Short report

Boosting positive mood in medical and emergency personnel during the COVID-19 pandemic: preliminary evidence of efficacy, feasibility and acceptability of a novel online ambulatory intervention

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ABSTRACT

Objectives The aim of this project was to test the efficacy of a brief and novel online ambulatory intervention aimed at supporting psychological health and well-being for medical personnel and first responders during the COVID-19 pandemic.

Methods Interested participants, n=28, actively employed as medical personnel, support staff and emergency responders, in the Midwestern USA in May–June of 2020, provided informed consent and were randomised to complete either low-dose or high-dose intervention, one time daily for 1 week via smartphone application. Each daily intervention included expressive writing, adaptive emotion regulation activity and (one vs two) positive emotion-generation activities, lasting 3–6 min a day. Ratings of negative and positive emotion were provided before and after each activity daily. Analyses tested compliance, acceptability, as well as efficacy at increasing positive emotion and decreasing negative emotion with each use and across time.

Results The results indicated a 13% increase in positive emotion, t(25)=2.01, p=0.056; and decrease in negative emotion by 44%, t(25)=−4.00, p=0.001 across both doses. However, there was a clear advantage for individuals in the high-dose condition as daily boosts in positive emotion were significantly greater (an additional 9.4%) B=0.47, p=0.018. Overall, compliance was good. Acceptability ratings were good for those who completed the follow-up assessment.

Conclusion Front-line personnel, including medical staff and emergency responders, are experiencing unprecedented psychological stress during the COVID-19 pandemic. This investigation suggests both feasibility and efficacy for a brief, daily, ambulatory intervention which could provide essential psychological support to individuals at risk in the workplace.

Key messages

What is already known about this subject?

- It is well documented that front-line responders are struggling with a significant psychological burden during the COVID-19 pandemic.
- Some research testing conventional interventions during this pandemic has shown limited benefit.

What are the new findings?

- This brief daily online ambulatory intervention, based on a novel combination of existing efficacious interventions, is feasible and efficacious in boosting positive and reducing negative emotions, key elements of psychological health, in front-line responders.

How might this impact on policy or clinical practice in the foreseeable future?

- This research suggests the practical utility of inexpensive ambulatory support services for at-risk personnel due to occupational stressors.
- Further research and development is needed.

The excessive psychological burden of the COVID-19 pandemic on medical and emergency personnel is well documented.[1] However, time, resource and pandemic restrictions make conventional interventions less feasible. Moreover, some prior research suggests that conventional interventions are less effective at this time.[2] Decrements to mental health of essential personnel can lead to clinical practice failures, impacting patient health and increasing practitioner burnout.[3] Positive emotions (PEs) broadly support physical health and well-being, and underlying psychological health and resilience.[4 5] PEs also facilitate complex decision-making and interpersonal communication, which are essential in good clinical practice.[6]

Research over the last several decades has demonstrated the daily toll that highly aversive events can take on individuals, even those who will show resilient outcomes. Although the preponderance of research argues strongly against traditional psychotherapeutic approaches for most individuals during crises,[7] there is evidence that even the most resilient will experience symptoms and disruptions in functioning.[8] During the current COVID-19 pandemic, communities are relying heavily on medical personnel and first responders to maintain

► Additional supplemental material is published online only. To view, please visit the journal online (http://dx.doi.org/10.1136/oemed-2021-107427).

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Received 28 January 2021
Revised 28 March 2021
Accepted 8 April 2021

To cite: Coifman KG, Disabato DD, Seah THS, *et al*. *Occup Environ Med* Epub ahead of print: [please include Day Month Year]. doi:10.1136/oemed-2021-107427

high levels of psychological functioning so as to ensure adequate patient care. As such, it is essential to support personnel, leveraging factors that facilitate management of daily distress and maintenance of well-being, even during a crisis.

There has been compelling evidence of the broad benefits of expressive writing for stressed populations to facilitate the review of emotionally evocative experiences in relation to health and occupational functioning.[9] One mechanism may be the role documentation of stressful experience plays, but also the emotion-regulatory benefit of self-distancing from the evocative elements of experience through shifts in perspective.[10] In addition, positive emotional responses are broadly considered to be the cornerstone of well-being and happiness, and are consistently predictive of psychological health over time.[4 5] This may be due in part to the strong predictive association between PEs and self-care behaviours that serve to maintain those emotions over time (eg, seeking support, exercise).[11] Importantly, there is also evidence that well-being and health can be enhanced and maintained, even in those under significant stress, through brief PE prompts directing people to savour the good (eg, gratitude journaling).[12]

Prior research has largely examined expressive writing, self-distancing, and PE generation individually and for longer duration, although efficacy for each is clear. However, during this unprecedented time of high anxiety and extreme overtaxing of medical and first responder resources, there is little, if any time for individuals to engage in longer interventions yet clear evidence for a need for support.

This investigation tests a novel combination of these three elements *for the first time* by applying a two-level randomised treatment design. If efficacious, the intervention would serve as a feasible and invaluable resource for medical personnel and first responders to facilitate adaptive coping responses and support long-term adjustment now and in future crises. Given the considerable supporting evidence, we anticipated benefits at both doses as evident by within-person increases in PE and decreases in negative emotion (NE) across uses. However, participants randomised to high dose received two PE prompts each day, as compared with one in the low dose. We hypothesised that those in the high-dose condition would receive greater benefit with significantly increased positive emotional responses, suggesting greater efficacy at boosting mood.

METHODS

Study design, recruitment and procedures

Medical and emergency personnel from two urban hospital centres, as well as police and fire departments were invited via email and targeted postings on social media to test the 'Daily Coping Toolkit' intervention in May/June of 2020 in the Midwestern, USA. According to the National Institute of Environmental Health Sciences' COVID-19 Pandemic Vulnerability Index (covid19pvi.niehs.nih.gov), the region was considered at heightened vulnerability due to elevated infection rates and still limited medical resources. Twenty-eight participants provided informed consent, completed online measures of demographics, mental health symptoms and general well-being (online supplemental table S1), and downloaded the research application onto their smartphone. Participants were adults (M_{age}=45.33; SD=9.60), largely female (75%) and Caucasian (89%). These were experienced front-line personnel (M_{years} in position=13.74; SD=9.85), including first responders (21%), medical personnel (46%) and support staff (29%), and the majority (54%) were directly working with patients with COVID-19. Participants were randomised (using a random number generator) to one of two intervention doses and blinded to condition (participants were blinded to the specifics of their condition and were told they would 'receive a set of shorter (3–4 min) or slightly longer (4–6 min) daily activities so that we (the researchers) can test which works best'). The initial participation period was 7 days. No compensation was offered.

Daily Coping Toolkit intervention

The once-a-day (3–6 min) intervention included three steps: (1) typing a narrative of challenges occurring that day, which constituted an expressive writing activity; (2) practising adaptive emotion regulation by revisiting distressing events from a distanced perspective, which constituted an explicit self-distancing activity; and (3) responding to one or two, depending on dose, (of eight) randomised prompts to generate PE. Overall compliance was adequate. Mean participation was 3.14 days of toolkits, SD=2.62, or 45%. Importantly, when the intervention was used, compliance with activities was high (88.34%). This was coded based on responses to steps 1 and 3. Intervention details are in online supplemental materials.

Daily emotion ratings

Before and after each toolkit session, participants rated intensity of specific negative (disgust, anger, sadness, fear, distress) and PE (happiness, amusement, affection, contentment, relief) words on a 5-point scale (from 1='not at all' to 5='extremely') used commonly in ambulatory research.[11] The primary outcomes were PE and NE rated post-toolkit. Pre-toolkit ratings were covariates or used to derive change scores for analyses.

Post-intervention treatment acceptability

The day after the 1-week intervention, participants were prompted via email to respond to follow-up assessments to index acceptability of the intervention. These were single-item ratings that included perceived efficacy and likelihood of negative impact. Twelve participants responded (43%). There was no difference in condition between those that responded to follow-up assessment and those that did not (X^2=0.19, p=0.66), nor differences in compliance, demographics or exposure to patients with COVID-19.

RESULTS

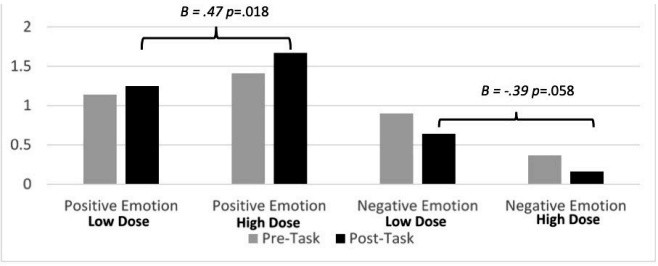
Preliminary analyses

Comparisons across groups revealed successful randomisation indicated by no significant differences across all baseline variables: psychiatric/treatment history, current symptoms, psychological well-being and compliance (online supplemental table S1).

Primary analyses

Initial analyses of within-person average change scores confirmed all participants received benefit. Toolkit sessions significantly *de*creased NE by 44%, MΔ=−0.28, t(25)=−4.00, 95% CI: −0.43 to −0.14; p=0.001; SD=0.40, d=0.80 and *in*creased PE by 13%, MΔ=+0.17, t(25)=2.01, 95% CI: 0.00 to 0.35; p=0.056; SD=0.43, d=0.40. Post-hoc exploration revealed that completion of the PE prompt (step 3) was key—when prompts were *not* completed (n=13, 6.6%), there were no gains in PE: MΔ=−0.02, SD=0.38.

To test the dose hypothesis, individuals who completed at least two toolkit sessions (n=19, range 2–7) were included in linear mixed-effects models. As predicted, for those in the higher



Testing the Dose Effect: Fixed Effects (df = 19)							
Post-task Positive Emotion				**Post-task Negative Emotion**			
	B[1] (SE)	*p*	*Effect*[2]		B[1] (SE)	*p*	*Effect*[2]
Pre-task Positive Emotion	.62 (.08)	<.001	.42	**Pre-task Negative Emotion**	.48 (.08)	<.001	.34
Dose: (Low v. High)	**.47(.18)**	**.018**	**.23**	**Dose: (Low v. High)**	**-.39 (.19)**	**.058**	**.19**
Time Between Sessions	-.03 (.03)	.30	.17	**Time Between Sessions**	.00 (.02)	.90	.01
# of Sessions	-.02 (.04)	.52	.02	**# of Sessions**	.04 (.03)	.24	.04
Pre-Intervention Symptoms	-.22 (.16)	.18	.05	**Pre-Intervention Symptoms**	.08 (.16)	.63	.09
Pre-Intervention Wellbeing	.06 (.13)	.66	.14	**Pre-Intervention Wellbeing**	-.10 (.13)	.41	.05
Psych/Treatment History	-.11 (.38)	.77	.03	**Psych/Treatment History**	.25 (.37)	.51	.07

Figure 1 Mean momentary change in positive and negative emotion when using the Daily Coping Toolkit.[1]B = indicates the expected mean difference in post-toolkit emotion by condition (high versus low dose) while considering pre-toolkit emotion.[2]Effect size as the standardized raw score of the fixed effect: Baldwin, S. A., Imel, Z. E., Braithwaite, S. R., & Atkins, D. C.(2014). Analyzing multiple outcomes in clinical research using multivariate multilevel models. *J Consult Clin Psychol* 82(5), 920.

dose condition, PE increased from pre-session to post-session by an additional 9.4%, B=0.47, SE=0.18, p=0.018, while NE decreased by an additional 7.8%, B=−0.39, SE=0.19, p=0.058, with time between sessions, number of sessions, symptoms, well-being and psychiatric/treatment history included as covariates (see figure 1).

Follow-up acceptability analyses

Ratings from the 12 participants (43%) who responded to follow-up suggested that acceptability and perceived efficacy were good: 70% rated the intervention as having moderate to high effectiveness and 70% rated negative side effects as unlikely.

DISCUSSION

COVID-19 has created a crisis of burnout and distress across medical and emergency personnel. This *novel* intervention, tested with experienced medical and emergency personnel during early pandemic months, significantly decreased NE and increased PE after only 3–6 min of daily activity. Those randomised to the higher dose and who completed at least two sessions benefited significantly more. Importantly, participants who did complete follow-up ratings rated the intervention as acceptable and effective.

The results suggest considerable potential for this brief, smartphone intervention to support professionals at risk due to occupational stressors. Although limitations include the small sample size and limited response to follow-up, the potential of these findings is clear. The COVID-19 pandemic presents an unprecedented taxing on the mental health resources of front-line personnel and need for intervention is great. Moreover, a broad consensus from public health experts suggests that the mental health impacts of this pandemic may impact some more than others. Notably, a relatively large proportion of our sample reported some psychiatric history (80%–89%), suggesting that this intervention has potential to benefit even those at greatest risk. Finally, the online nature of our intervention may also increase its accessibility to other at-risk communities impacted by COVID-19 or in other high-risk contexts.

Emotional experiences of essential personnel impact their own health as well as patient care. This ambulatory tool may fill a critical need as adjuvant to conventional treatments and institutional support structures for personnel at risk due to occupational stress. Future research should replicate and extend findings by including a no-treatment control, larger samples and longer assessment.

Contributors All authors contributed to the research design and manuscript development. KGC, THSS, DDD, SO-D and PAP completed data collection.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Not required.

Ethics approval All procedures were preapproved by the university institutional review board.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. This research consists of preliminary feasibility data for NCT0439827. All data and materials are available upon request to the lead author, KGC, at kcoifman@kent.edu.

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SUPPLEMENTAL MATERIALS

Table S1. Descriptive Statistics for Full Sample and Tests of Difference by Dose

	Full Sample N = 28	**Low Dose n = 15**	**High Dose n = 13**	**Test of Difference by Dose**
Sex	21 female; 7 male	11 female; 4 male	10 female; 3 male	X^2=.05, p = .83
Age	M =45.33; SD = 9.60	M =45.73; SD =8.97	M = 44.83; SD = 10.72	t=.24, p=.81
Race	25 White; 3 Non-white	13 White; 2 Non-White	12 White; 1 Non-White	X^2=.90, p =.64
Position	6 Firefighter/Paramedic/Police 13 Licensed medical Provider 8 Medical/Emergency Support Staff 1 Did not report	3 7 5 0	3 6 3 1	X^2=4.89, p =.43
Years in Position	M =13.74 years; SD =9.85	M = 13.20; SD = 8.68	M = 14.42; SD = 11.51	t=-.31, p=.76
Working directly with COVID-19 Patients	15 No; 11 Yes; 2 Did not report	9 No; 6 Yes	6 No; 5 Yes; 2 Did not report	X^2=1.50, p = .68
Prior Psychiatric Disorder	3 No; 25 Yes	2 No; 13 Yes	1 No; 12 Yes	X^2=1.45, p = .49
Prior Psychiatric Treatment	8 No; 20 Yes	4 No; 11 Yes	4 No; 9 Yes	X^2=.06, p = .97
Pre-Intervention Symptoms[a]	M = 1.14; SD = .72 Range 0-3, Median = 1.00	M = 1.32; SD = .71	M = 0.99; SD = .71	t=1.25, p =.23
Pre-Intervention Well-being[b]	M = 3.68; SD = 1.08 Range 2-5.33, Median = 3.66	M = 3.93; SD = 1.07	M = 3.38; SD = 1.04	t=.65, p =.18
Number of Toolkit Sessions	M = 3.14; SD = 2.62	M = 3.93; SD = 1.07	M = 3.39; SD = 1.04	t=.41, p =.69

Note: M = Mean; SD = Standard Deviation

[a.] Patient Health Questionnaire-4; Kroenke, Spitzer, Williams & Lowe, 2009 plus one additional item to capture disrupted sleep ("Trouble falling or staying asleep or sleeping too much"; per the DSM-5: APA 2013). Higher scores reflect greater symptoms. The response options were slightly modified to adapt to

the instructions asking about the past week rather than the past 2 weeks: 0 = Not at all; 1 = A few days; 2 = More than half the days; 3 = Nearly every day.

[b.] To create a brief, yet broad, index of well-being, one item was adapted from the 1) Satisfaction with Life Scale ("I felt satisfied with my life"; Diener, Emmons, Larsen, & Griffin, 1985), 2) Meaning in Life Questionnaire - presence subscale ("I felt my life was meaningful"; Steger, Frazier, Oishi, & Kaler, 2006), and 3) Positive and negative affect schedule - positive affect subscale ("I felt very happy"; Watson, Clark, & Tellegen, 1988), for the purposes of the present study. Response options were created to reflect the frequency of well-being over the past week as research suggests that frequency more important than intensity (Diener, Sandvik, & Pavot, 2009): 1 = Never; 2 = Rarely; 3 = Sometimes; 4 = Often; 5 = Most of the time; 6 = All of the time.

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A Daily Coping Toolkit©: *For Medical Personnel and Emergency Responders during the COVID-19 Pandemic*

Feasibility Study

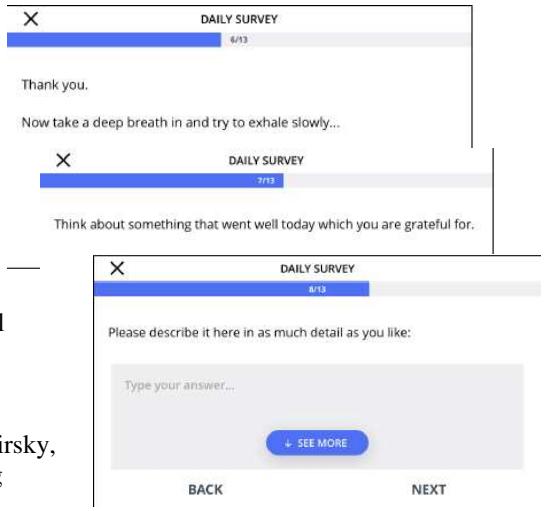
Procedure: Interested individuals go to www.tinyurl.com/dailycopingtoolkit for information, including the informed consent. Once consent is provided, individuals complete a brief assessment of current symptoms, well-being and psychiatric/treatment history and then receive instructions to download the research application ExpiWell (www.expiwell.com), a secure platform that operates on iOS/Android devices (e.g., smartphone) upon which we administer the Toolkit. Once downloaded, participants are randomized to a high versus low treatment condition and will receive daily prompts to complete the intervention. After 7 days, they complete a brief assessment of symptoms, well-being, and acceptability of the intervention and consent again for continuation in the research.

Daily Coping Toolkit Intervention: Participants are prompted one time daily (with 1-2 reminders) to complete the intervention which consists of the following three parts. *Randomization to high versus low condition is maintained for the first 7 days to test for relative dose effects.*

1. **Expressive Writing Activity: Participants respond to an open-ended prompt to write about their day in an open text box in response to the prompt: "What was today like for you?"** For the last several decades there has been compelling evidence of the broad benefits of expressive writing for any stressed population to facilitate this process, particularly in relation to health and occupational functioning (Baikie & Wilhelm, 2005; Frisina, Borod & Lepore, 2004; Harris, 2006; Pennebaker, 2018).

2. **Expressive Writing and Self Distancing Activity: After this is completed, they are prompted that if the experience was very challenging, to revisit that experience in their mind by taking a "fly on the wall" perspective** (Ayduk & Kross, 2010; Kross & Ayduk, 2016; Kross et al, 2012; see figure for instructions). There is significant research demonstrating that shifting perspective about negative emotional experiences can facilitate a healthier distance from it.

3. **<u>Positive Emotion Generation Activity (1 v. 2 prompts)</u>**
Participants are prompted to take a deep breath and then respond to 1 (or 2) of 8 possible prompts in which they can generate positive emotions. In response to each, they are asked to describe their thoughts or memories in open-ended text box. *Note:* For the first 7 days, participants are randomized to either respond to one (low dose) or two (high dose) prompts so as to test the relative efficacy of the "dose". After 8 days, all participants default to the higher dose of 2 prompts. Prompts are designed to elicit gratitude, positive social experiences, amusing memories, kind acts they committed, satisfaction/pride with accomplishments, positive future focus, and love for close others. Prior research (Fredrickson & Joiner, 2018; Joiner et al, 2001; Moskowitz et al, 2017; Sin & Lyubomirsky, 2009) has demonstrated that positive emotions generated during highly stressful events predict resilience and improved emotion regulation and coping. Moreover, positive emotion generation has been shown broadly to predict increased psychological wellbeing. Here are the 8 positive emotion prompts which were followed by a screen with a free text box that indicated "Please describe it here in as much detail as you like":



   a. Think about a recent moment when you laughed and remember what was so funny.
   b. Think about something kind you did for another person today.
   c. Think about a time you were at your best today and used one of your strengths.
   d. Think about something that you accomplished today which gave you satisfaction.
   e. Think about a recent experience so good that you had to tell someone about it.
   f. Think about something that went well today which you are grateful for.
   g. Think about someone you love and one specific thing you love about them.
   h. Think about something kind you did for another person today.

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