

RUNNING HEAD: WHY COVID-19 IS A TRAUMATIC STRESSOR

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**Why the COVID-19 pandemic is a traumatic stressor**

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## WHY COVID-19 IS A TRAUMATIC STRESSOR

28 Abstract

29 The COVID-19 pandemic does not fit into prevailing Post-traumatic Stress  
30 Disorder (PTSD) models, or diagnostic criteria, yet emerging research shows traumatic  
31 stress symptoms as a result of this ongoing global stressor. Current pathogenic event  
32 models focus on past, and largely direct, trauma exposure to certain kinds of life-  
33 threatening events. Nevertheless, among a sample of online participants ( $N = 1,040$ ) in five  
34 western countries, we found participants had PTSD-like symptoms for events that had not  
35 happened and when participants had been directly (e.g., contact with virus) *or* indirectly  
36 exposed to COVID-19 (e.g., via media). Moreover, 13.2% of our sample were likely  
37 PTSD-positive, despite types of COVID-19 “exposure” (e.g., lockdown) not fitting DSM-5  
38 criteria. The emotional impact of “worst” experienced/anticipated events best predicted  
39 PTSD-like symptoms. Our findings add to existing literature supporting a *pathogenic event*  
40 *memory* model of traumatic stress.

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## WHY COVID-19 IS A TRAUMATIC STRESSOR

### 44 **Why the COVID-19 pandemic is a traumatic stressor**

45 The COVID-19 pandemic is ravaging all areas of human life (e.g., social,  
46 financial), creating distress, and exacerbating mental health issues (1). Recent research  
47 suggests that *traumatic stress reactions* during the pandemic—including intrusive re-  
48 experiencing and heightened arousal—are particularly prevalent (2). But exposure to the  
49 pandemic does not fit neatly within prevailing Post-traumatic Stress Disorder (PTSD)  
50 models (pathogenic event models) (3,4). These models, along with the DSM-5 diagnostic  
51 criteria (5), attribute traumatic stress reactions to past, and largely direct, exposure to  
52 certain life-threatening events, and thus do not readily account for the emerging data. We  
53 propose that people’s traumatic stress reactions to the COVID-19 pandemic may relate  
54 more to: the future than the past; indirect (e.g., via media coverage) than direct (e.g.,  
55 contact with the virus) exposure; and stressful events (e.g., unemployment, isolation, non-  
56 sudden illness/death) that do not meet Criterion A (i.e., actual or threatened death, injury or  
57 sexual violation). Therefore, we sought evidence for this proposal. Although we know  
58 traumatic stress reactions to future, indirect trauma exposure, and non-Criterion A events  
59 exist (6,7), the COVID-19 pandemic gives us a unique opportunity to extend this research  
60 by considering all three factors simultaneously. Our goal was not to unnecessarily  
61 pathologize normal transient stress reactions (8), but rather to document types of “events”  
62 that lead to traumatic stress reactions and thus inform PTSD models which may—  
63 currently—not capture all people who require help for traumatic stress symptoms.

64 We first turn to the idea of traumatic stress as a problem of the past. Existing PTSD  
65 models largely focus on traumatic stress as a problem that occurs in response to past, not  
66 future, events. Perhaps there is a profound ontological distinction between something that  
67 has happened in the past and something that might happen in the future. Yet, Addis (9 p.  
68 233) argues that remembering and imagining are “fundamentally the same process” (see

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69 also 10); both involve the mental rendering of experience. Certainly, there is convincing  
70 evidence that similar neural networks underlie remembering the past and imagining the  
71 future (11). Thus, it is possible that problematic reactions can occur in response to *any*  
72 mentally rendered experience, whether it is remembered and/or imagined. Existing  
73 evidence fits with this idea: imagining *future* trauma—e.g., among soldiers before  
74 deployment, expectant mothers, or people anticipating the death of a loved one—can cause  
75 PTSD-related symptoms and distress at similar or higher levels than for past trauma (6,12–  
76 14). Indeed, participants in these studies have reported—on scales adapted from traditional  
77 PTSD measures—experiencing not only more typical symptom candidates like image-  
78 based flashforwards to a specific future event, but also nonspecific symptom candidates  
79 such as heightened irritability and negative mood. Therefore, traumatic stress symptoms  
80 may be a problem of anticipating the future, as well as a reaction to something in the past  
81 (6,13,14). Given the unknown timeline of COVID-19, it seems especially likely that  
82 PTSD-like symptoms could arise due to anticipating any number of negative future events  
83 (e.g., loved ones becoming sick) associated with the virus, particularly in the early weeks  
84 of the pandemic (when the current data were collected). Moreover, given COVID-19 is  
85 still unfolding, people may experience peri-traumatic reactions (responses at the time of a  
86 stressful event or immediately after).

87 We now examine the idea of traumatic stress arising only from *direct* exposure to a  
88 trauma. Criterion 4A of the DSM-5 states that some types of *indirect* trauma exposure,  
89 such as exposure to others' traumatic experiences (termed “vicarious trauma” e.g., first  
90 responders collecting human remains), can result in PTSD symptomology (5). However,  
91 this criterion does not apply when this exposure occurs via electronic media—unless this  
92 exposure is *work* related (e.g., police officers repeatedly exposed to child exploitation  
93 images). Yet, PTSD symptomology is also found among members of the general public

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94 who are exposed only to traumatic *material*, usually via news media. For example, media  
95 exposure was associated with higher acute stress than direct exposure to the Boston  
96 Marathon bombings (15). In China, nurses *not* involved in caring for COVID-19 patients  
97 (non-front-line nurses) and the general public had higher PTSD-like symptoms (e.g.,  
98 intrusive thoughts), depression, anxiety, and stress symptoms, and physiological reactions  
99 (e.g., no appetite), than front-line nurses (16). Li et al. (16) speculated that perhaps non-  
100 front-line nurses and the general public consumed more COVID-19 media. Recent  
101 evidence supports this interpretation: exposure to COVID-19 related news in the initial  
102 stages of the outbreak was associated with negative affect, anxiety, depression and stress  
103 (17). Moreover, searching for additional information about COVID-19 via traditional and  
104 social media was related to increased fear about consequences of the virus (18). Therefore,  
105 it seems possible that indirect exposure to the pandemic, such as via the 24-hour news  
106 cycle, could produce PTSD-like symptoms.

107         Last, we turn to the idea of traumatic stress arising only from *exposure to actual or*  
108 *threatened death, serious injury or sexual violation* (i.e., only to certain kinds of serious  
109 events). Under the current diagnostic criteria, traumatic stress symptoms following events  
110 that do not involve an immediate threat to life or physical injury—such as divorce, job  
111 loss, or non-sudden medical events—do not qualify as PTSD. Yet, we know PTSD  
112 symptoms arise after a range of events that do not meet this narrow definition (7). For  
113 example, ongoing financial stressors and low social support following Hurricane Katrina,  
114 not only direct exposure to hurricane-related events, were associated with PTSD symptoms  
115 measured 18-24 months post-hurricane (19). Notably, financial stressors independently  
116 predicted PTSD symptom duration, while hurricane-related traumatic events did not.  
117 Further, 6-20% of cancer sufferers and their families are diagnosed with cancer-related  
118 PTSD (20)—although the true prevalence of cancer-related PTSD is likely much higher.

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119 The moment when cancer is diagnosed—i.e., the traumatic “event”—often does not meet  
120 DSM-5 criteria specifying a “sudden and catastrophic” medical event, and commonly  
121 reported intrusive symptoms would not count because they relate to the future (e.g., fear of  
122 relapse), not the past (20). Thus, direct exposure to a past event that threatens death, injury,  
123 or sexual violation is not the only precipitator of PTSD-like symptoms. Again, these data  
124 suggest that a range of COVID-19 related stressful events (e.g., job loss, isolation) could  
125 lead to traumatic stress symptoms, despite even the direst of COVID-19 events not meeting  
126 stringent DSM-5 criteria that state medical events must be sudden and “catastrophic” (5).

127 In summary, we predicted that people would report experiencing *pre-*, *post-*, and  
128 *peri-*traumatic stress reactions in response to COVID-19, regardless of whether they had  
129 been directly (e.g., COVID-19 diagnosis) or indirectly (e.g., media) exposed to the virus,  
130 or had other negative experiences (e.g., lockdown). We were specifically interested in  
131 people’s psychological, not immunological, response to the virus. We expected that  
132 pre/peri/post-traumatic stress reactions, as well as other psychological functioning  
133 indicators (well-being, psychosocial impairment, emotions, depression, anxiety, and stress)  
134 would fluctuate alongside COVID-19 exposure, and that psychological functioning would  
135 vary by demographics (e.g., age, healthcare).

136 We recruited online participants from five English speaking western countries of  
137 similar socio-economic make up (United States, United Kingdom, Canada, Australia and  
138 New Zealand). To date, research on COVID-19 as a traumatic stressor has primarily been  
139 conducted in China (2), and only one unpublished study has focused on one of our  
140 populations of interest (United States (21)). Participants indicated what COVID-19 events  
141 they had experienced and what future events they were concerned about (see  
142 Supplementary Online Material), and of these, which event bothered/bothers them the most  
143 and why. We also measured COVID-19 media consumption. Participants completed the

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144 Posttraumatic Stress Disorder Checklist-5 (PCL-5 (22)), adapted to measure pre/peri/post-  
145 traumatic reactions, and measures of general emotional reactions, well-being, psychosocial  
146 functioning, and depression, anxiety, and stress symptoms. Importantly, although emerging  
147 research on COVID-19 and traumatic stress reactions has typically not specified whether  
148 participants anchored their reactions to COVID-19 itself (e.g., (23)), we asked our  
149 participants to respond to the PCL-5 in relation to COVID-19.

### 150 **Method**

151 This experiment was approved by the Flinders University Social and Behavioral  
152 Research Ethics Committee. We have reported all measures, conditions, and data  
153 exclusions. We preregistered this experiment (<https://osf.io/dxhek>), and together with the  
154 data file, all supplementary material—including full demographic breakdown, analyses by  
155 country, and other descriptive and inferential statistics—can be found under this project:  
156 <https://osf.io/jn7zx/>

### 157 **Participants**

158 Correlations stabilize when sample size approaches 260 (24). We excluded 18  
159 responses: five provided answers consistent with bots/farmers (e.g., “interested”), and 13  
160 took the survey twice. Thus, after exclusions, we collected 260 participants in each of four  
161 locations (Australia/NZ combined for analysis; a participant error resulted in 261  
162 participants from Canada, and 259 from Australia/NZ), from Mechanical Turk (MTurk;  $n$   
163 = 320) and Prolific ( $n = 720$ ) between April 10-21, 2020, exceeding the pre-registered  
164 sample size ( $N = 1,000$ ). We know that MTurk data are reliable (25,26) and sometimes  
165 even superior to university sourced participants (e.g., participants fail fewer attention  
166 checks (27)). Prolific data appear to be as reliable as MTurk, and similar, if not superior to,  
167 university research pools (28). Further, the prevalence of mental health disorders in MTurk  
168 populations matches or exceeds that of the general population (29), suggesting MTurk is an

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169 excellent source for collecting clinical and subclinical populations. We specifically abide  
170 by Mellis and Bickel's (30) advice for conducting online research, to mitigate concerns in  
171 these populations (e.g., non-naivete, worker inattention, fraudulent responses and worker  
172 treatment). To minimize "bots"/server farmers completing the survey (31,32), participants  
173 had to pass a captcha, a simple arithmetic question (presented as an image to make it  
174 difficult for bots to read), and score at least 8/10 on an English proficiency test. We are  
175 confident that these entry requirements screened out almost all bots/server farmers; in one  
176 estimate, the addition of an English proficiency test screened out 96% of bots/server  
177 farmers (33). In addition to these entry requirements, participants had to pass at least one  
178 of three attention check questions embedded in the survey itself to be included in the final  
179 sample (34,35).

180 Participants ranged from 18-78 years ( $M = 35.7$ ,  $SD = 12.3$ ), half were male  
181 (50.70%, female = 48.8%, non-binary = 0.4%; 0.2% did not answer) and most were  
182 Caucasian 59.9%. Others were of Asian (13.4%); African (including "Black", 4.7%);  
183 Middle Eastern (including "Eurasian", 0.8%); European (3.5%); and Hispanic (1.2%)  
184 descent, or Indigenous (0.3%); Pacific Islander (0.1%); Mixed (3.3%) ethnicity. Some  
185 participants provided nationality (e.g., "Australian" 12.8%) or no answer (0.2%). Seventy  
186 percent were employed, 19.8% were students. Participants' highest level of education was  
187 a college/university undergraduate degree (54.8%), postgraduate degree (18.7%), high  
188 school (25.6%); 1.0% < high school. Participants had a median of three people in their  
189 household (including themselves). Modal household income was (local currency):  
190 Australia/NZ = \$100,000-\$149,999, Canada = \$100,000-\$149,000, UK = £20,000-  
191 £29,999, US = \$50,000-\$59,999. Most participants (88.8%) had health-care coverage for  
192 COVID-19 expenses and were not in a high-risk group (82.6%) for developing COVID-19



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193 (e.g., elderly, medical condition; 14.9% of participants identified as high risk, 2.5% did not  
194 know). Just under half (45.2%) had experienced a Criterion A event.

### 195 **Materials**

196 We first asked demographic questions, described above. Note that other pre-  
197 registered measures (i.e., media avoidance, engagement with fictional/non-fictional media,  
198 perceptions of sharing the pandemic with others) are not reported here.

199 **General emotional reactions.** We assessed current stress (0 = no stress, 10 = worst  
200 stress possible), and, when thinking about COVID-19, how intensely participants felt  
201 negative emotions (sad, angry, anxious, frustrated, helpless, fearful, disgusted; 0 = not at  
202 all, 7 = extremely). We averaged these emotion items ( $\alpha = .89$ ).

203 **Exposure to COVID-19 and related impact.** We provided a list of 32 COVID-19  
204 related events (ranging from exposure to the virus itself to stressors like job loss; see  
205 Appendix: <https://osf.io/tkemz/>), within nine predetermined categories. Participants  
206 selected all the events they had experienced, with an option for ‘other’ leading us to create  
207 four additional—and modify 10—categories. We recategorized seven “other” responses  
208 into new categories and 37 into modified/existing categories. We then re-presented the  
209 same list of events, but asked participants to select events they were concerned about  
210 happening in the future (“other” events led to three additional categories [seven responses  
211 recategorized] and eight modified categories [15 recategorized]). For both lists,  
212 participants identified which of their selected events bothered them the most and why (text  
213 response), and how much it bothered them emotionally (1 = not at all, 5 = very much).

214 **Media exposure.** Participants identified the social media (e.g., Facebook) and news  
215 media (e.g., television) sources used to engage with COVID-19 content. We assessed  
216 frequency of use (how many: hours in the past day, days in the past week, average hours in  
217 the past week), and combined these items to create a score for both media types.



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243 Minister Johnson was released after hospitalization for COVID-19, the Queen addressed  
244 the nation, and lockdown restrictions were extended. In Canada, deaths reached 1,500, and  
245 an unrelated shooting occurred in Nova Scotia. In Australia/NZ, lockdown procedures  
246 were introduced or maintained, and both countries showed signs of reduced COVID-19  
247 spread from the first wave.

248 We ran analyses using Null-Hypothesis Significance Tests ( $\alpha = .05$ ) in SPSS  
249 Version 25 and JASP for MacOS version 0.13.1 (39). Where data were missing, we used  
250 the average mean score from the appropriate subscale. In total there were only six missing  
251 data points from five participants: two participants missed items on the Posttraumatic  
252 Stress Disorder Checklist (PCL-5; one participant missed two items), two participants  
253 missed one item on the WHO-5 (measure of wellbeing), and one participant missed one  
254 item on the Depression, Anxiety and Stress Scale (DASS-21).

255 First we present a snapshot of COVID-19's effect on mental health. Descriptive  
256 statistics for overall stress, emotional reactions and psychological functioning ratings  
257 appear in Table 1.

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259 Table 1

260 *Descriptive statistics – emotion and psychological functioning variables (full sample)*

	Range	Mean	Median	SD
Pre/Peri/Post-Traumatic Stress Reactions (PCL-5)	0-66	17.37	14.00	13.29
Re-experiencing	0-20	3.51	2.00	3.82
Avoidance	0-8	2.01	1.00	2.04
Alterations in cog/mood	0-26	6.78	6.00	5.36
Alterations in arousal	0-24	5.07	4.00	4.21
Stress	0-10	4.99	5.00	2.39
Negative emotions	1-7	3.72	3.86	1.40
Physical Disgust	1-7	3.74	4.00	1.84
Moral Disgust	1-7	5.33	6.00	1.57
Wellbeing	0-100	46.27	48.00	22.53
Psychosocial Functioning	0-100	24.42	20.00	22.43
Depression (DASS-21)	0-42	12.50	10.00	11.22
Anxiety (DASS-21)	0-42	6.43	4.00	8.07
Stress (DASS-21)	0-42	12.50	10.00	10.38

261

262           These variables were highly correlated. According to the conservative cut-off for  
263 clinical significance for PCL-5 scores (< 32 = negative, ≥ 33 = positive) (40), 13.2% of our  
264 participants could be classified PTSD-positive. For *depression*, 47.3% of our participants  
265 were in the normal range; 28.8% mild-moderate; 24.0% severe-extremely severe  
266 (Depression, Anxiety and Stress Scale [DASS-21] manual cut-offs). For *anxiety*: 68.0%  
267 normal, 15.9% mild-moderate, 16.1% severe-extremely severe; and for *stress*: 63.0%  
268 normal, 22.6% mild-moderate, 14.4% severe-extremely severe. Participants' mean DASS-  
269 21 scores were higher than non-clinical samples (41). For well-being, 55.4% of  
270 participants scored below 50 (0 = worst, 100 = best). Overall well-being was below the UK  
271 population mean of 58.6 (42). For psychosocial functioning, 64.0% of participants reported

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272 some impairment due to COVID-19. Completing day-to-day activities (e.g., chores,  
273 medical appointments; self-care subscale: 62.8%) was most common. Troubles with  
274 training/education (27.6%) created the highest level of impairment ( $M = 3.3$ ,  $SD = 1.7$ ).

275 Taken together, our findings support emerging research that COVID-19 can be  
276 understood as a traumatic stressor event capable of causing PTSD-like responses and  
277 exacerbating other related mental health problems. Thus, next we addressed our main  
278 aim—to examine evidence for our proposal that people are experiencing traumatic stress  
279 symptoms as a result of COVID-19 because *direct* exposure to a *past* event that threatens  
280 *death, injury, or sexual violation*, is not the only circumstance capable of precipitating  
281 PTSD-like symptoms.

282 First, we examined evidence that traumatic stress is a problem not only of  
283 remembering the past, but also of anticipating the future. We calculated the frequency of  
284 exposure to experienced and anticipated COVID-19 events. On average, participants  
285 anticipated ( $M = 8.98$ ,  $SD = 5.24$ ) more events than they had experienced ( $M = 6.34$ ,  $SD =$   
286  $2.74$ ;  $d = 0.49$ ). The most common worst experiences were being in lockdown (13.1%),  
287 trouble obtaining supplies (11.2%), and voluntarily self-isolating (10.8%). The most  
288 common worst anticipated experience was close family/friends passing away (38.1%),  
289 followed by becoming ill or passing away (22.2%), and close family/friends testing  
290 positive (9.2%). However, worst anticipated and experienced event judgements were fairly  
291 evenly distributed across our full list.

292 We next examined whether traumatic stress reactions were associated with  
293 anticipated (and experienced) events. We found small correlations between PTSD-like  
294 symptoms and total experienced ( $r = .20$ ,  $p < .001$ ) and anticipated ( $r = .23$   $p < .001$ )  
295 events. Both exposure measures weakly correlated with other stress and psychological  
296 functioning measures (experienced:  $r_s = .10-.19$ ; anticipated:  $r_s = .12-.22$ ).

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297           However, because examining event totals tells us nothing about how distressing  
298 *each* experienced/anticipated event was, we next focused on our nine event categories, and  
299 participants' *worst* experienced and anticipated events. Participants who had contact with  
300 the virus ( $d = 0.34$ , 95% CI [0.20, 0.47]), lost work/income ( $d = 0.18$  [0.05, 0.30]),  
301 experienced lockdown directives ( $d = 0.13$  [0.004, 0.25]), changes to children/dependents  
302 ( $d = 0.15$  [0.02, 0.28]), and had trouble buying supplies ( $d = 0.34$  [0.22, 0.46]) reported  
303 higher PTSD symptoms than participants not reporting these experiences. However, there  
304 was no difference based on whether people experienced changes to work/education, travel  
305 plans, closure of non-essential gatherings, or voluntarily self-isolated ( $d$ s 0.02 - 0.11).  
306 Similarly, participants who anticipated contact with the virus ( $d = 0.44$ , 95% CI [0.15,  
307 0.72]), losing work/income ( $d = 0.25$  [0.12, 0.37]), lockdown directives ( $d = 0.15$  [0.03,  
308 0.28]) and changes to children/dependents ( $d = 0.35$  [0.18, 0.51]) had higher PTSD  
309 symptoms than participants who did not anticipate these events. Contrary to experienced  
310 events, participants who anticipated changes to work/education ( $d = 0.38$ , [0.16, 0.61]),  
311 travel plans ( $d = 0.26$  [0.12, 0.40]), and closure of non-essential gatherings ( $d = 0.29$  [0.07,  
312 0.50]) reported higher PTSD symptoms than participants who did not anticipate these  
313 events. There was no difference based on whether people anticipated voluntarily self-  
314 isolating ( $d = 0.24$  [0.01, 0.46]), or having trouble buying supplies ( $d = 0.12$  [-0.02, 0.25]).  
315           On average, participants' worst anticipated event ( $M = 3.97$ ,  $SD = 1.04$ ) was more  
316 emotionally bothersome than their worst experienced event ( $M = 3.35$ ,  $SD = 1.15$ ; two-  
317 tailed paired samples:  $t(1039) = -18.18$ ,  $p < .001$ ,  $d = 0.56$ , 95% CI [0.50, 0.63]). Both  
318 ratings strongly correlated with PTSD symptoms (experienced:  $r = .48$ ; anticipated:  $r =$   
319  $.45$ ) and other stress and psychological functioning measures (experienced:  $r$ s .30-.51;  
320 anticipated:  $r$ s .25 - .46). However, total PCL score does not tell us how often participants  
321 *attributed* symptoms to experienced and anticipated events, or something currently

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322 happening. Nearly half (48.1%) of participants reported symptoms in relation to all time  
323 periods (23.3% past/future, 7.5% past/current, 0.8% past/future; 14.5% current, 0.2% past,  
324 1.7% future; 3.9% reported no symptoms). Some participants failed to index individual  
325 symptoms to a timeframe; 0.6% did not index any. Notably, 73.5% of participants reported  
326 at least one symptom related to something that had not happened. These symptoms fell into  
327 all four symptom clusters (50.1% of participants attributed intrusion symptoms to the  
328 future; 15.4% avoidance, 48.0% hyperarousal and 56.5% cognition and mood). In other  
329 words, PTSD-like symptoms for events that had not yet happened did not only manifest as  
330 intrusive thoughts (which might be narrowly conceptualized as worries about the future)  
331 but also as nonspecific symptoms such as irritability and alertness.

332         Second, we examined whether traumatic stress reactions occurred regardless of  
333 direct versus indirect exposure to COVID-19. Participants reporting PTSD symptoms in  
334 relation to *future* events already supports this prediction. In addition, we found small  
335 correlations between COVID-19 related social media consumption ( $r = .18, p < .001$ ) and  
336 PTSD symptoms, and all psychological functioning variables ( $r_s = .09 - .20$ ) except well-  
337 being; and between traditional media consumption and PTSD symptoms ( $r = .12, p <$   
338  $.001$ ), stress, and negative emotions ( $r_s = .14, p < .001$ ), but not other psychological  
339 functioning variables. Although small, considering the average adult spends three hours  
340 and 30 minutes a day on a mobile device—equating to 53 days in a year and countless  
341 exposure to news media (43)—these effects could rapidly accumulate, leading to adverse  
342 consequences (44).

343         Third, we examined evidence that PTSD-like symptoms occur for events that do  
344 not involve actual or threatened death, injury, or sexual violation. Arguably, *none* of our  
345 events/categories meet Criterion A; medically-based trauma is limited to sudden  
346 catastrophe (e.g., waking during surgery, anaphylactic shock (5)). Even our most extreme

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347 direct exposure variables (e.g., being hospitalized in a critical condition) do not qualify.  
348 Therefore, it is troubling that 13.2% of participants could be classified as PTSD-positive  
349 when anchoring the PCL-5 to COVID-19. We explored whether PTSD-positive  
350 participants had direct exposure to the virus via events which, while not classed as  
351 Criterion A, could be life threatening. Direct exposure included personally testing positive  
352 or being hospitalized as a result of COVID-19, or suspecting you may have been exposed  
353 to the virus, or knowing close others (e.g., family/friends) who have tested positive, were  
354 hospitalized, or who have passed away, as a result of COVID-19. More participants who  
355 had some form of direct virus exposure ( $n = 327$ ) were PTSD-positive (16.5%), than  
356 participants who had no virus exposure ( $n = 713$ ; PTSD-positive = 11.6%). But  
357 participants who were *not* directly exposed to the virus accounted for more (8%) of the  
358 PTSD-positive participants ( $\chi^2(1) = .031, \phi = .067$ ). Additionally, there was no difference  
359 in the percentage of PTSD-positive participants who had experienced (6.8%) or not (6.3%)  
360 a Criterion A event previously, suggesting participants anchored PCL-5 responses to  
361 COVID-19 experiences rather than other lifetime traumas.

362 Together, these data support our proposal that PTSD-like reactions can occur in  
363 relation to past, ongoing, and future stress events, indirect stress event exposure, and for a  
364 variety of stressors not covered by Criterion A. To examine the relative contribution of our  
365 exposure variables, while also controlling for demographic variables that could increase  
366 participants' susceptibility to PTSD symptoms, we regressed PCL-5 total on these  
367 variables. For all regression analyses, tolerance and variance inflation factors showed  
368 multicollinearity was not an issue.

369 First, we examined which demographic variables related to PTSD-like reactions.  
370 PCL-5 total scores were higher for females ( $d = 0.41, 95\% \text{ CI } [0.29, 0.54]$ ), students ( $d =$   
371  $0.16, [0.01, 0.32]$ ), people at high risk of contracting COVID-19 ( $d = 0.30, [0.14, 0.46]$ ),



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372 and people with lifetime Criterion A trauma ( $d = 0.31$ , [0.18, 0.43]), and were weakly  
373 correlated with age and income ( $r_s < .10$ ). Age, household income, sex, risk status, and  
374 prior Criterion A exposure, best predicted PCL-5 total (7.9% of the variance;  $F(6, 1031) =$   
375 15.68,  $p < .001$ ).

376 To examine the unique additional variance explained by actual and anticipated  
377 exposure to COVID-19 (event totals), media consumption (social and traditional media  
378 summed), and the emotion associated with worst events (experienced and anticipated), we  
379 reran the regression with demographic variables entered at Step 1, exposure variables at  
380 Step 2, and emotion variables at Step 3. After controlling for demographics, exposure  
381 variables explained an additional 7.8% of the variance in PCL-5 total ( $F_{change} (3, 1019) =$   
382 31.86,  $p < .001$ ). Importantly, emotion associated with worst events explained an additional  
383 16.7% of the variance in PCL-5 total ( $F_{change} (2, 1017) = 126.78$ ,  $p < .001$ ; regression  
384 coefficients and standard errors appear in Table 2). The final model explained 32.4% of the  
385 variance in PCL total ( $F (10, 1027) = 50.23$ ,  $p < .001$ ), and, notably, experienced event  
386 totals was no longer a significant predictor.

387

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388 Table 2

389 *Regression analysis summary for demographic factors, exposure variables, and the*

390 *emotion associated with worst events (experienced and anticipated) predicting PCL total*

391 *scores*

Model		<i>B</i>	<i>95% CI</i>	<i>β</i>
Step 1	Constant	27.12	[22.09, 31.15]	
	Age	-0.14	[-0.22, -0.07]	-.13**
	Household income	-0.27	[-0.51, -0.03]	-.07*
	Sex	4.60	[3.01, 6.17]	.17**
	Risk status	-4.00	[-6.15, -1.84]	-.11**
	Lifetime trauma exposure	-3.39	[-4.98, -1.80]	-.13**
	Student status	0.08	[-2.10, 2.26]	.002
Step 1	Constant	27.49	[23.49, 31.49]	
	Age	-0.15	[-0.21, -0.08]	-.13**
	Household income	-0.28	[-0.52, -0.04]	-.07*
	Sex	4.52	[2.94, 6.10]	.17**
	Risk status	-3.99	[-6.14, -1.84]	-.11**
	Lifetime trauma exposure	-3.48	[-5.08, -1.89]	-.13**
Step 2	Constant	12.28	[7.28, 17.27]	
	Age	-0.14	[-0.21, -0.08]	-.13**
	Household income	-0.31	[-0.54, -0.08]	-.08*
	Sex	4.02	[2.48, 5.55]	.15**
	Risk status	-3.51	[-5.58, -1.44]	-.10*
	Lifetime trauma exposure	-2.63	[-4.18, -1.08]	-.09*
	Media consumption total	0.33	[0.21, 0.44]	.16**
	Total experienced events	0.44	[0.15, 0.73]	.09*
	Total anticipated events	0.46	[0.32, 0.61]	.18**
	Step 3	Constant	-5.18	[-10.22, -0.14]
Age		-0.09	[-0.15, -0.03]	-.09*
Household income		-0.27	[-0.47, -0.06]	-.07*
Sex		1.69	[0.28, 3.10]	.06*
Risk status		-2.17	[-4.03, -0.31]	-.06*
Lifetime trauma exposure		-2.64	[-4.03, -1.25]	-.10**
Media consumption total		0.17	[0.06, 0.28]	.08*
Total experienced events		0.04	[-0.23, 0.31]	.01
Total anticipated events		0.27	[0.14, 0.40]	.11**
Experienced worst event emotion		3.34	[2.64, 4.03]	.29**
Anticipated worst event emotion		3.08	[2.31, 3.85]	.24**

392 Note: \*  $p < .005$ , \*\*  $p < .001$

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393 Overall, we found that participants had PTSD-like symptoms for events that had  
394 not yet happened, challenging the nature of traumatic stress as a problem pertaining only to  
395 the past. Participants reported these reactions whether they had been directly (e.g.,  
396 COVID-19 diagnosis) *or* indirectly exposed (e.g., via media) to COVID-19, challenging  
397 the idea that people need to experience a direct, in person event to develop PTSD-like  
398 symptoms. Finally, 13.2% of our sample were PTSD-positive, despite COVID-19  
399 “exposure” not fitting within Criterion A. The emotion associated with participants’ *worst*  
400 experienced and anticipated events predicted PTSD-like symptoms *beyond* demographic  
401 and exposure variables, suggesting that subjective evaluations of emotional impact may be  
402 more important in determining traumatic stress reactions than individual characteristics or  
403 objective levels of exposure.

404 Dominant pathogenic event models focus on PTSD arising for specific kinds of  
405 external events, and emphasize factors during/after encoding, including differential  
406 processing for perceptual (e.g., sensory) versus conceptual (e.g., meaning) details, and poor  
407 integration of the trauma in autobiographical memory (3,4). Thus, they do not account for  
408 symptoms in response to anticipated events, indirect exposure to trauma, or events that do  
409 not meet Criterion A. Our findings fit instead with a *pathogenic event memory* model,  
410 which accounts for traumatic stress in response to future and/or imagined events (45).

411 Of course, an alternative explanation of our data for anticipated events is that they  
412 simply reflect people expressing distress—including negative or threatening thoughts and  
413 images—about potential threats looming in their future, which may reflect worry, or a  
414 generalized anxiety disorder (5,46). Indeed, the PCL-Civilian—which is indexed to  
415 “stressful life experiences” rather than a specific trauma—correlates highly with measures  
416 of depression and general anxiety, suggesting that without the anchor to a specific trauma,  
417 the PCL-5 may pick up negative emotionality more generally (47). However, we did ask

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418 people to indicate specific events that had happened to them, or that they were concerned  
419 about happening in the future, and then index their symptoms in relation to COVID-19.  
420 Therefore, it seems likely participants were thinking about specific COVID-19 related  
421 events rather than unknown/non-specific future events.

422 Our findings may also reflect the “hedonic treadmill” (48), whereby mildly  
423 stressful events feel more negative against the backdrop of relatively stress-free lives,  
424 particularly in the context of data from western countries, as we measured here. This  
425 explanation does not diminish that our participants were experiencing genuine distress, but  
426 explains why exposure to events like government lockdowns and inability to source  
427 supplies was associated with traumatic stress symptoms—and in some cases, above clinical  
428 cut-off levels.

429 COVID-19’s psychological fallout has been dubbed the “second curve,” predicted  
430 to last for months to years. Notably, while most of our participants reported experiencing  
431 some form of psychological distress and 13.2% of our sample were likely PTSD positive  
432 when anchoring symptoms to COVID-19, only 2% of our total sample reported they had  
433 personally tested positive to COVID-19, and only 5% reported that close family and  
434 friends had tested positive. It therefore seems likely that the psychological fallout from  
435 COVID-19 may reach further than the medical fallout. Short term, our findings highlight  
436 the need to focus on the acute psychological distress—especially the perceived emotional  
437 impact of particular events—associated with COVID-19. Our results also support the  
438 WHO recommendation (49) to minimize consumption of COVID-19 media. Long-term,  
439 comprehensive documentation of COVID-19 related traumatic stress reactions will allow  
440 health professionals to help people who could otherwise fall through the cracks. Although  
441 our data suggest that COVID-19 could be understood as a traumatic stressor, this  
442 conceptualization might contribute to the problem of “conceptual bracket creep” (8). Thus,

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443 we must consider the difference between genuine symptoms of a disorder and normal  
444 stress reactions. Failure to do so may undermine efforts to understand the psychological  
445 mechanisms that contribute to PTSD symptoms.

446 Our research has limitations. First, we used the PCL-5, a self-report measure, to  
447 examine PTSD-like symptoms cross-sectionally. The Clinician Administered PTSD Scale  
448 (CAPS-5 (50)) is a more comprehensive measure that identifies the frequency and intensity  
449 of PTSD-like symptoms for an indexed event and allows a clinician to diagnose if PTSD  
450 might be present. However, we wanted to capture PTSD-like symptoms in a large sample  
451 across multiple locations that were at different points of the pandemic at the time, a goal  
452 that could not be achieved using a clinician administered scale. Second, the CAPS-5 can  
453 only be completed on clients who have experienced a Criterion A event. Here, our aim was  
454 to examine traumatic stress reactions to any type of COVID-19 event that might produce  
455 such symptoms, rather than events specifically falling within this category. Similarly, we  
456 cannot determine whether symptom levels in our sample would qualify for a PTSD  
457 diagnosis. Future research could use experience-sampling methods to capture longitudinal  
458 symptoms, or a clinician administered scale to diagnose PTSD.

459 Second, our sample only examined five countries that were all Western, English  
460 speaking countries similar in culture and socio-economic status. As such, we can only  
461 cautiously generalize these findings to other parts of the world. Third, of course, although  
462 our data provide evidence for the potential psychological fallout of the COVID-19  
463 pandemic, we did not investigate any personality traits, or external factors such as social  
464 support or other coping strategies, that might moderate this response. Finally, we only  
465 asked participants to focus on negative outcomes of COVID-19; future research could  
466 examine positive outcomes (e.g., growth, resilience).

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467           COVID-19 related traumatic stress symptoms expose weaknesses in dominant  
468 PTSD models, which fail to account for traumatic stress reactions arising from anticipated,  
469 indirect, or non-life threatening stressors. This study clearly demonstrates that a single  
470 global event can lead to PTSD symptoms for a range of anticipated, indirect, and non-life  
471 threatening stressors. As Horesh and Brown (51) state, there is a clear need to expand  
472 PTSD models and in turn, better capture *all* people who need help for PTSD.  
473  
474

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### 475 Author Contributions

476 All authors developed the study design, and contributed to data collection, compilation and  
477 analysis. VMEB, EKM and MKTT drafted the manuscript, with critical revisions from all  
478 other authors. All authors approved the final version.

479

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