Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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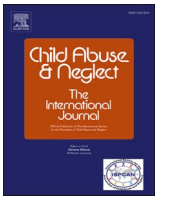

COVID-19 impacts and adolescent suicide: The mediating roles of child abuse and mental health conditions

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ABSTRACT

Background: Considerable research has established the harmful impacts of the COVID-19 pandemic on children's and adolescents' health and well-being. However, the literature has been constrained by studies using less representative samples, hindering the generalization of the findings.

Objective: This study aimed to investigate the associations of employment disruption and school closures during the pandemic with suicidal ideation and behavior in children and adolescents—and to consider the potential mediating effects of child psychological and physical abuse and subsequent mental health conditions.

Participants and setting: This study used the Adolescent Behaviors and Experiences data (n = 4692) — a nationally representative survey administered by the CDC of the United States from January to June 2021.

Methods: Logistic regression models were conducted to investigate the associations. A series of multiple mediation models were performed.

Results: School closures directly reduced child psychological and physical abuse and suicidal ideation and behavior. Employment disruption did not directly predict suicidal ideation and behavior but primarily through child abuse. Mental health's mediation role was significant in the associations between child psychological abuse and suicidal ideation and behavior, but no evidence suggested the same mediating pattern for the physical abuse-suicidal ideation and behavior relationship. Within the covariates, sexual orientation was the most consistent and highest risk factor.

Conclusions: This study contributes to current knowledge on disaster impact, child abuse, and suicidal ideation and behavior, and it can also provide policy and intervention awareness for social workers.

1. Introduction

Suicide represents a significant threat to children's and adolescents' health. According to estimates from the World Health

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Organization (WHO), suicide was the fourth leading cause of death for youth between aged 15 to 29 globally in 2019 (WHO, 2021). Data from the United States in 2019 indicated that suicide was the second leading cause of death for children aged 10 to 19 (Centers for Disease Control and Prevention, 2022; Hink, Killings, Bhatt, Ridings, & Andrews, 2022). Children and adolescents are one of the most vulnerable groups to suicide during the COVID-19 pandemic (Efstathiou et al., 2022; Farooq, Tunmore, Wajid Ali, & Ayub, 2021), and thus the ongoing COVID-19 pandemic provides a unique opportunity to identify factors that might shape suicidal ideation and behavior in children and adolescents, having implications for suicide prevention and intervention.

Despite tremendous concerns about the increased risk of suicide since the COVID-19 pandemic (Gunnell et al., 2020), there has been limited evidence about the impact of public health emergencies on suicidal ideation and behavior. In fact, a systematic review has only identified eight studies for documenting such relationships occurred before COVID-19, dispersing in the Great Influenza Epidemic (1 study), the Russian Influenza (1 study), the 2003 Severe Acute Respiratory Syndrome (four studies), Ebola (1 study) and one unidentified influenza in the United States (Zortea et al., 2021). After the outbreak of the COVID-19 pandemic, an early review indicated that the experience of difficulties during COVID-19 alone did not necessarily lead to increased suicide-related deaths in a short time (Efstathiou et al., 2022). More recent studies demonstrated that the prevalence of suicidality varied across different cultures and periods. Compared with the data before the COVID-19 pandemic, there was a decline in suicidality in Japan in early 2020, but it increased later with the lasting of the pandemic (Sakamoto, Ishikane, Ghaznavi, & Ueda, 2021; Tanaka & Okamoto, 2021). Data from South Korea showed no significant changes in suicidality before the pandemic and during 2020 and 2021 (Kim et al., 2022; Kim, Kim, Park, & Choi, 2021; Lee & Hong, 2022). Suicidality counts data from 14 states of the United States in 2021 did increase overall but decreased in Montana and Alaska (Charpignon et al., 2022). Since the COVID-19 pandemic and the countermeasures, such as social distancing and quarantine requirements, have lasted almost three years, scholars have been calling for attention to the long-term effects of COVID-19 on mental health and suicide (Efstathiou et al., 2022) and improving the well-being of vulnerable groups, such as children and adolescents and those with mental health disorders or previous suicide history (Efstathiou et al., 2022; Farooq et al., 2021).

Global evidence demonstrates that children and adolescents are among the most vulnerable groups to engage in suicidal behavior during the COVID-19 pandemic (Kim et al., 2022; Tanaka & Okamoto, 2021). Visiting records in emergency departments in parts of the United States (Hill et al., 2021) and Australia (Sara et al., 2022) indicated increased suicide ideation and attempts among children and adolescents. Also, one analysis of text from a crisis help-seeking platform in the United States before and during COVID-19 proved an increase in suicidal help-seeking, especially among children and LGBT youth (Runkle et al., 2022). In Japan, the monthly suicide rates of children and adolescents increased by 49 % between July and October 2020, compared with a 16 % overall rate of increase among the population (Tanaka & Okamoto, 2021). Considering that suicide is a leading cause of death for children and adolescents (Centers for Disease Control and Prevention, n.d.; WHO, 2021), the COVID-19 pandemic might pose extra stressors to children and adolescents, contributing to greater risk of suicidal ideation and behavior.

Disasters or pandemics can impact children and adolescents in at least three ways: the direct physical impact, the indirect impact through social or community disruptions, and the psychological influence from the negative information (Abramson, Park, Stehling-Ariza, & Redlener, 2010; Han, Petal, et al., 2021; Peek, 2008). Limited studies from SARS and Ebola showed that exposure to the pandemic, risk perception, and social disconnectedness were the primary conditions related to suicide ideation and attempts (Zortea et al., 2021). Investigation from India indicated that social media COVID-19 information exposure, fear of infection, financial strain, loneliness, social stigma-related infection and quarantine, work-related stress, lockdown-related restrictions, and unavailability of alcohol all led to possible suicide (Dsouza, Quadros, Hyderabadwala, & Mamun, 2020). The pandemic may impair children's and adolescents' mental health through stress spillover from other family members, parent-child relationship changes, and disruptions of social support (Feinberg et al., 2022; Guessoum et al., 2020; Han, Wang, et al., 2021; Qi et al., 2020, p. 19), which may trigger suicide ideation and attempts. Thus, this study aims to address the relative scarcity of research examining suicide induced by COVID-19 among adolescents.

The interpersonal theory of suicide is a useful framework for understanding the link between COVID-19 and suicidality among children and adolescents. This theory posits that perceived burdensomeness, thwarted belongingness and capacity of suicide are the factors leading to lethal suicidal behaviors (Chu et al., 2017; Van Orden et al., 2010), Except the well-established risk factors of suicide, such as the history of suicide attempts, mental health disorders, serious physical illness, substance abuse, adverse childhood experiences, the COVID-19 pandemic exerted physical infection, financial burden, social disruption, mental and behavioral problems to individuals (Efstathiou et al., 2022; Han, Fu, Liu, & Guo, 2018). Childhood abuse is associated with suicidal behaviors among the general population, and psychological abuse has the strongest effect (Liu et al., 2017). The impact on education, family and services access are the primary stressors, affecting children's and adolescents' maltreatment during COVID-19 (Katz et al., 2021). However, a recent review including 12 studies indicated that the linkage between infection of COVID-19 on suicide and self-harm cannot be inferred (Sinyor et al., 2022). Meanwhile, the association between school closures and suicide rates was insignificant, at least in Japan (Isumi, Doi, Yamaoka, Takahashi, & Fujiwara, 2020). The COVID-19 pandemic's impact on adolescent suicidality is complex. Though unemployment and school closures can be risk factors for children's and adolescents' maltreatment and suicidal behavior, the dynamics and interactions of both parents' and children's coping strategies determine the final consequence of suicidality together (Lawson, Piel, & Simon, 2020).

Based on the discussion above, we investigate the impact of COVID-19 on children's and adolescents' suicidality (intention, planning, attempt, and serious consequence) using data from a recent nationally representative sample of American children and adolescents (Adolescent Behaviors and Experiences Survey). Drawing on the interpersonal theory of suicide (Van Orden et al., 2010) and recent empirical evidence on child maltreatment and protection during COVID-19 (Katz et al., 2021), we propose a conceptual framework that the direct impact of COVID-19 — as measured by job loss among parents and children and school closures –will be

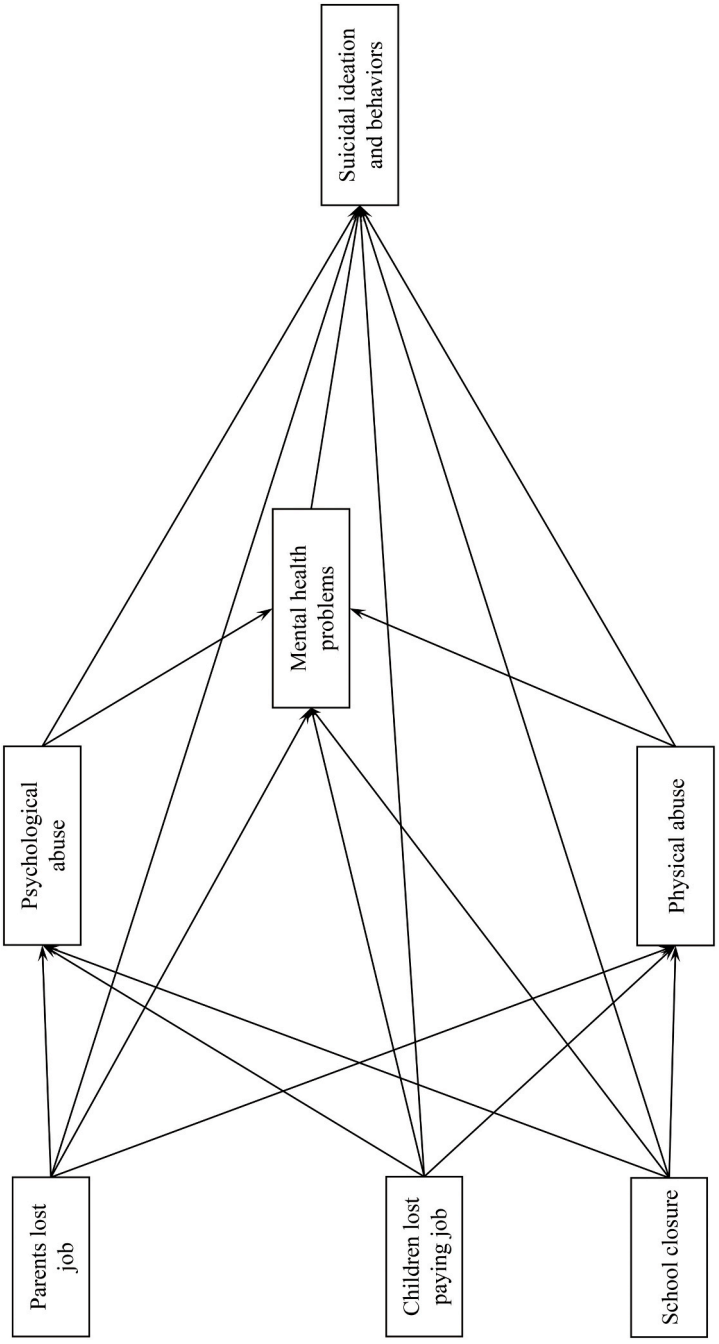

Fig. 1. Conceptual model.

linked to the domestic relations (i.e., child physical and psychological abuse) and then children's and adolescents' mental health conditions, and, in turn, leads to suicidal intentions and behaviors (Fig. 1). This study contributes to the literature by utilizing one of the most recent national surveys collected during the COVID-19 pandemic in 2021 and considering the complexity linkages in the association between the COVID-19 pandemic impact on child abuse, mental health and suicidality.

2. Methods

2.1. Data and sampling

This analysis used data from the Adolescent Behaviors and Experiences Survey (ABES) collected by the Centers for Disease Control and Prevention (CDC) of the United States between January and June 2021. The ABES survey is a web-based survey using a nationally representative sample of children and adolescents. The information was collected online because many students had to attend school virtually due to the COVID-19 pandemic. The survey covered high school students from grade 9 to 12 in all 50 States and the District of Columbia. The ABES was designed to assess the health impact of the COVID-19 pandemic on children and adolescents, and the co-

Table 1
Descriptive analysis.

Variables	N	Mean/prop.	SD	Min	Max
Suicidal behaviors					
Suicidal purpose	4692	0.21	0.41	0	1
Suicidal plan	4692	0.17	0.37	0	1
Actually attempts	4692	0.09	0.29	0	1
Suicidal consequence	4692	0.02	0.14	0	1
Parents lost job	4692	0.26	0.44	0	1
Adolescents lost paying job	4692	0.09	0.28	0	1
School closure	4692	0.21	0.40	0	1
Psychological abuse	4692	2.09	1.16	1	5
Never	1975	0.42	–	0	1
Rarely	1126	0.24	–	0	1
Sometimes	989	0.21	–	0	1
Most of the time	397	0.09	–	0	1
Always	205	0.04	–	0	1
Physical abuse	4692	1.17	0.53	1	5
Never	4143	0.88	–	0	1
Rarely	363	0.08	–	0	1
Sometimes	141	0.03	–	0	1
Most of the time	25	0.005	–	0	1
Always	20	0.004	–	0	1
Mental health problems	4692	5.85	2.32	2	10
Age	4692	15.98	1.23	12	≥18
Race					
American Indian or Alaska Native	343	0.07	–	0	1
Asian	339	0.07	–	0	1
Black or African American	827	0.18	–	0	1
Native Hawaiian or other Pacific Islander	61	0.01	–	0	1
White	3122	0.67	–	0	1
Sex					
Female	2555	0.54	–	0	1
Male	2137	0.46	–	0	1
Sexual orientation					
Not Heterosexual	1159	0.25	–	0	1
Heterosexual	3533	0.75	–	0	1
School relations	4692	3.23	1.21	1	5
Strongly disagree	559	0.12	–	0	1
Disagree	744	0.16	–	0	1
Not sure	1098	0.23	–	0	1
Agree	1661	0.35	–	0	1
Strongly agree	630	0.13	–	0	1
Family relations	4692	4.41	0.85	1	5
Never	72	0.02	–	0	1
Rarely	123	0.03	–	0	1
Sometimes	332	0.07	–	0	1
Most of the time	1445	0.31	–	0	1
Always	2720	0.58	–	0	1
Speak English well	4692	3.85	0.41	1	4
Not at all	16	0.003	–	0	1
Not well	41	0.01	–	0	1
Well	569	0.12	–	0	1
Very well	4066	0.87	–	0	1

occurrence of health risk behaviors. It followed a similar methodology design and contents to the Youth Risk Behavior Surveillance Survey (YRBSS).

According to the ABES user's manual, 7998 of the 16,037 sampled students from 128 schools returned the questionnaires, and 7705 questionnaires remained after data cleaning. A weighting variable was included to adjust the non-response and over-sampling of the Black and Hispanic students. Thus, the final sample can match the population projections for each survey year. Respondents with missing values of the variables were dropped directly, and our final analytical sample included 4692 individuals. Table 1 presents descriptive statistics of the selected variable in the analysis.

2.2. Measures

2.2.1. Suicidal ideation and behaviors

Four separate questions from the ABES survey inquired the suicidal ideation and behaviors. The respondents were asked whether they had (1) seriously considered suicide, (2) made plan about suicide, (3) actually attempted suicide, and (4) injured/poisoned or overdosed by suicide that had to be treated by a doctor. All four variables were considered dummy variables, with one as "yes" and zero as "no".

2.2.2. Child abuse

Parents' psychological abuse and physical abuse toward to the adolescents were used as the indirect impact of the COVID-19 respectively. For the psychological abuse, adolescents were asked "how often did a parent or other adult in your home swear at you, insult you, or put you down during the COVID-19 pandemic?". For the physical abuse, the question was "how often did a parent or other adult in your home hit, beat, or physically hurt you during the COVID-19 pandemic". Both psychological and physical abuse were measured on a 5-point Likert scale (1 = *never*, 5 = *always*).

2.2.3. Mental health status

Two questions were used. The adolescents were asked how often their mental health was not good in the past 30 days, and during the COVID-19 pandemic. The response to each question was measured by a 5-point Likert scale (1 = never, 5 = always), indicating the frequency of an adolescent's experience of mental health problems in the past 30 days or during the COVID-19 pandemic period. In the data analysis, the adolescents' mental health status in the past 30 days and during the COVID-19 period were combined as one variable and the sum was used as an indicator of the mental health status (Cronbach's alpha = 0.86).

2.2.4. COVID-19 impacts

Three variables were included as the direct impact of the COVID-19 pandemic: job loss of parents, the job loss of adolescents, and school closures. The respondents were asked whether they had lost their paying job, even for a short time, during COVID-19 (0 = *no*, 1 = *yes*) and whether their parents had lost their paying jobs during COVID-19. Since the ABES did not ask about school closures directly, we generated one variable from responses to the question, "During the past 12 months, have you ever been bullied on school property?". There are three options to this question, "I have not attended school in-person during the past 12 months," "yes," and "no," and thus we treated respondents who chose "not attended school in-person" as the ones who experienced school closures, and all the others as not experienced.

2.2.5. Covariates

We included seven control variables. Two variables measured the adolescents' closeness to their parents and people in school and five were demographic attributes. The two questions about their social relations were "do you agree or disagree that you feel close to people at your school?" and "how often do your parents or other adults in your family know where you are going or with whom you will be?", and the answers to both questions were measured by five-point Likert scale. The demographic variables were (1) English proficiency (1 = *not at all*, 4 = *very well*), (2) age, (3) race (1 = *White*, 2 = *American Indian or Alaska Native*, 3 = *Asian*, 4 = *Black or African American*, 5 = *Native Hawaiian or other Pacific Islander*), (4) sex (0 = *female*, 1 = *male*), and (5) sexual orientation (0 = *heterosexual*, 1 = *non-heterosexual*).

2.3. Data analysis

We used logistic regression models to investigate the associations between COVID-19 impact, child abuse, mental health and suicidal behaviors, and multiple mediation models with bootstrap resampling method were employed (Hayes, 2017). All models controlled for age, race, sex, and sexual orientation. The data were cleaned and recoded using Stata/SE version 15.0, and the logistic regression models and multiple mediation models were conducted by Mplus version 8.0 and PROCESS macro in SPSS version 25.

3. Results

Table 1 presented the means (proportion), standard deviations, and range of all variables. More than one-fifth (21 %) of the respondents had seriously considered suicide during COVID-19, 17 % of them had made plans for suicide, nearly one in ten (9 %) had actually attempted to suicide once or more, and about 2 % had been injured and to be treated by medical professionals due to their suicidal behaviors. On average, 26 % of the respondents reported that at least one of their parents lost a job during COVID-19, and 9 %

reported that they had lost a paying job themselves, 21 % of them had to stay at home for school during the pandemic. 3 %, 0.5 %, 0.4 % of the respondents had been physically abused by their parents "sometimes" "most of the time" and "always" respectively. Similarly, 21 %, 9 %, 4 % reported that they were "sometimes" "most of the time" or "always" mentally abused. The mean score of self-reported mental health problems among adolescents was 5.85.

Regarding the demographic attributes and social relations, 46 % of the respondents were male, 25 % indicated that they were non-heterosexual, 33 % of them were minorities, and the average age was 15.98 years old. About 1.3 % reported that they did not speak English well, 28 % indicated that they did not have a good relation with people in school, while 5 % said they did not have a good communication with their parents.

3.1. Direct effects of COVID-19 impacts on parental abuse and mental health

As shown in Table 2, both jobs losing of parents ($\beta = 0.18$, $SE = 0.04$, $p < 0.01$) or adolescents themselves ($\beta = 0.26$, $SE = 0.06$, $p < 0.01$) were correlated to the increase of parental psychological abuse within family, with similar results observed for physical abuse. Moreover, parental psychological abuse increased the mental health burdens ($\beta = 0.64$, $SE = 0.03$, $p < 0.01$), while no significant association was observed between physical abuse and mental health problems. When both the COVID-19 impact and parental abuse included in models when the mental health status were used as dependent variables, the parents' loss of jobs were still positively correlated with poor mental health status ($\beta = 0.27$, $SE = 0.06$, $p < 0.01$), while the loss of jobs for the adolescents themselves' effect became non-significant. The school closure was negatively associated with parental psychological abuse ($\beta = -0.23$, $SE = 0.04$, $p < 0.01$) and physical abuse ($\beta = -0.07$, $SE = 0.02$, $p < 0.01$) at home, but they did not have significant impacts on mental health status.

3.2. Direct effect of parental abuse and mental health on suicidal ideation and behaviors

Both parental psychological abuse and physical abuse were directly and positively associated with all the suicidal measures, including the suicidal intention (psychological: $\beta = 0.36$, $SE = 0.04$, $p < 0.01$; physical: $\beta = 0.42$, $SE = 0.08$, $p < 0.01$), making suicidal

Table 2
Direct effects of family employment status, school closure and mental health on suicidal behaviors.

Predictors	Parents psychological abuse	Parents physical abuse	Mental health problems	Suicidal purpose	Suicidal plan	Actually attempts	Suicidal consequence
Mental health problems				0.52*** (0.03)	0.42*** (0.03)	0.42*** (0.04)	0.37*** (0.07)
Psychological abuse			0.64*** (0.03)	0.36*** (0.04)	0.37*** (0.04)	0.27*** (0.06)	0.22* (0.12)
Physical abuse			0.04 (0.06)	0.42*** (0.08)	0.36*** (0.08)	0.58*** (0.09)	0.33** (0.13)
Parents lost job	0.18*** (0.04)	0.09*** (0.02)	0.27*** (0.06)	−0.04 (0.10)	0.08 (0.10)	0.04 (0.13)	0.48** (0.23)
Children lost paying job	0.26*** (0.06)	0.10*** (0.03)	0.14 (0.10)	0.07 (0.15)	−0.09 (0.16)	0.05 (0.19)	0.12 (0.33)
School closure	−0.23*** (0.04)	−0.07*** (0.02)	0.01 (0.07)	−0.31*** (0.11)	−0.31** (0.12)	−0.83*** (0.17)	−1.33*** (0.44)
Race (White as reference)				0.03 (0.04)	0.06 (0.04)	0.11** (0.05)	0.08 (0.09)
American Indian or Alaska Native				0.08 (0.14)	0.28* (0.15)	0.18 (0.19)	0.13 (0.39)
Asian				−0.15 (0.15)	0.01 (0.16)	−0.24 (0.22)	−1.25* (0.74)
Black or African American				−0.30*** (0.11)	−0.20* (0.12)	−0.06 (0.15)	−0.13 (0.31)
Native Hawaiian or other Pacific Islander				0.02 (0.32)	0.20 (0.34)	0.22 (0.46)	0.72 (0.75)
Gender (female as reference)				0.21** (0.10)	0.08 (0.11)	−0.29** (0.14)	−0.32 (0.28)
Age				−0.02 (0.04)	−0.01 (0.04)	−0.06 (0.05)	0.02 (0.10)
Sexual orientation (heterosexual as reference)				0.77*** (0.09)	0.82*** (0.10)	0.56*** (0.12)	0.60** (0.25)
Speak English well				0.14 (0.11)	0.09 (0.11)	−0.12 (0.13)	0.01 (0.22)
School relations				−0.15*** (0.04)	−0.18*** (0.04)	−0.16*** (0.05)	−0.14 (0.09)
Family relations				−0.17*** (0.05)	−0.22*** (0.05)	−0.31*** (0.06)	−0.39*** (0.11)
N	4692	4692	4692	4692	4692	4692	4692

Notes: Standard errors in parentheses.
* $p < 0.10$.
** $p < 0.05$.
*** $p < 0.01$.

plan (psychological: $\beta = 0.37$, $SE = 0.04$, $p < 0.01$; physical: $\beta = 0.36$, $SE = 0.08$, $p < 0.01$), actually attempts (psychological: $\beta = 0.27$, $SE = 0.06$, $p < 0.01$; physical: $\beta = 0.58$, $SE = 0.09$, $p < 0.01$), and seriously injury consequence from suicidal behavioral (psychological: $\beta = 0.22$, $SE = 0.12$, $p < 0.10$; physical: $\beta = 0.33$, $SE = 0.13$, $p < 0.05$). Mental health problems were also positively correlated to all the suicidal measures. Mental health issue predicted higher suicidal intention ($\beta = 0.52$, $SE = 0.03$, $p < 0.01$), suicidal plan ($\beta = 0.42$, $SE = 0.03$, $p < 0.01$), actually attempts ($\beta = 0.42$, $SE = 0.04$, $p < 0.01$), and seriously consequence ($\beta = 0.37$, $SE = 0.07$, $p < 0.01$).

3.3. Mediation effects of parental abuse and mental health

We used the bootstrap sampling method to examine the multiple mediation effects of parental abuse and adolescents' mental health problems. The indirect effects of parents' job losses, the adolescents' job loss, the school closure on the four dependent measures of suicidal intention and behaviors, through parental abuse and mental health status were tested.

As shown in Table 3 and Fig. 2, both parental psychological abuse and physical abuse mediated the associations between both parental and adolescent's job losses, school closure and all the four suicidal measures, the suicidal intention, suicidal plan, actually attempts, and suicidal consequences, except that adolescent's job losses on suicidal consequences via parental psychological abuse was not confirmed. Also, mental health measures mediated the associations between parental job loss and all the four suicidal measures. Meanwhile, multiple mediation effects between COVID-19 impact and adolescent suicidal measures were observed, e.g., parental job loss → psychological abuse of children → poor mental health status → suicidal measures. The full mediation pathways visualization for the four suicidal ideation and behaviors can be found in Fig. 2.

3.4. The roles of covariates on suicidal measures

Overall, sexual orientation was a risk factor of suicidal intention and behaviors among adolescents, while the family and school relations were protective factors (Table 2). The gender, age, race, English proficiency's effects were not significant. Compared with their heterosexual peers, the non-heterosexual adolescents had 109 %, 123 %, 52 %, 63 % higher probability of having suicidal intention ($\beta = 0.77$, $SE = 0.09$, $p < 0.01$), making suicidal plan ($\beta = 0.82$, $SE = 0.10$, $p < 0.01$), trying actually actions ($\beta = 0.56$, $SE = 0.12$, $p < 0.01$), and being injured due to suicidal actions ($\beta = 0.60$, $SE = 0.25$, $p < 0.05$) respectively. Better family relations can reduce the probability of having suicidal intention ($\beta = -0.17$, $SE = 0.05$, $p < 0.01$), making suicidal plan ($\beta = -0.22$, $SE = 0.05$, $p < 0.01$), trying actually actions ($\beta = -0.31$, $SE = 0.06$, $p < 0.01$), and being injured ($\beta = -0.39$, $SE = 0.11$, $p < 0.01$). The school relation can

Table 3
Indirect effects of family employment status and school closure on suicidal behaviors via mental health.

Predictors	Suicidal purpose		Suicidal plan		Actually attempts		Suicidal consequence	
	B (SE)	95 % CI	B (SE)	95 % CI	B (SE)	95 % CI	B (SE)	95 % CI
Parents lost job → psychological abuse → outcome	0.06 (0.02)*	0.04, 0.10	0.07 (0.02)*	0.04, 0.10	0.05 (0.01)*	0.02, 0.08	0.04 (0.02)*	0.002, 0.09
Parents lost job → physical abuse → outcome	0.04 (0.01)*	0.02, 0.06	0.03 (0.01)*	0.01, 0.06	0.05 (0.01)*	0.03, 0.08	0.03 (0.02)*	0.003, 0.06
Parents lost job → mental problems → outcome	0.14 (0.03)*	0.08, 0.21	0.11 (0.03)*	0.06, 0.17	0.11 (0.03)*	0.06, 0.17	0.10 (0.03)*	0.05, 0.17
Parents lost job → psychological abuse → mental problems → outcome	0.06 (0.01)*	0.04, 0.09	0.05 (0.01)*	0.03, 0.07	0.05 (0.01)*	0.03, 0.07	0.04 (0.01)*	0.02, 0.07
Parents lost job → physical abuse → mental problems → outcome	0.00 (0.00)	−0.004, 0.01	0.00 (0.00)	−0.003, 0.01	0.00 (0.00)	−0.003, 0.01	0.00 (0.00)	−0.003, 0.01
Children lost job → psychological abuse → outcome	0.09 (0.03)*	0.05, 0.14	0.09 (0.03)*	0.05, 0.15	0.07 (0.02)*	0.03, 0.12	0.06 (0.03)	−0.001, 0.13
Children lost job → physical abuse → outcome	0.04 (0.02) *	0.01, 0.08	0.04 (0.02) *	0.01, 0.07	0.06 (0.02) *	0.02, 0.10	0.03 (0.02)*	0.002, 0.08
Children lost job → mental problems → outcome	0.07 (0.06)	−0.04, 0.19	0.06 (0.04)	−0.03, 0.15	0.06 (0.05)	−0.03, 0.15	0.05 (0.04)	−0.03, 0.15
Children lost job → psychological abuse → mental problems → outcome	0.09 (0.02)*	0.04, 0.13	0.07 (0.02)*	0.04, 0.11	0.07 (0.02)*	0.03, 0.11	0.06 (0.02)*	0.03, 0.11
Children lost job → physical abuse → mental problems → outcome	0.0 (0.00)	−0.004, 0.01	0.00 (0.00)	−0.003, 0.01	0.00 (0.00)	−0.004, 0.01	0.00 (0.00)	−0.003, 0.01
School closure → psychological abuse → outcome	−0.08 (0.02)*	−0.12, −0.05	−0.08 (0.02)*	−0.12, −0.05	−0.06 (0.02)*	−0.10, −0.03	−0.05 (0.03)*	−0.10, −0.001
School closure → physical abuse → outcome	−0.03 (0.01) *	−0.05, −0.01	−0.03 (0.01) *	−0.05, −0.01	−0.04 (0.01)*	−0.07, −0.02	−0.02 (0.01)*	−0.05, −0.002
School closure → mental problems → outcome	0.01 (0.04)	−0.07, 0.08	0.00 (0.03)	−0.05, 0.06	0.00 (0.03)	−0.05, 0.06	0.00 (0.03)	−0.05, 0.06
School closure → psychological abuse → mental problems → outcome	−0.08 (0.01)*	−0.11, −0.05	−0.06 (0.01)*	−0.08, −0.04	−0.06 (0.01)*	−0.09, −0.04	−0.05 (0.02)*	−0.09, −0.03
School closure → physical abuse → mental problems → outcome	−0.002 (0.00)	−0.01, 0.003	−0.001 (0.00)	−0.01, 0.002	−0.001 (0.00)	−0.01, 0.002	−0.001 (0.00)	−0.01, 0.002

Notes: Bias-corrected 95 % confidence intervals based on 5000 bootstrap samples.
* CI did not encompass zero, indicating mediation is assumed.

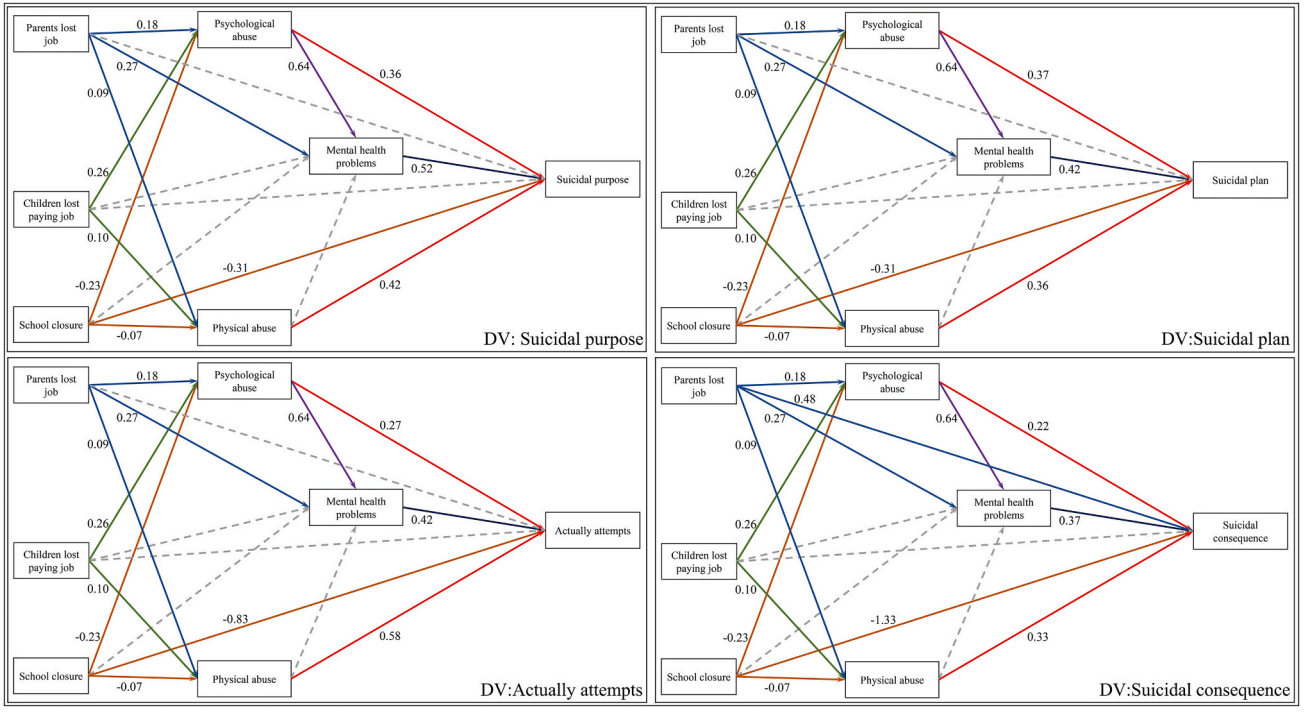

Fig. 2. Structural models of the multiple mediations.
Notes: Insignificant paths are shown as dashed lines. The effects of covariates on explanatory variables and mediators are omitted.

also reduce the suicidal intention ($\beta = -0.15$, $SE = 0.04$, $p < 0.01$), suicidal plan ($\beta = -0.18$, $SE = 0.04$, $p < 0.01$), and actually attempts ($\beta = -0.16$, $SE = 0.05$, $p < 0.01$), but not the consequence of being injured.

4. Discussion

Suicide has become the second leading cause of death among adolescents aged 15 and 19 in the United States (Shain et al., 2016). This study investigated the COVID-19 impacts on children's and adolescents' suicidal behaviors using the ABES data collected by CDC in 2021. Though the ABES data collected in 2021 is not comparable to previous YRBS data due to different modes of data collection (web-based vs. paper and pencil) and settings (out-of-school vs. in-school), we can see significant increases in all the suicide measures in the 2021 ABES data, compared to the 2019 YRBS data (Supplement 1).The potential mediating pathways underlying the link between the COVID-19 impact, child abuse, mental health status, and suicidal behaviors were examined. This study improves our understanding of adolescents' suicidal behaviors during the pandemic or harsh situations in the following aspects.

First, different types of COVID-19 impact have varied effects on adolescents' suicidal behaviors. We included job loss of parents, job loss of children, and school closures as measures of the COVID-19 impact on adolescents and their families. School closures can directly reduce all four suicidal behaviors (intention, planning, attempts, and severe consequence) and child physical and psychological abuse. In contrast, the direct associations between the unemployment experience of both parents and adolescents and suicidal behaviors were insignificant. However, both the job loss experience of parents and children can increase suicidal behaviors through child abuse. Unlike the claims that school closures can increase potential parent-child conflict (Griffith, 2020), this analysis revealed that school closures may reduce adolescents' suicidal behaviors because they have to spend more time with families. The economic strains caused by job loss could elevate the risk of suicidal behaviors in children and adolescents and child abuse. This finding is consistent with previous studies, showing that physical isolation and unemployment due to the pandemic are positively linked to parent-child conflict and child abuse (Griffith, 2020; Lawson et al., 2020; Lee, Ward, Lee, & Rodriguez, 2021).

Second, physical or psychological child abuse is associated with a higher likelihood of all four suicidal behavior measures. Psychological abuse can also increase suicidal behaviors by affecting mental health status, but the association between physical abuse and mental health problems was insignificant. Indeed, child abuse is a high-risk factor for children's and adolescents' suicide (Bridge, Goldstein, & Brent, 2006; Wagner, 1997), yet the strength of this association has not been adequately studied in the context of COVID-19 (Hoekstra, 2020). Furthermore, this study demonstrated that psychological abuse hurts children and adolescents more than physical abuse in terms of suicidal intention, suicidal planning, and suicidal consequence. Since psychological abuse is more invisible, children's protection policy and social worker interventions should pay more attention to this issue, especially during a crisis.

Third, our findings demonstrated that LGBTQ (Lesbian, Gay, Bisexual, Transgender, and Questioning) adolescents had a much higher risk of conducting suicidal behaviors compared with their heterosexual peers, which aligns with previous studies conducted during normal times (Russell & Joyner, 2001). However, the risk was much higher in our analysis since the LGBTQ rights and vulnerability to the crisis has rarely investigated. More studies should be conducted in future as it's very important for policymakers and social workers to be aware the vulnerability of such group.

This study has two main limitations. First, we could not make causal inferences because this is a cross-sectional study. Second, although the ABES has similar contents to the Youth Risk Behavior Survey (YRBS) series, they are not comparable to the pre-COVID-19 situation because the data collection methods (web-based vs. paper-and-pencil) and settings (out-of-school vs. in-school) are different.

5. Conclusion

This study investigated the linkage between COVID-19 impact, child abuse, mental health status, and suicidal behaviors using representative and updated national data collected by the CDC of the United States. School closures can reduce child psychological and physical abuse, and the likelihood of suicide directly, but school closures are not directly linked to poor mental health. The job loss of parents and children themselves does not directly predict a higher likelihood of suicide, but they can impact suicidal behaviors through child abuse — both psychological and physical. Parents' job loss can also increase suicidal behaviors through poor mental health.

Supplementary data to this article can be found online at https://doi.org/10.1016/j.chiabu.2023.106076.

Data availability

Data is publicly available at CDC's website (https://www.cdc.gov/healthyyouth/data/abes/data.htm).

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