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Exploring the relationship between suicide vulnerability, impulsivity and executive functioning during COVID-19: A longitudinal analysis

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A B S T R A C T

Public health emergencies increase the presence and severity of multiple suicide risk factors and thus may increase suicide vulnerability. Understanding how suicide risk factors interact throughout the course of a global pandemic can inform how to help the most vulnerable groups in society. The aims of the research were to explore the associations between, and changes in, suicide vulnerability, COVID-related stress, worry, rumination, executive functioning and impulsivity across the first 6 weeks of the UK COVID-19 lockdown (1st April – 17th May, 2020). 418 adults in the UK completed an online survey at three time points during the first lockdown (Time 1 (1st - 5th April), Time 2 (15th – 19th April), Time 3 (13th – 17th May)). Impulsivity and executive functioning remained stable across the first six weeks of UK lockdown. COVID-related stress, worry, and rumination decreased throughout the 6 weeks. Suicide vulnerability was associated with greater impulsivity and poorer executive functioning. Sub-group analysis revealed individuals vulnerable to suicide reported worse COVID-related stress, poorer executive function and greater impulsivity than individuals who reported no suicide vulnerability. Individuals vulnerable to suicide appear to have experienced poorer executive functioning, greater impulsivity and COVID-related stress in the initial phase of the COVID-19 pandemic.

1. Introduction

The most recent public health emergency, Coronavirus disease 2019 (COVID-19), is estimated to have infected approximately 397 million individuals and resulted in 5.7 million deaths worldwide (WHO, 2020). The first two months of the COVID-19 UK lockdown resulted in a worsened average mental distress score by 8.1% but this was greater for young adults and women who were already at risk for mental health problems, suggesting the pandemic was contributing to growing mental health inequities (Banks and Xu, 2020; Fancourt et al., 2021). There have been the emergence of different mental health trajectories over the course of the pandemic; those who were younger with lower incomes and pre-existing mental health difficulties have experienced higher initial levels of depression and anxiety that continued to increase or stay stable across time despite the cessation of the first UK lockdown (Saunders et al., 2021). The long-term effects of COVID-19 remain unknown and research has not yet considered the impact of COVID-19 on the mental health trajectories, over time, in individuals who are vulnerable to suicide. Despite there being no increase in risk of suicide since the pandemic began (Pirkis et al., 2021); pre-pandemic research indicates there were

elevated levels of known risk factors, higher worry and impulsivity, in individuals with a history of suicide, compared to individuals with no history (O'Connor et al., 2021). However, much less is known about the psychological factors that may be associated with this increased vulnerability to suicide during the current COVID-19 pandemic.

Impulsivity and executive functioning are important constructs implicated in risk of suicide behaviour as well as other mental health outcomes (Amlung et al., 2019; Han et al., 2016) and are likely to be exacerbated during the stress of a pandemic. Impulsivity is a behavioural construct that reflects impaired self-regulation which can lead to pursuance of actions with little consideration of the consequences. Whereas executive functioning is a broader term referring to a set of cognitive functions that manage thoughts, emotions and actions which in turn help us in goal-directed behaviour. Although the constructs represent a degree of cognitive control and self-regulation, these constructs have been found to be distinct and independent (e.g., Friedman et al., 2020). In a large scale review and meta-analysis of impulsivity and suicide behaviour, the relationship between impulsivity and suicide behaviour was found to be significant but small in magnitude (Anestis et al., 2014). In addition, a cross-sectional study in patients with a history of suicide attempt and

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major depressive disorder by Onat et al. (2019) reported a positive correlation between greater impulsivity scores and poorer executive function. Similarly, poor executive functioning has also been found to be implicated in suicide behaviour; greater executive functioning has been recently associated with lower levels of suicidal behaviour (Zelazny et al., 2019). The Integrated-Motivational Volitional model (IMV; O'Connor and Kirtley, 2018) acknowledges impulsivity and executive functioning as important volitional moderators translating suicide ideation to suicide behaviour. There have also been suggestions that the impulsivity – suicide behaviour relationship is likely to be indirect, rather than causal, and the presence of stress may exacerbate this relationship (Anestis et al., 2014).

Stress-diathesis models have a long history in the field of suicide research (O'Connor et al., 2020). An early example was introduced by Schotte and Clum (1987) in the context of their diathesis-stress-hopelessness model of suicide behaviour; these authors found evidence that impaired social problem-solving, a specific cognitive vulnerability factor, acted as a diathesis and it was associated with suicide behaviour in the presence of stress. More recent research supports this notion by finding that recent life stress can impair executive functioning, specifically working memory (Shields et al., 2016). Thus, it is imperative to understand how these mechanisms interact in relation to suicide behaviour.

Public health emergencies, such as the outbreak of COVID-19, increase the presence, variety and severity of stressors (Gunnell et al., 2020); a shift to a new normal involving forced working from home or loss of work, isolation or entrapment within difficult family structures, all of which are known risk factors for suicide behaviour (Lee, 2020; Moreno et al., 2020). However, we know relatively little about how changes in stress-related variables might interact with other risk factors such as impulsivity and executive functioning during periods of sustained stress and change. For example, it is likely that increased levels of COVID-related stress, worry and rumination may be associated with more impulsive behaviours or may interfere with aspects of executive functioning. Recent research found that higher-levels of COVID-related stress, worry and rumination were also associated with poorer mental health (O'Connor et al., 2022; Prudenzi et al., 2021).

To summarise, this longitudinal study aimed to investigate changes in key suicide risk factors: stress, worry, rumination, impulsivity, executive functioning during the early stages of the UK lockdown and to determine whether the effects of COVID-related stress, worry and rumination on impulsivity and executive dysfunction were greater in individuals vulnerable to suicide compared to non-vulnerable individuals. In this study we consider suicide vulnerability to include individuals who have reported *either* lifetime suicide ideation or suicide attempts (O'Connor et al., 2020, 2021). The specific aims were:

1. To explore changes in COVID-related stress, rumination and worry, impulsivity and executive functioning during lockdown.
2. To examine whether suicide vulnerability was associated with greater impulsivity levels and poorer executive functioning during lockdown.
3. To explore whether COVID-related stress, rumination and worry were associated with greater impulsivity levels and poorer executive functioning, and whether these relationships were moderated by suicide vulnerability.

2. Methods

2.1. Design and participants

557 participants recruited through social media and Prolific (aged 18 and over and fluent in English) enrolled in the study at time 1 (T1; 1st April, 2020), 468 participants (84%) completed at time 2 (T2; 14th April, 2020) and 439 participants (78.8%) completed at time 3 (T3; 28th April, 2020). Following the final survey (T3), 21 participants were excluded as they did not disclose their history of suicide ideation or attempts so could

not be included in the analysis. The current analysis is based on 418 participants who completed all three time points and disclosed suicide history. Participants were aged between 18 and 75 years of age (M = 35.37, SD = 13.74) and were predominantly Caucasian (See Table 1 for summary of demographics). Participants reported their history of suicide as follows; 37 participants reported history of attempting to take their own life, 96 participants reported suicide ideation throughout their lifetime and 285 participants reported no suicide ideation or attempts. Following the approach of earlier work (O'Connor et al., 2020, 2021), participants were categorised into a suicide vulnerability group (suicide ideation and attempt groups combined) and a non-suicide vulnerability group (control group). Combining the groups allowed us to analyse the data from the entire sample and ensured we captured a good range of scores on the outcome measures. The study was approved by the University of Leeds ethics committee (ref: PSYC-23) and the main analyses were preregistered on AsPredicted (reference number: 41985, see supplementary materials for further information).

2.2. Background measures

2.2.1. Suicide vulnerability

Two questions were taken from the Adult Psychiatric Morbidity Survey (APMS, McManus et al., 2007) to determine both lifetime suicide ideation: "Have you ever seriously thought of taking your life, but not actually attempted to do so?" and lifetime suicide attempts "Have you ever made an attempt to take your life, by taking an overdose of tablets or in some other way?" Response options were "yes", "no" or "would rather not say". The APMS measure has been used frequently to determine lifetime history of suicide ideation and attempts (e.g., Wetherall et al., 2018; O'Connor and Kirtley, 2018). Participants who answer yes to either question were categorised into the suicide vulnerability group. Participants who answered no to both questions were categorised into the non-suicide vulnerability group.

2.3. Two weekly measures

2.3.1. COVID-related measures

Single item measures of COVID-related stress, worry and rumination were developed for the purpose of the current study based on previous research which has shown single item measures of stress, rumination and worry to be reliable and valid (Clancy et al., 2020; O'Connor and Ferguson, 2016). These measures were also found to be significant predictors of poorer psychological health in previous research (Prudenzi et al., 2021).

2.3.2. COVID-related stress

Participants were asked "In the past two weeks, to what extent has life become more stressful, difficult or upsetting because of the COVID-19 outbreak?" on a scale of 1 – "not at all stressful, upsetting or

Table 1
Baseline characteristics for participants *(n = 418).*

Characteristic	Total sample *(n = 418)*	Suicide vulnerability group *(n = 133)*	Non-suicide vulnerability group *(n = 285)*
Age (SD)	35.37 (13.74)	33.06 (12.44)	36.45 (14.19)
Sex (% female)	331 (79.2%)	109 (82%)	222 (77.9%)
Ethnic background			
White	386 (92.3%)	125 (94%)	261 (91.6%)
Mixed/Multiple ethnicities	10 (2.4%)	4 (3%)	6 (2.1%)
Asian	17 (4.1%)	3 (2.3%)	14 (4.9%)
Black/African/ Caribbean	4 (1%)	1 (0.8%)	3 (1.1%)
Other ethnic group	1 (0.2%)	0 (0%)	1 (0.4%)

bothersome" to 7 – "extremely stressful, upsetting or bothersome". Given the time urgency associated with launching studies early in the pandemic, the COVID specific measures (i.e., stress, worry & rumination) were devised by an expert panel of highly experienced researchers and considered to have good face validity (O'Connor et al., 2022). Moreover, in another study, they were found to have good concurrent and convergent validity with other related psychological measures (e.g., depression, anxiety and wellbeing; see O'Connor et al., 2022; Wilding et al., 2022).

2.3.3. COVID-related worry

Preceding the question, participants were provided with a definition of COVID-related worry: "Negative, repetitive thoughts about future events which have the potential to be stressful or upsetting. These worrisome thoughts are usually distressing, can be difficult to control and can lead to a spiral of different worries". Participants were then asked "Over the last two weeks, how often did you worry or focus on COVID-19-related things that may occur or happen in the future?" Participants were required to indicate their answer on a Likert scale from 1 – "never" to 7 – "very often".

2.3.4. COVID-related rumination

A definition of rumination was provided to participants: "Negative, repetitive thoughts about upsetting emotions or events which have happened in the past (including today). These ruminative thoughts are usually distressing, can be difficult to control and can lead to a spiral of different ruminations." Participants were asked "Over the last two weeks how often did you ruminate over COVID-19-related things that have happened to you, or upset you in the past?" Participants rated their response on a Likert scale from 1 – "never" to 7 – "very often".

2.3.5. Executive functioning

Webexec (Buchanan, 2010): a 6-item measure of executive functioning whereby participants rate the extent of problems experienced from 1 – "no problems" to 4 – "many problems". The Webexec was modified for this study to reflect on the problems experienced in the past 2 weeks. Example items for this measure asked participants "do you have difficulty carrying out more than one task at a time?" and "do you find it difficult to keep your attention on a particular task?". Scores ranged from 6 to 24; the greater the summed score indicated poorer executive function. The Webexec had good internal consistency in the study (6 items; T1: $\alpha = 0.87$; T2: $\alpha = 0.90$; T3: $\alpha = 0.90$) and has been shown to be associated with self-reported psychological symptoms and a reliable measure for self-reported executive function symptom assessment (Keen et al., 2020).

2.3.6. Impulsivity

Momentary impulsivity scale (MIS; Tomko et al., 2014): a 4-item measure asking participants to "Please indicate how much each statement below describes your experience over the past 2 weeks?" This statement was adapted from the original MIS question of "Describe how much each statement described their experience since the last completed prompt". Each statement was rated from 1 – "not at all or very slightly" to 5 – "extremely". Example statements included "I have felt impatient" and "I said things without thinking". The MIS had good internal consistency (4 items; T1: $\alpha = 0.75$; T2: $\alpha = 0.76$; T3: $\alpha = 0.78$). Scores range from 4 to 20 with a higher score indicating more self-reported impulsive behaviours, since the last prompt.

2.4. Procedure

All participants were screened when beginning the questionnaire to ensure participants were aged 18 years or older and they were fluent in English language and provided written online consent. Once participants completed online consent, they completed the online baseline questionnaire. Participants were then contacted by email two and four weeks later to complete a brief follow-up questionnaire.

2.5. Data analysis

Preliminary analysis to explore data distributions and missingness was conducted. Analyses were conducted using complete case analyses whereby only participants completing all three timepoints and disclosed their suicide history were eligible for inclusion in the analysis. To examine the pattern of missingness and determine if data were missing completely at random, Little's missing completely at random (MCAR) test was performed; there was missing data in Level 2 that was not MCAR ($X^2(1054) = 1177.87$, $p = .004$). Following the approach adopted by O'Connor et al. (2022), multiple imputations were carried out and 10 imputed datasets were generated; analyses were then conducted on a randomly selected imputed dataset and the results of the multiply imputed dataset and single mean imputation were compared. The results of both analyses were substantively the same, therefore, we have reported the findings from the multiple imputed dataset. There was no missing data in Level 1 following removal of non-completers and individuals who did not disclose their suicide history.

The data was analysed using univariate and multivariate analysis of variance (ANOVA and MANOVA) in SPSS 22 and hierarchical linear modelling in HLM8 (Raudenbush et al., 2019). The analyses were conducted on the entire sample (418 participants). The data was considered to have a two-level hierarchical structure, with Level 1 capturing the within-person relations between the predictors (COVID-related stress, worry and rumination) and the dependent variables (impulsivity and executive function) with level 2 representing the between-person variability (suicide vulnerability, age, gender). The level 1 variables were group mean centred and modelled as random as we assumed that each of the within person variables would be variable. The level 2 dichotomous variables (suicide vulnerability, gender) was uncentered and the level 2 continuous variable (age) were grand mean centred. Note that in order to account for multiple testing, we have adopted a more conservative p value in all the analyses (p < .017; p < .05/3) reflecting the number of tests conducted in each set of analyses (i.e., the three main study variables). Lastly, the recommendations set out by Simmons et al. (2011) regarding transparency were followed so that the unadjusted (no covariates) and adjusted (covariates) analyses are presented. The general form of the HLM model is expressed by the following equation:

2.5.1. Level-1 model

State Impulsivity/Executive function = $\beta_{0j} + \beta_{1j}$*(COVID-related stress) + r_{ij}

2.5.2. Level-2 model

$\beta_{0j} = \gamma_{00} + \gamma_{01}$*(age) + γ_{02}*(gender) + γ_{03}*(suicide vulnerability) + u_{0j}

$\beta_{1j} = \gamma_{10} + \gamma_{11}$*(suicide vulnerability) + u_{1j}

3. Results

Descriptive statistics for the main study variables are presented in Table 2. For the entire sample the mean impulsivity scores did not alter noticeably across the three time points, yet at each time point individuals vulnerable to suicide demonstrated higher impulsivity scores compared to individuals with no vulnerability. A similar pattern emerged for the entire sample when looking at executive function across the three time points, there was no substantial variation in the scores across the lockdown period. Yet, individuals with vulnerablility to suicide exhibited poorer executive functioning (shown by a higher score) at all-time points compared to individuals with no vulnerability. COVID-related stress, worry and rumination each showed decreases across time for the entire

Table 2
Descriptive statistics for main study variables at each time point *(n = 418)*.

	Time point								
	1 (April 1, 2020)			2 (April 14, 2020)			3 (April 28, 2020)		
	Suicide vulnerability group M (SD)	*Non-suicide vulnerability group M (SD)*	*Total M (SD)*	*Suicide vulnerability group M (SD)*	*Non-suicide vulnerability group M (SD)*	*Total M (SD)*	*Suicide vulnerability group M (SD)*	*Non-suicide vulnerability group M (SD)*	*Total M (SD)*
COVID-related stress	5.01 (1.41)	4.76 (1.20)	4.84 (1.28)	4.53 (1.41)	4.34 (1.44)	4.40 (1.43)	4.35 (1.57)	4.04 (1.51)	4.14 (1.53)
COVID-related Worry	5.23 (1.58)	5.07 (1.50)	5.12 (1.52)	4.75 (1.61)	4.48 (1.62)	4.56 (1.62)	4.53 (1.66)	4.16 (1.53)	4.28 (1.58)
Rumination	3.95 (1.83)	3.44 (1.65)	3.60 (1.72)	3.83 (1.66)	3.34 (1.66)	3.49 (1.68)	3.76 (1.67)	3.27 (1.67)	3.42 (1.69)
Executive function*	14.92 (4.23)	11.93 (4.07)	12.88 (4.34)	15.50 (4.33)	12.62 (4.47)	13.54 (4.62)	15.26 (4.16)	12.34 (4.44)	13.27 (4.56)
Impulsivity	9.68 (3.30)	8.69 (3.38)	9.00 (3.38)	9.78 (3.41)	8.57 (3.33)	8.95 (3.40)	9.83 (3.69)	8.68 (3.43)	9.05 (3.55)

Note. * = high mean score indicates poorer executive function.

sample, and the same pattern emerged for individuals vulnerable to suicide reporting greater COVID-related stress, worry and rumination compared to individuals with no vulnerability.

3.1. Completer vs non-completer analysis

A series of ANOVAs were performed to determine if there were any differences in COVID-related stress, worry, rumination, executive functioning and impulsivity between individuals who completed (completers $(n = 439)$ all surveys compared to non-completers $(n = 118)$. Specifically, univariate analyses showed that when comparing completers to non-completers, completers were significantly higher in COVID-related stress $(F (1, 555) = 13.22; p < .001;$ partial $\eta^2 = 0.02)$, COVID-related worry $(F (1, 555) = 10.36; p = .001;$ partial $\eta^2 = 0.02)$ and COVID-related rumination $(F (1, 555) = 6.91; p = .009;$ partial $\eta^2 = 0.01)$ compared to non-completers. There were no differences in executive functioning and impulsivity between completers and non-completers that were statistically significant.

In addition to the above ANOVAs, we explored whether there were any differences in demographic variables amongst completers and non-completers. An independent samples *t*-test suggested no significant differences in the age of participants depending on whether they completed $(M = 35.05, SD = 13.65)$ or did not complete all the surveys $(M = 32.98, SD = 13.29; t(554) = −1.46, p = .144)$. Additionally, a chi-square test revealed no significant relationship between completion status and gender $(X^2(2) = 3.92, p = .141)$.

3.2. Changes in COVID-related stress, rumination and worry, impulsivity and executive functioning during UK lockdown

A series of ANOVA's were conducted to test the first hypothesis, exploring the changes in executive function, impulsivity, COVID-related stress, worry and rumination across lockdown. Univariate analyses showed effects of time on both COVID-related stress $(F (2, 1251) = 26.30; p < .001;$ partial $\eta^2 = 0.04)$ and worry $(F (2, 1251) = 30.67; p < .001;$ partial $\eta^2 = 0.05)$. Tukey post-hoc comparisons found COVID-related stress was significantly lower at T2 compared to T1 and T3 compared to T1. Although decreases were seen between T2 and T3, when applying Bonferroni corrections to interpret the p-values the decrease was no longer significant. COVID-related worry was significantly lower at T2 compared to T1 and T3 compared to T1, again decreases in COVID-related worry occurred between T2 and T3 but were not significant when adjusting the p-value accounting for multiple testing $(p = .017)$. There were no significant changes across lockdown for COVID-rumination, executive function or impulsivity.

3.3. Main effects of suicide vulnerability on impulsivity and executive function

The HLM analyses found that there was a main effect of suicide vulnerability on impulsivity (unadjusted $\beta = 0.29, p < .001;$ adjusted $\beta = 0.25, p < .001$) and executive functioning (unadjusted $\beta = 2.89, p < .001$, adjusted $\beta = 2.62, p < .001$) such that individuals vulnerable to suicide reported higher levels of impulsivity and poorer executive function (See Supplementary Tables 3 and 4) compared to individuals with no vulnerability.

3.4. Effects of COVID-related stress, rumination and worry on impulsivity and executive function

The HLM analyses also found that the level 1 slope between COVID-related stress and impulsivity was significant in both the unadjusted $(\beta = 0.09, p < .001)$ and adjusted models $(\beta = 0.09, p < .001)$ indicating that recent COVID-related stress was associated with greater impulsivity across the initial stages of the UK lockdown. The level 1 slope between COVID-related stress and executive function was significant in both unadjusted $(\beta = 0.34, p < .001)$ and adjusted $(\beta = 0.34, p < .001)$ indicating greater COVID-related stress was associated with poorer executive function. After adjusting the p-value criterion using Bonferroni correction, the level 1 slope between COVID-related worry and impulsivity was significant in the unadjusted $(\beta = 0.05, p = .013)$ and adjusted models $(\beta = 0.05, p = .013)$. The level 1 slope between COVID-related worry and executive function was significant in both the unadjusted $(\beta = 0.30, p = .002)$ and adjusted models $(\beta = 0.30, p = .001)$ indicating that higher levels of COVID-related worry were associated with poorer executive function. The level 1 slope between COVID-related rumination and impulsivity was significant in both the unadjusted $(\beta = 0.06, p = .003)$ and adjusted models $(\beta = 0.06, p = .004)$. The level 1 slope between COVID-related rumination and executive function was also significant in both the unadjusted $(\beta = 0.24, p = .008)$ and adjusted model $(\beta = 0.24, p = .009)$.

3.5. Moderating effects of suicide vulnerability on the COVID-related stress, worry and rumination - impulsivity and executive function relationships

Suicide vulnerability did not moderate the level 1 COVID-related stress – impulsivity slope in either model (unadjusted $(\beta = −0.08 p = .057)$; adjusted $(\beta = −0.07, p = .059)$). Suicide vulnerability did not moderate the level 1 slope between COVID-related rumination and impulsivity (unadjusted $(\beta = −0.02 p = .622)$; adjusted $(\beta = −0.02, p = .625)$). The level 1 slope between COVID-related worry and impulsivity

was not moderated by suicide vulnerability in either model (unadjusted ($\beta = 0.04$, $p = .340$); adjusted ($\beta = 0.04$, $p = .341$)).

Similarly, the level 1 slope between COVID-related stress and executive function was not moderated by suicide vulnerability in either the unadjusted ($\beta = -0.03$, $p = .864$) or adjusted model ($\beta = -0.03$, $p = .884$). The level 1 rumination – executive function slope was not moderated by suicide vulnerability (unadjusted ($\beta = 0.09$, $p = .590$); adjusted ($\beta = 0.09$, $p = .586$)). Lastly, suicide vulnerability did not moderate the level 1 worry – executive function relationship in either model (unadjusted ($\beta = 0.11$, $p = .547$); adjusted ($\beta = 0.11$, $p = .545$)).

4. Discussion

This is one of the first longitudinal studies, to our knowledge, that provides evidence for how risk factors for suicide interact throughout the course of a lockdown in a global pandemic. There were four key findings. First, over the course of the 6-week period measured in the first UK lockdown, COVID-related stress and COVID-related worry decreased, whereas impulsivity and executive functioning remained stable. Second, suicide vulnerability was associated with greater impulsivity and poorer executive function during the lockdown period suggesting suicide vulnerability may put individuals at a greater risk of negative consequences from the pandemic. Third, in weeks when people experienced greater COVID-related stress, more impulsive behaviours and poorer executive functioning were also reported. However, suicide vulnerability did not moderate these associations. Fourth, in weeks when people experienced greater COVID-related worry and rumination, more impulsive behaviours and poorer executive functioning were also reported. Again, suicide vulnerability did not moderate these associations.

COVID-related stress and worry decreased over the lockdown period. This is consistent with Fancourt et al. (2020) whereby stress relating to COVID-19 (catching and becoming ill) continued to decrease across the first 5 weeks of lockdown and worries about money, employment and access to food decreased. Whereas COVID-related rumination, impulsivity and executive functioning remained stable across the lockdown period. Combined, the current study, alongside Fancourt et al. (2020), suggests that many individuals adjusted quickly to the lockdown in the UK.

Suicide vulnerability was found to be associated with poorer executive functioning. This finding aligns with studies whereby self-reported executive functioning was poorer in a sample of individuals reporting suicide attempts, depression and anxiety, compared to a sample with no attempt controls (Loyo et al., 2013). It is important to note the difficulty to directly compare results of the current study to other literature on executive functioning as few studies have measured self-reported executive functioning in relation to suicide, instead opting for performance based measures, especially when there is reported to be minimal overlap with performance and self-reported measures of executive functioning (Toplak et al., 2013). However, one study to our knowledge reported that individuals who had made a recent suicide attempt reported significantly worse self-reported executive functioning compared to individuals who had recently experienced suicide thoughts, suggesting executive functioning (self-reported) may represent an important risk factor for recent suicide attempts (Saffer and Klonsky, 2017). The authors reported no differences in executive dysfunction when comparing lifetime history of suicide ideation compared to lifetime history of suicide attempts but executive function differences were present when comparing individuals with recent suicide ideation compared to individuals with recent suicide attempts. Future research should consider the recency of suicide in relation to the stress – executive relationship.

The present study found suicide vulnerability to be associated with higher impulsivity. This is consistent with previous research whereby aggregated self-reported momentary impulsivity was related to baseline suicide risk in individuals with bipolar disorder (Depp et al., 2016),

although this research did not consider the relationship between individual momentary ratings of impulsivity and suicide risk, unlike the present study. Moreover, greater weekly COVID-related stress was associated with more impulsive behaviours. This is in keeping with previous work that found self-reported impulsivity was higher during periods of stress compared to no stress, in a sample of individuals with borderline personality disorder as well as healthy controls (Cackowski et al., 2014). A potential explanation for this is that high levels of impulsive traits may increase vulnerability to problematic coping behaviours during COVID-19, and their influence may be exacerbated during times of stress (Albertella et al., 2021).

Future psychological interventions for individuals vulnerable to suicide ought to consider targeting changes in executive functioning and impulsivity. Previous research posits that a variety of interventions can improve executive functioning in children aged 4–12 years old (Diamond and Lee, 2011). Executive functioning intervention from a younger age may mitigate transition to suicide risk, but whether better executive functioning could become a protective factor against suicide behaviour is yet to be determined. Future research is needed to explore whether global or individual constructs of executive functioning relate to suicide behaviour so intervention can target the most relevant constructs and thus be most effective. This is supported by the previous research which states if an intervention is not successful in addressing the executive functioning problems in adolescence, it is possible that over time, some adolescents who experience attentional impairments go on to engage in more lethal suicide attempts (Sommerfeldt et al., 2016).

There are inevitable shortcomings to the current study that ought to be acknowledged. First, the study had no true baseline, the first assessment was taken 1 week into the first UK lockdown, reflecting the window of time between 1-week pre-lockdown and 1-week into the first lockdown, which may have already increased individual stress and impacted wellbeing prior to the first measures being administered. Thus, attributing any changes in measures observed to lockdown is not appropriate. Secondly, the measure of state executive functioning is not a gold standard performance-based measure. There are reported differences between performance-based measures compared to self-report measures of executive function (Keen et al., 2020). Nevertheless, the self-report measure used in the current study has been shown to be reliable and valid (Banks and Xu, 2020). Lastly, although it may have been useful to measure personality traits (e.g., neuroticism, perfectionism) together with suicide vulnerability in the current study, our approach was focussed on investigating the changes in state measured variables during the early stages of the COVID-19 pandemic in relation to suicide vulnerability. However, this does not under mind the important of such variables, therefore, future research ought to consider the role of personality traits alongside the associations between suicide vulnerability and the state measured variables explored in this study.

5. Conclusion

To conclude, this is one of the first longitudinal studies that provides evidence for how risk factors for suicide interact throughout the early stages of a global pandemic lockdown. COVID-related factors decreased in the initial phase of the pandemic. Individuals vulnerable to suicide appear to have experienced poorer executive functioning, greater impulsivity and COVID-related stress in the initial phase of the COVID-19 pandemic. Psychological intervention for individuals vulnerable to suicide ought to consider targeting changes in execute functioning and impulsivity.

Data availability

Data are available from the authors upon reasonable request.

Informed consent

Informed consent was obtained from all individual participants included in the study.

Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Author statement

OR, AP & DoC conceptualised this study. OR and AP conducted the study. OR and DoC drafted the initial manuscript. All authors approved of publication.

Declaration of competing interest

The authors have none to declare.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https ://doi.org/10.1016/j.psycom.2022.100088.

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