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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Deliberate self-harm in adolescents during COVID-19: The roles of pandemic-related stress, emotion regulation difficulties, and social distancing

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ABSTRACT

The objective of this study was to conduct an ecologically valid test of etiological models of deliberate self-harm (DSH) during the COVID-19 pandemic. Using a sample of Canadian adolescents, we investigated: (1) the association between COVID-19-related stress and DSH; (2) whether emotion regulation (ER) difficulties mediated/moderated this association, including whether these effects differed by age; and (3) whether the mediating/moderating effects of ER difficulties were stronger among socially distanced youth. Canadian adolescents (N = 809) aged 12-18 were recruited on social media and completed an online survey. COVID-19-related stress was associated with recent DSH. Nonacceptance of emotional responses and limited access to ER strategies fully mediated this association. The indirect effect through nonacceptance of emotional responses was stronger among more socially distanced youth, whereas the indirect effect through limited access to ER strategies was stronger among older and more socially distanced youth. COVID-19-related stress and ER difficulties did not interact to predict DSH, nor did age or social distancing moderate these interactions. These results align with etiological models proposing central roles for stress and ER difficulties in DSH. Furthermore, this study underscores a need to support adolescents, particularly older teens with reduced in-person interactions, in adaptively coping with pandemic-related stress.

1. Introduction

The coronavirus disease 2019 (COVID-19) pandemic resulted in unparalleled public health responses (e.g., social distancing, school closures, stay-at-home orders) that dramatically changed the lives of youth. In addition to extensive disruptions to social and personal care routines, the pandemic engendered fear of infection, concerns with the health of family and friends, and worry of overloading the healthcare system (Craig et al., 2021; Ellis et al., 2020; Styck et al., 2020). These COVID-19-related stressors may have taxed adolescents' coping resources and elevated their risk of mental health difficulties, including anxiety, depression, post-traumatic stress, and deliberate self-harm (DSH; Ammerman et al., 2021; Carosella et al., 2021; Craig et al., 2021; Cost et al., 2021; Hamza et al., 2020; Li et al., 2021; Singh et al., 2020). DSH refers to intentional, self-inflicted, and non-fatal harm to one's body irrespective of the intended outcome and includes suicide attempts (self-injurious behavior with the intent to die) and nonsuicidal self-injury (NSSI; self-injurious behavior without the intent to die; Hawton et al., 2003; Silverman et al., 2003). DSH often begins in adolescence (Hawton & Harriss, 2008; Plener et al., 2015), affects 16% of youth (Muehlenkamp et al., 2012), and contributes to psychosocial impairment (Borschmann et al., 2017), strained healthcare resources (Centers for Disease Control and Prevention [CDC], 2017), and increased risk of suicide (CDC, 2017; Owens et al., 2002). Prominent etiological models conceptualize DSH as a coping strategy to reduce distressing thoughts, feelings, and somatic sensations triggered by acute stress, particularly stress that is perceived as uncontrollable and without a solution (e.g., Chapman et al., 2006; Linehan, 1993; Nock, 2009; Williams, 1997). Given that the COVID-19 pandemic was an acute, large-scale, and uncontrollable stressor, it provided an ecologically valid opportunity to test etiological models and identify risk factors that can guide mitigation strategies to reduce DSH now as well as in future pandemics.

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1.1. Stress and DSH

A large body of literature demonstrates a robust link between stress and DSH. Youth who have engaged in DSH report more stressful life events, have greater physiological reactivity to stress, and are less able to tolerate stress relative to youth without such histories (Hankin & Abela, 2011; Nock & Mendes, 2008; O'Connor et al., 2012; Madge et al., 2011). Moreover, stress predicts DSH both concurrently (i.e., within the same day; Kleiman et al., 2018; Miller et al., 2019) and prospectively (i.e., across hours, days, and months; Liu et al., 2014; Victor et al., 2019; Yen et al., 2005), implicating stress as a proximal risk factor. Although limited research has examined this association in the context of COVID-19, one study found that female adolescents who engaged in NSSI during the pandemic reported higher levels of perceived stress, loneliness, and lower family support than those with a lifetime history of NSSI but who did not engage in this behavior during the pandemic (Carosella et al., 2021). In a similar vein, Ammerman et al. (2021) found that several COVID-19-related experiences (e.g., general distress, fear of physical harm, effects of social distancing policies) were associated with past-month suicidal ideation and suicide attempts among community adults. These findings, combined with etiological theories (e.g., Chapman et al., 2006; Linehan, 1993; Nock, 2009; Williams, 1997), suggest that youth who experienced higher levels of COVID-19-related stress may have engaged in more DSH during the pandemic.

1.2. Emotion regulation difficulties as mediators and moderators

Given the rationale for expecting COVID-19-related stress to predict DSH, an important step is to identify mediators and moderators of this association. One likely candidate is emotion regulation (ER) difficulties, a multidimensional construct encompassing several deficits in modulating emotional experiences, including: (1) lack of emotional awareness; (2) lack of emotional clarity; (3) difficulty engaging in goal-directed behavior when distressed; (4) impulse control difficulties when upset; (5) nonacceptance of emotional responses; and (6) limited access to ER strategies (Gratz & Roemer, 2004). Indeed, etiological models of DSH propose that ER difficulties explain both why stress predicts DSH and for whom this association is strongest. On the one hand, Linehan (1993) proposes that individuals with borderline personality disorder (BPD) may use DSH to escape from distressing environmental stressors due to ER difficulties, most notably a tendency to be nonaccepting of emotional reactions. In fact, dialectical behavior therapy is believed to reduce DSH, in part, through the development of more adaptive ER skills (Linehan, 1993). In a similar vein, Nock's (2009) integrative model of NSSI posits that stressful life events can undermine an individual's ability to adaptively regulate their emotions, which in turn can lead to NSSI to reduce or modify internal states. In support of these mediation hypotheses, stressful life events have been shown to predict more ER difficulties, which in turn predict more DSH (Ewing et al., 2019; Richmond et al., 2017; Sim et al., 2009). On the other hand, diathesis-stress models propose that pre-existing vulnerabilities (e.g., ER difficulties) interact with stress to predict DSH (Liu et al., 2016; Van Heeringen, 2012; Williams, 1997). For example, William's (1997) cry of pain model states that heightened stress, combined with the underlying belief that nothing can be done to effectively solve one's problems, leads to suicidal behavior. Consistent with these moderation hypotheses, ER difficulties have been shown to strengthen the relation between stress and NSSI (Voon et al., 2014), although no known studies have tested this hypothesis with respect to suicide attempts. Collectively, etiological models point to specific dimensions of ER difficulties that may be particularly salient mediators and/or moderators of the association between COVID-19-related stress and DSH, namely nonacceptance of emotional responses and limited access to ER strategies.

It is important to acknowledge that these mediation and moderation hypotheses are not thought to be mutually exclusive. In fact, Liu et al. (2016) propose sequential roles for these processes, whereby stress elevates the risk for DSH in younger adolescents through the development of diatheses (e.g., ER difficulties) and, as these diatheses stabilize in late adolescence or early adulthood, their relation to stress and DSH transitions from mediation to moderation. Evidence for the sequential hypothesis would involve finding that the indirect effect of stress on DSH via ER difficulties is stronger among younger youth, whereas the interaction between stress and ER difficulties in predicting DSH is stronger among older youth. Testing both mediation and moderation models during the COVID-19 pandemic can therefore elucidate why youth are at risk for DSH (mediation), who this risk is greatest for (moderation), and whether these processes differ in younger versus older youth.

1.3. Social distancing

In addition to the emotional burden of the COVID-19 pandemic, adolescents experienced unprecedented disruptions to their social connections. In many Canadian provinces, public health mandates to socially distance contributed to a prolonged state of isolation from peers, teachers, school counsellors, extended families, and community members. Restricting youths' access to their support networks was a salient social stressor that may have compounded their risk of mental health problems, including DSH (Galea et al., 2020; Clemens et al., 2020; Hasking et al., 2020; Killgore et al., 2020). Furthermore, having regular in-person interactions with people beyond one's family is believed to bolster adaptive ER, as observing and interacting with peers, teachers, and other community members can help youth acknowledge, clarify, and accept difficult emotions, as well as identify strategies to cope with these experiences (Fried, 2011; Reindl et al., 2016). Consequently, youth who limited their interactions to a smaller network than usual during the COVID-19 pandemic may have lost opportunities to engage in adaptive ER, rendering them especially vulnerable to DSH.

1.4. The present study

The objective of this study was to conduct an ecologically valid test of etiological models of DSH during the COVID-19 pandemic. Consistent with etiological models (e.g., Chapman et al., 2006; Linehan, 1993; Nock, 2009; Van Heeringen, 2012; Williams, 1997), we hypothesized that COVID-19-related stress would be positively associated with recent DSH (Hypothesis 1) and that ER difficulties would mediate (Hypothesis 2; see Fig. 1A) and moderate (Hypothesis 3; see Fig. 1B) this association. Consistent with Liu et al.'s (2016) sequential hypothesis, we anticipated that the indirect effects of COVID-19-related stress on DSH via ER difficulties would be stronger among younger youth (Hypothesis 4A; see Fig. 1C), whereas the interactions between COVID-19-related stress and ER difficulties in predicting DSH would be stronger among older youth (Hypothesis 4B; see Fig. 1D). Finally, consistent with the idea that limited in-person social contact may diminish adaptive ER (Fried, 2011; Reindl et al., 2016), we hypothesized that the mediating (Hypothesis 5A; see Fig. 1E) and moderating (Hypothesis 5B; see Fig. 1F) effects of ER difficulties in the association between COVID-19-related stress and DSH would be stronger among adolescents who engaged in more social distancing.

2. Methods

2.1. Participants

Participants were 809 Canadian youth (56% female, 74% White) aged 12 to 18 (M_{age} = 15.67, SD = 1.37) with Internet access. Participants resided in all provinces and territories except Nunavut. The sample was generally consistent with population-based statistics of Canadian youth (e.g., demographics, access to mental health services; Craig et al., 2021). Full demographic information is reported in Craig et al. (2021).

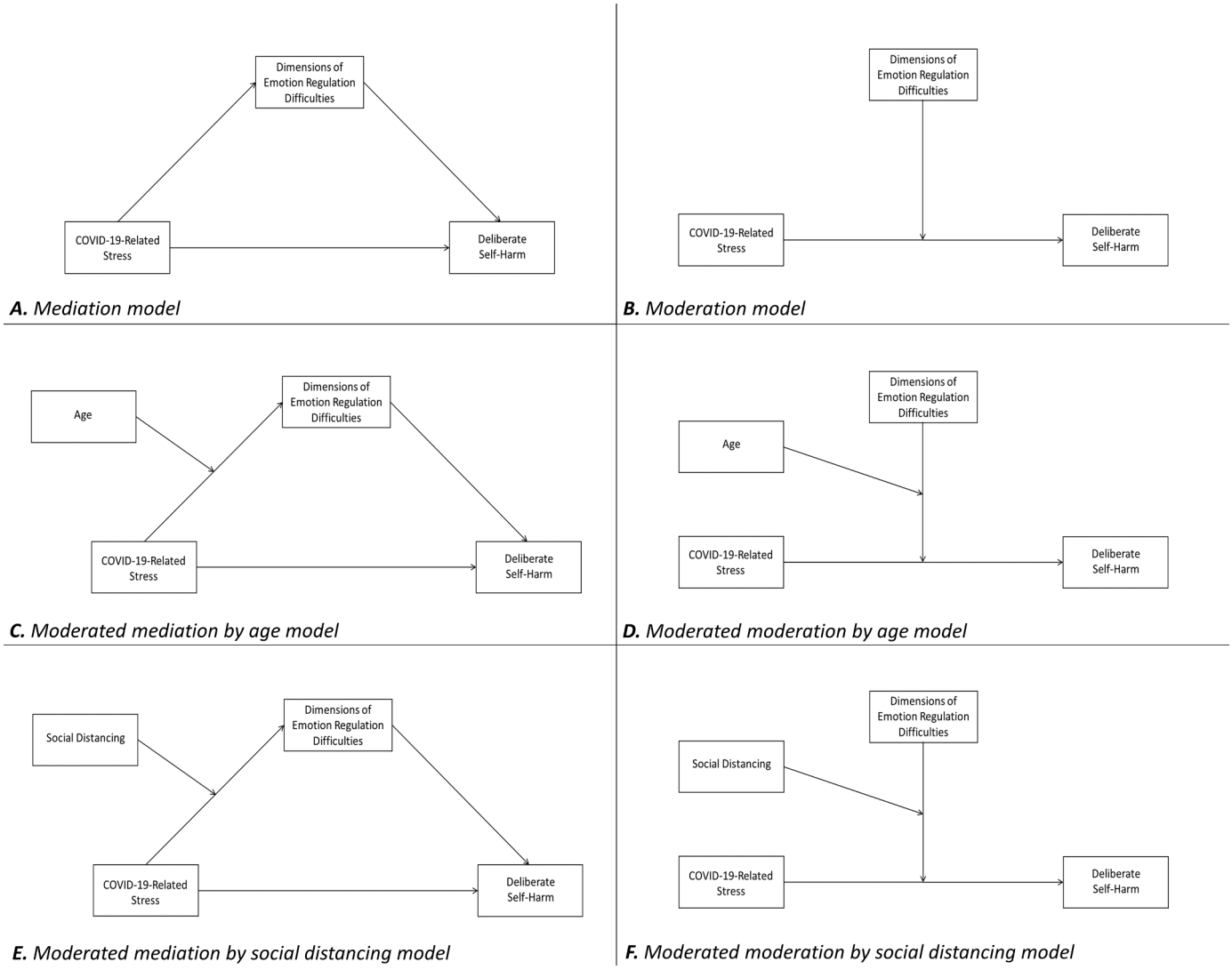

Fig. 1. Hypothesized Mediators and Moderators of the Association Between COVID-19-Related Stress and DSH.

2.2. Procedures

Study procedures were approved by all authors' Research Ethics Boards. Briefly, youth were recruited via advertisements on social media platforms between June 17 and July 31, 2020. Adolescents were asked two questions about the purpose, risks, and benefits of the study to ensure competency to consent. Youth who were unable to answer at least one of these questions correctly (n = 168) were excluded from the study.[1] Youth who successfully completed the consent questions and online surveys were entered into a draw for a $250 electronic gift certificate.

2.3. Measures

2.3.1. COVID-19-related stress

The extent to which adolescents were stressed about the personal, social, and societal impacts of COVID-19 was measured using 11 items from the Statistics Canada COVID-19 Stress Scale (Findlay et al., 2020). Example items included, "My own health", "Overloading the health system", and "Maintaining social ties". These stressors were rated from "Not at all" (0) to "Extremely" (3) and summed to create an overall score of COVID-19-related stress. The Cronbach's alpha of this scale was .82.

2.3.2. ER difficulties

ER difficulties were measured using the 18-item version of the Difficulties in Emotion Regulation Scale (DERS-18; Victor et al., 2016). The DERS-18 has six subscales: (1) Awareness (i.e., lack of emotional awareness); (2) Clarity (i.e., lack of emotional clarity); (3) Goals (i.e., difficulty engaging in goal-directed behavior when distressed); (4) Impulse (i.e., impulse control difficulties when upset); (5) Nonacceptance (i.e., nonacceptance of emotional responses); and (6) Strategies (i.e., limited access to ER strategies). Youth rated each item from "Almost never" (1) to "Almost always" (5). Responses were summed, with higher scores reflecting more ER difficulties. The Cronbach's alphas of these subscales ranged from .78 to .91 (see Table 1).

2.3.3. Social distancing

Social distancing was measured using three items: (1) "In the past month, to what extent did you engage in social distancing?" (adapted from Oosterhoff et al., 2020); (2) "When you saw people outside of your household, how often did you maintain six feet (two meter) distance?" (developed for this study); and (3) "How often in the past month did you socialize in person with someone outside your immediate household or allowable social bubble?" (developed for this study). Responses ranged from "Not at all" (0) to "A great deal" (4). The third item was reverse

[1] Not included in the 809 participants

Table 1
Descriptive Statistics and Bivariate Correlations.

	Min	Max	Mean	SD	α	1	2	3	4	5	6	7	8	9
1. COVID-19-Related Stress	0	33	15.93	6.17	.82	1								
2. Awareness	3	15	9.16	3.13	.78	-.13**	1							
3. Clarity	3	15	8.34	3.59	.87	.17**	.17**	1						
4. Goals	3	15	10.39	3.91	.91	.21**	-.04	.47**	1					
5. Impulse	3	15	6.18	3.42	.90	16**	.05	.37**	.50**	1				
6. Nonacceptance	3	15	8.66	4.17	.91	.16**	.06	.49**	.52**	.39**	1			
7. Strategies	3	15	7.84	3.71	.81	.21**	.01	.50**	.64**	.59**	.61**	1		
8. Social Distancing	0	12	7.34	2.70	.69	.22**	.08*	-.02	-.02	-.08*	.03	-.01	1	
9. Deliberate Self-Harm	0	2	0.39	0.62	-	.13**	.10*	.36**	.33**	.35**	.41**	.50**	.05	1

Note. Min = minimum value in the scale; Max = maximum value in the scale; SD = standard deviation; α = Cronbach's alpha; *p < .05, **p < .01.

scored, and items were summed so that higher values reflected more social distancing. The Cronbach's alpha of this scale was .69.

2.3.4. DSH

DSH over the past four months (i.e., since the beginning of March 2020) was measured using one item from the Ontario Child Healthy Study Scales (OCHS; Duncan et al., 2019), a 52-item self-report measure of emotional and behavioral problems. Youth were asked, "I deliberately try to hurt or kill myself", with responses coded as "Never or not true" (0), "Sometimes or somewhat true" (1), and "Often or very true" (2).

2.4. Data analytic strategy

To test Hypothesis 1 and ensure our predictors were associated with our outcome, bivariate correlations between all study variables were examined using SPSS Version 27.0 (IBM Corp, 2020). All other analyses were performed using MPlus 8.5 (Muthén & Muthén, 1998-2017). To test Hypothesis 2, we constructed a mediation model whereby the six dimensions of ER difficulties were entered simultaneously as mediators of the association between COVID-19-related stress and DSH (see Fig. 1A). To test Hypothesis 3, the six dimensions of ER difficulties were entered simultaneously as moderators of the association between COVID-19-related stress and DSH (see Fig. 1B). Hypothesis 4A was evaluated by constructing a moderated mediation model, with age entered as a moderator of the indirect effects of COVID-19-related stress and DSH via each facet of ER difficulties (see Fig. 1C). Hypothesis 4B was evaluated by constructing a moderated moderation model, with age entered as a moderator of the interactions between COVID-19-related stress and each facet of ER difficulties in predicting DSH (see Fig. 1D). Similarly, Hypothesis 5A was tested by constructing a moderated mediation model, with social distancing entered as a moderator of the indirect effects of COVID-19-related stress and DSH via each dimension of ER difficulties (see Fig. 1E). Finally, Hypothesis 5B was evaluated by constructing a moderated moderation model, with social distancing entered as a moderator of the interactions between COVID-19-related stress and each facet of ER difficulties in predicting DSH (see Fig. 1F). All models were estimated using maximum likelihood estimation and assessment of significant direct and indirect effects was based on the associated 95% confidence intervals, from k = 1,000 bootstrap re-samples, not containing zero. All continuous variables were standardized before entry into the models. Model fit was evaluated based on a non-significant Chi-Square (χ^2), a root mean square error of approximation (RMSEA) below .10, and comparative fit index (CFI) above .90 (Hu & Bentler, 1999; Schermelleh-Engel et al., 2003).

3. Results

3.1. Preliminary analyses

Descriptive statistics and bivariate correlations are presented in Table 1. Most variables were weakly to moderately correlated in the anticipated directions (rs = .13 to .61), except for the Awareness subscale of the DERS-18 (rs = -.13 to .17), the Goals subscale of the DERS-18 (rs = -.04 to .64) and social distancing (rs = -.02 to .22). Consistent with Hypothesis 1, COVID-19-related stress was positively associated with DSH (r = .13, p < .001). About one third (31.64%, n = 256) of youth reported recent DSH, with 24.10% (n = 195) sometimes engaging in DSH and 7.54% (n = 61) often engaging in DSH. Youth who were cis-gender females, non-binary, transgender, or gender fluid reported more DSH than cis-gender males (t[806] = -3.31, p = .001). Thus, gender was included as a covariate in all analyses. Gender was coded as cis-gender males (0) and any other gender identity (1).

3.2. Hypothesis 2: ER difficulties as mediators

The model fit the data well, $\chi^2(1) = .06$, p = .809, CFI = 1.00, RMSEA = .00 [95% CI .00, .06]. Once indirect effects were included, the direct effect of COVID-19-related stress on DSH was not significant (β = .02, SE = .03, p = .603, 95% CI [-.04, .07]), whereas the indirect effects through Nonacceptance (β = .02, SE = .01, p = .024, 95% CI [.01, .04]) and Strategies (β = .07, SE = .02, p < .001, 95% CI [.04, .10]) were significant. Specifically, COVID-19-related stress predicted more of these ER difficulties, which predicted more DSH. The indirect effects via Awareness (β = -.01, SE = .01, p = .096, 95% CI [-.02, -.002]), Clarity (β = .01, SE = .01, p = .077, 95% CI [.003, .03]), Goals (β = -.01, SE = .01, p = .262, 95% CI [-.02, .003]), and Impulse (β = .01, SE = .01, p = .200, 95% CI [.00, .03]) were not significant. These results are depicted in

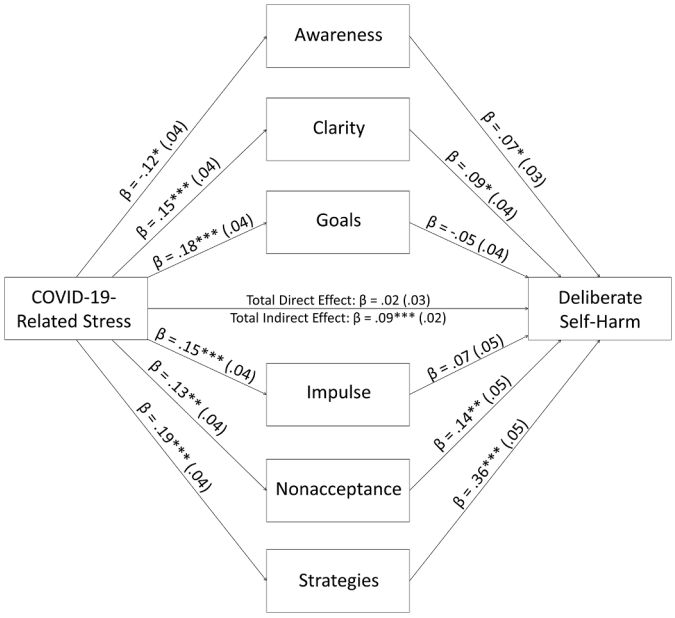

Fig. 2. Indirect Effects of COVID-19-Related Stress on DSH via ER Difficulties
Note. Standardized coefficients and standard errors are reported; analyses adjusted for gender; *p < .05; **p < .01, ***p < .001.

Fig. 2.

3.3. Hypothesis 3: ER difficulties as moderators

The model did not fit the data well, $\chi^2(74) = 1773.34$, $p < .001$, CFI = .48, RMSEA = .17 [95% CI .16, .18], and efforts to improve model fit were unsuccessful. COVID-19-related stress did not interact with Awareness (β = .001, SE = .03, p = .969, 95% CI [-.05, .05]), Clarity (β = .02, SE = .04, p = .707, 95% CI [-.05, .08]), Goals (β = .03, SE = .04, p = .490, 95% CI [-.04, .10]), Impulse (β = -.03, SE = .05, p = .612, 95% CI [-.10, .10]), Nonacceptance (β = .04, SE = .05, p = .414, 95% CI [-.06, .12]), or Strategies (β = -.04, SE = .06, p = .496, 95% CI [-.14, .06]) to predict DSH.

3.4. Hypothesis 4A: moderated mediation by age

The model fit the data adequately, $\chi^2(12) = 53.20$, $p < .001$, CFI = .98, RMSEA = .07 [95% CI .05, .08]. Age moderated the indirect association between COVID-19 stress and DSH via Strategies, such that the indirect effect was stronger one standard deviation above the mean (β = .09, SE = .02, $p < .001$, 95% CI [.05, .13]) than one standard deviation below the mean (β = .06, SE = .02, p = .003, 95% CI [.03, .10]). This suggests that the indirect effect of COVID-19-related stress on DSH via Strategies was stronger among older youth. Age did not moderate the indirect effects via Awareness, Clarity, Goals, Impulse, or Nonacceptance (see Table 2).

3.5. Hypothesis 4B: moderated moderation by age

The model did not fit the data well, $\chi^2(181) = 2537.92$, $p < .001$, CFI = .40, RMSEA = .13 [95% CI .12, .13], and efforts to improve model fit were unsuccessful. Age did not moderate the interactions between COVID-19-related stress and Awareness (β = -.06, SE = .03, p = .058, 95% CI [-.11, -.006]), Clarity (β = .03, SE = .04, p = .371, 95% CI [-.03, .10]), Goals (β = -.02, SE = .04, p = .625, 95% CI [-.10, .04]), Impulse (β = -.03, SE = .04, p = .511, 95% CI [-.10, .04]), Nonacceptance (β = -.03, SE = .05, p = .595, 95% CI [-.10, .10]), or Strategies (β = .03, SE = .05, p = .516, 95% CI [-.10, .12]) in predicting DSH.

3.6. Hypothesis 5A: moderated mediation by social distancing

The model fit the data adequately, $\chi^2(55) = 1769.78$, $p < .001$, CFI = .96, RMSEA = .09 [95% CI .07, .11]. Social distancing moderated the indirect association between COVID-19-related stress and DSH via Nonacceptance, such that the indirect effect was significant one standard deviation above the mean (β = .02, SE = .01, p = .022, 95% CI [.01, .04]), but not one standard deviation below the mean (β = .01, SE = .01, p = .542, 95% CI [-.01, .02]). Similarly, social distancing moderated the indirect effect via Strategies, such that the indirect effect was significant one standard deviation above the mean (β = .12, SE = .03, $p < .001$, 95% CI [.08, .16]), but not one standard deviation below the mean (β = .03, SE = .02, p = .106, 95% CI [.003, .07]. This suggests that the indirect effects of COVID-19-related stress on DSH via Nonacceptance and Strategies were stronger among youth who engaged in more social distancing. Social distancing did not moderate the indirect effects via Awareness, Clarity, Goals, or Impulse (see Table 3).

3.7. Hypothesis 5B: moderated moderation by social distancing

The model did not fit the data well, $\chi^2(190) = 4180.51$, $p < .001$, CFI = .28, RMSEA = .16 [95% CI .16, .17], and efforts to improve model fit were unsuccessful. Social distancing did not moderate the interactions between COVID-19-related stress and Awareness (β = -.02, SE = .02, p = .261, 95% CI [-.10, .01]), Clarity (β = -.04, SE = .03, p = .161, 95% CI [-.10, .003]), Goals (β = .02, SE = .03, p = .560, 95% CI [-.03, .10]), Impulse (β = -.02, SE = .02, p = .329, 95% CI [-.10, .02]), Nonacceptance (β = .02, SE = .03, p = .629, 95% CI [-.03, .10]), or Strategies (β = .00, SE = .04, p = .996, 95% CI [-.10, .10]) in predicting DSH.

4. Discussion

The COVID-19 pandemic was an acute, large-scale, and uncontrollable stressor that may have taxed adolescents' coping resources and exacerbated mental health concerns, including DSH (Ammerman et al., 2021; Carosella et al., 2021; Cost et al., 2021; Craig et al., 2021; Hamza et al., 2020; Li et al., 2021; Singh et al., 2020). Accordingly, the pandemic provided a unique opportunity to test etiological models that propose central roles for stress and ER difficulties in the development of DSH (e.g., Chapman et al., 2006; Linehan, 1993; Nock, 2009; Van Heeringen, 2012; Williams, 1997). Consistent with these models and Hypothesis 1, youth who experienced more personal, social, and societal stress related to COVID-19 engaged in more frequent DSH during the pandemic. Moreover, in line with Hypothesis 2, we found that this association was fully mediated by two dimensions of ER difficulties, namely nonacceptance of emotional responses and limited access to ER strategies. This supports Linehan's (1993) and Nock's (2009) proposition that ER difficulties explain why stress leads to DSH. However, contrary to Hypothesis 3 and 4A/B, we did not find support for a diathesis-stress model or the sequential hypothesis (Liu et al., 2016; Van Heeringen, 2012; Williams, 1997). In fact, we found that the indirect effect of COVID-19-related stress on DSH via limited access to ER strategies was stronger among older youth, rather than younger youth as expected. Finally, in support of Hypothesis 5A/B, the indirect effects of

Table 2
Moderated Mediation Results for ER Difficulties Across Levels of Age.

	Indirect Effect	SE	p	95% CI
Awareness X Low Age	-.01	.01	.155	-.02, -.001
Awareness X High Age	-.01	.01	.088	-.02, -.002
Clarity X Low Age	.01	.01	.121	.003, .03
Clarity X High Age	.02	.01	.075	.004, .03
Goals X Low Age	-.01	.01	.273	-.02, .001
Goals X High Age	-.01	.01	.239	-.03, .003
Impulse X Low Age	.02	.01	.184	.001, .04
Impulse X High Age	.01	.01	.174	.001, .030
Nonacceptance X Low Age	.02	.01	.044	.01, .04
Nonacceptance X High Age	.02	.01	.018	.01, .04
Strategies X Low Age	.06	.02	.003	.03, .10
Strategies X High Age	.09	.02	<.001	.05, .13

Notes. Standardized coefficients and standard errors are reported. Analyses adjusted for gender.

Table 3
Moderated Mediation Results for ER Difficulties Across Levels of Social Distancing.

	Indirect Effect	SE	p	95% CI
Awareness X Low Social Distancing	-.002	.004	.720	-.01, .004
Awareness X High Social Distancing	-.01	.01	.106	-.02, -.002
Clarity X Low Social Distancing	.01	.01	.214	.00, .02
Clarity X High Social Distancing	.02	.01	.071	.004, .03
Goals X Low Social Distancing	-.004	.01	.389	-.02, .001
Goals X High Social Distancing	-.01	.01	.264	-.03, .004
Impulse X Low Social Distancing	.01	.01	.273	.00, .03
Impulse X High Social Distancing	.01	.01	.177	.00, .03
Nonacceptance X Low Social Distancing	.01	.01	.542	-.01, .02
Nonacceptance X High Social Distancing	.02	.01	.022	.01, .04
Strategies X Low Social Distancing	.03	.02	.106	.003, .07
Strategies X High Social Distancing	.12	.03	<.001	.08, .16

Notes. Standardized coefficients and standard errors are reported. Analyses adjusted for gender.

COVID-19-related stress on DSH via nonacceptance of emotional responses and limited access to ER strategies were stronger among youth who engaged in more social distancing, and therefore had less in-person social support and modelling of adaptive ER (Fried, 2011; Reindl et al., 2016). Collectively, these findings underscore a need to support youth, particularly older teens with limited in-person social interactions, in developing adaptive ER skills to cope with pandemic-related stress.

Our findings suggest that nonacceptance of emotional responses and limited access to ER strategies play a particularly salient role in the association between COVID-19-related stress and DSH, aligning with etiological models that emphasize these dimensions (Linehan, 1993, Williams, 1997). Extreme and uncontrollable stress, such as that encountered during a pandemic, may provoke emotions that are difficult for youth to accept and increase the perception that nothing can be done to effectively modulate these emotions. Indeed, previous work shows that the pandemic triggered myriad emotions that were hard for adolescents to reconcile, including anger, frustration, grief, guilt, sadness, and boredom (Demkowicz et al., 2020; Singh et al., 2020). Compounding these difficult emotions, the public health responses to the pandemic (e.g., social distancing, school closures, stay-at-home orders) prevented many adolescents from engaging in their typical ER strategies, such as seeking support from peers, maintaining a consistent routine, exercising, and spending time outdoors (Demkowicz et al., 2020; Dunton et al., 2020; Lee, 2020). In such circumstances, adolescents may be particularly drawn to DSH because it provides a clear and controllable way of expressing their emotions and regaining a sense of agency or predictability (see Stänicke et al., 2018, for a review). Given the possibility of another pandemic in the future, it will be important to develop or increase access to interventions that bolster adaptive ER skills among youth. Although mental health resources such as coping and self-help strategies are widely available online (e.g., Suicide Prevention Lifeline; Self-Injury Outreach & Support), such resources may not be sufficient for youth with underlying ER difficulties. Online programs that coach at risk youth on how to accept and manage the complex emotions that often accompany major societal events may potentially reduce the negative mental health impacts of COVID-19 and prepare youth to weather future crises.

Contrary to Liu et al.'s (2016) sequential hypothesis, the indirect effect of COVID-19-related stress on DSH via limited access to ER strategies was stronger among older youth and no support for a diathesis-stress model was found. Considering that the adolescents in our sample were between 12 and 18 years old, one explanation could be that ER difficulties had not yet stabilized into a diathesis. Indeed, Liu et al. (2016) acknowledge that this stabilization process may occur in young adulthood, consistent with research showing that ER skills continue to develop past adolescence (Zimmerman & Iwanski, 2014). Bearing this in mind, it is possible that a diathesis-stress model may not be applicable until young or perhaps even middle adulthood. At the same time, it is important to note that our cross-sectional design was not ideal for testing the sequential hypothesis. Future research should recruit participants spanning early adolescence to middle adulthood and use a longitudinal design to investigate whether the associations between stress, ER difficulties, and DSH change throughout development.

A final contribution of this study was that it highlighted the complementary role of social environments in explaining who is at risk of DSH. Notably, the indirect link between COVID-19-related stress and DSH via ER difficulties was stronger among youth with less in-person social contact during the pandemic. Several researchers have warned about the unintended consequences of social distancing (and its resulting isolation) on adolescent mental health (Clemens et al., 2020; Galea et al., 2020; Hasking et al., 2020; Killgore et al., 2020), and our results support this concern. Adolescence is a key period for learning how to manage complex and intense emotional experiences (Zimmerman & Iwanski, 2014) and youth rely on their social support networks to advise, model, and offer feedback on coping with stress (Reindl et al., 2016; Fried, 2011). Our results speak to the importance of finding alternative means for youth to maintain their social networks during pandemics. For example, digital technologies can bridge social distance when physical distancing measures are in place. Online social events that bring youth together in light-hearted ways (e.g., through games or hobbies) may be particularly valuable to youth who feel overwhelmed, have underlying ER difficulties, and are restricting in-person interactions. Given the relevance of these findings to weighing the costs and benefits of social distancing policies and lockdown measures (Clemens et al., 2020), it will be important for researchers to replicate and expand our results using a longitudinal design.

Several study limitations should be acknowledged. First, this study was cross-sectional so claims regarding the directionality and causality of our findings cannot be made. Longitudinal research is needed to draw conclusions about the temporal associations between COVID-19-related stress, ER difficulties, and DSH. In a similar vein, given that we did not measure stress, ER difficulties, and DSH before the start of COVID-19, we could not examine how these constructs changed throughout the pandemic (e.g., whether rates of DSH increased relative to before the pandemic). Second, this study used a single item to measure DSH that did not assess intent (suicidal versus non-suicidal) or methods (e.g., cutting, burning, hitting), which are important markers of clinical severity (Baer et al., 2020; Muehlenkamp & Gutierrez, 2007). Single-item measures tend to underestimate the prevalence of DSH (Muehlenkamp et al., 2012), making indirect and interaction effects harder to detect. Moreover, our conceptualization of DSH prevented us from testing whether the detected effects were significant specifically to suicide attempts, NSSI, or both, which would have enabled more rigorous testing of etiological models. Finally, although we expected to find evidence for a diathesis-stress model, particularly among older youth, the restricted age range of our sample (12-18 years old) may have hindered our ability to test this model.

Notwithstanding these limitations, our study provides preliminary evidence that COVID-19-related stress is associated with DSH and that specific dimensions of ER difficulties explain this association. Moreover, these associations seem to be stronger among older youth with reduced in-person social interactions, underscoring a need to support these teens in building adaptive ER skills. With these supports, adolescents may be better equipped to cope with the aftermath of COVID-19 and future pandemics.

CRediT authorship contribution statement

Christina L. Robillard: Project administration, Conceptualization, Methodology, Formal analysis, Writing – original draft, Visualization. **Brianna J. Turner:** Conceptualization, Writing – review & editing, Supervision. **Megan E. Ames:** Investigation, Resources, Data curation, Writing – review & editing, Supervision, Funding acquisition. **Stephanie G. Craig:** Investigation, Resources, Data curation, Writing – review & editing, Supervision, Funding acquisition.

Declaration of Competing Interest

The authors have no conflicts of interests, real or perceived, to declare.

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