Crisis response among essential workers and their children during the COVID-19 pandemic

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ABSTRACT

Limited research has been conducted on the mental health concerns of frontline and essential workers and their children during the COVID-19 pandemic in the United States (U.S.). This study examined the association between working on the frontlines in the U.S. during the COVID-19 pandemic (March to July 2020) and personal crisis text concerns (e.g., self-harm, suicidal thoughts, anxiety/stress, and substance abuse) for frontline essential workers and the children of frontline workers. We used a novel data set from a crisis texting service, Crisis Text Line (CTL), that is widely used throughout the U.S. Generalized Estimating Equations examined the individual association between eight specific crisis types (Depression, Stress/Anxiety, Self-Harm, Suicidal Thoughts, Substance Abuse, Isolation, Relationship Issues, and Abuse) and being in frontline work or being a child of a frontline worker during the early phase of the pandemic. Using CTL concerns as a proxy for the prevalence of mental health issues, we found that children of workers, specifically the youngest demographic (13 years and under), females, and non-conforming youth had a higher risk of specific crisis events during the COVID-19 pandemic. Additionally, Hispanic children of workers reported higher rates of stress/anxiety, whereas African American children of workers had higher rates of abuse and depression. Frontline workers had a higher risk of suicidal thoughts, and the risk of crisis events was generally highest for non-binary, transgender, and male users. Increases in CTL usage among frontline workers were noted across 7–28 days after spikes in local COVID-19 cases. The research to date has focused on the mental health of frontline essential workers, but our study highlights troubling trends in psychological stress among children of these workers. Supportive interventions and mental health resources are needed not only for frontline essential workers, but for their children too.

1. Introduction

In the U.S., little research has been conducted on the mental health of frontline essential workers during the COVID-19 pandemic. Nearly a third of the essential workforce is comprised of healthcare workers (McNicholas and Poydock, 2020), whereas others serve as non-health workers (e.g., agriculture, police, food production, or essential manufacturing). Prior research from China, Brazil, and Italy has shown that workers are at risk for developing many adverse mental health symptoms during the pandemic, including anxiety, depression, emotional distress, sleep problems, and substantially higher levels of perceived stress (Lai et al., 2020a, Lai et al., 2020b, Rossi et al., 2020, Kang et al., 2020, De Boni et al., 2020). Essential workers shoulder a high psychological burden from the pandemic due to excessive workload, insufficient personal protective equipment, worries about infecting family members, economic concerns, and inadequate social support (Lai et al., 2020a, Lai et al., 2020b, Spoorthy et al., 2020, McCormack et al., 2020).

Children of frontline essential workers also face additional challenges from the ongoing COVID-19 pandemic. The impact of school closures, economic uncertainty, and the stress of parental health may create or exacerbate ongoing mental health conditions. In the U.S., the proportion of all emergency department visits for children's mental health-related concerns increased, reaching high levels from late March to October 2020 (Leeb et al., 2020). In China, anxiety, depression, and stress were common among children and adolescents during quarantine

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and government closures due to COVID-19 (Tang et al., 2020, Duan et al., 2020a, Duan et al., 2020b, Xie et al., 2020). To date, little research has explored the mental health impacts on frontline essential workers' children or the impacts on workers in the U.S. (Dubey et al., 2020). Furthermore, no studies have used digital platforms that passively collect data on mental well-being outside of Google search trends (Ayers et al., 2020, Stijelja and Mishara, 2020, Halford et al., 2020a, Halford et al., 2020b) to examine the mental health impacts of the early part of the pandemic in frontline essential workers and their children.

Although addressing the needs and health concerns of frontline essential workers during the COVID-19 pandemic is a high research priority (Holmes et al., 2020), data to inform such efforts are scarce and often limited to cross-sectional surveys administered to large populations in a single geographical area (Spoorthy et al., 2020; De Boni et al., 2020; Lai et al., 2020a; Lai et al., 2020b). This study leveraged data from Crisis Text Line (CTL), a national crisis text platform for individuals in crisis, to investigate the mental health outcomes among frontline essential workers and the children of workers. Our study examined the association between working on the frontlines in the U.S. during the COVID-19 pandemic (March to July 2020) and personal crisis text concerns (e.g., self-harm, suicidal thoughts, anxiety/stress, and substance abuse) for frontline essential workers and the children of frontline workers. We also investigated how individual crisis events compare to underlying COVID-19 rates. Results will provide insight into the emotional and mental effects of the pandemic on vulnerable frontline workers and their families.

2. Methods

2.1. Participant data

Daily anonymized crisis text data from CTL, a U.S.-based not-for-profit organization that offers free 24/7 text-based service for people in crisis, were used in this analysis. Many CTL users are adolescents and young adults seeking crisis support counseling (Thompson et al., 2018), but the service is provided to all age groups. At the end of each crisis conversation, texters are invited to participate in a survey that collects demographic data, including whether they are frontline essential workers, children of frontline essential workers, or none of the above. Only conversations among participants who answered the survey question about frontline essential workers' status were included in the analysis. The analysis included three groups from March 13 to July 20, 2020: 1) frontline essential workers ($n = 4835$ conversations); 2) children of frontline essential workers ($n = 7749$ conversations), and 3) texters who did not identify as an essential/frontline worker ($n = 12720$ conversations) or child of a frontline/essential worker ($n = 9976$).

2.2. Crisis response outcomes

Daily text conversations flagged for anxiety/stress (yes/no), depression (yes/no), suicidal thoughts (yes/no), isolation (yes/no), relationship issues (yes/no), substance abuse (yes/no), and abuse (yes/no) were included as separate outcomes in the analysis. Categories of the crisis conversations were based on CTL's machine learning algorithm and tags from crisis counselors, which have been used in previous publications (e.g., Larsen et al., 2019; Sugg et al., 2019; Runkle et al., 2020). All CTL conversations were assigned to an area code, prefixed to each telephone number issued in its service areas.

2.3. Potential covariates and COVID-19 rates

Research shows that mental health in young people differs across age, racial/ethnic, gender, and sexual orientation groups (Gunnell et al., 2018; Golberstein et al., 2020; Srivastava et al., 2020). The following were included as covariates in the analysis: age (13 years and under, 14 to 24 years, 25 to 44 years, 45 to 64 years, and 65 years and older); race/

ethnicity (White, Black or African American, American Indian/Alaska Native, Asian, Hispanic, Mixed Race, No Response, Other, Prefer not to answer); and gender orientation (female, male, no response, non-binary, transgender, other).

2.4. Statistical analysis of crisis events

To adjust for repeated text conversations for each CTL user, we fit logistic regression models using generalized estimating equations (GEE) to estimate adjusted odds ratios (aOR) and 95% Confidence Intervals (CIs) for each crisis response outcome separately (e.g., stress/anxiety, depression). The covariance structure was selected as AR1 to account for the clustering of repeated texting conversations over time using an actor ID (a unique ID for each CTL user) and was determined using the smallest Quasi Information Criterion (QICu) (Hardin, 2005). Covariates included in the model were age group, race/ethnicity, sexual orientation, and gender identity. GEE logistic regression models were estimated for the following groups: frontline essential workers compared to adults (non-frontline workers) and children of frontline workers compared to children (non-frontline workers).

2.5. Statistical analysis of crisis events and underlying COVID-19 rates

We conducted a separate secondary analysis to examine the effects of the COVID-19 rates in the surrounding residential area on the mental health status of workers. Daily counts of COVID-19 cases for each U.S. county from March 23rd, 2020 (the first available date) through July 20th, 2020 were matched using CTL-participant area code data (Elfelt, 2020a, Elfelt, 2020b). As CTL crisis event data were available at the area-code-level (i.e., large irregular spatial boundary) rather than county-level, the daily maximum county-level COVID-19 cases within each area-code spatial unit were used as a proxy for the underlying COVID-19 cases in the community. Although the area code is not an ideal spatial boundary, our analysis provides a first step in the understanding of how high COVID-19 burden may influence crisis events among workers and their children.

Poisson mixed-effect models were used to examine the effect of county-level COVID-19 rates on individual crisis response outcomes with area code as a random intercept. The association between daily COVID-19 rates and crisis response was investigated at the daily time scale, using a 7-day lag, 14-day lag, and 21-day lag. Results were examined at the national level and for New York (NY), which was an early emerger for the COVID-19 pandemic. For the NY analysis, we used a restricted temporal period with high-CTL usage (April 10 to June 20) among workers and their children (Supplemental Fig. 1). The significance level for all analyses was set at α = 0.05, and all tests were 2-tailed. All analyses were performed in R using the package *geepack, tableone,* and *lme4* (Højsgaard et al., 2006, Yan and Fine, 2004, R Core Team, 2020), and tables were created using *sjPlot* (Lüdecke, 2020). This study was deemed exempt by the institutional review board at App State (#19-0270).

3. Results

During the pandemic, a total of 3045 workers and 4021 children of workers engaged with the crisis service, resulting in 4835 and 7749 conversations, respectively. Active rescues (i.e., initiation of emergency services) were more common among workers themselves (0.7%) than children of frontline workers (0.2%) and non-workers (0.2%) (Table 1). Children of essential workers demonstrated higher and more frequent engagement with the CTL service than workers for all crisis concerns except bereavement (5.4% for workers, 5.0% for children), substance abuse (2.9% for workers, 1.5% for children), stress/anxiety (47.1% for workers, 39.9% for children), and mentioning of COVID-19 (16.3% for workers, 9.6% for children) (Table 2). Compared to other child texters, children of frontline workers were more likely to experience

Table 1
Descriptive Statistics of CTL users who responded to survey questions on their status as frontline or essential workers or a child of frontline or essential worker from March 23 to July 20, 2020.

	Strata	Yes, I am an essential/ frontline worker	Non-frontline workers	Yes, my parent(s) is an essential/ frontline worker	Non-frontline children
		$n = 4835$	$n = 12,720$	$n = 7749$	$n = 9976$
Conversation number (mean (SD))		2.32 (5.38)	3.72 (11.22)	2.77 (4.91)	3.05 (5.92)
Active rescue* (%)	No	4802 (99.3)	12,689 (99.8)	7730 (99.8)	9948 (99.7)
	Yes	33 (0.7)	31 (0.2)	19 (0.2)	28 (0.3)
Imminent risk** (%)	No	4777 (98.8)	12,542 (98.6)	7575 (97.8)	9738 (97.6)
	Yes	58 (1.2)	178 (1.4)	174 (2.2)	238 (2.4)
Month (%)	March	39 (0.8)	183 (1.4)	70 (0.9)	125 (1.3)
	April	1202 (24.9)	3134 (24.6)	1908 (24.6)	2368 (23.7)
	May	2216 (45.8)	5738 (45.1)	3376 (43.6)	4492 (45.0)
	June	1151 (23.8)	2999 (23.6)	1930 (24.9)	2417 (24.2)
	July	227 (4.7)	666 (5.2)	465 (6.0)	574 (5.8)
Race (%)	African American	565 (11.7)	1287 (10.1)	795 (10.3)	964 (9.7)
	American Indian / Alaska native	132 (2.7)	304 (2.4)	259 (3.3)	284 (2.8)
	Asian	164 (3.4)	747 (5.9)	394 (5.1)	630 (6.3)
	Hispanic	539 (11.1)	1655 (13.0)	1189 (15.3)	1582 (15.9)
	Mixed race	85 (1.8)	256 (2.0)	176 (2.3)	248 (2.5)
	No response	804 (16.6)	2118 (16.7)	1310 (16.9)	1469 (14.7)
	Other	42 (0.9)	75 (0.6)	27 (0.3)	65 (0.7)
	Prefer not to answer	220 (4.6)	535 (4.2)	342 (4.4)	415 (4.2)
	White	2284 (47.2)	5743 (45.1)	3257 (42.0)	4319 (43.3)
Gender (%)	Female	2972 (61.5)	8137 (64.0)	5265 (67.9)	6590 (66.1)
	Male	851 (17.6)	1763 (13.9)	576 (7.4)	1162 (11.6)
	No response	721 (14.9)	1930 (15.2)	1098 (14.2)	1290 (12.9)
	Non-binary	20 (0.4)	82 (0.6)	81 (1.0)	120 (1.2)
	Other	210 (4.3)	539 (4.2)	498 (6.4)	522 (5.2)
	Transgender	61 (1.3)	269 (2.1)	231 (3.0)	292 (2.9)
Age (%)	13 and under	N/A	N/A	1480 (19.1)	1929 (19.3)
	14–24	1977 (40.9)	8047 (63.3)	5224 (67.4)	8047 (80.7)
	25–44	2174 (45.0)	3379 (26.6)	0 (0.0)	0 (0.0)
	45–64	535 (11.1)	1126 (8.9)	0 (0.0)	0 (0.0)
	65+	32 (0.7)	168 (1.3)	0 (0.0)	0 (0.0)
	Not available	117 (2.4)	0 (0.0)	1045 (13.5)	N/A

* An active rescue is an event in which the CTL supervisor was unable to de-escalate and help a texter in crisis to disconnect from the means of harm and work towards a safety plan, which involves contact with emergency services. These CTL users are at the *highest risk* of harming themselves. Less than 1% of crisis conversations end in an active rescue.
** Means the texter has suicidal thoughts, plan, means, and timeframe and is at imminent risk.

bereavement (5% for children of workers, 3.6% for children of non-workers), substance abuse (1.5% for children of workers, 1.3% for children of non-workers), bullying (3.05% for children of workers, 2.6% for children of non-workers), eating (4.5% for children of workers, 4.2% for children of non-workers), isolation (26.8% for children of workers, 25.2% for children of non-workers), abuse (8.0% for children of workers, 6.5% for children of non-workers), and relationship issues (36.1% for children of workers, 35.6% for children of non-workers). Frontline workers had a higher number of conversations associated with depression (36.5% for workers, 36.4% for non-workers), substance abuse (2.9% for workers, 2.2% for non-workers), and bereavement (5.4% for workers, 4.7% for non-workers) (Table 2).

3.1. Analysis of frontline/essential workers, their children, and CTL users with no association with frontline/essential workers

Fig. 1 shows the adjusted odds ratios for a) adult frontline and essential workers compared to adults (non-frontline) and b) children of frontline essential workers compared to children (non-frontline). Children of workers were 11% more likely to experience isolation and 23% more likely to experience abuse than other children using the service. Frontline workers were 1.15 times more likely to report suicidal thoughts compared to adult texters not engaged in frontline work. Surprisingly, frontline workers also reported a significantly lower association with abuse and isolation than non-frontline adults texters.

3.2. Crisis outcomes for frontline essential workers and children of workers

Table 3 depicts the relationship between crisis conversations for each outcome and the demographic characteristics of frontline essential workers. The odds of suicidal thoughts and self-harm were significantly lower for Hispanic workers than White workers. African Americans also had significantly lower odds of stress and anxiety than White workers. Notably, mixed-race workers had a 68% increase in the odds of relationship issues compared to White workers, although the sample size was small for this demographic ($n = 85$).

Workers in the 25 to 44 age group were more likely to experience stress/anxiety and substance abuse and significantly less likely to experience abuse, depression, self-harm, and suicidal thoughts than the workers in the 14 to 24 age group. Workers over 45 had lower odds of relationship issues, depression, and suicidal thoughts (Table 3).

Female workers had over 200% higher odds of self-harm and abuse and significantly lower odds of substance abuse and suicidal thoughts than their male counterparts. CTL-workers identifying as "no response, other for gender" had much higher odds of substance abuse and abuse and significantly lower odds of relationship issues. Most notably, texts for self-harm were higher among all gender categories compared to male workers, with the highest odds observed for non-binary workers (Table 3).

Table 4 depicts the relationship between demographic characteristics and crisis events among children of frontline workers. African American children of workers had significantly higher odds of abuse and depression and lower odds of stress/anxiety and self-harm than White children of frontline workers. Self-reporting of stress/anxiety was significantly higher among Hispanic children and significantly lower among American Indian/Alaskan Native children compared to White children. Asian children of workers were less likely to report depression in relation to White children of workers.

Children of frontline workers (13 and under) were characterized by a higher crisis response for depression, self-harm, and suicidal thoughts than older children (14 to 24 years old) (Table 4). However, children (13 and under) had lower crisis responses for stress/anxiety and relationship issues than adolescents (14 to 24 years old).

Like frontline essential workers, children of workers had over a 50% increase in self-harm across all gender types (except non-binary

Table 2

The number of crisis conversations by crisis outcome for frontline essential workers and children of frontline essential workers.

Crisis tags		Yes, I am an essential/ frontline worker n (%)	Non-frontline workers n (%)	Yes, my parent(s) is an essential/ frontline worker n (%)	Non-frontline children n (%)
Total		n = 4835	n = 12,720	n = 7749	n = 9976
Depressed	No	3071 (63.5)	8090 (63.6)	4848 (62.6)	6150 (61.6)
	Yes	1764 (36.5)	4630 (36.4)	2901 (37.4)	3826 (38.4)
Suicidal thoughts*	No	3978 (82.3)	10,268 (80.7)	5987 (77.3)	7532 (75.5)
	Yes	857 (17.7)	2452 (19.3)	1762 (22.7)	2444 (24.5)
Self-harm	No	4403 (91.1)	11,079 (87.1)	6463 (83.4)	8185 (82.0)
	Yes	432 (8.9)	1641 (12.9)	1286 (16.6)	1791 (18.0)
Stress and anxiety	No	2557 (52.9)	7130 (56.1)	4660 (60.1)	6006 (60.2)
	Yes	2278 (47.1)	5590 (43.9)	3089 (39.9)	3970 (39.8)
Relationship issues	No	3131 (64.8)	8242 (64.8)	4954 (63.9)	6420 (64.4)
	Yes	1704 (35.2)	4478 (35.2)	2795 (36.1)	3556 (35.6)
Substance abuse	No	4694 (97.1)	12,446 (97.8)	7632 (98.5)	9850 (98.7)
	Yes	141 (2.9)	274 (2.2)	117 (1.5)	126 (1.3)
Bereavement	No	4574 (94.6)	12,126 (95.3)	7359 (95.0)	9613 (96.4)
	Yes	261 (5.4)	594 (4.7)	390 (5.0)	363 (3.6)
Bully	No	4783 (98.9)	12,528 (98.5)	7520 (97.0)	9714 (97.4)
	Yes	52 (1.1)	192 (1.5)	229 (3.0)	262 (2.6)
Eating	No	4730 (97.8)	12,341 (97.0)	7402 (95.5)	9554 (95.8)
	Yes	105 (2.2)	379 (3.0)	347 (4.5)	422 (4.2)
Isolated	No	3735 (77.2)	9493 (74.6)	5671 (73.2)	7462 (74.8)
	Yes	1100 (22.8)	3227 (25.4)	2078 (26.8)	2514 (25.2)
Abuse	No	4504 (93.2)	11,846 (93.1)	7126 (92.0)	9324 (93.5)
	Yes	331 (6.8)	874 (6.9)	623 (8.0)	652 (6.5)
LGBTQ**	No	4790 (99.1)	12,475 (98.1)	7524 (97.1)	9663 (96.9)
	Yes	45 (0.9)	245 (1.9)	225 (2.9)	313 (3.1)
COVID-19	No	4049 (83.7)	10,976 (86.3)	7007 (90.4)	9095 (91.2)
	Yes	786 (16.3)	1744 (13.7)	742 (9.6)	881 (8.8)
Was this conversation helpful?	No	365 (7.5)	707 (5.6)	329 (4.2)	435 (4.4)
	Yes	2837 (58.7)	6986 (54.9)	4098 (52.9)	5120 (51.3)
	N/A	1633 (33.8)	5027 (39.5)	3322 (42.9)	4421 (44.3)

* Means the texter has suicidal thoughts, plan, means, and timeframe and is at imminent risk.
** LGBTQ = lesbian, gay, bisexual, transgender, and queer.

children) compared to male children. Surprisingly, non-binary children of workers were also characterized by significantly lower odds of isolation, relationship issues, and depression than males. Children of workers who identified 'no response, other for gender' had lower odds of isolation and higher odds of abuse.

3.3. Analysis of COVID-19 rates and CTL usage

Table 5 shows the association between CTL usage for the top eight crisis events for frontline essential workers and children of frontline essential workers at 7-, 14-, 21-, and 28-day lags in county-level COVID-19 cases counts. Results across the entire temporal period demonstrated little to no association between rates of COVID-19 at the county level and CTL usage for children of workers across the US. However, a significant association was observed for frontline workers in the US, particularly for 14- and 21-day lags. A sensitivity analysis was performed that included frontline essential workers and children of frontline essential workers in New York, which experienced high COVID-19 cases during our study period. We found even higher odds of CTL usage in frontline essential workers, particularly for the longer 21-day and 28-day periods. In New York, children of workers also had significantly higher CTL-usage for 21-day and 28-day lags.

4. Discussion

Our study leverages a digital texting platform to investigate crisis response among frontline essential workers and their children during the early months of the COVID-19 pandemic. To date, our study is the first to use national crisis response data to examine the mental health response in frontline essential workers and the children of these workers. Results revealed that younger frontline essential workers (age 14 to 24 years) were more likely to connect with CTL for self-harm, suicidal thoughts, depression, and abuse than older workers (age 25 to 44 years) during the pandemic. Workers were more likely to report higher rates of suicidal thoughts than similar demographics with no association to workers. CTL-users whose parents were frontline essential workers were much more likely to experience isolation and abuse than children with no association to frontline essential workers. Children of workers reporting abuse were more likely to self-report being transgender or 'no response, other for gender,' and a higher proportion of children of workers who texted for abuse concerns were African American. Among children of workers, the risk for self-harm was particularly high for the youngest demographic (age 13 and under). Findings from this research demonstrate the significant mental health burden shouldered by frontline essential workers and an especially alarming trend in more severe crisis concerns, like suicidal thoughts. Given essential workers comprise nearly half of the American workforce (Blau et al., 2020), our results are concerning and suggest a need for more targeted mental health interventions not only during severe COVID-19 outbreaks but also during times of normal operations, especially since previous pandemics (e.g., SARS 2003) have shown that workers that suffer high levels of occupational stress and low well-being during the pandemic had similar feelings before the pandemic (Magnavita et al., 2021).

Our work parallels other work in the U.S., which has noted increases in psychological distress (e.g., depression, suicidal ideation), and notably higher distress for the younger demographics, Hispanics, and females during the COVID-19 pandemic (McGinty et al., 2020, Killgore et al., 2020, Bruine de Bruin, 2021). Among frontline essential workers, workers identifying as non-binary or female were more likely to report self-harm than male frontline essential workers. In contrast, male workers experienced increased substance abuse and suicidal thoughts during the pandemic. Among minorities, African American children of frontline essential workers were more likely to report increased abuse and depression, and Hispanic children were more likely to experience increased stress and anxiety. In the U.S., severe suicide ideation was reported in 18.6% Hispanic and 15.1% Blacks adults, respectively, compared to 7.9% White adults in June 2020 (Czeisler et al., 2021, Czeisler et al., 2020). Our findings, in combination with previous national survey results, highlight the need for culturally tailored interventions and messaging to address these racial disparities, which are likely a result of access barriers to healthcare, income disparities, racial stigma, or under-representation in frontline essential services (Cook
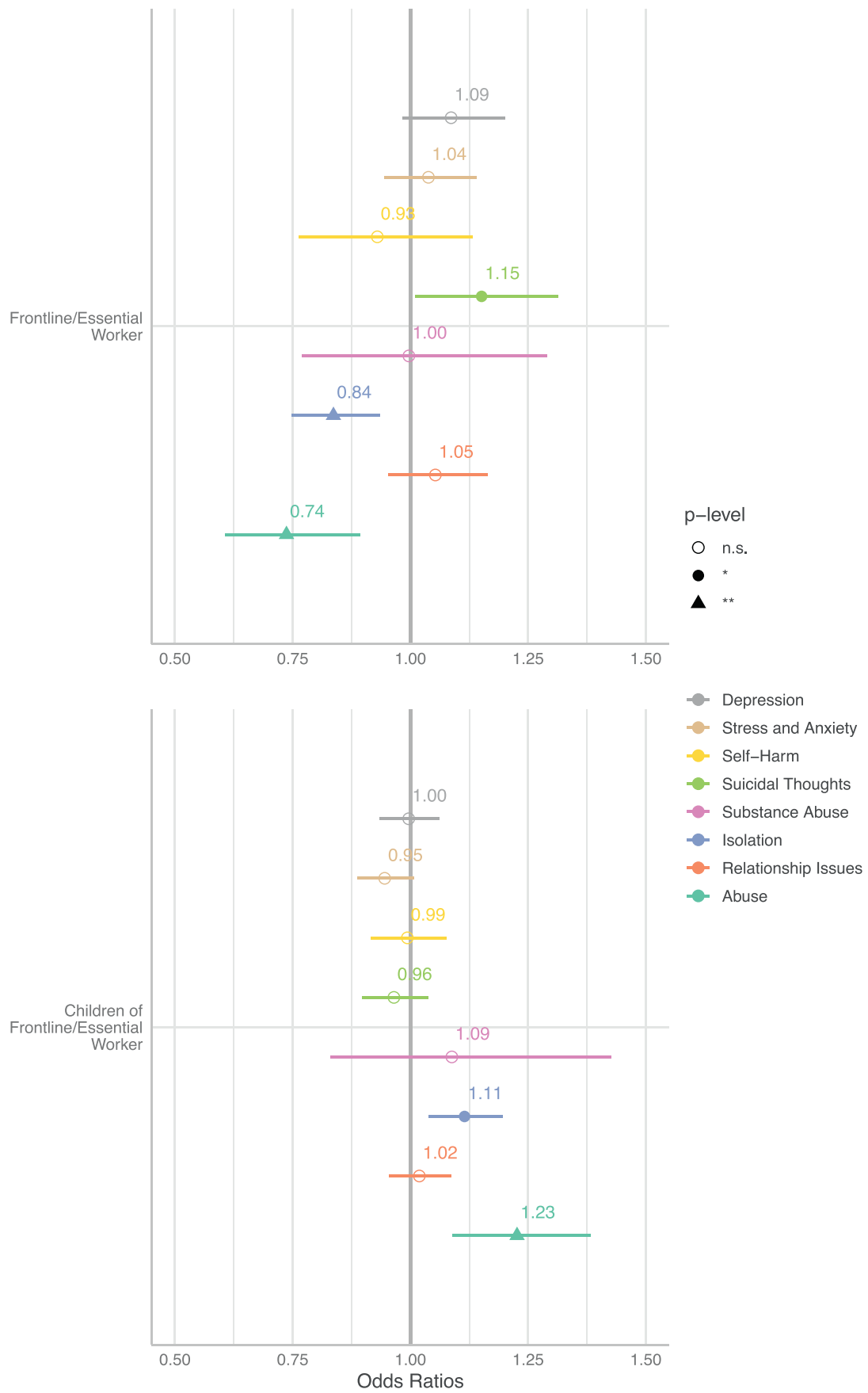
Fig. 1. Forest plot of odds ratios (Y-Axis) of crisis events for frontline and essential workers and children of frontline and essential workers from March 23 to July 20, 2020. *refers to significance at *p*-value <0.05 **refers to significance at *p*-value <0.01 ***refers to significance at *p*-value <0.001, n.s., refers to not significant.

Table 3

Generalized estimating equation (GEE) crisis conversation model results for frontline and essential workers using the 14 to 24 age group, males, and White as a reference category from March 23 to July 20, 2020.

Predictors	Depression			Stress/anxiety			Self-harm			Suicidal thoughts		
	aOR	CI	p	aOR	CI	p	aOR	CI	p	aOR	CI	p
(intercept)	0.59	0.50–0.70	**<0.001**	0.81	0.68–0.95	**0.009**	0.08	0.06–0.12	**<0.001**	0.35	0.28–0.42	**<0.001**
Female	1.17	1.00–1.38	0.056	1.13	0.97–1.32	0.123	2.46	1.73–3.50	**<0.001**	0.73	0.60–0.89	**0.002**
No response / other for gender	0.85	0.66–1.10	0.207	0.92	0.72–1.17	0.496	2.31	1.45–3.69	**<0.001**	0.93	0.68–1.27	0.646
Non-binary	2.54	1.04–6.24	**0.042**	1.50	0.62–3.62	0.370	8.53	2.97–24.47	**<0.001**	1.35	0.52–3.51	0.543
Transgender	1.05	0.61–1.82	0.864	0.75	0.44–1.27	0.283	4.20	1.92–9.19	**<0.001**	1.19	0.65–2.20	0.576
Male	1.0	(referent)		1.0	(referent)		1.0	(referent)		1.0	(referent)	
African American	0.97	0.80–1.18	0.779	0.80	0.66–0.96	**0.017**	0.60	0.42–0.86	**0.006**	0.99	0.78–1.27	0.950
American Indian / Alaska native	0.76	0.52–1.11	0.152	0.84	0.59–1.20	0.346	1.21	0.70–2.10	0.503	1.02	0.64–1.62	0.944
Asian	0.82	0.58–1.15	0.239	1.04	0.75–1.43	0.833	0.55	0.29–1.02	0.060	0.70	0.44–1.12	0.137
Hispanic	0.92	0.75–1.12	0.387	1.01	0.83–1.22	0.925	0.43	0.29–0.64	**<0.001**	0.72	0.56–0.93	**0.014**
Mixed race	1.08	0.69–1.69	0.727	0.64	0.41–1.00	0.050	0.81	0.39–1.67	0.563	0.61	0.32–1.18	0.142
No response/ other for race	1.18	0.94–1.46	0.147	0.94	0.76–1.16	0.568	0.66	0.46–0.94	**0.023**	0.95	0.72–1.26	0.744
White	1.0	(referent)		1.0	(referent)		1.0	(referent)		1.0	(referent)	
25 to 44	0.87	0.77–0.99	**0.040**	1.22	1.07–1.38	**0.002**	0.50	0.40–0.63	**<0.001**	0.73	0.63–0.86	**<0.001**
45 to 65	0.70	0.57–0.86	**0.001**	1.10	0.90–1.33	0.348	0.27	0.17–0.43	**<0.001**	0.57	0.44–0.75	**<0.001**
65 and older	0.37	0.15–0.90	**0.027**	1.13	0.55–2.30	0.741	0.42	0.10–1.81	0.247	0.12	0.02–0.92	**0.041**
[Not available]	0.74	0.47–1.16	0.188	0.91	0.59–1.41	0.679	0.61	0.27–1.38	0.235	0.45	0.24–0.87	**0.017**
14 to 24	1.0	(referent)		1.0	(referent)		1.0	(referent)		1.0	(referent)	
N	3045 actor_id			3045 actor_id			3045 actor_id			3045 actor_id		
Observations	4835			4835			4835			4835		

Predictors	Substance abuse			Isolation			Relationship issues			Abuse		
	aOR	CI	p	aOR	CI	p	aOR	CI	p	aOR	CI	p
(intercept)	0.03	0.02–0.05	**<0.001**	0.32	0.27–0.39	**<0.001**	0.63	0.53–0.74	**<0.001**	0.05	0.03–0.07	**<0.001**
Female	0.55	0.36–0.84	**0.005**	0.93	0.78–1.11	0.433	0.95	0.81–1.11	0.491	2.32	1.55–3.48	**<0.001**
No response / other for gender	2.71	1.58–4.64	**<0.001**	0.90	0.68–1.21	0.496	0.68	0.53–0.88	**0.003**	3.59	2.12–6.09	**<0.001**
Non-binary	0.00	0.00–0.00	**<0.001**	1.72	0.67–4.42	0.258	1.26	0.51–3.11	0.618	0.00	0.00–0.00	**<0.001**
Transgender	1.75	0.59–5.18	0.315	1.16	0.65–2.06	0.625	0.72	0.41–1.28	0.269	1.93	0.65–5.72	0.237
Male	1.0	(referent)		1.0	(referent)		1.0	(referent)		1.0	(referent)	
African American	0.84	0.47–1.50	0.558	0.87	0.70–1.10	0.241	1.12	0.92–1.36	0.247	0.84	0.57–1.25	0.362
American Indian / Alaska native	0.81	0.33–2.00	0.643	1.00	0.66–1.51	0.984	1.08	0.75–1.56	0.683	1.04	0.53–2.04	0.910
Asian	0.49	0.16–1.47	0.203	1.00	0.69–1.46	0.988	0.91	0.65–1.29	0.602	1.38	0.82–2.32	0.219
Hispanic	1.07	0.62–1.83	0.819	1.09	0.87–1.35	0.461	0.84	0.68–1.02	0.084	0.75	0.51–1.12	0.164
Mixed race	0.81	0.19–3.46	0.780	1.29	0.79–2.09	0.305	1.68	1.08–2.59	**0.020**	0.77	0.30–1.97	0.588
No response/ other for race	0.27	0.16–0.46	**<0.001**	0.86	0.67–1.11	0.245	1.27	1.02–1.57	**0.031**	0.54	0.35–0.83	**0.005**
White	1.0	(referent)		1.0	(referent)		1.0	(referent)		1.0	(referent)	
25 to 44	1.50	1.03–2.18	**0.033**	1.02	0.88–1.18	0.791	0.91	0.80–1.04	0.167	0.68	0.53–0.87	**0.003**
45 to 65	1.59	0.92–2.74	0.095	0.84	0.66–1.07	0.153	0.76	0.62–0.94	**0.010**	0.81	0.55–1.17	0.261
65 and older	1.49	0.29–7.49	0.631	0.82	0.33–2.04	0.667	0.33	0.13–0.89	**0.028**	0.50	0.12–2.14	0.353
[Not available]	0.44	0.06–3.26	0.420	1.32	0.81–2.13	0.261	0.69	0.43–1.09	0.113	1.05	0.48–2.31	0.894
14 to 24	1.0	(referent)		1.0	(referent)		1.0	(referent)		1.0	(referent)	
N	3045 actor_id			3045 actor_id			3045 actor_id			3045 actor_id		
Observations	4835			4835			4835			4835		

+ aOR = adjusted odds ratio; all models were adjusted for the following covariates: Race/ethnicity, gender identity, and age group.

et al., 2014, Czeisler et al., 2021).

Although we could not differentiate between the types of essential frontline workers, we found an alarming increase in CTL usage for all crisis events for our cohort, whereby use increased with COVID-19 cases after 14–28 days. These trends suggest increased psychological distress among healthcare workers as they typically deal with the most severe patients hospitalized for a COVID-19 infection (Tenforde et al., 2020). In future infectious disease outbreaks, additional counseling and mental health interventions should be offered to the frontline essential workers throughout the intensive response effort and additional support may be needed even after response efforts have ceased.

Our results revealed some positive effects in frontline essential workers, evidenced by a decrease in abuse and isolation during the early pandemic period compared to non-workers (Fig. 1). Our results support findings from China, which discovered a reduction in psychological stress four weeks after the COVID-19 epidemic, though results were not clinically significant (Wang et al., 2020), and results in the UK, which found essential workers were less likely to experience depressive symptoms (Iob et al., 2020a,b, Murphy et al., 2020).

In addition to the demanding workload, high stress, and burnout facing many frontline essential workers, gaps in available and affordable childcare likely served as an important stressor for these workers. As a result, the pandemic has greatly increased the caretaking responsibilities of families (Power, 2020). Women have been particularly impacted by the additional burden of managing multiple roles: work, childcare, and household responsibilities (Kantamneni, 2020). In our sample, females comprised over 60% of CTL-users seeking crisis counseling. While additional funds through the CARES Act were allocated to childcare facilities, funds and policies were enacted on a state-by-state basis. Closures or severely restricted hours of operation during the stay-at-home orders served to amplify financial stressors when parents were employed or seeking new employment.

Clear evidence shows that children fare worse among psychologically distressed caregivers or caregivers who experience their own adverse mental health outcomes (Russell et al., 2020, Patrick et al., 2020). In children of frontline essential workers, we noted high reports of crisis events. Our results are comparable with results from studies of children from China, which noted higher levels of anxiety and depressive symptoms during the COVID-19 outbreak (Duan et al., 2020a, Duan et al., 2020b), and results from the U.S., which found at least one mental health condition in nearly 3 out of 4 young adults (Czeisler et al., 2021, Czeisler et al., 2020). Yet, our findings are specific to children of workers

Table 4

Generalized estimating equation crisis conversation model results for the **children** of frontline and essential workers using the 14 to 24 age group, males, and White as a reference category from March 23 to July 20, 2020. Adjustments for covariates race, gender, and age. Models exclude participants within the "Not Available" age group.

Predictors	Depression			Stress/anxiety			Self-harm			Suicidal thoughts		
	aOR	CI	p	aOR	CI	p	aOR	CI	p	aOR	CI	p
(intercept)	0.65	0.54–0.79	**<0.001**	0.61	0.50–0.74	**<0.001**	0.14	0.11–0.19	**<0.001**	0.30	0.24–0.38	**<0.001**
Female	0.91	0.76–1.10	0.350	1.13	0.93–1.37	0.217	1.50	1.14–1.97	**0.004**	0.92	0.74–1.14	0.449
No response / other for gender	0.84	0.66–1.07	0.162	1.16	0.90–1.48	0.245	1.99	1.42–2.78	**<0.001**	1.24	0.94–1.65	0.132
Non-binary	0.59	0.35–0.99	**0.047**	0.89	0.53–1.50	0.660	1.28	0.65–2.52	0.468	1.64	0.99–2.72	0.053
Transgender	0.98	0.70–1.35	0.881	0.74	0.52–1.04	0.085	1.67	1.09–2.56	**0.018**	1.42	0.99–2.03	0.056
Male	1.0	(referent)		1.0	(referent)		1.0	(referent)		1.0	(referent)	
African American	1.19	1.00–1.40	**0.044**	0.84	0.70–1.00	**0.045**	0.71	0.57–0.90	**0.004**	1.02	0.85–1.24	0.815
American Indian / Alaska native	0.90	0.68–1.20	0.485	0.65	0.48–0.87	**0.004**	1.23	0.88–1.71	0.228	0.88	0.64–1.22	0.437
Asian	0.77	0.60–0.98	**0.031**	1.06	0.84–1.33	0.642	0.81	0.60–1.11	0.193	0.78	0.59–1.03	0.079
Hispanic	0.98	0.85–1.14	0.817	1.23	1.06–1.42	**0.005**	1.07	0.89–1.28	0.469	0.99	0.84–1.17	0.930
Mixed race	1.03	0.75–1.43	0.842	1.13	0.82–1.56	0.452	0.82	0.54–1.25	0.352	0.94	0.65–1.37	0.758
No response/ other for race	1.12	0.94–1.34	0.199	1.12	0.93–1.34	0.231	0.63	0.50–0.79	**<0.001**	0.70	0.56–0.86	**0.001**
White	1.0	(referent)		1.0	(referent)		1.0	(referent)		1.0	(referent)	
13 and under	1.15	1.02–1.30	**0.024**	0.61	0.54–0.70	**<0.001**	1.54	1.34–1.79	**<0.001**	1.60	1.40–1.83	**<0.001**
14 to 24	1.0	(referent)		1.0	(referent)		1.0	(referent)		1.0	(referent)	

Predictors	Substance-use			Isolated			Relationship			Abuse		
	aOR	CI	p	aOR	CI	p	aOR	CI	p	aOR	CI	p
(intercept)	0.02	0.01–0.04	**<0.001**	0.41	0.33–0.50	**<0.001**	0.58	0.48–0.71	**<0.001**	0.06	0.04–0.09	**<0.001**
Female	0.94	0.45–1.97	0.877	0.99	0.81–1.22	0.951	1.03	0.85–1.25	0.770	1.40	0.94–2.10	0.099
No response / other for gender	0.40	0.15–1.08	0.069	0.72	0.55–0.94	**0.015**	0.85	0.66–1.09	0.195	2.48	1.54–4.00	**<0.001**
Non-binary	0.83	0.10–7.15	0.866	0.45	0.24–0.88	**0.019**	0.40	0.22–0.74	**0.004**	1.14	0.38–3.44	0.811
Transgender	0.52	0.11–2.49	0.416	0.74	0.51–1.07	0.106	0.75	0.53–1.06	0.105	1.90	1.05–3.41	**0.033**
Male	1.0	(referent)		1.0	(referent)		1.0	(referent)		1.0	(referent)	
African American	1.34	0.74–2.43	0.328	1.16	0.97–1.39	0.095	1.14	0.96–1.35	0.137	1.49	1.13–1.96	**0.005**
American Indian / Alaska native	0.81	0.25–2.64	0.731	0.82	0.60–1.13	0.224	0.90	0.68–1.20	0.464	1.54	0.99–2.40	0.057
Asian	0.18	0.02–1.32	0.091	0.91	0.71–1.18	0.483	1.10	0.87–1.39	0.419	1.25	0.83–1.87	0.290
Hispanic	0.65	0.33–1.25	0.197	0.90	0.76–1.05	0.185	0.91	0.78–1.06	0.220	0.88	0.67–1.17	0.395
Mixed race	0.78	0.19–3.27	0.735	1.19	0.85–1.67	0.306	1.24	0.91–1.70	0.180	1.30	0.75–2.25	0.356
No response/ other for race	1.39	0.68–2.85	0.366	1.18	0.97–1.43	0.090	1.23	1.03–1.48	**0.022**	0.73	0.53–0.99	**0.042**
White	1.0	(referent)		1.0	(referent)		1.0	(referent)		1.0	(referent)	
13 and under	0.57	0.30–1.07	0.080	0.90	0.78–1.02	0.106	0.78	0.69–0.88	**<0.001**	0.78	0.62–0.98	**0.036**
14 to 24	1.0	(referent)		1.0	(referent)		1.0	(referent)		1.0	(referent)	
N	3479 actor_id			3479 actor_id			3479 actor_id			3479 actor_id		
Observations	6704			6704			6704			6704		

aOR = adjusted Odds Ratio; All models were adjusted for the following covariates: race/ethnicity, gender identity, and age group.

rather than the general population of children, who may face additional hardships with isolation from their parents and/or increased mental distress about their parent's health or financial well-being. Moreover, separation from parents has been reported to increase the chance of crisis events and increase the risk of mental health disorders (Norredam et al., 2018), and our cohort of children experienced significantly higher feelings of isolation than non-frontline essential worker children. Among adolescents, concerns about school performance and increased isolation are associated with higher mental health distress (Czeisler et al., 2021, Son et al., 2020, Horigian et al., 2020). Our results highlight the need for psychological interventions among frontline essential workers and their children and elevated awareness among providers to target this at-risk population specifically.

Mental health and adverse childhood experiences are higher among LGBTQ and gender nonconforming youth. We found an elevated risk for self-harm across both workers and their children identifying as non-conforming, which likely parallels elevated risk experienced before COVID-19 (Baams, 2018). Our sample also noted significantly higher rates of depression among workers identifying as non-binary and abuse among children of workers identifying as transgender. During the COVID-19 pandemic, studies on LGBTQ youth have noted feelings of isolation in this group for individuals with unsupportive families, and the loss of socialization/support is placing unique stressors on this vulnerable subgroup (Fish et al., 2020).

4.1. Strengths and limitations

An important strength of our study is that we were able to leverage data from a large national mental health repository to examine patterns in crisis response among this understudied and highly vulnerable group. Our study contributes to a growing body of evidence of the mental health impacts from COVID-19 by using a new indicator of mental health distress (e.g., helping-seeking behaviors for crisis text line). Our study contributes to work showing mental health trends using Google search trends (Ayers et al., 2020, Stijelja and Mishara, 2020, Halford et al., 2020a, Halford et al., 2020b), outpatient visits (Yang et al., 2020), and multiple cross-sectional surveys (Czeisler et al., 2020, Ettman et al., 2020, Horigian et al., 2020).

Our results are subject to a few limitations. We could not discern which sectors were represented by frontline essential workers and could not infer socioeconomic vulnerability in these data. For example, we could not understand the mental health effects on low-income workers with presumably fewer resources to buffer the many challenges posed by the pandemic than workers who had more resources (e.g., could take paid time off). Another important limitation is our inability to determine if frontline workers in our sample were associated with the children simultaneously connecting with CTL services over the same temporal period. Our study also included multiple statistical comparisons across different sub-groups, which may elevate the risk for type I error. Lastly, our results are limited to specific populations that engage with CTL, and therefore, our results may not be generalizable to the larger population.

Table 5
Mixed effect modelling results of the relationship between COVID-19 rates within the area code and CTL usage for the top 8 crisis events. Results are presented for children of frontline essential workers across the US and in New York State, and for frontline essential workers across the US and in New York. Area code is a random effect and the data is restricted from April 10 to June 20, 2020, to account for large CTL usage and lag-time periods.

Predictors	Children of frontline essential workers			Children of frontline essential workers in New York			Frontline essential workers			Frontline essential workers in New York		
	Incidence rate ratios	CI	p	Incidence rate ratios	CI	p	Incidence rate ratios	CI	p	Incidence rate ratios	CI	p
7-day lag	1.01	0.98–1.04	0.448	0.95	0.86–1.06	0.380	1.03	1.02–1.05	**<0.001**	1.01	0.96–1.06	0.797
14-day lag	1.00	0.96–1.03	0.866	0.96	0.86–1.07	0.462	1.02	1.00–1.04	**0.039**	1.06	1.01–1.12	**0.025**
21-day lag	1.01	0.98–1.05	0.495	1.14	1.01–1.28	**0.036**	1.05	1.03–1.07	**<0.001**	1.23	1.16–1.31	**<0.001**
28-day lag	1.02	0.98–1.07	0.315	1.19	1.04–1.37	**0.014**	1.02	0.99–1.04	0.183	1.21	1.12–1.30	**<0.001**

However, our results point to the necessity of additional longitudinal studies for examining the wide-ranging psychological impacts of the pandemic on frontline essential workers and their children.

5. Conclusion

Our study is the first to examine the acute mental health impacts of frontline essential workers and their children in the early COVID-19 pandemic period (March to July 2020). Children of workers were characterized by higher CTL volume for isolation and abuse, whereas frontline workers experienced a higher proportion of suicidal thoughts. Our results varied across demographics. For instance, over a 100% increase in self-harm conversations was observed for female, transgender, and non-binary gendered texters. Elevated crisis events in frontline essential workers were observed following peaks in local COVID-19 cases. Findings reveal that more research is needed to understand the progression of these adverse mental health trajectories in workers and their families and provide insight into how supportive mental health resources can be incorporated into digital interventions for this vulnerable group.

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CRediT authorship contribution statement

Margaret M. Sugg: Conceptualization, Methodology, Formal analysis, Funding acquisition, Data curation, Writing – original draft, Writing – review & editing, Supervision. **Jennifer D. Runkle:** Conceptualization, Formal analysis, Methodology, Funding acquisition, Writing – original draft, Writing – review & editing, Supervision. **Lauren Andersen:** Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing, Visualization, Supervision, Project administration, Funding acquisition. **Jaclyn Weiser:** Data curation. **Kurt D. Michael:** Investigation, Writing – original draft, Writing – review & editing, Visualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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