Association of Parental Mental Health with Youth Internalizing and Externalizing Behaviors during the COVID-19 Pandemic: A Comparison between 2018 and 2020 in Chongqing, China

by

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Thesis submitted in partial fulfillment of
the requirements for the degree of
Master of Science in the Duke Global Health Institute
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ABSTRACT

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Abstract

Background: Maladjustment, categorized as internalizing and externalizing behaviors, is a process whereby an adolescent is unable to satisfy the psychological needs successfully. Youth behavioral problems may strengthen during the COVID-19 pandemic that put individuals through many mental health difficulties. The objectives of this study are to (1) examine the difference of youth behavioral problems between before and during the pandemic; (2) to investigate the association of parental mental health changes with youth behavioral problems during COVID-19; (3) to identify the predictors of parental mental health changes during the COVID-19. Methods: This study used the data from Wave 8 and Wave 10 of the China sample in the Parenting Across Cultures project. The study sample included 115 families in Chongqing, China. Linear mixed effects models and Full Information Maximum Likelihood estimation were performed. Results: Adolescents experienced a significant increase in internalizing behaviors during COVID-19 ($p = 0.002$). The COVID-19 disruption brought a 0.20 increment in youth internalizing behaviors. Paternal mental health was significantly associated with youth internalizing behaviors ($p = 0.020$) and externalizing behaviors ($p = 0.034$). Youth's gender, educational level, family structure, employment status, and family mental wellness significantly predicted parental mental health changes during COVID-19. Conclusions: As the first longitudinal study in China measuring the changes in youth

behavioral problems before and during COVID-19, this study stressed the impact of COVID-19 disruption on the increment of youth internalizing behaviors between 2018 and 2020 in China. The results have important policy implications for adolescents-oriented mental health prevention and mitigation during COVID-19.

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1. Introduction

Maladjustment, a process whereby an adolescent is unable to satisfy the psychological needs successfully, is categorized as internalizing and externalizing behaviors (Achenbach, 1966; Mangal, 1995). Internalizing behaviors are displayed inwardly and indicative of youth's psychological and emotional status (J. Liu et al., 2011), while externalizing behaviors are outward-directed and manifested by behaviors towards the physical environment such as aggression, anger, impulsivity, and low regulation (Eisenberg et al., 2001; McMahon, 1994). In 2019, the number of maladjustments globally for adolescents aged 15-19 was 86,275,000. Numerous studies demonstrated that parenting practices and sociocultural risks (for example, poverty, parental stress and social isolation) are linked to a wide range of adverse behavioral outcomes in childhood and adolescence (Deater–Deckard et al., 1998; Patterson et al., 1989). The impact of these risk factors on youth behavioral outcomes could strengthen during stressful life events such as pandemics (Khoury et al., 2021; Steeger et al., 2017).

COVID-19 was first identified in China, where the government responded quickly and effectively to this public health crisis (Burki, 2020). This pandemic poses a fatal threat to physical and mental health while causing disruptions to daily life due to socially and economically public health directives in China (Prime et al., 2020), such as strict lockdowns and stay-at-home orders (Burki, 2020). Life changes during the COVID-19 pandemic put individuals through many mental health difficulties (Khoury et al., 2021), including depression, anxiety, anger, and argumentative behaviors (Rossi et al., 2020; Bignardi et al., 2021). If responding to the pandemic as a family unit, these mental health changes taken together have resulted in psychological distress for all family members, particularly adolescents (aged 10-19 years) who require more careful considerations from their parents due to the vulnerability (Fegert et al., 2020; Guessoum et al., 2020).

Longitudinal research has emphasized youth's adjustments during the pandemic (Wade et al., 2020). However, many current studies were designed without comparing the changes from before COVID-19 to during COVID-19 (for example, Li & Zhou, 2021; Parola et al., 2020), and only a handful of longitudinal studies have been conducted to date. For example, children and adolescents aged 8-18 years from Netherlands reported higher internalizing behaviors from pre-pandemic to during-pandemic (Fischer et al., 2021). In contrast, in a sample of 675 first-year university students in the U.S., only externalizing behaviors increased upon the onset of COVID-19 pandemic (Copeland et al., 2021). Furthermore, no significant differences in adverse behavioral outcomes were found among adolescents in an ecological momentary assessment study from before COVID-19 to during the pandemic (Janssen et al., 2020). These conflicting results showed that additional research is still needed to examine the change of youth internalizing and externalizing behaviors before and during the pandemic.

Family mental wellness is an essential condition for adjustment in adolescence.

Parental psychological distress exhibited in the parenting practices would be linked to poor adjustments for adolescents (Lieneman, 2018; Natarajan, 2013), especially under the stressful life events (Roustit et al., 2010). Previous research indicated that internalizing and externalizing behaviors may be more significant for COVID-19-exposed adolescents due to the home confinement that against the independence apart from parents in adolescence, which can be further catalyzed by negative parenting behaviors (Khoury et al., 2021; Prime et al., 2020). Gender of the youth could moderate the changes in behavioral problems as adolescent girls experienced more pronounced effects during the COVID-19 (Magson et al., 2021). Since much of the research was conducted in developed countries, there is a need to examine the association of parental mental health changes with youth internalizing and externalizing behaviors in developing countries, especially in China where the effects of COVID-19 are ongoing for a long time.

Given that parents are experiencing mental health difficulties during COVID-19 that further influence youth behavioral problems, it is imperative to identify the risk factors of parental mental health during the pandemic. Socioeconomic status is one factor that should be considered when examining mental health outcomes, given research demonstrating that individuals with fewer socioeconomic resources are less likely to coping with financial disruptions smoothly in the face of the pandemic (Patel et al., 2020). Gender and family structure are the other two risk factors due to the potential gender differences in the mental health changes and the association of adverse family structural characteristics with youth maladjustments found in previous studies (Dagher et al., 2015; Mack et al., 2015).

The primary objective of this study is to examine the difference of youth internalizing and externalizing behaviors between before the pandemic and during the pandemic in China. The secondary objective is to investigate the association of parental mental health changes during the COVID-19 pandemic with youth internalizing and externalizing behaviors. The present study also aims to identify the risk factors of parental mental health changes during the COVID-19. We hypothesized that (1) there would be an increase in youth internalizing and externalizing behaviors during the pandemic, excluding the time effect; (2) parental mental health changes during the COVID-19 pandemic would be associated with youth behavioral problems in China; (3) youth's gender, socioeconomic status, and family structure would be risk factors of parental mental health changes during COVID-19.

2. Methods

2.1 Setting

This study is secondary data analysis using the data from the Parenting Across Cultures (PAC) project. The PAC project is a longitudinal study across nine countries (China, Colombia, Italy, Jordan, Kenya, Philippines, Sweden, Thailand, and the United States) that is currently in its eleventh year of research regarding parenting, child's adjustment, attitudes and beliefs, cultural values, and self-regulation. The funders of this project include the Eunice Kennedy Shriver National Institute of Child Health and Human Development, the Fogarty International Center, and the Jacobs Foundation. The PAC project was approved by the ethical review boards at Duke University, Duke Kunshan University, and Chongqing Medical University, and the high school authorities in Chongqing, China.

The study used data from two waves (Wave 8 and Wave 10) of the PAC project based in Chongqing, China. Chongqing is a provincial-level municipality in southwest-central China, covering 82,000 square kilometers (*Britannica*, 2020). With a fertility rate of 10.5%, Chongqing has 31.2 million people, among which 66.8% live in urban areas (*Britannic*, 2020). Heavy industries such as automobile manufacturing and the complex of integrated iron and steel plants dominate the economy in Chongqing, and the disposable income per capita is 4,474 US dollars *(Britannica, 2020; National Bureau of Statistics of China, 2020)*. In addition, 96% of the total population aged six years have attended or are attending school and 6.5% have a university education or above (*National Bureau of Statistics of China, 2020*).

2.2 Participants

The participants in this study included 115 families from the China sample of the PAC project. These families were recruited from a district-level key high school located in Yuzhong District, Chongqing. Data from Wave 8 and Wave 10 were respectively collected in November 2018 and from November 2020 to April 2021, when, on average, children were aged 15 and 17 years, respectively. The initial sample consisted of 115 families, 113 families provided data at Wave 8 (attrition rate: 1.7%), and 98 families provided data at Wave 10 (attrition rate: 14.8%) were the final sample in each year. In addition to the attrition, item nonresponse was a concern at Wave 10 with approximately 29.6% of survey responses missing data for at least one item, which was accounted for in the analytical plan.

2.3 Procedures

China coordinators administered the data collection procedure for the Chongqing sample of the PAC project. Participants were recruited through letters sent home with children from the high school and signed the informed consent. In 2018 (Wave 8), surveys were conducted by site collaborators at Chongqing Medical University in face-to-face, telephone interviews, or written questionnaires that lasted 1.5 to 2 hours. Mothers, fathers, and children responded either orally or in writing.

Interviews of all family members, including children, were conducted separately so that all responses would be private. In 2020 (Wave 10), participants completed the follow-up surveys online by Qualtrics or through a mailed questionnaire due to the accommodation for the pandemic. In addition, a five-minute extra COVID-19 survey was conducted at Wave 10. All survey instruments were translated into Chinese and back-translated to ensure measurement validity. Modest financial compensation was given to the parents for their participation during the study period.

2.4 Measures

2.4.1 Adolescent Behavioral Outcomes

The 59-item Youth Self-Report (YSR) and the 52-item Young Adult Self-Report (YASR) were used in Wave 8 and Wave 10, respectively, to measure adolescents' self-reported behaviors. The YSR and YASR both include internalizing behavior subscale and externalizing behavior subscale. The internalizing behavior subscale consists of 29 items for YSR (24 for YASR) from withdrawn, somatic complaints, anxious or depressed subscales, capturing behaviors and emotions such as loneliness, nervousness, sadness, and anxiety. The externalizing behavior subscale consists of 30 items for YSR (28 items for YASR) from delinquent behavior and the aggressive behavior subscales, measuring behaviors such as lying, bullying, vandalism, disobedience, physical violence, and tantrums. All the adolescents were asked to rate whether each behavior was "not true" (coded as 0), "somewhat or sometimes true" (coded as 1), or "very or often true" (coded as 2) during the last six months. Nonresponses were coded as 0 in the scales measuring adolescent's internalizing and externalizing behaviors to address the missing data. To facilitate comparison of scores between survey waves, we calculated the total score for internalizing behavior and externalizing behavior subscales by averaging all the adolescents' responses in each subscale. The internalizing behavior scale scores (α = 0.68) and externalizing behavior scale scores (α = 0.57) demonstrated less strong reliability due to different scales used when adolescents aged 15 (Wave 8) and 17 (Wave 10). The Chinese version of Achenbach measures was used in this study in line with the official language of China.

2.4.2 Mental Health Changes and Exposure Status during COVID-19

The 6-item scale developed by the PAC team was used to measure the changes in feelings or behaviors exhibited during the pandemic as compared to prior to the outbreak of COVID-19. All the participants (parents and adolescents) rated changes in their anxiety, depression, anger, and argumentativeness from 1 (strongly disagree) to 4 (strongly agree) on a 4-point scale, for example, "I feel more anxious now than I did before the outbreak". Total score of mother-report, father-report, and adolescent-report mental health changes was respectively calculated by taking the mean of the six items (α =0.82).

In addition, one question on a 10-point scale was included to measure the overall adverse influences by the COVID-19 outbreak. All the adolescents and their parents rated how much the COVID-19 pandemic has been disruptive to daily routines, work and family life from 0 (not at all disruptive) to 9 (extremely disruptive). By taking the maximum value between mother reports and father reports, we calculated the magnitude of parental exposure to COVID-19 disruption. All adolescents were further classified into two groups given the magnitude they reported: low exposure to COVID-19 (0≤reported score≤4) and high exposure to COVID-19 (5≤reported score≤9).

2.4.3 Measurement of family characteristics

Household income, family structure, and sociodemographic information were three measures to carve the characteristics of a family.

Parents were asked to indicate which 1 of 10 gross annual income bands the household fell into based on a salary of the whole family at Wave 8 and Wave 10. The average annual household income in each year was calculated by taking the mean of mother reports and father reports. According to the Chongqing Municipal Bureau of Statistics (2020), the average disposable income per capita in 2020 was ¥30,824. We assigned Level 1-10 for household income respectively as 1 = less than ¥50,000, 2 = ¥50,001 to ¥70,000, 3 = ¥70,001 to ¥90,000, 4 = ¥90,001 to ¥110,000, 5 = ¥110,001 to ¥150,000, 6 = ¥150,001 to ¥200,000, 7 = ¥200,001 to ¥250,000, 8 = ¥250,001 to ¥300,000, 9 = ¥300,001 to ¥350,000, 10 = More than ¥350,000. In addition, parents responded the household annual income change in the last 12 months using the 5-point scale (1 = decreased more than 25%, 2 = decreased between 5 and 25%, 3 = changed less than 5%, 4 = increased between

5 and 25%, 5 = increased more than 25%). We further respectively combined subscales representing decrease and increase in the household income and finalized by three dichotomous variables—decrease, no significant change, and increase—each coded 0 if absent or 1 if present.

Family structure was measured by the question "How many adults live in your household?" and "How many children live in your household?" in the follow-up surveys responded by parents. The mean value for each answer was calculated by averaging across mother's and father's responses. In addition, parents-reported marital status by the question "How are the two parents completing the survey related?" was used to measure the type of family structure. We combined the following responses—divorced, separated, cohabiting, in a relationship but not living together—as not married and further dichotomized marital status as married (coded as 1 if present or 0 if absent). Father reports were used to prevail when the answers differed between the parents.

Sociodemographic characteristics were collected at Wave 8 and Wave 10. Youth's gender (coded 0 = female, 1 = male), age of youth, parental age, parental educational level (coded as the highest level of education attained, and measured in years), and parental employment status (coded as 0 = unemployed, 1 = employed) were self-reported by the participants.

2.5 Analysis

All analyses were performed in RStudio (Version 1.4.1103) and Stata/SE 17.0. We calculated the score of youth internalizing and externalizing behaviors in 2018 and 2020. Descriptive statistics including parent's sociodemographic background, youth characteristics, family structure, and household income were reported both in 2018 and 2020, with paired sample T-tests to measure any significant changes before and during the COVID-19 pandemic. Mean values and standard deviation (SD) were reported in the descriptive statistics and t-tests were significant at 0.05.

The magnitude of the COVID-19 disruption and mental health changes for all family members in a family was calculated. All of these COVID-19-related experiences were stratified by youth's gender and t-test was conducted to determine if a significant difference existed. In addition, the mean score of youth internalizing and externalizing behaviors was used when comparing the difference between 2018 and 2020. Youth's gender was stratified to explore the gender difference in youth internalizing and externalizing behaviors at different survey waves. Paired t-test was used to measure the change of behavioral problems between 2018 and 2020 in each subgroup (female and male) and overall study population.

The influence of COVID-19 on youth internalizing and externalizing behaviors was measured by conducting a quasi-experimental study. In the study, all adolescents were categorized into two groups—high or low exposure to the COVID-19 disruption—

to control the difference of behavioral problems between 2018 and 2020 in the low-exposed group. Linear mixed effects models were conducted to measure the impact of COVID-19 on these differences. Both numeric-coded and categorical-coded exposure status to COVID-19 were separately included in the models.

Full information maximum likelihood (FIML) estimation in multivariable regression models were used to account for the missing data and estimate the association of youth behavioral problems with parental mental health changes during COVID-19. In the model targeted on father's mental health changes, multivariable regression analyses were carried out twice to measure the direct effects and total effects, once with adjusting for the family member's mental wellness and once without. These analyses were repeated to estimate the association of youth behavioral problems with maternal mental health changes, respectively. Gender and exposure status to COVID-19 disruption were adjusted in all models above. Linear regression models with FIML estimation were further conducted to identify the predictors of parental mental health changes during the COVID-19 pandemic. Family structure and sociodemographic characteristics were separately included in the model, while annual household income was adjusted by family exposure status. Coefficients and 95% confidence interval (CI) were computed in all models and significant at p-value<0.05.

3. Results

3.1 Description of the sample

Demographic characteristics of the sample are presented in Table 1. Mothers were 45 years of age (SD = 5.54), and fathers were 48 years of age (SD = 5.48) on average in 2020. Approximately 90% of parents were married (M = 0.88, SD = 0.33). More than one-fifth of mothers were unemployed in 2020 (M = 0.79, SD = 0.41). On average, families in the sample consisted of 2.6 adults (SD = 0.84) and 1.3 children (SD = 0.61). The average level of education attained by parents was 11 years (SD = 3.41). Annual household income in CNY (Chinese yuan) was ¥106,369.5 on average in 2020 (SD = 4,915.25), and ¥113,101.5 in 2018 (SD = 3,829.53). Self-reported annual household income had significant difference between 2018 and 2020: 43% of the families reported a decrease in their annual income from 2019 to 2020, compared with 27% from 2017 to 2018 (p = 0.012).

Table 1 Descriptive Statistics of the Families in Chongqing, China: 2018 versus 2020

	Mean (SD)	
	Wave 8 (2018)	**Wave 10 (2020)**
N (families)	114	98
Youth Characteristics		
Male vs. Female	0.48 (0.50)	0.45 (0.50)
Age	15.30 (0.55)	17.3 (0.6)
Socio-demographics		
Parental Age		
Mother reports	43.09 (4.72)	45.44 (5.54)
Fathers reports	46.14 (5.08)	47.89 (5.48)
Parental Educational Level (years)		
Mother reports	11 (4.09)	10.75 (3.42)

Father reports	11.79 (3.71)	11.51 (3.40)
Employed (coded as 1, versus 0)		
Mother reports	0.83 (0.38)	0.79 (0.41)
Father reports	0.84 (0.37)	0.91 (0.28)
Family Structure		
Number of Adults in the House	2.80 (1.01)	2.60 (0.84)
Number of Children in the House	1.34 (0.56)	1.26 (0.61)
Parents are Married (coded as 1, versus 0) [a]		
Mother reports	0.92 (0.27)	0.93 (0.25)
Father reports	0.89 (0.31)	0.88 (0.33)
Household Income		
Annual Family Income (CNY ¥)	113,101.5 (3,829.53)	106,369.5 (4,915.25)
Annual Income Change		
Decreased (coded as 1, versus 0)*	**0.27 (0.45)**	**0.43 (0.50)**
No significant change (coded as 1, versus 0)**	**0.57 (0.50)**	**0.36 (0.48)**
Increased (coded as 1, versus 0)	0.12 (0.33)	0.08 (0.27)

Note: ***p<.001, **p<.01, *p<.05; [a] Here we only reported the proportion of the married parents.

3.2 Gender and COVID-19-related experience

Youth-reported disruptive influence caused by COVID-19 significantly differed in gender (p = 0.003), among which the adolescent girls rated 2.98 on average (SD = 2.02), and the adolescent boys averagely rated 2.14 (SD = 1.89) (Table 2). After dichotomizing the disruptive influence into two levels, high and low, the magnitude of exposure status did not vary as a function of gender (p = 0.433). In addition, there was an association between youth's gender and their mental health changes in 2020 (p = 0.016). COVID-19 brought more impact on mental health to adolescent girls (M = 2.00, SD = 0.58), with the comparison to adolescent boys (M = 1.73, SD = 0.50). Youth-reported mental health changes (M = 1.88, SD = 0.56) were lower than the mother's and father's mental health changes, with the average score 1.96 (SD = 0.53) and 1.94 (SD = 0.48), respectively. Parents with a daughter were more likely to experience mental health concerns than those with a son (p = 0.018), and the average score was 2.03 (SD = 0.39) and 1.82 (SD = 0.37), respectively.

Table 2 Variations of Exposure Status to the COVID-19 Disruption and Mental Health Changes by Youth's Gender

	Mean (SD)			p-value
	Female	**Male**	**Total**	
Exposure status to COVID-19				
Mother reports	2.89 (2.52)	2 (2.03)	2.91 (2.31)	0.830
Father reports	2.59 (2.04)	2.34 (1.92)	2.46 (1.97)	0.581
Youth reports	2.98 (2.02)	2.14 (1.89)	2.56 (2.00)	**0.003****
Parents combined	3.49 (2.41)	3.27 (1.92)	3.36 (2.19)	0.498
High exposure to COVID-19 Disruption†				
Youth reports	0.1 (0.30)	0.07 (0.26)	0.09 (0.29)	0.433
Mental Health Changes				
Mother reports	2.04 (0.48)	1.82 (0.51)	1.96 (0.53)	0.053
Father reports	2.00 (0.49)	1.88 (0.47)	1.94 (0.48)	0.239
Youth reports	2.00 (0.58)	1.73 (0.50)	1.88 (0.56)	**0.016***
Parents combined	2.03 (0.39)	1.82 (0.37)	1.95 (0.40)	**0.018***

Note: ***p<.001, **p<.01, *p<.05; † Coded as 1, versus 0

3.3 Gender, survey waves, and youth behavioral problems

Adolescents experienced a significant increase in internalizing behaviors scores during the outbreak of COVID-19, with a p-value at 0.002 (Table 3). Their internalizing scores in 2018 were 0.53 at average (SD = 0.32), and climbed to 0.68 in 2020 (SD = 0.48).

Variation of internalizing behavior changes by gender was found in this study. Adolescent girls were more likely to experience a significant difference in internalizing behavior scores from 2018 to 2020 (p = 0.010) than the boy subgroup (p = 0.067). In addition, adolescents reported no significant difference of externalizing behaviors between 2018 and 2020 (p = 0.317). After the stratification by gender, the relationship still persisted (p = 0.437 in female subgroup and p = 0.531 in male subgroup).

Table 3 Youth Internalizing and Externalizing Behavior Scores by Gender and Survey Waves

	Mean (SD)		p-value
	Wave 8 (2018)	**Wave 10 (2020)**	
Internalizing Behaviors (0-2 scale)			
Full sample	0.53 (0.32)	0.68 (0.48)	**0.002****
Female	0.59 (0.15)	0.75 (0.25)	**0.010***
Male	0.48 (0.17)	0.61 (0.24)	0.067
Externalizing Behaviors (0-2 scale)			
Full sample	0.27 (0.16)	0.31 (0.24)	0.317
Female	0.27 (0.15)	0.32 (0.25)	0.437
Male	0.26 (0.17)	0.30 (0.24)	0.531

Note: ***p<.001, **p<.01, *p<.05

3.4 Impact of COVID-19 disruption on youth behavioral problems

Youth internalizing behaviors increased on average after the COVID-19 pandemic began (Figure 1). Perceived COVID-19 disruption brought 0.20 increment in youth internalizing behaviors after adjusting for differences in the youth maladjustments between the high-exposed and low-exposed group in the pre-COVID wave (Table 4).

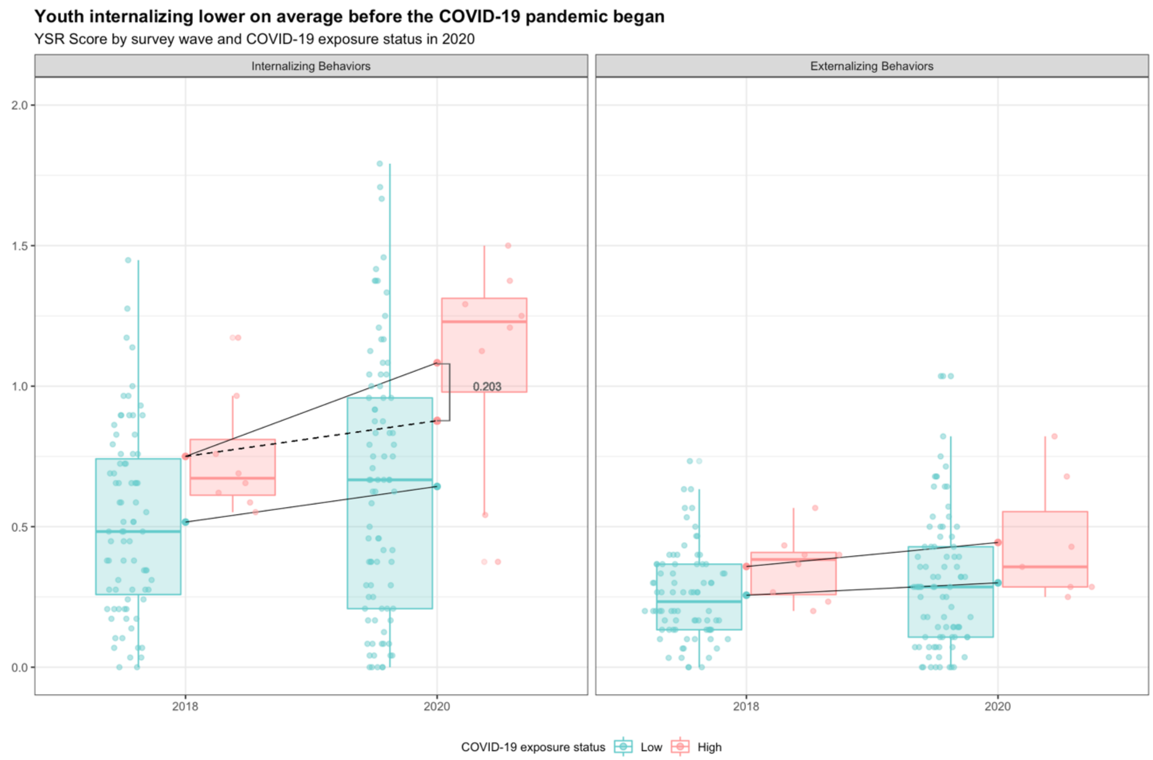

Figure 1 Variations in Youth Behavioral Problems by COVID-19 Exposure Status and Survey Waves

In addition to the dichotomized case, COVID-19 exposure status as a numeric variable in the model showed that youth-reported exposure to COVID-19 was significantly associated with internalizing behaviors ($p = 0.001$). There was a 0.02 increase in youth internalizing behaviors for every 1-unit increase in the youth-reported level of exposure status to COVID-19, which was an increase of 1% in the internalizing scores on a 0-2 scale. These findings demonstrated that the disruptive influence of

COVID-19 impacted the increase of youth internalizing behaviors. However, no similar association was found in youth externalizing behaviors. COVID-19 disruption was not associated with youth externalizing behaviors (coefficient = 0.00, p = 0.878).

Table 4 Linear Mixed Effects Modeling Estimating the Difference of Youth Behavioral Problems Pre-pandemic and During the Pandemic in China

	Internalizing Behaviors		Externalizing Behaviors	
	Coefficient (CI)	**p-value**	**Coefficient (CI)**	**p-value**
Model 1: Exposure status to COVID-19 coded as a numeric variable				
Intercept	0.37 (0.25, 0.50)	<0.001	0.24 (0.17, 0.31)	<0.001
Year 2020 vs. Year 2018	0.09 (-0.05, 0.22)	0.200	0.03 (-0.04, 0.11)	0.398
Exposure Status to COVID-19	0.07 (0.03, 0.11)	**0.001****	0.02 (-0.01, 0.04)	0.165
Survey Wave*Exposure Status	0.02 (-0.02, 0.06)	0.327	0.00 (-0.02, 0.03)	0.878
Model 2: Exposure status to COVID-19 coded as numeric coded as a dichotomized variable				
Intercept	0.52 (0.43, 0.61)	<0.001	0.27 (0.22, 0.31)	<0.001
Year 2020 vs. Year 2018	0.12 (0.04, 0.21)	**0.006****	0.03 (-0.02, 0.08)	0.178
Exposure Status to COVID-19	0.23 (-0.06, 0.52)	0.126	0.09 (-0.06, 0.24)	0.226
Survey Wave*Exposure Status	0.21 (-0.08, 0.50)	0.149	0.05 (-0.12, 0.23)	0.533

Note: ***p<.001, **p<.01, *p<.05; CI: confidence interval

3.5 Association between parental mental health and youth behavioral problems

The relationship between father's mental health and youth behavioral problems was found in this study. In the multivariable regression model (Table 5), after adjusting youth's gender and exposure status to COVID-19, paternal mental health was significantly associated with both internalizing behaviors (p = 0.020) and externalizing behaviors (p = 0.034). There was no association between maternal mental health and youth maladjustments during the COVID-19 outbreak (p = 0.756 for internalizing behaviors, and p = 0.242 for externalizing behaviors). Direct effects of father-reported mental health changes on youth internalizing behaviors were still significant after the adjustment for family members' mental health changes (mother and child). Higher mental score for fathers during the COVID-19 was associated with greater youth internalizing problems (coefficient = 0.24, p-value = 0.031). Neither total effects nor direct effects of mother's mental health was significant in the models.

Table 5 Multivariable Regression Model with FIML Estimating the Association of Youth Behavioral Problems with Parental Mental Health During COVID-19

	Internalizing Behaviors		**Externalizing Behaviors**	
	Coefficient (95% CI)	**p-value**	**Coefficient (95% CI)**	**p-value**
Model 1: Total Effects of Father-reported mental health changes				
Intercept	0.43 (-0.29, 1.15)	0.170	0.05 (-0.17, 0.27)	0.671
Female vs. Male	0.03 (-0.15, 0.21)	0.753	-0.01 (-0.10, 0.09)	0.912
Exposure to COVID-19 Disruption	0.08 (0.04, 0.12)	**<0.001*** **	0.01 (-0.01, 0.04)	0.262
Father-reported Mental Changes	0.24 (0.04, 0.44)	**0.020***	0.12 (0.01, 0.23)	**0.034***
Model 2: Total Effects of Mother-reported mental health changes				
Intercept	0.38 (0.02, 0.75)	**0.041***	0.16 (-0.04, 0.36)	0.121
Female vs. Male	0.06 (-0.12, 0.25)	0.513	0.00 (-0.11, 0.10)	0.923
Exposure to COVID-19 Disruption	0.08 (0.04, 0.13)	**<0.001*** **	0.01 (-0.01, 0.04)	0.244
Mother-reported Mental Changes	0.03 (-0.15, 0.21)	0.756	0.06 (-0.04, 0.16)	0.242
Model 3: Direct Effects of mental health changes adjusted for family members' mental health changes				
Intercept	-0.02 (-0.46, 0.43)	0.940	-0.06 (-0.29, 0.18)	0.652
Female vs. Male	0.03 (-0.15, 0.22)	0.727	-0.02 (-0.12, 0.07)	0.664
Exposure to COVID-19 Disruption	0.07 (0.03, 0.12)	**0.002****	0.00 (-0.02, 0.03)	0.768
Father-reported Mental Changes	0.24 (0.02, 0.46)	**0.031***	0.07 (-0.05, 0.19)	0.235
Mother-reported Mental Changes	-0.05 (-0.24, 0.14)	0.608	0.01 (-0.10, 0.11)	0.892
Youth-reported Mental Changes	0.07 (-0.12, 0.26)	0.493	0.11 (0.01, 0.21)	**0.026***

Note: ***p<.001, **p<.01, *p<.05; CI: confidence interval

3.6 Predictors of parental mental health

Gender of adolescents, mother's employment status, and family members' mental wellness were significant predictors of maternal mental health during the

COVID-19 (Table 6). Mother-daughter relationship exposed mothers to greater mental health risks than mother-son relationships (p = 0.046). Employed mothers were more likely to experience mental health changes after the pandemic outbreak (coefficient = 0.34, p = 0.017). Family members' mental wellness also significantly predicted mother-reported mental health changes, with p-value at 0.005 for husband and 0.001 for child. Educational level, marital status, household income, and family structure had no significant impact on maternal mental health changes during COVID-19.

Educational level, number of children in the house, mother's mental wellness, and youth mental wellness significantly predicted father-reported mental health changes since COVID-19 began. Less-educated fathers were more likely to experience elevated levels of mental health changes (coefficient = -0.04, p = 0.003). Family structure had an impact on father's mental health as a positive association of the number of children in a family was found during COVID-19 (coefficient = 0.19, p = 0.032). In line with the predictors of mother's mental health, the mental health of family members significantly predicted father's mental state. Wife and children's mental health scores positively influenced father's mental health changes during the pandemic (coefficient = 0.29, p = 0.006; coefficient = 0.34, p<0.001).

Table 6 Regression Models with FIML Estimation Predicting Risk Factors of Parental Mental Health Changes during COVID-19

	Maternal Mental Health		**Paternal Mental Health**	
	Coefficient (95% CI)	**p-value**	**Coefficient (95% CI)**	**p-value**
Intercept	1.83 (1.66, 2.00)	<0.001	1.87 (1.72, 2.03)	<0.001

Female vs. Male	0.24 (0.00, 0.47)	**0.046***	0.13 (-0.08, 0.34)	0.230
Intercept	1.91 (1.54, 2.28)	<0.001	2.45 (2.10, 2.80)	<0.001
Parental Education	0.00 (-0.03, 0.04)	0.765	-0.04 (-0.07, -0.01)	**0.003****
Intercept	1.99 (1.64, 2.33)	<0.001	1.76 (1.41, 2.10)	<0.001
Parents are Married	-0.03 (-0.40, 0.34)	0.867	0.21 (-0.16, 0.59)	0.267
Intercept	1.69 (1.44, 1.94)	<0.001	2.09 (1.86, 2.32)	<0.001
Mother-report Employment Status	0.34 (0.06, 0.61)	**0.017***	-0.18 (-0.44, 0.08)	0.164
Intercept	2.10 (1.72, 2.48)	<0.001	2.14 (1.76, 2.52)	<0.001
Father-report Employment Status	-0.16 (-0.56, 0.25)	0.451	-0.21 (-0.61, 0.18)	0.294
Intercept	1.80 (1.44, 2.15)	<0.001	2.04 (1.72, 2.35)	<0.001
Household Income	0.01 (-0.04, 0.06)	0.796	-0.03 (-0.08, 0.01)	0.166
Exposure Status to COVID-19	0.04 (-0.02, 0.10)	0.242	0.01 (-0.04, 0.06)	0.747
Intercept	1.78 (1.52, 2.05)	<0.001	1.72 (1.48, 1.95)	<0.001
Number of Children in the House	0.14 (-0.05, 0.32)	0.151	0.19 (0.02, 0.35)	**0.032***
Intercept	2.06 (1.67, 2.45)	<0.001	1.81 (1.47, 2.15)	<0.001
Number of Adults in the House	-0.04 (-0.18, 0.11)	0.878	0.05 (-0.07, 0.18)	0.410
Intercept			1.38 (0.97, 1.79)	<0.001
Mother-reported Mental Health Changes			0.29 (0.08, 0.49)	**0.006****
Intercept	1.29 (0.80, 1.77)	<0.001		
Father-reported Mental Health Changes	0.34 (0.10, 0.59)	**0.005****		
Intercept	1.31 (0.91, 1.70)	<0.001	1.29 (0.94, 1.65)	<0.001
Youth-reported Mental Health Changes	0.34 (0.15, 0.54)	**0.001****	0.34 (0.16, 0.52)	**<0.001*****

Note: ***p<.001, **p<.01, *p<.05; CI: confidence interval

4. Discussion

Findings of this study indicated a significant increase in adolescent's internalizing behaviors from before (2018) to during the pandemic (2020). This study observed the impact of the COVID-19 disruption on youth maladjustments in Chongqing, China. Furthermore, father's mental health changes during COVID-19 was associated with youth internalizing and externalizing behaviors, and this association persisted after adjusting the youth's gender and their exposure status to the COVID-19 disruption. We further explored risk factors of parental mental health changes during COVID-19 and found that youth's gender, employment status, educational level, family structure, and family members' mental wellness were significant predictors.

To our knowledge, this is the first longitudinal study in China measuring the changes in youth behavioral problems prior to and during the COVID-19 pandemic. The present findings extended cross-sectional research conducted in China by demonstrating that the severity of child internalizing problems—withdrawn, somatic, anxious, and depressed symptoms—was higher, compared to pre-pandemic (Chen et al., 2020; Du et al., 2021). These findings also corroborated previous longitudinal studies in developed countries, for example, Canada and the U.S.. (Bignardi et al., 2021; Fischer et al., 2021). In line with prior literature (e.g. Rosen et al., 2021), this study demonstrated that youth internalizing symptoms increased since the COVID-19 pandemic began. The exposure status to the COVID-19 disruption in daily life impacted the elevated levels of youth behavioral problems. However, there was no significant increment in youth externalizing behaviors prior to and during the COVID-19 in this study, which was contrary to previous findings (Achterberg et al., 2021; Cantiani et al., 2021). One possible explanation was the National College Entrance Examination (NCEE) that participants were going to have as senior-year high school students in 2020. Universities in China rely almost exclusively on NCEE scores for admission decisions (Zhang, 2016). The mounting pressure generated by NCEE could lead to more internalizing symptoms, such as depressed mood and anxious feelings, rather than externalizing problems (Lu et al., 2018; Sun et al., 2012). In particular under the context of COVID-19 where the Chinese Ministry of Education postponed the exam by 1 month, greater anxiety and depression were exhibited among senior high school students (Ma et al., 2021; Zhang et al., 2021). Thus, a significant increase in internalizing behaviors were found in this study, but not in externalizing behaviors.

Gender difference was found in youth maladjustments, exposure status to COVID-19 disruption, and mental health changes during the pandemic. Female adolescents experienced higher levels of internalizing behaviors compared to their male peers, which was in line with a hand of prior work (Abreu et al., 2021; Kostić et al., 2021; Racine et al., 2021). Female's vulnerability to negative emotions and psychological distress during the COVID-19 pandemic may be contributing factors to the increased behavioral problems (Horesh et al., 2020; Qi et al., 2020; Riecher-Rössler, 2017), which coincided with our findings that reported higher levels of disruptive influence and mental health changes faced by adolescent girls in China. More psychological vulnerability to COVID-19 among female adolescents could be explained by social isolation and academic stress (Connor et al., 2020; Dalgard et al., 2006; Ding et al., 2021). In light of school closures during COVID-19, female school-aged adolescents were less likely to access previously cultivated supportive relationships and were thrust into social isolation as schools are their primary social venue (Connor et al., 2020; Wang et al., 2021). As these adolescents were in their final year at high school, NCEE-related academic stress could lead females to display more considerable mental health challenges as well (Lu et al., 2018). Taken together, our findings highlighted the essential consequences of disproportionate responses to the threat of COVID-19 by gender.

This study investigated the relationship between parental mental health and youth maladjustments since the COVID-19 began and emphasized the father's important role in youth behavioral problems. Fathers who experienced more mental health difficulties during the pandemic referred to increased youth internalizing and externalizing problems, which supported the previous statement by Trumello et al. (2021). Importantly, elevated levels of paternal depressive and anxious behaviors could impact youth internalizing behaviors, while hostile symptoms could directly influence youth externalizing behaviors in the context of the COVID-19 pandemic (Khoury et al., 2021; Whittle et al., 2020). Compared with mothers, fathers were underrepresented in previous studies on parental mental health changes during the COVID-19 pandemic (Dubois-Comtois et al., 2021; He et al., 2021; Trumello et al., 2021). The finding in our study further underscored that childcare is also a "father issue" in China, where father's participation in child-rearing remains lacking (Li, 2020).

In contrast to past literature showing the association between maternal mental health and youth adjustments during COVID-19 (Dollberg et al., 2021; Dubois-Comtois et al., 2021; Tchimtchoua Tamo, 2020), maternal mental wellness was not linked to youth behavioral problems in the present study. This is probably due to the common patriarchal relationships among Chinese families that mothers act as a servicing role while fathers as a controlling role (Sheng, 2012). Mothers tended to display higher responsiveness and demandingness than fathers at home especially during the special period where their children faced NCEE-related stress under the pattern of online courses due to the pandemic (Quach et al., 2015; Zhang et al., 2021). Thus, maternal influence on adolescent's behavioral problems may be reduced to some degree.

This study identified distinct risk factors of paternal and maternal mental health changes during the COVID-19 pandemic. Less-educated fathers with more than one child were prone to report more mental health difficulties, which is consistent with a hand of research on father's mental health (Cameron et al., 2020; Luciano et al., 2014). Due to public health directives such as work from home and school closures, fathers with children at home reported difficulties managing multiple responsibilities within the home, including their work responsibilities, caring for young children, and home schooling (Y. Liu & Jiang, 2021). Feelings of stress were heightened when fathers had to choose between prioritizing work and parenting their children since they were unable to fully attend to either role (Dawes et al., 2021; Trumello et al., 2021). Under the universal two-child policy in China, a second child was even associated with deteriorated fathers' mental wellness since their experiences of time pressure worsened (Jia et al., 2020; Y. Liu & Jiang, 2021). This could be one mechanism explaining the association between the number of children in the household and father's mental health challenges during the COVID-19. In addition, lower levels of education would predict greater father's mental wellness, which is aligned with some observations of previous studies within the context of COVID-19 (Jia et al., 2020; Yang et al., 2020). This association possibly refers that less-educated fathers might have less access to the COVID-19-related information that appropriate to cope with their children's psychological distress and managing father-child relationship, thus the stress from which deteriorated father's mental health changes during COVID-19 (AlAzzam et al., 2021; Purba et al., 2021).

Employment status and gender of child were associated with maternal mental health during the pandemic. In line with findings from previous studies (Kotlar et al., 2021; Wei et al., 2021), employed mothers were more likely to develop psychological distress since the COVID-19 began. Compared to fathers, mothers tended to bear a more considerable burden in the division of domestic work during the COVID-19, even while still working (Zamarro & Prados, 2021). The disproportionate responsibilities for childcare and other household needs would thrust working mothers into mental health challenges during the pandemic (Almeida et al., 2020). Moreover, our finding showed that youth's gender was a predictor of maternal mental health. This is supported by past literature demonstrating the gendered theory of parenting (R. X. Liu, 2020; Y. Liu & Jiang, 2021). According to this theory, mothers tended to spend more time with their daughter and had closer affectional bonds with them (R. X. Liu, 2020). In the mother-daughter relationship, daughter's distress had negative mental consequences for mothers (Ge et al., 1995), and this association persisted in the context of COVID-19 (Ayalon & Segel-Karpas, 2022).

Spouse's and children's mental wellness were the shared factors related to parental mental health during the COVID-19 pandemic in China. Past literature showed that the severity of mental health changes was related to the family environment that emphasized subjective experiences and emotions of family members (He et al., 2021; Landesman et al., 1991). A positive family environment could play an important role in the increase of family interactions and subjective well-being during the COVID-19 pandemic (Gaxiola Romero et al., 2021), under which the positivity in a parent-child relationship could benefit both parental and youth mental health during the pandemic (Bate et al., 2021). Moreover, adequate social support provided by spouses represented a protective factor for the psychological well-being in the context of COVID-19 (Di et al., 2021; Tella et al., 2020), which corroborated by our finding that mental health changes of mothers and fathers were mutually influential.

4.1 Study strengths and limitations

The strength of this study includes the availability of longitudinal data collected prior to the outbreak of COVID and during the pandemic from adolescents and parents in China. The present findings should also be considered in light of study limitations. First, this study had a relatively small sample size. Additional significant associations—for example, between maternal mental health and youth behavioral problems—would possibly be detected in a larger sample. Second, different scales of youth internalizing and externalizing behaviors were used due to the consideration of their age at Wave 8 and Wave 10. The imperfect measurements were acknowledged due to relative low Cronbach's alpha value, although average scores of these constructs were used to compare the changes before and during COVID-19. Third, some variables not included in the models may have important effects on youth behavioral problems. For instance, household income that may have potential effects on the association between parental mental health and youth behavioral problems during the COVID-19 were not adjusted due to the concern regarding sample size; academic performance is another potential moderators to influence youth behavioral problems among school-aged adolescents, but it was not included as well due to data availability. Ranges of moderators should be expanded to understand more correlates of changes in youth maladjustments during the COVID-19 pandemic.

4.2 Implications for policy and practice

Due to the ongoing phases of the COVID-19 pandemic in China, a two-pronged approach of prevention and mitigation is needed to reduce the risk of psychological distress in adolescents while providing early interventions for those who already reported internalizing or externalizing problems to prevent an exacerbation.

First, policymakers should provide a friendly environment through mainstream media and initiate family-oriented health education organized by communities. One effective form of health education is online self-directed family-based interventions that provide parents with the materials necessary for self-learning at home. A meta-analysis conducted by Tarver et al. (2014) demonstrated that the interventions effectively reduced parental mental health difficulties as well as adolescent's internalizing and externalizing behaviors. Specifically, one of the self-directed interventions—Positive Parenting Program (Triple P) —has already been applied in China. The efficacy was proved by a randomized control trial showing the long-term effects on significant improvements in youth and parental adjustments (Guo et al., 2016).

Second, school administration should develop strategies that facilitate psychosocial support. Regular group- or class-based psychoeducation is essential to help students relieve the psychological stress in the context of COVID-19, where gender difference should be considered. Moreover, for adolescence who are going to have NCEE in 2022, targeted psychological interventions, such as the counseling service, should be provided to relieve academic stress during public health emergencies.

4.3 Implications for further research

Future work with larger samples is necessary to replicate this study. More detailed assessments of mental health changes during the COVID-19 would be used in further research to explore the undetected association between maternal mental health challenges and youth behavioral problems after the onset of the pandemic. Continued longitudinal studies are essential to identify the mechanisms that account for the elevated levels of youth internalizing and externalizing behaviors as well as parental mental health in the context of COVID-19.

5. Conclusion

To our knowledge, this is the first longitudinal study in China measuring the changes in youth behavioral problems prior to and during the COVID-19 pandemic. This study demonstrated the increment of youth internalizing behaviors between 2018 and 2020 in China and stressed the impact of COVID-19 disruption on this increase. The finding of this study investigated the relationship between parental mental health and youth maladjustments since the COVID-19 began and emphasized the father's important role in youth behavioral problems in China. Youth's gender, employment status, educational level, number of children in the house, and family members' mental wellness were significant predictors of parental mental health changes during the COVID-19. These results have important policy implications for the Chinese government to initiate family-oriented health education in a friendly environment provided through mainstream media and develop strategies that facilitate psychoeducation at school.

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