Using a Mobile Application to Address Stress-Related Symptoms in Emergency Dispatchers

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ABSTRACT

Introduction: Emergency dispatchers report significant job stress, yet few controlled investigations examine their specific psychological complaints. Additionally, research examining the use of interventions directed at alleviating their work-related stress is limited.
Objective: This study aims to examine the efficacy and feasibility of a mobile application (PTSD Coach) on various indicators of psychosocial well-being among emergency telecommunicator dispatchers.
Methods: A sample of 117 emergency dispatchers attending the 2018 NAVIGATOR conference agreed to participate in a study examining the impact of Post-traumatic stress disorder (PTSD) Coach on work-related stress. Over a one-month period of use, they completed weekly surveys of mood. The results indicated that dispatchers experience a wide range of emergency calls, some of which create moderate to severe distress.
Results: Twenty-three percent (23%) of the sample (n = 27) met criteria for PTSD. Engagement with PTSD Coach over a one-month period resulted in statistically significant decreases in PTSD symptom severity and other psychological indicators.
Conclusion: Mobile application such as PTSD Coach offer accessible and often free psychoeducational and self-management tools to those who may shy away from conventional mental health treatment. The tools provided in the PTSD Coach allowed the dispatchers to practice managing their mood discretely. Additional modifications and application relevance are discussed.

INTRODUCTION

One often under-researched group of first responders is emergency telecommunication dispatchers.[1] Emergency telecommunicators must quickly assess incoming telephone calls to secure the emergency scene and dispatch appropriate help. Coordination in response to emergencies while being physically distant from the situation requires the ability to remain calm and problem-solve in a high-pressure environment. While emergency telecommunicators are not visually in contact with the emergencies, they are responsible for sending other first responders to dangerous environments. They also provide psychological support to civilians on the other end of the call without having direct control over the situation. Additionally, they must respond (often immediately) to the next incoming call without having the opportunity to process the conversation from the previous call. Considering the frequency, nature, and intensity of duty-related traumatic exposures,[2] understanding the impact of these traumatic events on the mental health of emergency telecommunicators is of utmost importance.

A broad range of long-term mental health consequences can result from work-related traumatic exposures.[3,4] For emergency telecommunicators, work-related stress creates significant levels of fatigue, which puts these individuals at considerable risk for burnout, workplace injury, sick leave, or disability.[4] Mental fatigue due to work-related injuries and illnesses in these professionals costs over one million dollars each year.[5] Furthermore, first responders, including emergency dispatchers, frequently experience an array of emotional and behavioral disturbances such as distress, worry, disturbed sleep or concentration, anger outbursts, difficulties with interpersonal relationships, increase in substance use, somatization, anxiety, and depression.[6] Common psychiatric disorders include Acute Stress Disorder (ASD), acute and chronic Posttraumatic Stress Disorder (PTSD), and Major Depression (MD).[7] Additionally, many members of

the first responder community may have subclinical levels of PTSD. Defined by symptoms insufficient in number, distribution, or severity to meet full criteria, individuals nonetheless report significant distress and impairment.[8] Twenty-five percent of those who display subclinical PTSD symptoms go on to develop PTSD.[9,10] Based on the few studies that have examined the rates of PTSD in North American emergency dispatchers, between 9 to 30 percent showed PTSD symptoms,[11,12] which is much higher than the roughly 4% prevalence rate found among the general U.S. population.[13] Hence, early intervention is crucial to reducing the prevalence of stress-related disorders in emergency dispatchers.

With such a high prevalence of mental health disorders, why do emergency dispatchers not seek treatment? While services such as employee assistance programs are available, there is a lack of mental health utilization among all first responders due to the cultural stigma surrounding help-seeking behaviors.[14] There is a sense of criticism toward the utilization of mental health treatment, producing a significant barrier to care.[15] First responders who suffered from a psychiatric condition were much more likely to be viewed negatively by their peers than if they suffered from a physical condition.[14] First responders may also resist acknowledging a need for mental health services as they may have previously judged others who are suffering from stress as failures.[16]

Additionally, dispatchers operate on shift schedules, which may make scheduling appointments difficult. These barriers to care might be overcome through the use of innovative methods of mobile technology, such as a smartphone. The mobile device opens the opportunity for those who would not typically seek care due to stigma, geographic restrictions, or time commitment to do so on their own schedule from their phone.

The evolutionary growth of mobile technologies, such as smartphones, has brought increased focus on specialized e-Health modalities known as mobile health or m-Health. There are over 3.2 billion unique mobile users worldwide.[17] Modern smartphones, are lightweight, easy to operate and have a wide variety of purposes. Mobile applications are well suited for health information dissemination as an individual can inconspicuously manage their needs without judgment. Individuals can choose an application based on their mental health needs and tailor the applications towards managing their specific symptoms and level of severity.

By introducing psychoeducation and coping skills through mobile applications, dispatchers can find resources and help that they need from home or perhaps even during a break at work. Specifically, for telecommunication dispatchers, short times between calls can provide a valuable moment for relaxation. Emotional and behavioral disturbances such as anger outbursts, anxiety and sleep difficulties (often experienced by first responders) overlap significantly with the symptoms of subclinical PTSD and other stress-related disorders experienced by the military population.[6,18] Thus, using a mobile application designed to treat PTSD may be an appropriate intervention due to their similar presentation of PTSD symptoms. The PTSD Coach mobile application, initially designed for veterans, helps individuals learn to manage symptoms of PTSD and other stressors.[19] PTSD Coach was designed either as a standalone psychoeducation and self-management tool or as an adjunctive tool to more traditional treatment. PTSD Coach uses stress inoculation training to 1) concisely provide psychoeducation of PTSD symptoms, 2) enables the remote practice of stress reduction strategies, and 3) provides direction and mood tracking charting options. A randomized clinical trial for PTSD Coach was effective in reducing PTSD symptoms by 47 percent compared to 26 percent in the waitlist group within the military population.[18] Dispatchers who present with analogous trauma-related symptoms may benefit from PTSD Coach.

Thus far, very few studies have explored the utility of the mobile application for stress symptom reduction with first responders.

OBJECTIVE

This study aims to examine the acceptability, feasibility, and efficacy of PTSD Coach on various indicators of their psychosocial. It is hypothesized that psychosocial symptoms will decrease after the introduction and use of the PTSD Coach mobile application.

METHODS

Participants

One hundred- seventeen participants ranging in age from eighteen to fifty-nine years were recruited in-person from attendees at the 2018 NAVIGATOR emergency dispatcher conference. Participants were active emergency dispatchers with between one to twenty-six years of work experience. Participants had to be at least 18 years old, understand written and spoken English, and have a smartphone capable of downloading a mobile application. Individuals were excluded if they reported active suicidal ideation (determined by the self-report measure PHQ-9) or engaged in uncontrolled episodes of alcohol or drug abuse that require treatment (determined by the AUDIT). Participants received $25 compensation at pre-intervention and post-intervention for completion of the study. Dispatchers who completed the post-intervention time point was considered as a study completer. Sample characteristics are depicted in Table 1.

To assure that the sample was representative of dispatchers nationwide, we assessed exposure to distressing calls[1] using a list of 17 potentially traumatic calls, ranging from traffic accidents to shootings that they have experienced during their career. Each call was rated using a five-point scale ranging from 0 (None) to 5 (Extremely) on the degree of distress at the time of the first assessment.

Assessments

PTSD Checklist PCL-5,[20] is a reliable and valid self-report measure of PTSD symptoms based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-5).[21] The DSM-5 identifies PTSD as the compilation of four symptom clusters: re-experiencing intrusions, persistent avoidance of internal and external trauma-related stimuli, negative cognitions and mood,

Characteristics		
	M	*SD*
Age	37.38	8.4
Years as telecommunicator	11.07	6.5
	n	%
Gender		
Female	90	76.9
Male	27	23.1
Marital status		
Single	26	22.2
Married	62	53.0
Other	22	24.8
Ethnicity		
Caucasian	91	77.8
African American	7	6.0
Hispanic	12	10.3
American Indian or Alaskan Native	4	3.4
Other	3	2.6
Education		
Less than high school	2	1.7
High school graduate	11	9.4
Some College	49	41.9
Graduate degree	45	38.5
Advanced degree	10	8.5
Psychological Symptoms	*M*	*SD*
PCL-5	20.2	15.8
PHQ-9	6.8	5.5
AUDIT	3.2	2.8
DAR-5	9.2	3.4
GAD-7	6.3	5.2

PCL-5 = PTSD Checklist 5; PHQ-9 = Patient Health Questionnaire-Depression Subscale; AUDIT = Alcohol Use Disorders Identification Test; DAR-5 = Dimensions of Anger Reactions; GAD-7 = Generalized Anxiety Disorder Scale.

Table 1. Demographic and Baseline Psychological Characteristics (n = 117)

and hyperarousal and reactivity.[21] Respondents indicated the degree to which they were bothered by each of the 20 PTSD symptoms during the past month on a 5-point Likert scale from 1 *(not at all)* to 5 *(extremely)*. The item scores are summed to provide a total symptom severity rating from 20 to 100. A score of 33 or above indicates a probable diagnosis of PTSD.[22]

Patient Health Questionnaire—Depression Subscale 9 (PHQ-9),[23] is a 9-item, self-report screening tool. The items are based directly on the diagnostic criteria for major depressive disorder in the Diagnostic and Statistical Manual of Mental Disorders-IV (DSM-IV).[24] This measure provides both the presence and severity of depressive symptoms. The PHQ-9 has demonstrated excellent psychometric properties, including test-retest reliability as well as internal consistency for symptoms of depression.[23]

Alcohol Use Disorders Identification Test (AUDIT),[25] is a 10-item self-report measure of problematic alcohol use and associated problems. It assesses the quantity and frequency of alcohol use and the potentially harmful consequences. A total score greater than 15 indicates a positive alcohol use disorder.

Generalized Anxiety Disorder Scale (GAD-7),[26] is the 7-item self-report instrument designed to assess anxiety symptoms. Questions are rated using a 4-point Likert scale ranging from 'not at all' to 'nearly every day' past week. A total score greater than 9 on the GAD-7 indicates moderate to severe anxiety symptoms. Internal consistency (α = 0.92), test-retest reliability (α = 0.83), sensitivity (0.89), and specificity (0.82) indicate the measure symptoms of anxiety adequately.[26]

Dimensions of Anger Reactions 5 (DAR-5),[27] contains five items measuring anger frequency, intensity, duration, interpersonal aggressiveness, and the extent to which anger interferes with interpersonal relationships. Items are measured on a 5-point scale, ranging from 1 (not at all) to 5 (very much). A score of 12 or higher indicates anger management issues. The DAR-5 has decent psychometric properties, including high internal consistency and internal reliability, with Cronbach's alpha ranging from 0.86 to 0.90 which captures the symptoms of anger in adults.[28]

PTSD Coach Acceptability Survey,[29] assesses the perceived helpfulness of PTSD Coach. Participants were asked how helpful they found PTSD Coach (e.g., learn and manage symptoms) on a 5-point Likert scale 0 (*not at all*), 1 (*slightly*), 2 (*moderately*), 3 (*very*), 4 (*extremely*). Additionally, they were asked to rate the helpfulness of the application in developing skills to manage symptoms and decreasing stigma towards PTSD, as well as seeking mental health treatment.

Procedure

During the six weeks of the study, the participants were encouraged to use PTSD Coach whenever they perceived the need to decrease stress. They could select modules such as deep breathing, mindfulness listening, muscle relaxation, and thought stopping. Every three days during this period, participants received a reminder email to use the app. Every seven days after baseline, participants received a survey link to assess psychological symptoms during that week. Assessments included questions regarding types of calls received and the PCL-5, AUDIT, DAR-5, GAD-7, and PHQ-9. These data were collected weekly for 6 weeks (including baseline) to determine changes in emotions and behavior while using the app. In addition to the weekly measures of symptoms, at the sixth (last) week of the study, participants completed questions regarding the application's helpfulness in managing stress symptoms.

Data analysis

Descriptive analysis (means, frequencies, standard deviation, and percentages) examined the utility of PTSD Coach for emergency dispatchers. For efficacy data, the Kolmogorov-Smirnov test was utilized to determine the normality distributions of the self-report measures, which indicated the samples were not normally distributed. Thus, two-tailed Wilcoxon test was used to evaluate the treatment efficacy for the PCL-5, AUDIT, DAR-5, GAD-7, and PHQ-9 to again account for the non-normality.

RESULTS

A comparison of individuals who completed the study (n = 50) and non-completers (*n* = 67) showed no significant group differences on demographic variables age, gender, marital status, and education. Similarly, individuals who completed the study and non-completers showed no significant difference on baseline psychological variables (PCL-5, PHQ-9, AUDIT, DAR-5, and GAD-7).

The dispatchers endorsed exposure to a mean of 12.09 various types of distressing calls (SD = 3.17), with 3 being the lowest number of potentially distress calls to 15 being the highest number of exposures to potential calls. Figure 1 shows the frequency of endorsed calls by the dispatchers. Chi-square comparison between the completer and the non-completer group suggests no significant difference in the frequency of types of calls experienced. Between-group t-test suggested no significant differences between the severity of the distress between those who completed the study and did not complete the study except for one type of call, shots fired. The significant difference found in the severity scores between the 100 individuals who endorsed experiencing a "shots fired" call, 44 completer (*M* = 4.20, SD = 1.50) and 56 non-completer (M = 3.34, SD = 1.58) groups; *t*(98) = 2.78, p = 0.01. However, given the number of statistical comparisons conducted, the application of the *Bonferroni* correction makes this comparison no longer statistically significant.

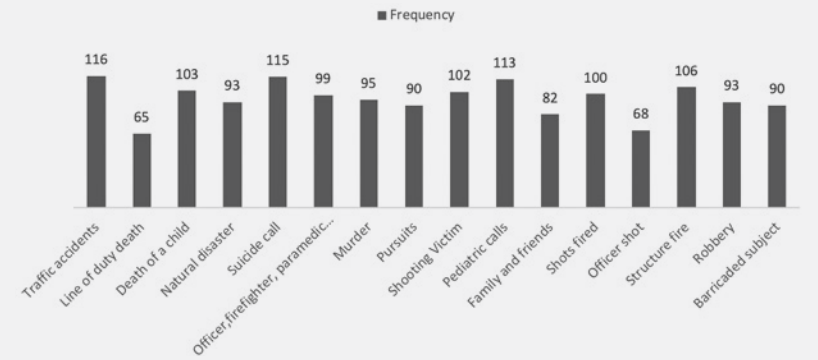

Figure 1. Frequency of Dispatchers Reporting Experiencing Different Emergency Calls

Dispatchers endorsed traffic accidents (96.7%) as the most common type of call experienced on the job. Second most common were suicide calls (95.8%) with pediatric calls following third (94.2%). Eighty-five percent (85.8%) of dispatchers endorsed dealing with calls that involved a death of a child; 88.3% endorsed taking calls involving structural fire damage; 85% stated they experienced a call in a situation where an individual was shot; 83.3% experienced calls where someone fired a weapon; 82.5% noted taking calls where a first responder (firefighter, police officer, EMT) was injured; 79.2% endorses calls that involved a murder; 78.5% experienced calls that involved an officer death in the line of duty; 77.5% stated they responded to natural disaster calls; 77.5% responded to calls that involved a robbery; 75% endorsed situations where a subject was barricaded; 68.3% endorsed taking calls that involved a family member; 68.7% endorsed calls where a police officer was shot. These data are consistent with national samples[4] suggesting that individuals participating at the conference were representative of emergency dispatchers.

While dispatchers may have experienced certain types of calls more often than others, their rating of distress from calls showed an interesting pattern (see Figure 2). Whereas traffic accidents are commonly experienced, only 11.2 percent of the dispatchers endorsed it as causing moderate to severe distress. In contrast, 97.8% dispatchers reported barricaded subjects as the most distressing call and in second with 92.3% a death of an officer in the line of duty.

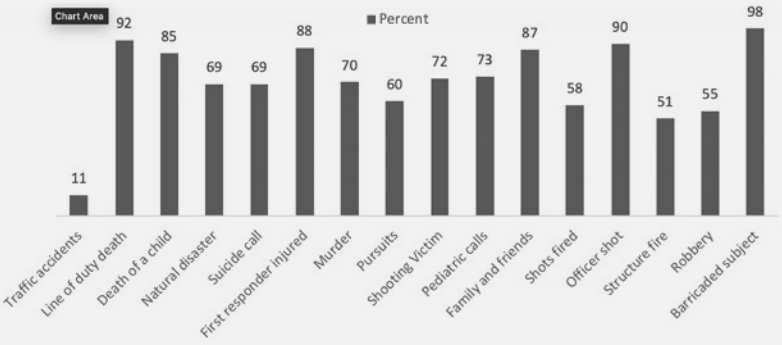

Figure 2. Percent Endorsing an Emergency Call as Moderately to Severely Distressing

For the completers, there was a statistically significant reduction in PTSD symptoms as assessed by the PCL-5. Wilcoxon Signed-ranks test indicated a significant decrease from baseline (Mdn = 18.00) to post-intervention (Mdn = 5.5), Z = 4.69, p < 0.001. Similarly, there was a significant decrease in PHQ-9 scores) from baseline (Mdn = 6.0) to post-intervention (Mdn = 3.0) Z = 2.3, p = 0.001. Significant decreases were also evident for the GAD-7 from baseline (Mdn = 5.00) to post-intervention (Mdn = 3.0) Z = 3.36, p = 0.001, on the DAR-5 between baseline (Mdn = 8.0) to post-intervention (Mdn = 6.0) Z = 3.1, p = 0.002, and on the AUDIT from baseline (Mdn = 2.0) to post-intervention (Mdn = 1.0) Z = 2.7, p = 0.007.

Feasibility, acceptability, and preliminary outcomes for PTSD Coach

Helpfulness

Results were broadly positive for the helpfulness ratings. The majority of the participants (53%) felt that the app helped them overcome the stigma of seeking mental health services. Eighty percent also reported overall satisfaction with PTSD Coach. Dispatchers provided feedback such as information regarding effects of stress due to "pain related to carpal tunnel," "how to talk to your supervisor about PTSD

symptoms," "more audio files on how to fall asleep," and "anonymous chat feature to connect to other dispatchers for support" to improve the helpfulness of PTSD Coach.

Efficacy

Table 2 present the means and standard deviation for all participants for PTSD symptoms and other indicators of emotional distress at baseline and across each week of assessment for study completers. A chi-square analysis showed no significant differences between non-completer and the completer group on any of these assessment measures or for the number of people who endorsed significant distress and met the criteria for PTSD (n = 27), anxiety (n = 30), depressive (n = 17) and anger symptoms (n = 25). Dispatchers endorsed PTSD symptoms such as feeling upset when something reminded them of the stressful experience, trouble avoiding memories, experiencing strong negative feelings (i.e., fear, horror, anger, guilt, shame), and difficulties concentrating, and falling or staying asleep.

	Time					
	Baseline	Week 2	Week 3	Week 4	Week 5	Post Intervention
Measure	n = 50	n = 43	n = 42	n = 46	n = 45	n = 50
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
PCL-5	19.9 (15.1)	14.3 (12.4)	12.3 (11.6)	11.1 (11.0)	10.5 (12.0)	10.1 (11.1)
PHQ-9	6.7 (4.9)	5.1 (4.2)	5.0 (4.18)	4.7 (4.2)	4.4 (4.3)	4.1 (4.4)
AUDIT	3.3 (3.7)	2.8 (3.5)	2.4 (2.9)	2.9 (3.4)	2.6 (3.0)	2.5 (2.9)
DAR-5	8.8 (3.1)	8.1 (3.1)	7.7 (3.1)	8.0 (3.2)	7.4 (3.3)	7.4 (2.9)
GAD-7	6.1 (5.1)	5.5 (4.2)	5.2 (4.4)	4.7 (4.0)	4.4 (4.7)	4.0 (4.1)

PCL-5 = PTSD Checklist 5; PHQ-9 = Patient Health Questionnaire- Depression Subscale; AUDIT = Alcohol Use Disorders Identification Test; DAR-5 = Dimensions of Anger Reactions; GAD-7 = Generalized Anxiety Disorder Scale.

Table 2. Psychological Symptom Measures of Completers from all time points

DISCUSSION

When discussing the secondary traumas experienced by first responders, emergency dispatchers are a group who are often understudied.[1] However, as indicated in this investigation, dispatchers who participated in the study experienced a variety of emergency calls ranging from a traffic accident to murders. The most common call was a traffic accident (96.7%) but only 11.2 % of the sample endorsed a traffic accident call that was moderately to severely distressful. The second most commonly experienced call was a suicide (95.8%) with more than two-thirds of the sample (68.8%) endorsing them as moderately to severe distress. With respect to frequency, the findings from this investigation are similar to other studies[1,4] where 75% of the sample endorsed experiencing calls related to traffic accidents, structural fire, natural disasters, and armed robbery. In contrast, there are fewer data available on the level of distress and severity elicited by various types of emergency calls. With the exception of the call rated as most distressing (barricaded situation), the majority of distressing calls entailed a degree of familiarity with the victim (death of an officer in the line of duty [92%], officer involved in a shooting [89.7%], first responder injured [87.9%], and friends and family involved in a call [86.6%]). We examined the frequency and severity of calls in this sample for two reasons. First, to address any concerns that this sample, recruited from a national conference, might be different from other methods of study recruitment. These data suggest that this is not the case. Second, to call attention to the fact that it is not simply the frequency of calls or totality of calls experienced across years of service that may lead to the development of psychological disorders such as PTSD. Special attention needs to be paid when telecommunicators are working calls that involve the death or injury of loved ones, friends, and co-workers. At those times, supervisors may need to signal understanding that, in the aftermath of such calls, time to decompress or deal with emotions may be needed.

To our knowledge, this is the first study to evaluate the use of a mobile application to alleviate psychological mood symptoms among emergency dispatchers. Although originally developed for the veteran community, there was a decrease in overall psychological symptoms. Thus, although not developed specifically for this population, it appeared to be sufficiently relevant to produce positive feedback and acceptance by a different population.

The psychological symptoms for this population ranged from mild and moderate. The estimated prevalence for PTSD in emergency personnel ranges from 9 to 30 percent.[11,12,30] Consistently, 23 percent of our study completers scored above the cut off score for PTSD. When interpreting our findings, it is important to note that the overall sample's average endorsement of psychological symptoms, one might think of this group as subclinical; a group that nonetheless has been noted to exhibit functional impairment even when not meeting all of the diagnostic criteria.

With respect to efficacy, the results support our primary hypothesis. There was a statically significant decrease in psychological symptomatology for PTSD, depression, anxiety, anger, and alcohol use. Results demonstrated a gradual decrease in symptoms across the weekly time points, indicating efficacy with this population. In contrast, there was no significant effect for interpersonal difficulties. However, participants reported only mild symptoms at baseline, which may not have provided any room for change (i.e., a floor effect). A second consideration is that the social resources within the mobile app are geared for Veterans. While there is a customizable section to include personal phone numbers, the majority of the contact information and service resources are for Veterans. The inclusion of contact information for mental health providers for civilians and emergency dispatchers may help improve this section for this particular population. Finally, the application does not provide tools to improve interpersonal communication or interactions, something that might be included in an application update.

The results of this investigation are consistent with studies examining PTSD Coach with veterans. Similar to veteran samples, the telecommunicators found PTSD Coach to be acceptable, feasible and helpful.[29] However, this study expands the potential use of the PTSD Coach in two ways. First, rather than an adjunctive aid, this study examined its use as a standalone aid over a brief (one month) period. Second, we examined its efficacy in a subclinical civilian population. Because of the brevity of the treatment, it is not clear whether they will continue to use the app in order to maintain or further improve over a longer period of time.

Limitations

While the results are encouraging, the study has some limitations. First, the participants were all attendees of the 2018 NAVIGATOR conference, and the psychological symptom severity may not fully reflect the dispatcher population. To more fully assess the feasibility and efficacy of PTSD coach for this group, nationwide recruitment is needed. Second, owning a smartphone was a requirement to participate in the study. We were unable to examine the reactions of dispatchers who do not own a smartphone. Third, the duration of PTSD Coach use was truncated to five weeks and may not mirror real-world use. An extended period may have provided more time to use and evaluate all of the features and functionality of the application. Fourth, the founders of PTSD Coach created the mobile application for the Veteran population. This is the first time the application was used with a civilian population. The data revealed that the application was useful but its utility could be enchanced to address the specific job requirements of this group. Finally, this study did not utilize a control group. However, given the novel use of the PTSD Coach for this investigation, a pilot study was deemed to be the best use of time and resources. Having now demonstrated initial success, larger scale investigations with appropriate control groups are warranted.

CONCLUSION

The data from this investigation contribute to the scant research on the use of technology-aided interventions for emergency dispatchers. These results have implications for how psychological symptoms in emergency dispatchers might be addressed on a large scale. Mobile application such as PTSD Coach offer accessible and often free psychoeducational and self-management tools to those who may shy away from conventional mental health treatment. The tools provided in the PTSD Coach allowed the dispatchers to practice manage their mood discretely. However, there were a few modules and exercises that were not appropriate for the dispatchers. Modules such as the Resources containing contact information for Veterans and lack of brief one-minute relaxation exercises to use between calls are examples. Therefore, further research of PTSD Coach is needed for the civilian population, specifically for emergency telecommunicators. An application such as a modified PTSD Coach is a potential option to not only bring down barriers to care but improve dissemination of preventative and effective skills for improving mental health care.

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