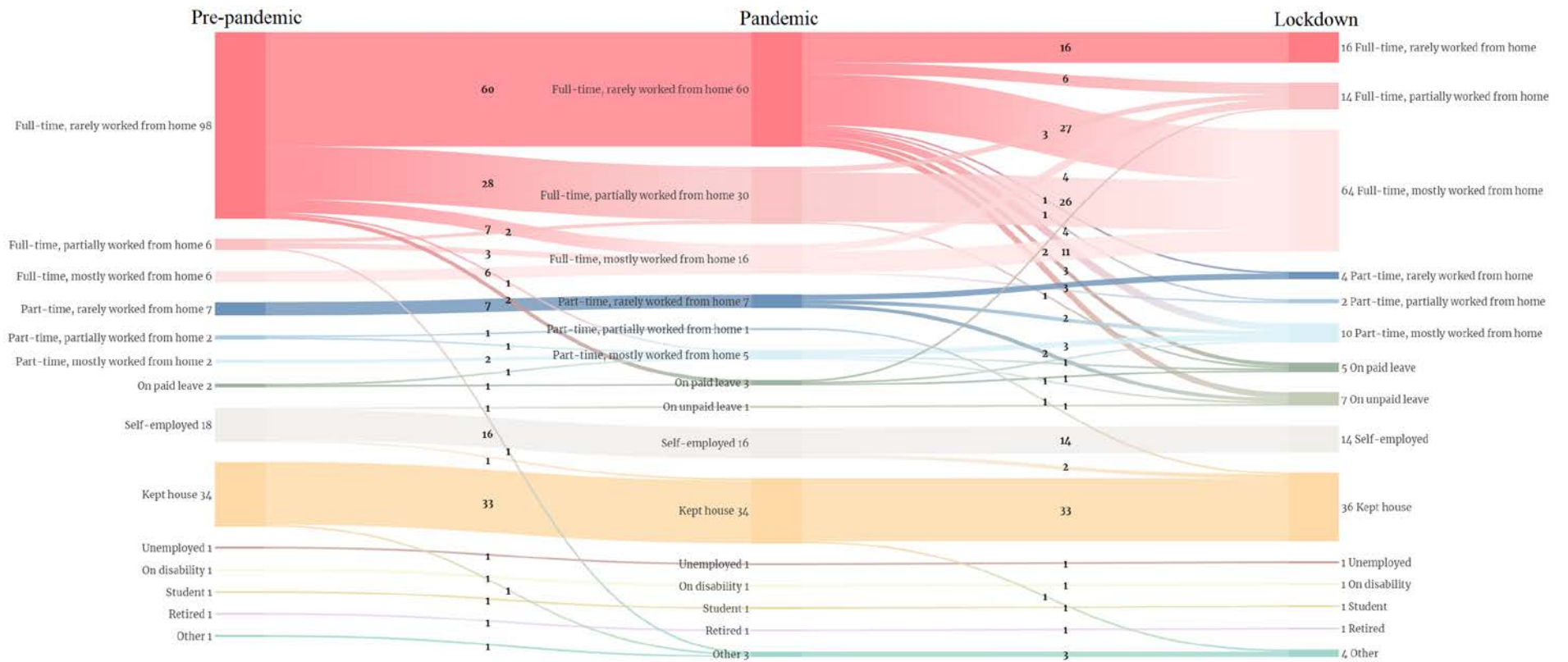
None of the participating families had any family members who were diagnosed with COVID-19. Seven adults and 6 children from 5 families had received either a QO, an LOA, or a SHN because of international travel or close contact with confirmed cases. Their perceived emotional well-being (anxiety and depression) did not differ significantly from their peers,  $-0.9 < ts < 0.4$ ,  $ps > .4$  for all timepoints for both adults and children.

#### **Effects of the pandemic and lockdown on household composition**

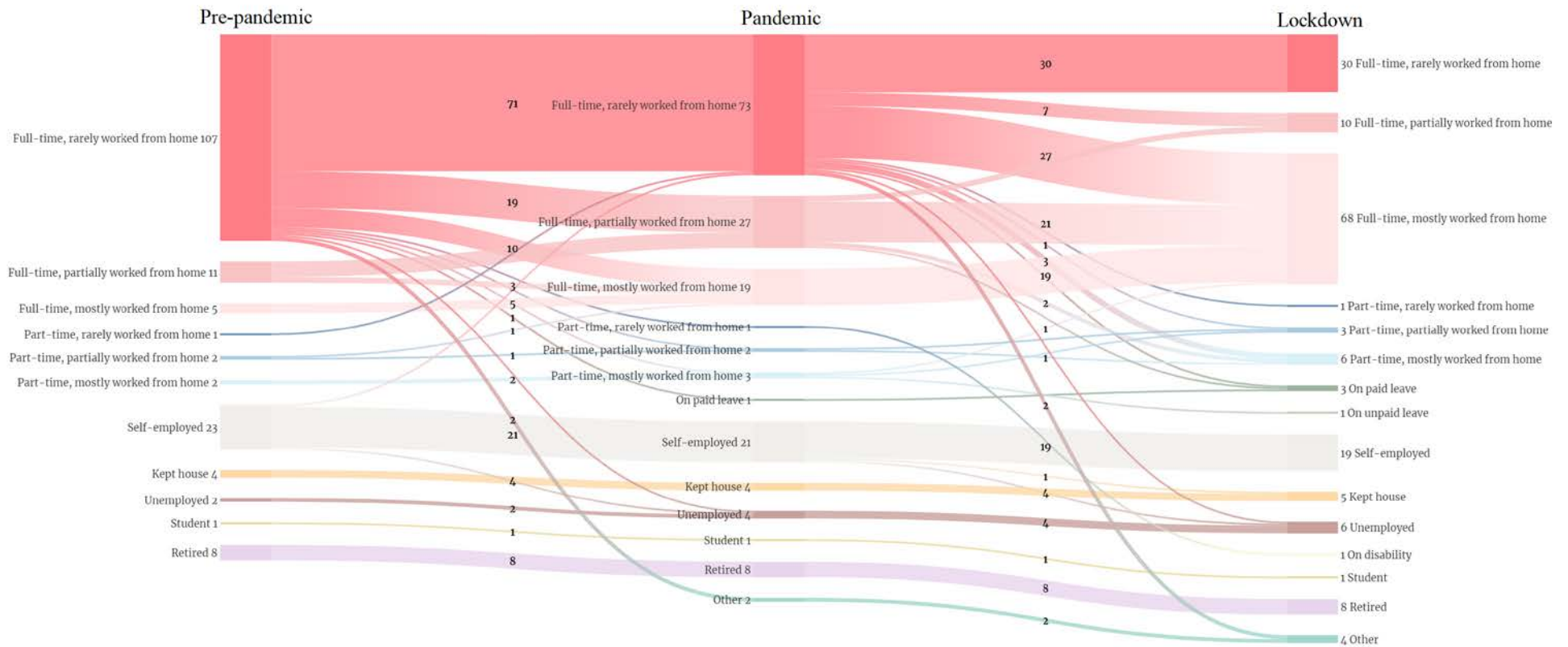
In our sample, the pandemic and lockdown had little impact on the composition of who lived in the household. Between January and May 2020, 2 out of the 198 families observed a change in children living in the household because of babies being born, and 4 families experienced a change in adults because of long-term pass holders not being able to renew their passes, or adult children or relatives moving out.

**Figure 2**

*Sankey Diagram Showing How Job Situations Changed During the COVID-19 Period for Mothers (a) and Fathers (b)*



(a) Mothers' job changes



(b) Fathers' job changes

*Note.* In the survey, “rarely” was defined as <20% of the time, “partially” was defined as between 20% and 80%, “mostly” was defined as >80%. “Kept house” referred to “kept house or raised children full-time”. “Unemployed” referred to “Unemployed and did not keep house”. “Other” included cases like part-time freelancer and part-time student. Numbers in the figure denote the number of parents in the flow or category.

**Effects of the pandemic and lockdown on jobs and income**

As shown in Figure 2, the most significant trend regarding parents' jobs was that 50% of full-time employees who rarely worked from home before the pandemic switched to mostly working from home during lockdown. In addition, number of parents who worked as a full-time employee decreased significantly from Pre-pandemic (233 out of 346) to Lockdown (202), Fisher's exact  $p = .018$ .

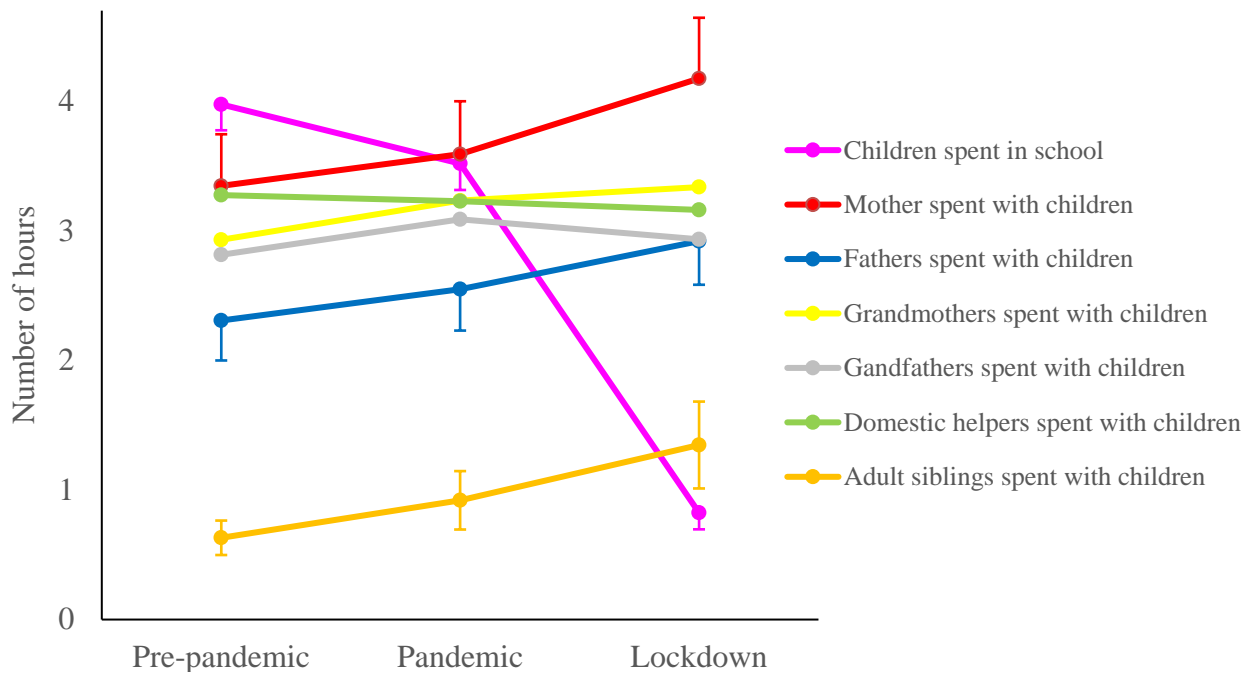
On average, monthly household income decreased 7% from Pre-pandemic to Lockdown, and 17% of the families suffered an income decrease of more than 30%. Mixed-effect model with family as a random effect variable showed a significant fixed effect of timepoint,  $\chi^2(2) = 66.1, p < .001$ . Average household income did not change significantly between Pre-pandemic and Pandemic,  $\beta = -145$ , 95% confidence interval (CI) = [-473, 182], but it decreased significantly from Pandemic to Lockdown,  $\beta = -575$ , CI = [-903, -247].

**Effects of the pandemic and lockdown on childcare arrangement**

Before the pandemic, 29% of infants (0-2y) in our sample attended daycare, 87% of preschoolers (3-6y) attended daycare or kindergarten (one additional 6-year-old attended primary school), and 90% of school-aged children and adolescents (7-18y) attended primary school, secondary school, or post-secondary institution. A mixed model with child and family as random effect variables showed that number of hours children spent in daycare, kindergarten, or school (including school-based student care) decreased from Pre-pandemic to Pandemic,  $\beta = -0.46$ , CI = [-0.80, -0.11], and decreased further from Pandemic to Lockdown,  $\beta = -2.70$ , CI = [-3.04, -2.35].

**Figure 3**

*Number of Hours per Day Different Caregivers Spent with Children During the COVID-19 Period*



*Note.* The number of hours are averaged across weekdays and weekends, reported from the caregiver’s perspective. For example, on average grandmothers spent three hours per day with their grandchildren did not imply that on average children spent three hours with their grandmother, because 1) not all children live with their grandmothers, and 2) the three hours may have been distributed across multiple grandchildren. Error bars denote standard error. Some error bars are omitted to improve readability.

As shown in Figure 3, the pandemic and lockdown had a significant effect on time spent with children for mothers, fathers, and adult siblings,  $\chi^2s > 16, p < .001$ . The effect was not significant for grandmothers, grandfathers, and domestic helpers,  $\chi^2s < 4.5, p > .01$ . Time spent

with children increased significantly from Pre-pandemic to Pandemic for mothers,  $\beta = 0.245$ , CI = [0.002, 0.487], and fathers,  $\beta = 0.241$ , CI = [0.055, 0.427]. It increased further from Pandemic to Lockdown for mothers,  $\beta = 0.584$ , CI = [0.341, 0.827], fathers,  $\beta = 0.371$ , CI = [0.185, 0.557], and adult siblings,  $\beta = 0.427$ , CI = [0.074, 0.779]. The breakdown of how caregivers spent time with children is shown in Table 3. Compared to Pre-pandemic, mothers spent more hours per day playing with children during Pandemic, and fathers spent more hours per day meeting children’s basic needs (e.g., feeding, bathing, putting to bed). It should be noted, though, that fathers still spent significantly less time meeting children’s basic needs (on average 0.86 hours per day) than mothers (1.38 hours) during Pandemic,  $-\beta = 0.521$ , CI = [0.253, 0.790]. Compared to Pandemic, both parents spent more time meeting children’s basic needs during Lockdown, as well as tutoring their homework or home-based learning, and playing with them. Adult siblings were also more involved in tutoring homework and playing with their younger siblings.

**Table 3**

*Effects of the Pandemic and Lockdown on How Caregivers Spent Time with Children*

	Mothers		Fathers		Adult siblings	
	$\beta$	95% CI	$\beta$	95% CI	$\beta$	95% CI
Meeting children’s basic needs						
Pandemic - Pre-pandemic	0.086	[-0.008, 0.179]	<b>0.069</b>	<b>[0.017, 0.121]</b>	0.022	[-0.033, 0.078]
Lockdown - Pandemic	<b>0.113</b>	<b>[0.019, 0.206]</b>	<b>0.084</b>	<b>[0.032, 0.136]</b>	0.026	[-0.029, 0.081]
Tutoring children’s homework						
Pandemic - Pre-pandemic	0.093	[-0.029, 0.215]	0.067	[-0.023, 0.156]	0.096	[-0.034, 0.226]
Lockdown - Pandemic	<b>0.272</b>	<b>[0.149, 0.394]</b>	<b>0.112</b>	<b>[0.023, 0.201]</b>	<b>0.136</b>	<b>[0.006, 0.266]</b>
Doing enrichment activities						
Pandemic - Pre-pandemic	-0.015	[-0.134, 0.104]	0.017	[-0.032, 0.065]	0.045	[-0.043, 0.134]
Lockdown - Pandemic	0.020	[-0.099, 0.14]	0.003	[-0.046, 0.052]	0.033	[-0.056, 0.121]
Playing with children						
Pandemic - Pre-pandemic	<b>0.083</b>	<b>[0.004, 0.163]</b>	0.090	[-0.014, 0.194]	0.127	[-0.022, 0.275]
Lockdown - Pandemic	<b>0.175</b>	<b>[0.096, 0.254]</b>	<b>0.164</b>	<b>[0.06, 0.268]</b>	<b>0.233</b>	<b>[0.085, 0.382]</b>

*Note.*  $\beta$ s and 95% CIs were reported from mixed-effect models with timepoint as a fixed-effect variable and individual and family as random-effect variables. Because Pandemic was set up as the reference group, the model reported coefficients that represented Pre-pandemic estimates minus Pandemic estimates. To make the statistics more intuitive to readers, here we report the reversed coefficients, which represent Pandemic estimates minus Pre-pandemic estimates.

### **Effects of the pandemic and lockdown on family dynamics**

Next we looked at family dynamics, including the frequencies of parents' rule setting, autonomy granting, conflicts with children, and conflicts with adults. Because parenting style play an important role in family dynamics and functioning (Wu et al., 2020), we included parental authoritarian value and its interaction with timepoint as fixed-effect variables in the mixed-effect model. Results showed significant effects of timepoint for six out of eight models, and significant authoritarianism  $\times$  timepoint interactions for three models (Table 4). To further investigate the interaction effects, we separated parents according to their authoritarian values using a median split. The high authoritarian group (authoritarianism score  $> 2$ ) included 79 mothers and 76 fathers. The low authoritarian group (authoritarianism score  $< 2$ ) included 43 mothers and 35 fathers.

**Table 4**

*Factors that Influenced Family Dynamics During the COVID-19 Period*

	Mothers			Fathers		
	$\chi^2$	<i>df</i>	<i>p</i>	$\chi^2$	<i>df</i>	<i>p</i>
Rule setting without explanation						
Timepoint	<b>32.0</b>	<b>2</b>	<b>&lt;.001</b>	<b>26.4</b>	<b>2</b>	<b>&lt;.001</b>
Authoritarianism	1.1	1	.30	3.2	1	.08
Authoritarianism × timepoint	2.1	2	.34	<b>7.6</b>	<b>2</b>	<b>.02</b>
Autonomy granting						
Timepoint	0.3	2	.87	3.6	2	.16
Authoritarianism	0.6	1	.43	1.9	1	.17
Authoritarianism × timepoint	<b>9.8</b>	<b>2</b>	<b>.007</b>	0.5	2	.76
Conflicts with children						
Timepoint	<b>57.0</b>	<b>2</b>	<b>&lt;.001</b>	<b>60.6</b>	<b>2</b>	<b>&lt;.001</b>
Authoritarianism	2.6	1	.11	2.5	1	.11
Authoritarianism × timepoint	0.3	2	.86	<b>7.7</b>	<b>2</b>	<b>.02</b>
Conflicts with adults						
Timepoint	<b>51.9</b>	<b>2</b>	<b>&lt;.001</b>	<b>45.7</b>	<b>2</b>	<b>&lt;.001</b>
Authoritarianism	0.9	1	.35	2.1	1	.15
Authoritarianism × timepoint	0.8	2	.67	1.8	2	.41

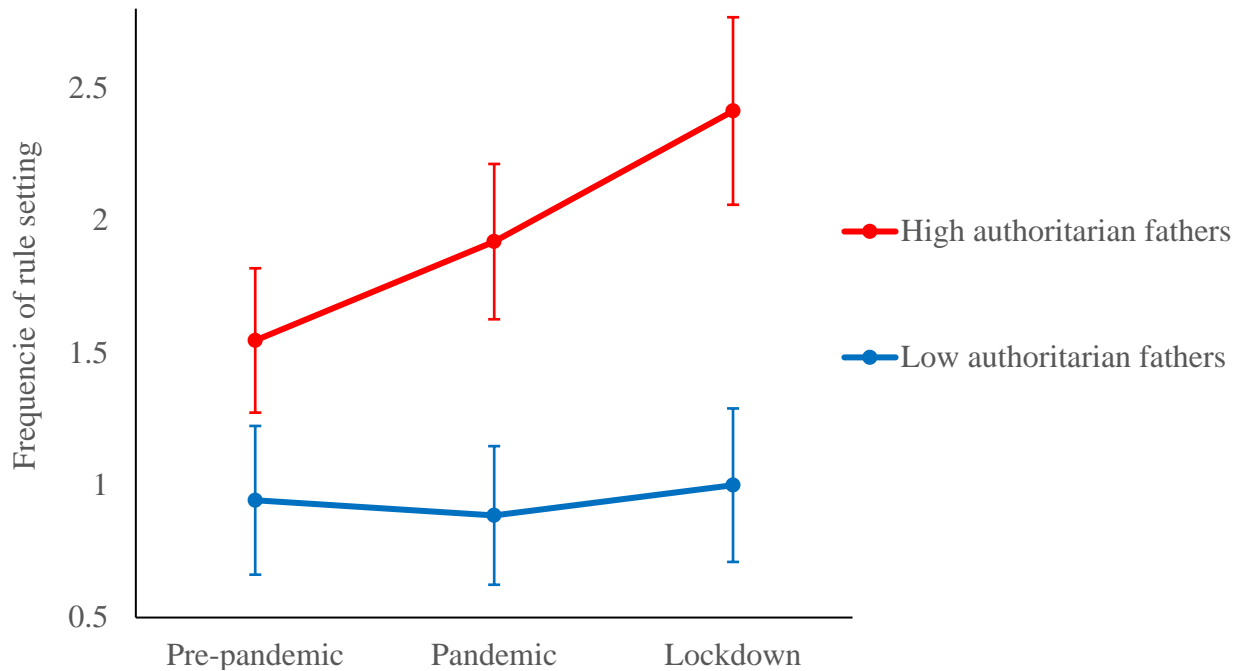
*Note.* Results reported here are from eight mixed-effect models, including one model fitted on mothers’ data and one fitted on fathers’ data for each of the four measures on family dynamics.  $\chi^2$  tests were reported from the analysis of deviance table of the mixed-effect models. It is used to test whether the inclusion of a fixed-effect variable significantly improved the model fit.

The first significant interaction effect was observed in fathers’ rule setting,  $\chi^2 (2) = 7.6, p = .02$  (Figure 4). Frequency of rule setting did not change across timepoints for low authoritarian fathers,  $\chi^2 (2) = 1.0, p = .60$ , but it increased significantly from Pandemic to Lockdown for high authoritarian fathers,  $\beta = 0.493, CI = [0.118, 0.869]$ .



**Figure 4**

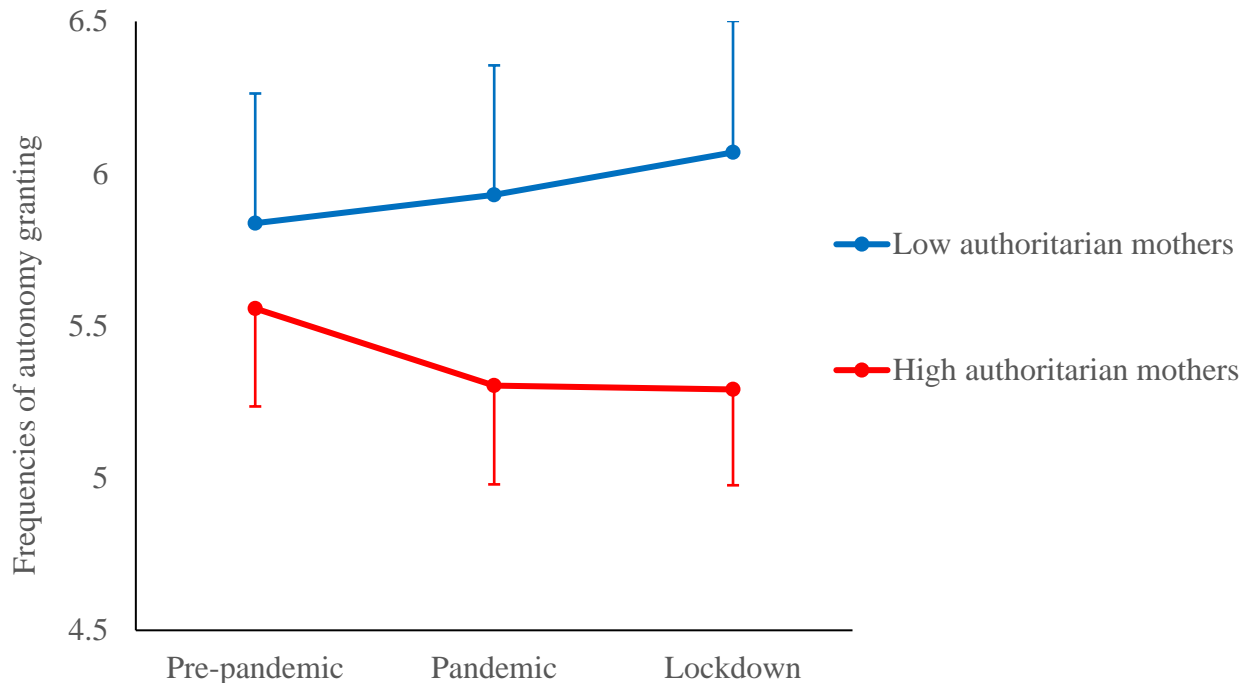
*Frequencies of Fathers Setting up Rules for Children to Follow Without Explaining Why During The COVID-19 Period (0: Never; 10: Always)*



The second significant interaction effect was observed in mother’s autonomy granting,  $\chi^2 (2) = 9.8, p = .007$  (Figure 5). Frequency of autonomy granting did not change across timepoints for low authoritarian mothers,  $\chi^2 (2) = 2.6, p = .28$ , but it decreased significantly from Pre-pandemic to Pandemic for high authoritarian mothers,  $\beta = -0.253, CI = [-0.501, -0.005]$ .

**Figure 5**

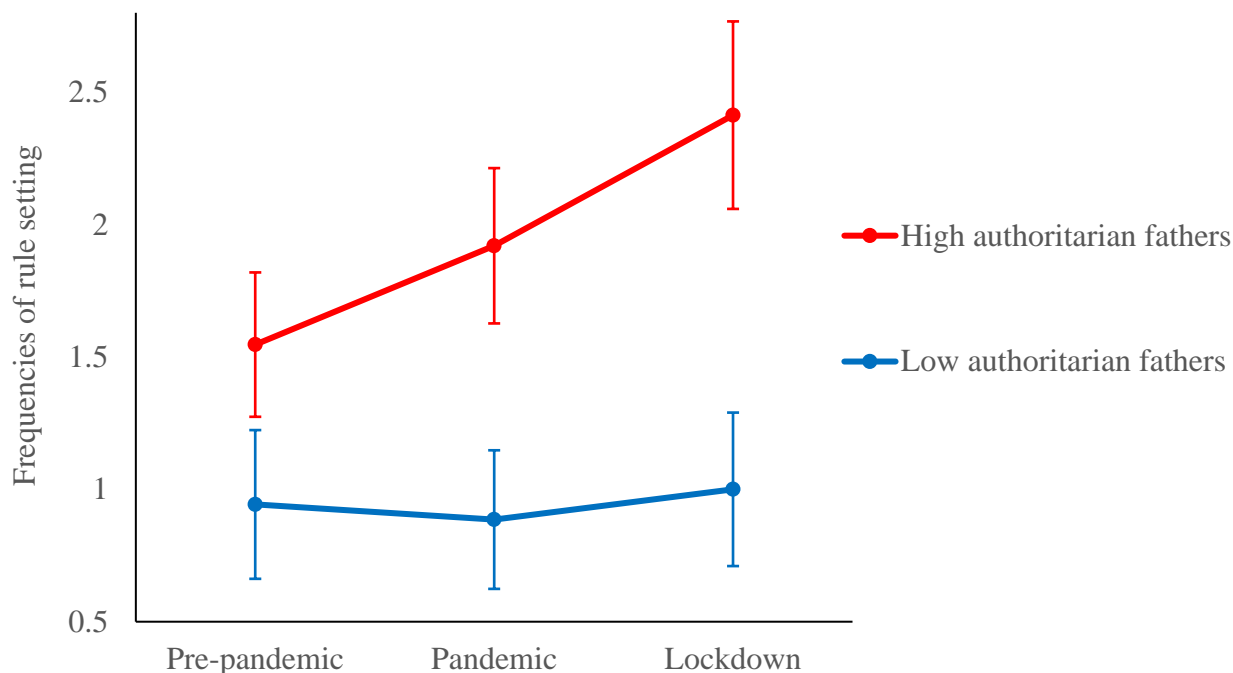
*Frequencies of Mothers Granting Children Autonomy to Make Their Own Decisions During the COVID-19 Period (0: Never; 10: Always)*



The third significant interaction effect was observed in father’s conflict with children,  $\chi^2 (2) = 7.7, p = .02$  (Figure 6). Frequency of conflict with children did not change across timepoints for low authoritarian fathers,  $\chi^2 (2) = 4.9, p = .09$ , but increased for high authoritarian fathers,  $\chi^2 (2) = 20.6, p < .001$ . The change was significant both from Pre-pandemic to Pandemic,  $\beta = 0.493$ ,  $CI = [0.175, 0.810]$ , and from Pandemic to Lockdown,  $\beta = 0.611, CI = [0.295, 0.927]$ .

**Figure 6**

*Frequencies of Father-Child Conflicts During the COVID-19 Period (0: Never; 10: Always)*



**Effects of the pandemic and lockdown on parents’ emotional well-being**

To examine the effects of the pandemic and lockdown on parents’ perceived emotional well-being (measured by the average score of PHQ-4), we ran mixed models with timepoint, gender, and gender × timepoint as fixed-effect variables, and individual and family as random-effect variables. Results showed significant main effects of both timepoint,  $\chi^2(2) = 154.1, p < .001$ , and gender,  $\chi^2(1) = 7.5, p = .006$ . Parents’ mental health issues increased significantly during Pandemic compared to Pre-pandemic,  $\beta = 0.356, CI = [0.216, 0.496]$ , and increased further during Lockdown compared to Pandemic,  $\beta = 0.299, CI = [0.159, 0.440]$ . On average mothers had more mental health issues than fathers,  $\beta = 0.225, CI = [0.003, 0.447]$ .

Table 5 showed parents’ experiences of various stressors associated with COVID-19. The top two stressors for both mothers and fathers during Lockdown were concerns about family members’ health and safety, and concerns about own health and safety. The next three top

stressors differed by gender: Mothers were stressed about caring for children, limited visiting of family/relatives, and reading about negative news. Fathers were stressed about high demand from job/business, limited travelling or going outside, and financial difficulties. The five stressors that increased the most in severity from Pre-pandemic to Lockdown were the same for mothers and fathers: limited visits of family/relatives, limited travelling or going outside, concerns about family members' health and safety, concerns about own health and safety, and inconveniences in working/doing business.

**Table 5**

*Parents' Experiences of Different Stressors Related to COVID-19 (0: Not Stressful at All; 10: Extremely Stressful)*

	Mothers			Fathers		
	Pre-pan- demic	Pande- mic	Lock- down	Pre-pan- demic	Pande- mic	Lock- down
Care for children	3.65	<b>4.27***</b>	<b>4.86***</b>	3.01	<b>3.55***</b>	<b>4.04***</b>
Care for elderly people	2.50	<b>3.10***</b>	<b>3.60***</b>	2.60	<b>3.13***</b>	<b>3.56**</b>
Housework	3.12	<b>3.62***</b>	<b>3.98***</b>	1.84	<b>2.16**</b>	<b>2.42**</b>
High demands from job/business	3.19	<b>3.68***</b>	<b>4.21***</b>	3.90	<b>4.41***</b>	4.61
Inconveniences in working/doing business	1.48	<b>2.60***</b>	<b>3.44***</b>	1.93	<b>2.93***</b>	<b>3.97***</b>
Worries about losing job/business	1.79	<b>2.59***</b>	<b>3.05**</b>	2.19	<b>3.16**</b>	<b>3.98***</b>
Financial difficulties	2.71	<b>3.23***</b>	<b>3.87***</b>	2.94	<b>3.58***</b>	<b>4.39***</b>
Difficulties in getting necessities	1.68	<b>2.91***</b>	<b>3.35**</b>	1.48	<b>2.60***</b>	<b>2.92*</b>
Suboptimal living conditions	0.93	<b>1.34***</b>	<b>1.59*</b>	1.01	<b>1.38**</b>	1.59
Concerns about own health and safety	2.99	<b>4.33***</b>	<b>5.03***</b>	3.07	<b>4.36***</b>	<b>4.99***</b>
Concerns about family members' health and safety	3.90	<b>5.41***</b>	<b>6.14***</b>	3.69	<b>5.00***</b>	<b>5.88***</b>
Reading about negative news	3.06	<b>4.01***</b>	<b>4.64***</b>	2.81	<b>3.73***</b>	<b>4.25***</b>
Limited travelling or going outside	2.14	<b>3.42***</b>	<b>4.44***</b>	2.24	<b>3.57***</b>	<b>4.48***</b>
Limited socialization with friends/colleagues	1.72	<b>2.71***</b>	<b>3.47***</b>	1.93	<b>2.93***</b>	<b>3.63***</b>
Limited visiting of family/relatives	2.02	<b>3.31***</b>	<b>4.64***</b>	1.87	<b>2.99***</b>	<b>4.25***</b>

*Note.* Bolded numbers indicate that parents' experiences of this stressor at this timepoint were significantly more severe than at the previous timepoint. The significance test was performed using the lmerTest package in R. \* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$

### **Factors influencing parents' emotional well-being**

To investigate factors influencing parents' emotional well-being, we fitted two mixed-effect models, one for mothers' PHQ-4 score, one for fathers' score. Individual was entered as a random-effect variable. The predictors we included in the model are ones that, judging from previous literature and common sense, can potentially cause changes to parents' emotional well-being. To avoid problems of multicollinearity, we did not include any predictors with a variance inflation factor (VIF) higher than 10. The only two predictors in the model with a VIF  $> 5$  were timepoint (VIF = 9.7 for mothers and 9.3 for fathers) and age  $\times$  timepoint (VIF = 5.9 for mothers and 5.5 for fathers), which we kept in the model because of their importance. Parents' experiences of various stressors were not included as predictors because they were highly correlated with each other as well as with emotional well-being. For predictors that were constant across timepoints (e.g., education level), we used both the predictor itself and its interaction with timepoint as independent variables with fixed effects. For predictors that varied across timepoints (e.g., conflict with other adults in the household), we used only the predictor itself. Results (Table 6) showed that factors influencing mother's emotional well-being included timepoint, age, education level  $\times$  timepoint, time spent on housework, conflict with adults, and number of children  $\times$  timepoint. Factors influencing fathers' emotional well-being included timepoint, education level  $\times$  timepoint, authoritarianism  $\times$  timepoint, and conflict with adults.

**Table 6***Factors Predicting Parents' Emotional Well-Being During the COVID-19 Period*

	Mothers			Fathers		
	$\chi^2$	<i>df</i>	<i>p</i>	$\chi^2$	<i>df</i>	<i>p</i>
Timepoint	<b>11.2</b>	<b>2</b>	<b>.004</b>	<b>7.4</b>	<b>2</b>	<b>.02</b>
Measurements for the parent						
Age	<b>3.9</b>	<b>1</b>	<b>.047</b>	2.0	1	.16
Age × timepoint	0.3	2	.86	0.7	2	.71
Education level	0.1	1	.80	0.4	1	.55
Education level × timepoint	<b>8.1</b>	<b>2</b>	<b>.02</b>	<b>9.8</b>	<b>2</b>	<b>.01</b>
Job flexibility	0.0	1	.94	0.6	1	.45
Job location	1.6	1	.20	1.1	1	.30
Monthly individual income	0.6	1	.45	0.6	1	.44
Authoritarianism	0.3	1	.59	2.4	1	.12
Authoritarianism × timepoint	0.2	2	.92	<b>7.6</b>	<b>2</b>	<b>.02</b>
Number of hours spent...						
working	0.6	1	.42	3.6	1	.06
doing housework	<b>14.4</b>	<b>1</b>	<b>&lt;.001</b>	2.9	1	.09
with children	0.2	1	.70	1.2	1	.27
sleeping	0.1	1	.76	1.5	1	.22
Conflict with children in household	1.8	1	.18	3.7	1	.06
Conflict with adults in household	<b>54.1</b>	<b>1</b>	<b>&lt;.001</b>	<b>25.1</b>	<b>1</b>	<b>&lt;.001</b>
Measurements for the family						
Citizenship	4.7	2	.10	0.1	2	.96
Citizenship × timepoint	3.1	4	.54	0.5	4	.97
Ethnicity	1.6	3	.65	3.2	3	.36
Ethnicity × timepoint	5.4	6	.49	5.8	6	.45
Number of children in household	0.1	1	.76	0.3	1	.57
Number of children × timepoint	<b>6.2</b>	<b>2</b>	<b>.046</b>	1.6	2	.45
Number of adults in household	0.0	1	.99	1.4	1	.24
Number of adults × timepoint	4.8	2	.09	0.2	2	.92
Monthly household income	0.9	1	.35	0.9	1	.33

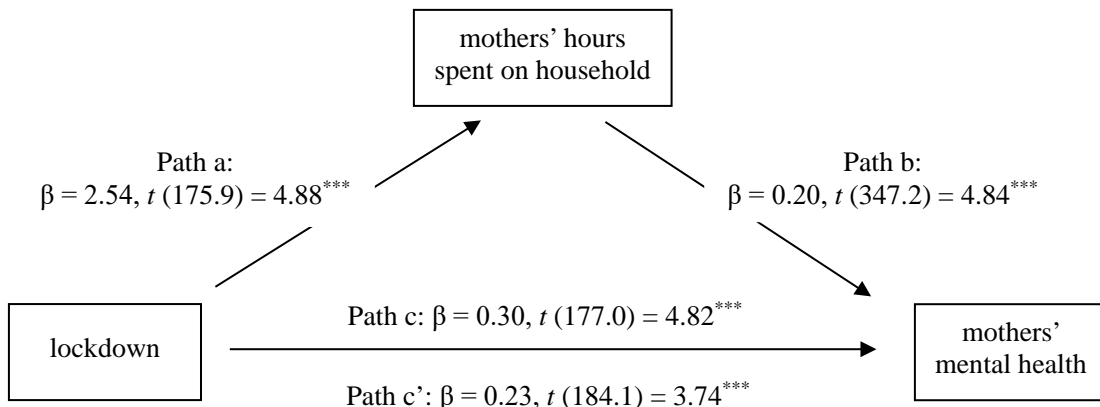
*Note.* Job flexibility was coded to be 1 for full-time jobs; 2 for part-time jobs, self-employment, and student; and 3 for all others. Job location was coded to be 1 for rarely worked from home; 2 for partially worked from home, self-employment, and student; and 3 for all others.

Among these factors, mothers' time spent on housework and both parents' conflict with adults increased significantly during the COVID-19 period,  $\chi^2s > 28$ ,  $ps < .001$ , and they also predicted concurrent emotional well-being. Therefore, we conducted mediation analyses on these two predictors.

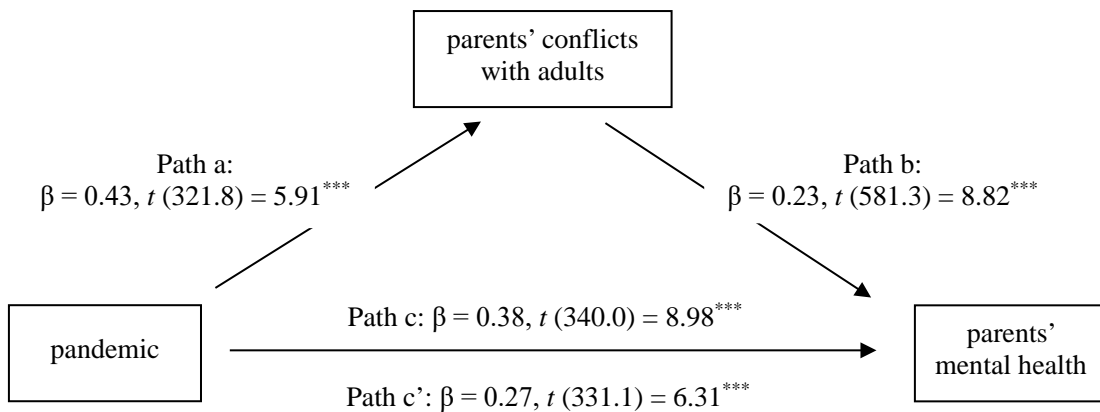
We first explored mothers' time spent on housework as a potential mediator. To examine whether housework mediated the effect of pandemic on mothers' emotional well-being, mothers' emotional well-being in the first two timepoints (Pre-pandemic and Pandemic) was fitted with a mixed-effect model with timepoint and housework as fixed-effect variables, and individual as a random-effect variable. Results showed that the main effect of housework was not significant,  $\beta = 0.077$ ,  $CI = [-0.016, 0.046]$ , therefore the effect of pandemic on mothers' emotional well-being was not mediated by housework. For lockdown, the mediation analyses (Figure 7a) showed that the coefficients for all three mixed-effect models were significant; The direct effect was significant but smaller than the total effect, which suggested a partial mediation. The mediation effect was tested with both Sobel's test (Sobel, 1982) and the bootstrap method. Sobel's test turned out to be significant,  $t = 3.35$ ,  $p < .001$ . Results from the Bayesian multilevel mediation model (Voorre & Bolger, 2018) also indicated a significant mediation effect,  $M = 0.11$ ,  $SE = 0.04$ , 95% credible interval =  $[0.06, 0.19]$ . Therefore, hours spent on household partially mediated the effect of lockdown on mothers' emotional well-being.

### **Figure 7**

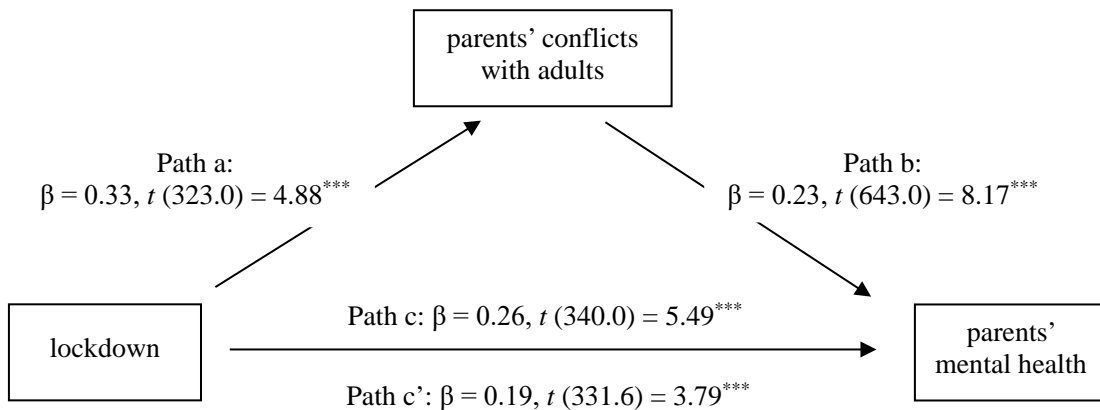
*Mediation Analysis for the Effect of Pandemic and Lockdown for Parents' Emotional Well-being*



(a)



(b)



(c)

Note. \*\*\*  $p < .001$

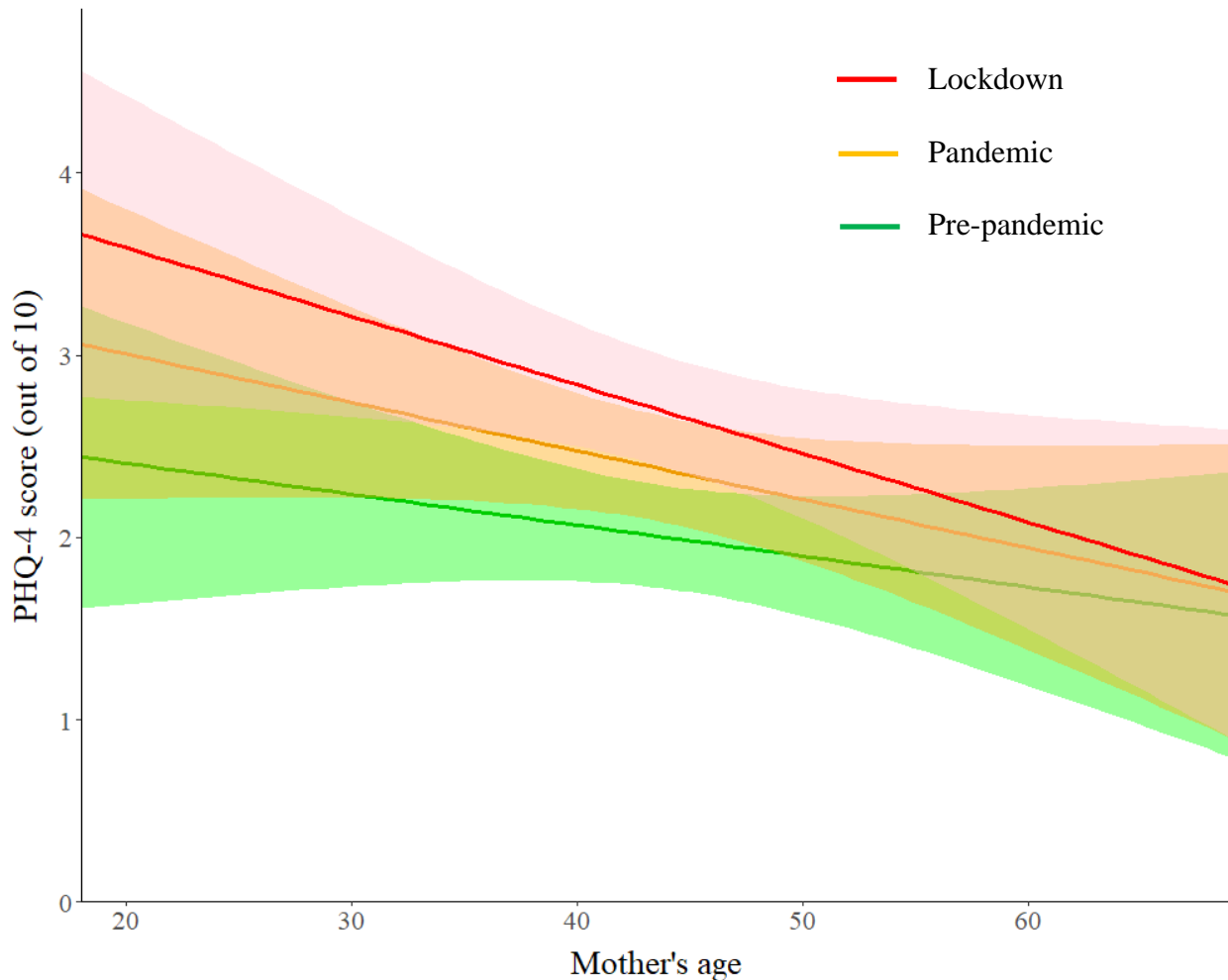


We then explored parents' conflicts with adults in the household as a second potential mediator. Three mixed-effect models were each fitted for pandemic (Figure 7b) and lockdown (Figure 7c), all with individual and family as mixed-effect variables, and all resulted in significant coefficients. For both pandemic and lockdown, the direct effect was significant but smaller than the total effect, which suggested a partial mediation. Sobel's test showed a significant mediation effect for both pandemic,  $t = 5.18, p < .001$ , and lockdown,  $t = 3.90, p < .001$ . The Bayesian multilevel mediation model has not been applied here because it is not suitable for three-level data (timepoint nested under individual, which was in turn nested under family). Notably, these mediation effects were also significant when mothers' and fathers' data were separated,  $ps < .001$ , indicating that conflict with adults served as a mediator for both mothers and fathers.

Next, we examined potential factors that may have moderated the effect of pandemic and lockdown on emotional well-being, starting with mothers' age. We fitted mother's emotional well-being with a mixed-effect model using timepoint, age, and age  $\times$  timepoint as fixed-effect variables and individual as a random-effect variable. Results showed a significant effect of timepoint,  $\chi^2(2) = 102.8, p < .001$ , as well as a significant age  $\times$  timepoint interaction,  $\chi^2(2) = 8.6, p = .01$ . When we separated the three timepoints (Figure 8), age was a significant predictor for mothers' emotional well-being during Lockdown,  $\beta = -0.038, CI = [-0.069, -0.006]$ , with younger mothers experiencing more mental health issues than older mothers. The age effect was not significant for Pre-pandemic,  $\beta = -0.017, CI = [-0.046, 0.012]$ , or Pandemic,  $\beta = -0.027, CI = [-0.057, 0.004]$ .

### Figure 8

*Mothers' Mental Health Issues by Age and Timepoint*



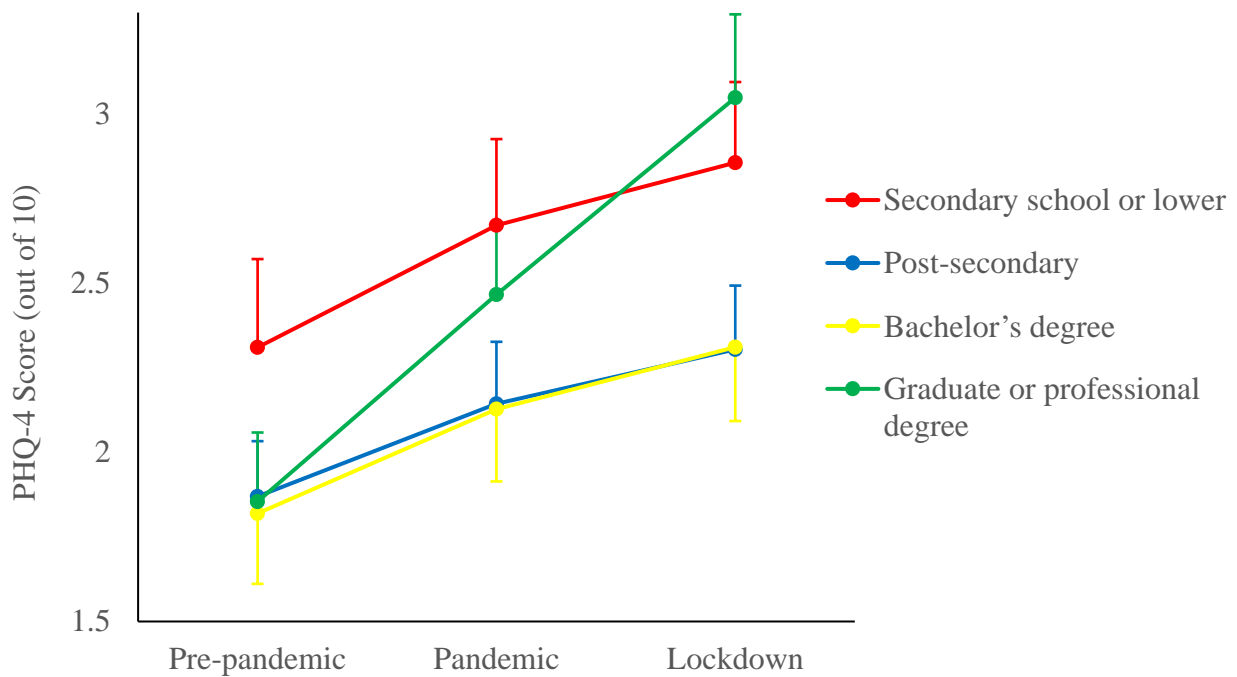
*Note.* Shaded areas denoted 95% CI of the regression lines.

To investigate the effect of education level, we fitted parents' emotional well-being with a mixed-effect model using timepoint, gender, education level, gender × timepoint, education level × timepoint, gender × education level, and gender × education level × timepoint as fix-effect variables, and individual and family as random-effect variables. Results showed a significant effect of timepoint,  $\chi^2(2) = 153.2, p < .001$ , as well as a significant education level × timepoint interaction,  $\chi^2(6) = 33.5, p < .001$ . No main or interaction effect involving gender was

significant. As shown in Figure 9, compared to parents with a post-secondary diploma, parents with secondary diploma or lower experienced an overall higher level of mental health issues,  $\beta = 0.487$ ,  $CI = [0.042, 0.931]$ . On the other hand, compared to parents with a post-secondary diploma, parents with a graduate or professional degree experienced a sharper increase of mental health issues both from Pre-pandemic to Pandemic,  $\beta = 0.338$ ,  $CI = [0.061, 0.615]$ , and from Pandemic to Lockdown,  $\beta = 0.421$ ,  $CI = [0.145, 0.698]$ . These results suggested that although parents with low education levels had overall lower levels of emotional well-being, parents with very high education levels may be more vulnerable to deterioration of emotional well-being during the period of COVID-19.

**Figure 9**

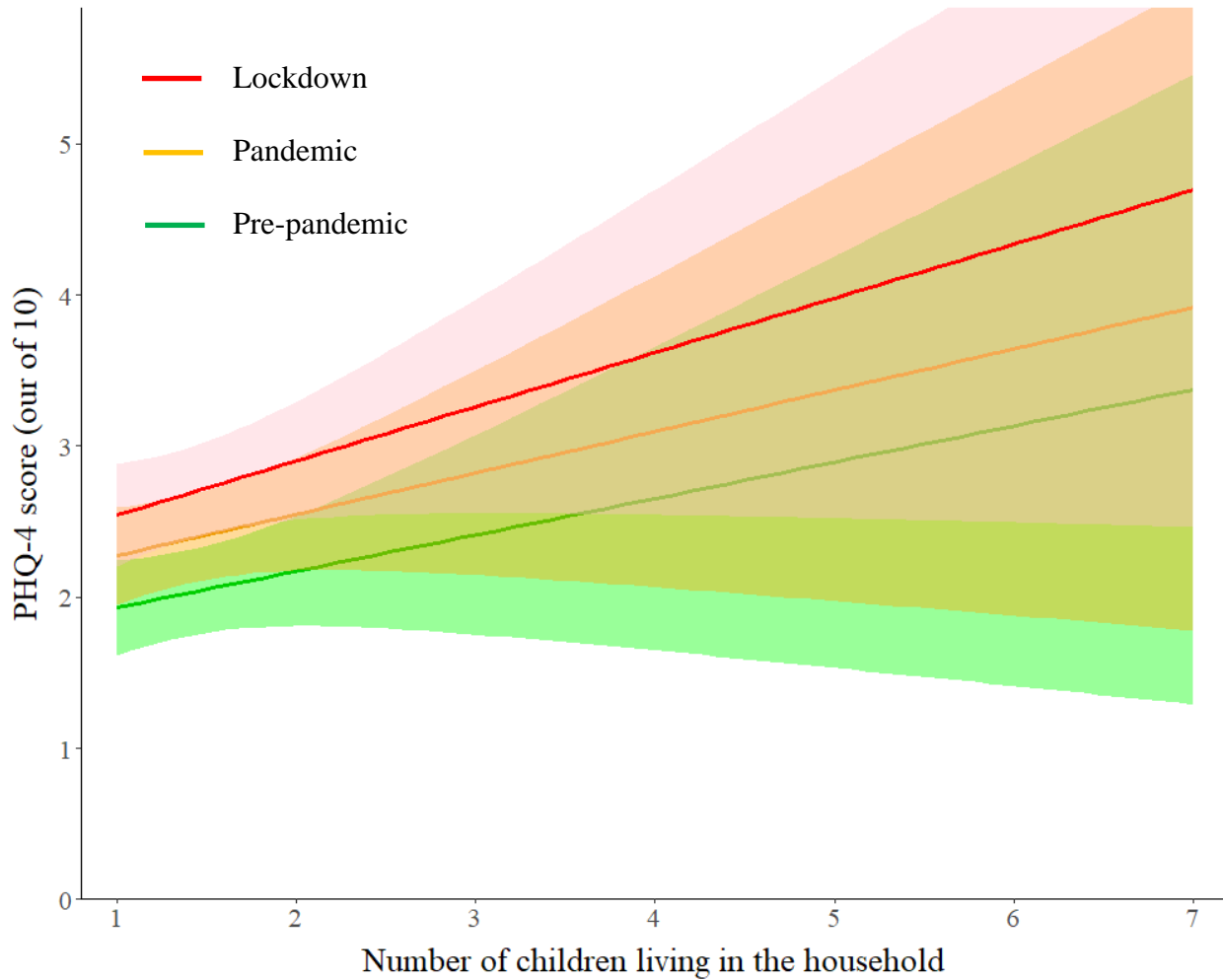
*Parents' Mental Health Issues by Education and Timepoint*



To investigate the effect of number of children in household, we fitted mother's emotional well-being with a mixed-effect model using timepoint, number of children, and number of children  $\times$  timepoint as fix-effect variables and individual as a random-effect variable. Results showed a significant effect of timepoint,  $\chi^2 (2) = 91.1, p < .001$ , but no significant effect of number of children, or number of children  $\times$  timepoint interaction,  $\chi^2 (2) < 91.18.6, ps > .2$ . When we separated the three timepoints (Figure 10), number of children did not predict mothers' emotional well-being in any of the timepoints,  $\beta s < 0.36, ps > .07$ . The interaction effect observed in the omnibus test may have been due to interactions between number of children and other predictors included in the model. The long-tail distribution of number of children (one family in our sample had 7 children living with them) may have also caused the results to be unstable.

### **Figure 10**

*Mothers' Mental Health Issues by Number of Children and Timepoint*

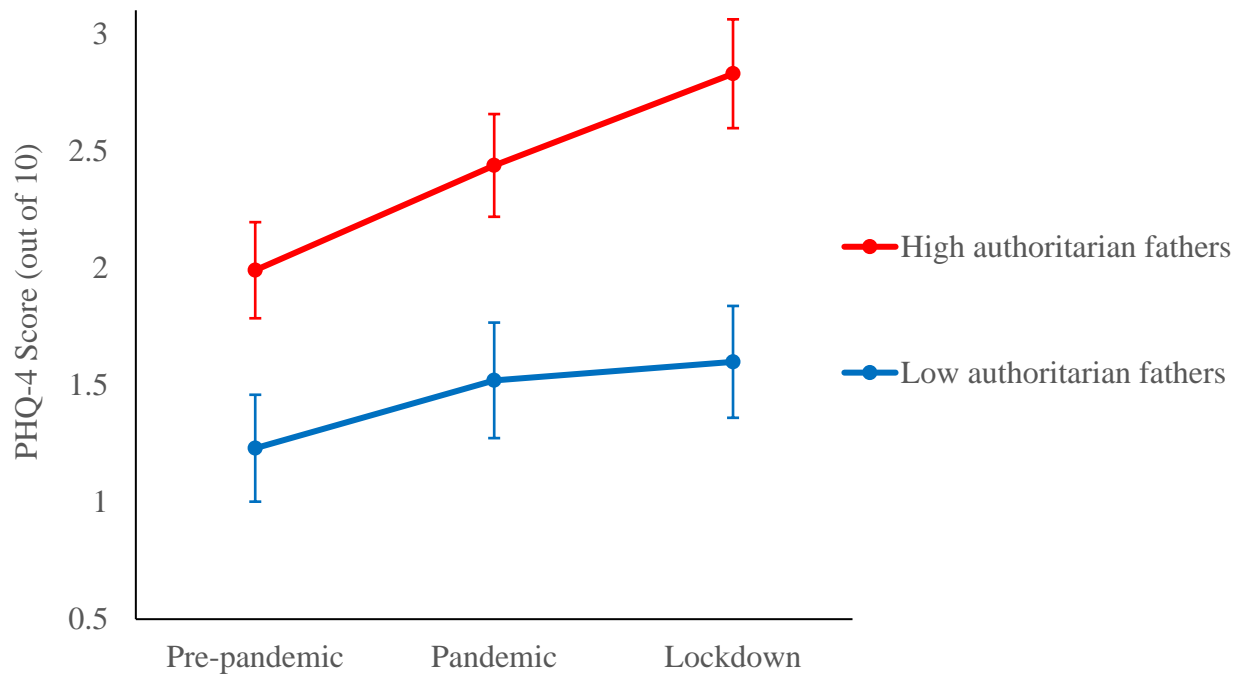


To investigate the effect of father’s authoritarianism, we fitted father’s emotional well-being with a mixed-effect model using timepoint, authoritarianism, and authoritarianism  $\times$  timepoint as fix-effect variables and individual as a random-effect variable. Results showed a significant effect of timepoint,  $\chi^2(2) = 65.6, p < .001$ , a significant effect of authoritarianism,  $\chi^2(1) = 5.2, p = .02$ , as well as a significant authoritarianism  $\times$  timepoint interaction,  $\chi^2(2) = 7.8, p = .02$ . As shown in Figure 11, low authoritarian fathers’ mental health issues increased significantly from Pre-pandemic to Pandemic  $\beta = 0.289, CI = [0.087, 0.492]$ , but did not increase significantly from Pandemic to Lockdown,  $\beta = 0.079, CI = [-0.124, 0.282]$ . High authoritarian fathers’ mental

health issues increased significantly both from Pre-pandemic to Pandemic,  $\beta = 0.451$ , CI = [0.193, 0.709], and from Pandemic to Lockdown,  $\beta = 0.391$ , CI = [0.133, 0.650].

**Figure 11**

*Father's Mental Health Issues by Authoritarianism and Timepoint*



**Discussion**

This study set out to address three research questions. For the first research question, our data revealed significant changes in jobs and income, childcare arrangement, family dynamics, and parents' emotional well-being throughout the COVID-19 period. Most of these changes were observed both between Pre-pandemic and Pandemic, and between Pandemic and Lockdown. However, some changes were more specifically related to the pandemic (e.g., autonomy granting for high authoritarian mothers), and others were more specifically related to the lockdown (e.g.,

household income). For the second research question, both mothers and fathers reported to worry most about the health and safety of family and self during the COVID-19 period. Other major stressors were largely aligned with their traditional gender roles. For the third research question, we found that mother's time spent on housework partially mediated the effect of lockdown on their emotional well-being, and parent's conflict with other adults in the household partially mediated the effect of both pandemic and lockdown on their emotional well-being. The effects of pandemic and lockdown on emotional well-being were moderated by parents' age, education level, and father's authoritarian values.

### **Jobs and income**

Half of full-time employees who rarely worked from home pre-pandemic switched to mostly working from home during lockdown. This is consistent with telecommuting trends observed across the world where many workplaces shifted to a "work from home" arrangement to reduce physical contact and minimize the spread of the coronavirus. During Singapore's circuit breaker, all non-essential businesses were required to stop operations at their workplace premises, and employees could only perform work by telecommuting from home (Gov.sg, 2020a). The number of parents who worked full-time also decreased during lockdown, which may be due to increased household responsibilities which would require parents to take time off work, or because of a reduction in operating business which led to parents losing jobs, switching from working full-time to part-time, or taking paid/unpaid leave.

Average household income did not decrease significantly from Pre-pandemic to Pandemic but did from Pandemic to Lockdown. This suggests that an imposed lockdown may have larger economic and financial effects on families due to the mandatory suspension of workplace and business activities. On the other hand, a delay from reduced business operations to laying off

employees or reducing their salary may explain why the average household income did not decrease significantly in the first two months of the pandemic.

### **Childcare arrangements**

The number of children attending daycares and schools decreased during the pandemic and decreased further during lockdown. The first decrease is probably due to parents voluntarily withdrawing their children from daycares and schools in face of the threat of COVID-19, whereas the second, more drastic decrease can be attributed to schools shifting to full-time home-based learning (HBL). These decreases were mirrored by an increase in the amount of time parents spent with their children due to the pandemic and subsequently a further increase during lockdown, which can be interpreted as due to increasing time at home instead of at daycare and schools. This increase in time together was not found to be the case for grandparents and domestic helpers, likely because the circuit breaker imposed reduction measures in visiting of grandparents living elsewhere, and because domestic helpers already spend a sizable amount of time with children on a normal basis as part of their hired responsibility.

A breakdown of how caregivers spent time with children revealed that mothers spent increased time playing with children, and fathers spent increased time meeting children's basic needs during the pandemic than before pandemic, even though the burden of meeting children's needs still mainly fell on mothers' shoulders during the pandemic. During lockdown, however, activities like homework tutoring started to take up more of parents' time. In addition, this responsibility during the circuit breaker also spilt over to adult siblings, where they were found to spend significantly more time playing and tutoring their younger siblings.

### **Family dynamics**



Child-rearing values play an important role in family dynamics, where parenting style has been found to be the main determinant of family functioning (Olson, 2000). Our study found that parental values moderated parents' rule setting, autonomy granting, and conflict with children when facing the pandemic and lockdown.

The increase in rule setting without explanation was found within high authoritarian fathers between Pandemic and Lockdown, whereas the decrease in autonomy granting was found within high authoritarian mothers from Pre-pandemic to Pandemic. This may reflect gender differences in authoritarian methods between mothers and fathers: authoritarian fathers may display their authority by making rules, whereas authoritarian mothers may display their authority by making important decisions for children. These tendencies may have been strengthened by external stressors such as COVID-19. Conflict between high authoritarian fathers and their children also increased during both Pandemic and Lockdown, which could be a result of increasing rule-setting.

### **Parents' emotional well-being**

Overall, parents' mental health issues increased during Pandemic, and increased further during Lockdown. Beyond common concerns about health and safety, stress origins were different between mothers (caring for children, limited visiting of family/relatives, and reading about negative news) and fathers (high demand from job/business, limited travelling or going outside, and financial difficulties). This suggests that in Singapore, COVID-related stress and worries largely align with the responsibilities of traditional gender roles, despite boundaries pertaining to traditional gender roles becoming increasingly blurred in recent years. For mothers, worries and stress surround their family and caregiving responsibilities, whereas for fathers, worries and stress surround their work and income-earning responsibilities. Research shows that

even with both parents working, the division of labor at home remains unequal (Parker, Horowitz, & Rohal, 2015). The advent of COVID-19 could have caused working parents to further fall back on conventional roles.

Time spent on housework were found to be partial mediator for the effect of lockdown on emotional well-being for mothers. COVID-19 might have led to an increase in household-related chores, due to extended periods of time spent at home and the need to keep the home environment clean and conducive for remote working and learning. Lockdown could have also led to an even larger increase due to the inability to outsource housework (Farré, Fawaz, González, & Graves, 2020). This could be especially relevant for families without domestic helpers or families who outsource their housekeeping chores to visiting part-time cleaners, which was disallowed as part of the circuit breaker. Together with caregiving and work-related duties, housework could have been an additional burden to parents. In particular, housework burden tends to fall on mothers rather than fathers during the pandemic (Del Boca, Oggero, Profeta, & Rossi, 2020; Farré et al., 2020), and decreased well-being could stem from unhappiness regarding this uneven split in responsibility, or guilt from not doing enough (Larsson, 2018). Indeed, in a YouGov research survey of gender equality in 24 countries, 71% of respondents (75% women, 67% men) in Singapore disagreed that “a woman’s place is at home”, yet 69% of respondents (78% women, 60% men) agreed that “men should spend more time doing housework” (YouGov, 2015). This suggests that while majority of Singaporeans react positively to women taking responsibilities outside the home, the burden of housework-related chores may still fall on them significantly.

Next, conflict with adults in the household mediated the effect of pandemic and lockdown on emotional well-being for both mothers and fathers, implying that conflict could have largely

been between parents themselves. COVID-related stress is likely to increase detrimental processes (e.g., hostility, withdrawal, less responsive support) which undermine couples' relationship quality (Pietromonaco & Overall, 2020) and may thus result in increased conflict between parents and decreased well-being for both. Providing resources in marital support, relationship management, and emotional regulation to families could help in reducing conflict between adults at home and hence enhance or protect their well-being during the pandemic.

Age, education level, and authoritarian values were found to be potential moderators of COVID-19 on parents' well-being. Firstly, younger mothers experienced more anxiety and depression, consistent with mental health studies investigating demographic indicators of age and gender (e.g., Kim & Kim, 2017). Young women were also found to worry more often than both young men and older adults (Gould & Edelstein, 2010). Clinically, young women aged 14-25 years are reported to have two times the prevalence rate of depressive disorders than men (Albert, 2015), but this rate decreases with age (Bebbington et al., 2003; Patten et al., 2006). Women also present with consistently higher rates of anxiety disorders than men (McLean, Asnaani, Litz, & Hofmann, 2011). Specific to COVID-19, it had been found that female gender and young age ( $\leq 40$  years) were associated with mental distress during the pandemic across countries (see Xiong et al., 2020 for a systematic review). This may be due to having economic stability at an older age (González-Sanguino et al., 2020), or older parents experiencing less negative affect to stressful events in general (Ha, Hong, Seltzer, & Greenberg, 2008). This may also be due to older parents being better than their younger counterparts at anticipating stressful events at home (Neupert & Bellinger, 2018). This age-related attenuation of emotional stress and feelings of depression may stem from a longer and wider range of life experiences, or due to older parents more likely to have older children who are granted greater independent mobility and autonomy

(Pacilli, Giovannelli, Prezza, & Augimeri, 2013; Shaw et al., 2015), requiring less supervision and caregiving.

Secondly, there was a significant education by timepoint interaction effect for parents' emotional well-being. Overall, parents with secondary diploma or lower experienced the highest level of mental health issues, yet parents with graduate or professional degrees experienced the sharpest increase of mental health issues during the COVID-19 period. The high-level of mental health issues for parents with low education levels was consistent with general findings that higher education levels are related to better outcomes in caregiver psychological well-being (Raina et al., 2004; Sloper & Turner, 1993). This pattern is also observed within the context of COVID-19, where lower education levels were associated with greater depressive symptoms during the pandemic (Gao et al., 2020; Mazza et al., 2020; Olagoke, Olagoke, & Hughes, 2020; C. Wang et al., 2020). The reason behind why parents with the highest education level experience the sharpest increase in mental health issues during the pandemic can be more speculative. One study reported that people with higher education and professional jobs exhibited more depressive symptoms in comparison to less educated individuals and those in service or enterprise industries during the COVID-19 period (Wang, Di, Ye, & Wei, 2020). Based on this, there may be two reasons for why highly educated parents might have had their well-being more greatly impacted by the pandemic in Singapore. First, many highly educated adults in Singapore are Professionals, Managers, Executives and Technicians (PMETs), which have started to form a large share of the retrenchment pool before the advent of COVID-19 (Heng, 2019). Thus, unemployment and financial strain might have contributed to the decreased well-being of highly educated parents in Singapore. Second, the changes in lifestyle required due to COVID-19 might have been more substantial for highly educated parents with professional

and graduate degrees. Many parents who work in offices had to get used to shifting their work online, and at the same time juggle caregiving and household responsibilities, which cumulatively could have contributed to poorer well-being.

Lastly, authoritarian fathers were found to be more affected by COVID-19 in terms of their well-being. This is in line with previous COVID-19 findings that anxiety, depression, and stress of parents with authoritarian parenting styles are significantly higher than parents with permissive parenting styles, with depression of authoritarian parents also being higher than authoritative parents. This may be due to conflict that arise from increased time spent with children at home and the inability of children to meet the generally higher demands of authoritarian parents (Wu et al., 2020).

### **Implications and Future Research**

In sum, results from this study suggest that both the COVID-19 pandemic and the lockdown measures associated with it posed significant social and psychological burdens on families with underaged children. These burdens can occur through direct mechanisms such as increasing parents' concerns about health and safety, but can also occur through indirect mechanisms such as increasing mothers' load of housework, or increasing conflicts among adults in the household. These effects were further moderated by demographic variables such as age and education level, as well as parenting values and practices. Finally, some of the more intuitive mechanisms, such as household income and childcare burden, did not appear to be significant predictors of parental well-being in our study. This could be due our sample being relatively homogenous regarding those variables (e.g., most families can still go by financially), or maybe their predictive power was explained by other variables that was co-entered into the model.

These findings have both theoretical and practical implications. Theoretically, the COVID-19 pandemic, especially the case of Singapore, provided an unfortunate opportunity of a “natural experiment” regarding how families function under pressure. We provided an example which shows that external stress, family dynamics, and parenting values can interact with each other to impact parents’ emotional well-being. Paternal authoritarian values, for example, is shown to be a risk factor which makes fathers vulnerable to repressive practices, conflicts with children, as well as mental health issues when under stress.

In practice, these findings call for attention towards social and psychological costs of lockdown measures, on top of economical ones. Though it is difficult to quantify the value of parents’ emotional well-being, the negative effects should at least be recognized and weighted against benefits of such measures on infection control. These findings also point to priorities in supporting services. For example, reopening part-time housekeeping may need to be granted priority, given that housework mediates the effect of lockdown on mothers’ emotional well-being. Marriage/family counselling may also be important given the mediating role of family conflicts.

One major limitation of this study is that we relied solely on retrospective self-report. These reports can be subject to biases related to social desirability (Brenner & Delamater, 2014; Mortel & Thea, 2008), memory errors (Sato & Kawahara, 2011; Stone & Shiffman, 2002), and common method variance (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Among these concerns, we attempted to minimize memory errors by finishing data collection within one month after the “circuit breaker”. Concerns about common method variance are mitigated to some extent by the fact that most variables in our study are not highly correlated with each other. However, social desirability is difficult to control or rule out, especially for questions related to well-being. Future

studies need to combine self-report data with data collected by other methodologies, ideally during the development of a crisis.

The other limitation is caused by the nature of people's responses to a crisis. In this paper we used the difference between Pre-pandemic and Pandemic as an approximation for the effects of the coronavirus itself and the voluntary responses to it, and we used the difference between Pandemic and Lockdown as an approximation for the additional effects brought by mandatory lockdown measures. The real situation can be much more dynamic and complicated though. For example, there might be a cumulative effect of stress in play, when long periods of low-level stressful event eventually lead to a mental breakdown (Prousky, 2014). On the other hand, a panic effect about the unknown may precede the appearance of the actual stressor (Bavel et al., 2020). One example is that Singapore experienced several instances of panic buying of groceries, which all occurred in the early stage of the pandemic when daily new cases were low, but the uncertainty was high. People can also adapt to stressors if they are present for a prolonged period (Herman, 2013). Tackling the temporal aspect of people's emotional well-being would be important for understanding the mechanisms under the development of mental health problems during the period of a crisis, and may require dense sampling along the timeline.

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## Appendix. The Full Survey Used in the Study

**Block 1: Background Information**

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**Q1. Please leave your email address or phone number so that we can contact you to disperse the S\$10 compensation after you submit your survey. Please note that the compensation process will take some time. If you leave your email address, we will also send you a copy of the overall results, and resources for coping with stress related to COVID-19.**

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**Q2. What is your citizenship status?**

- Singapore citizen
- Singapore permanent resident (PR)
- Employment pass holder (EP)
- S pass holder (SP)
- Work permit holder (WP)
- Dependent pass holder (DP)
- Long-term visit pass holder (LTVP)

**Q3. The ethnicity of your family is:**

- Chinese
- Malay
- Indian
- Filipino
- Caucasian/white
- Mixed or other, please specify \_\_\_\_\_

**Q4. Which of the official mother tongue languages (e.g., Mandarin, Malay, Tamil) do your children speak?**

- Mandarin
- Chinese Dialects (e.g., Hokkien, Teochew, Cantonese)
- Malay
- Tamil
- Tagalog
- None
- More than one language or other language, please specify \_\_\_\_\_

**Q5. What type of housing does your family live in?**

- 1 or 2 room HDB
- 3 room HDB
- 4 room HDB
- 5 room HDB
- Condominium or other apartment
- Landed property
- Other, please specify \_\_\_\_\_

**Q6. How many children (under 18) lived in your household for the whole period\* of January to May 2020?**

\* "Whole period" means the child did not sleep outside the house for more than 15 days during the period.

▼ 1 to 10

Q6A. If there are additional children who lived with you for part of the period\*, please explain here. Otherwise, please type in a dash "-".

\* For example, a child who usually lived with you, but went to live with other relatives for more than 15 days.

\_\_\_\_\_

**Q7. How many adults (above 21) lived in your household for the whole period\* of January to May 2020?\*** "Whole period" means the adult did not sleep outside the house for more than 15 days during the period.

▼ 1 to 10

Q7A. If there are additional adults who lived with you for part of the period, please explain here. Otherwise, please type in a dash "-".

\_\_\_\_\_

**Q8. Has anyone in your household been diagnosed with COVID-19?**

- Yes, please explain: \_\_\_\_\_
- No

**Q9. Has anyone in your household received a Quarantine Order (QO), a Leave of Absence (LOA), or a Stay-Home Notice (SHN)?**

- Yes, please explain: \_\_\_\_\_
- No

Block 2: Adult Information

**\*Researcher’s note: This section collects information from each adult in the household. The fields to be filled in (i.e. columns and rows) changes according to how many adults the respondent indicated in Block 1 (see Q7). This example assumes that the respondent indicated that there are 3 adults living in their household.**

**You have indicated that [no. of adults - answer from Q7; in this case: 3] adult(s) lived in your household for the whole period of January to May 2020. Please answer the following questions for each adult.**

**Q10. Please fill in the following information for each adult. If the same adult has different relations to different children (mother to one child and aunt to another), please choose "Other" and explain below.**

\* Mother/father include the cases of biological, step, adoptive, and foster parents.

^ Post-secondary refers to NITEC, polytechnic diploma, A levels, community college, vocational school, etc.

	Relation to children	Age	Education level	Any existing disabilities or mental health conditions?	
				Yes	No
<b>Adult 1 (yourself)</b>	▼ 1. Mother* 2. Father* 3. Grandmother 4. Grandfather 5. Full-time domestic helper 6. Part-time domestic helper 7. Aunt 8. Uncle 9. Guardian 10. Other	<input type="text"/>	▼ 1. Secondary school or lower 2. Post-secondary^ 3. Bachelor’s degree 4. Graduate or professional degree 5. Other	<input type="radio"/>	<input type="radio"/>
<b>Adult 2</b>	▼ 1. Mother* ... 10. Other	<input type="text"/>	▼ 1. Secondary school or lower ... 5. Other	<input type="radio"/>	<input type="radio"/>
<b>Adult 3</b>	▼ 1. Mother* ... 10. Other	<input type="text"/>	▼ 1. Secondary school or lower ... 5. Other	<input type="radio"/>	<input type="radio"/>

Q10A. If you answered "Other" to any of the questions above or "Yes" to the question on disabilities/mental health conditions, please explain here:

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**Q11. For each of the 4 pairs of desirable qualities, please indicate which one is more important for a child from the perspective of each adult in your household. Please consult each adult to make sure their values are accurately represented.**

	Independence	Respect for elders	Obedience	Self-reliance	Curiosity	Good manners	Being considerate	Being well-behaved
Adult 1 (yourself)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Adult 2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Adult 3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**Q12. Please select the option which best indicates each adult's job situation in a typical month before the local transmission of COVID-19 (e.g., Jan 2020), during the local transmission but before the circuit breaker (Feb-Mar 2020), and during the circuit breaker (Apr-May 2020).**

Full-time: worked as a full-time employee for >35 hours a week  
 Rarely: <20% of the time; partially: 20-80% of the time; mostly: >80% of the time

	Jan	Feb-Mar	Apr-May
Adult 1	▼ 1. Full-time, rarely worked from home 2. Full-time, partially worked from home 3. Full-time, mostly worked from home 4. Part-time, rarely worked from home 5. Part-time, partially worked from home 6. Part-time, mostly worked from home 7. Self-employed 8. Kept house or raised children full-time 9. On paid leave 10. On unpaid leave 11. On disability 12. Student 13. Retired 14. Unemployed and did not keep house 15. Other	▼ 1. Full-time, rarely worked from home ... 15. Other	▼ 1. Full-time, rarely worked from home ... 15. Other
Adult 2	▼ 1. Full-time, rarely worked from home ... 15. Other	▼ 1. Full-time, rarely worked from home ... 15. Other	▼ 1. Full-time, rarely worked from home ... 15. Other
Adult 3	▼ 1. Full-time, rarely worked from home ... 15. Other	▼ 1. Full-time, rarely worked from home ... 15. Other	▼ 1. Full-time, rarely worked from home ... 15. Other

Q12A. If you had answered "Other" to any of the options above, please explain here:

\_\_\_\_\_





