Review Article



# Mobile mental health interventions following war and disaster

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**Abstract:** Mobile technologies offer potentially critical ways of delivering mental health support to those experiencing war, ethnic conflict, and human-caused and natural disasters. Research on Internet interventions suggests that effective mobile mental health technologies can be developed, and there are early indications that they will be acceptable to war and disaster survivors, and prove capable of greatly increasing the reach of mental health services. Promising mhealth interventions include video teleconferencing, text messaging, and smartphone-based applications. In addition, a variety of social media platforms has been used during and immediately after disasters to increase agility in responding, and strengthen community and individual resilience. Globally, PTSD Coach has been downloaded over 243,000 times in 96 countries, and together with large-scale use of social media for communication during disasters, suggests the potential for reach of app technology. In addition to enabling improved self-management of post-trauma problems, mobile phone interventions can also enhance delivery of face-to-face care by mental health providers and increase the effectiveness of peer helpers and mutual aid organizations. More research is needed to establish the efficacy of mhealth interventions for those affected by war and disaster. Research should also focus on the identification of active elements and core processes of change, determination of effective ways of increasing adoption and engagement, and explore ways of combining the various capabilities of mobile technologies to maximize their impact.

**Keywords:** War; disaster; mental health; post-traumatic stress disorder (PTSD); mhealth; mobile health; technology; intervention

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Every year, millions of people around the world are exposed to wars, conflicts, and natural and human-caused disasters. For example, in 2013, it was estimated that 148.2 million people were affected by natural disasters or displaced by conflict (1). Individuals caught up in these events often experience multiple traumatic events, and mental health problems, especially post-traumatic stress, anxiety, and depression disorders, become a substantial public health challenge. As many as one-third to one-half or more of those whose lives are disrupted by disaster experience mental health problems and accompanying significant impairments in functioning (2-4). Similarly, war combatants and war-exposed civilians experience high rates of post-traumatic stress disorder (PTSD) and other trauma-related problems (5,6).

Even in well-resourced societies, psychological care is not received by many of those who may benefit. Among U.S. military veterans diagnosed with PTSD, for example, only 39% receive any form of mental health care (7,8), and utilization of PTSD treatment is even more limited for non-veterans (9). In war-torn areas, where PTSD prevalence is likely to be higher and health care resources more scarce, access to mental health services is extremely limited. For example, among those affected by conflicts in the Republic

of Georgia, fewer than 5% of those with mental health disorders had utilized any type of psychotherapy services (10). Disaster survivors also show low rates of participation in mental health services (11).

In the context of such extensive mental health needs, current models of service delivery that rely on individual face-to-face psychotherapy are not adequate (12), in either Western countries with functioning mental health infrastructures or in low and middle income countries (LMICs). Mobile technologies offer potentially critical ways of delivering mental health support to those experiencing war, ethnic conflict, and human-caused and natural disasters, all of which are likely to become more frequent in coming years due to climate change (13). Today, about 40% of the global population has access to the Internet and there are almost as many mobile phone subscriptions as there are human beings (14). These technologies are becoming used for a comprehensive range of daily tasks (e.g., shopping, banking, socializing) and their integration into mental health services is also taking place, with modes of delivery including conventional telephone services, video-teleconferencing, mobile phone-, and more recently smartphone-based interventions. Web-based programs are now being made available on mobile platforms, and the latest generation of mobile phones ("smartphones") offers functionalities that until recently were limited to desktop computers. Mobile devices are more ubiquitous and personal than computers, and large numbers of the population are smartphone-dependent for access to the Internet. Penetration of mobile cellular subscriptions per 100 inhabitants is 128 in developed nations and 89 in developing nations (14). Smartphone ownership is rapidly increasing, estimated at 16.7% penetration globally (14), and it is even more prevalent in developed nations, like the United States, where 68% of adults own a smartphone (15). Phones are almost always within immediate reach and turned on, providing opportunities to offer "just-in-time" support (e.g., managing acute distress, providing emergency information). Social media platforms such as Twitter and Facebook link large numbers of users and facilitate rapid communication. Of critical importance for the support of war- and disaster-affected communities is the fact that mobile mental health technologies can extend the geographic reach of care to rural areas and parts of the world that lack mental health infrastructure or have a shortage of mental health clinicians (16-18), and they present service options that are highly scalable (i.e., able to accommodate large numbers of users). They can most likely increase the effectiveness of mental health professionals, enable paraprofessional and peer mental health support (19), and increase active self-management of problems among survivors or war and disaster, including those in LMICs (20).

Below, we explore the utility of mobile mental health technologies for promoting psychological wellbeing and delivering effective care for survivors of war/ethnic conflicts and disasters, in terms of their effectiveness, acceptability to war and disaster survivors, and potential for greatly increasing the reach of mental health supports.

## Effectiveness of mobile mental health intervention

Research on mobile app interventions targeted at those exposed to traumas of war and disaster is in its infancy. PTSD Coach has received the most research attention. The first study of PTSD Coach was a preliminary, uncontrolled evaluation with 45 veterans being treated for PTSD in the U.S. Department of Veterans Affairs (VA) (21). After using the app for three days, veterans perceived it as being moderately to very helpful for managing acute distress, PTSD symptoms, and sleep difficulties. A subsequent pilot randomized controlled trial with 49 community trauma survivors with elevated PTSD symptoms showed that PTSD Coach was feasible, acceptable, and resulted in modest treatment effects (d=0.27) after 1 month of use relative to a waitlist control; however these effects were not statistically significant (22). Based on the findings of this pilot, an adequately powered, full-scale RCT of PTSD Coach was recently completed with 120 community trauma survivors (Kuhn *et al.*, unpublished data). In this study, three months of PTSD Coach use resulted in significantly greater improvements in PTSD severity, depression severity, and psychosocial functioning relative to a waitlist control condition. In addition to using PTSD Coach in a self-administered fashion, it has also been integrated in VA primary care settings with clinician support for use. A pilot RCT evaluating this approach with 20 VA primary care patients found promise of clinically significant reductions in PTSD symptoms and increased acceptance of referral to specialty mental health (23). Globally, PTSD Coach has been downloaded over 243,000 times and is associated with significant reductions in momentary distress for those who use at least one symptom management tool (24).

The fact that apps lend themselves to incorporation of the same kinds of common therapeutic components that are likely critical to Internet-based (and face-to-

face) intervention effectiveness (e.g., skills training with demonstration/modeling, individualized assessment, goal-setting, self-monitoring) provides reason to think that they can be effective in changing behavior and reducing distress. Internet interventions for PTSD have been found to be significantly more effective than passive controls, with medium to large effect sizes (25). Several trials have tested Interapy, an online, therapist-supported, narrative writing intervention for PTSD among trauma-exposed individuals with PTSD symptoms (26-28). Two studies of Ilajnafsy, an adaptation of the Interapy intervention for use in Iraq, suggest that such interventions will be helpful for war-and conflict-affected populations (29,30). Knaevelsrud *et al.* (30) tested the efficacy of a cognitive-behavioral Internet-based intervention for war-traumatized Arab residents in Iraq. PTSD symptoms were significantly reduced from baseline to post-treatment in the treatment group relative to the control group, suggesting that, even in unstable settings with ongoing exposure to human rights violations through war and dictatorships, cognitive-behavioral treatment provided entirely via technology may benefit trauma survivors. In the United States, a variety of web-based interventions for combat veterans experiencing post-traumatic stress difficulties have successfully reduced PTSD symptoms, depression, and/or alcohol use (31-33).

Mobile interventions with disaster survivors have received little attention to date, but research on the effectiveness of Internet-delivered interventions in disaster provides encouragement for mobile mental health approaches (34,35). A trial of the My Disaster Recovery web intervention among 56 survivors of Hurricane Ike showed that using it for an average of 1.8 hours reduced worry more than use of a non-interactive electronic book or usual care, although changes on other symptoms were non-significant (35). A Chinese variant of the website was tested in both an urban sample exposed to a variety of traumas and with rural survivors of the 2008 Szechuan earthquake in China (36). PTSD symptoms improved more among those using the tool than among controls.

In addition to their potential for enhancement of self-managed care, mobile apps might increase effectiveness of services for disaster and war survivors by supporting in-person counseling, especially delivery of evidence-based interventions (EBIs). Mobile phone-based videoconferencing (VC) can be used to allow trained clinicians to treat survivors at a distance and findings with U.S. war veterans show that treatment of PTSD and other trauma-related problems delivered via VC produces good treatment outcomes (37-47).

Smartphone apps can also be used to increase engagement and adherence to EBIs. For example, the PE Coach app (48) has been designed to enable patients to understand psychoeducational content associated with the Prolonged Exposure intervention, record their trauma narrative, complete and self-monitor *in vivo* and imaginal exposure homework assignments, master breathing retraining, measure PTSD symptom change, and schedule upcoming sessions. The U.S. VA has built a number of apps that support prominent treatments, including CBT-I Coach for Cognitive-Behavioral Therapy for Insomnia, CPT Coach for Cognitive Processing Therapy, ACT Coach for Acceptance and Commitment Therapy, and Stay Quit Coach for Integrated Care for Smoking Cessation, among others currently in development.

Mobile phones also provide text messaging [short messaging services (SMS) or texting] capabilities, which is important given current limitations in penetration of more sophisticated devices in LMICs. Text messaging, despite its limitations for providing more sophisticated interventions, affords significant opportunities to both assess and address post-traumatic symptoms and related problems following war and disaster. For example, text messaging has been used to monitor PTSD symptoms among injured trauma survivors in the 15 days after hospital discharge (49). Participants were responsive to these texts (83% responded at least once and on average responded to 63% of texts) and indicated high satisfaction with the approach. This demonstrates that using texting-based assessment following trauma could be a feasible way to monitor at-risk populations. Texting has been used as a tool to help address subthreshold PTSD symptoms in military service members within 5 years following deployment to Afghanistan or Iraq (50). A resilience enhancement group called GETSmart included a single 90-minute introductory session conducted by video (Skype or FaceTime) focusing on CBT skills and use of available smartphone apps for psychoeducation, relaxation, and engagement in social activities (e.g., PE Coach, Life Armor). Daily text messaging was then used to encourage use of the apps over the ensuing 6 weeks of intervention. A control condition received a shorter introductory session involving encouragement to use apps and daily text messages that provide inspirational sayings and positive aphorisms but no explicit directions to use specific apps (to control for contact). Preliminary findings from the first 13 participants completing the intervention were encouraging, with PTSD symptoms significantly improving at post-

 

intervention and being maintained at follow-up, whereas control participants did not see such improvements.

## Acceptability

If they are to be helpful, mobile mental health interventions must be acceptable to both disaster and war survivors and to potential mental health providers. Mobile technologies potentially offer a more convenient way of providing services to people who might otherwise not access formal treatment (51). Mobile mental health services may be especially useful for individuals who are concerned about social stigma or fear possible consequences of disclosure or help-seeking (e.g., members of certain ethno-cultural or religious groups, survivors of political persecution).

Research on patients using behavioral health web interventions has generally found them to be acceptable and satisfying (52) and compatible with establishment of good therapeutic relationships (27,53). In the U.S., many war veterans appear receptive to using mental health technologies [(54) and Whealin *et al.*, unpublished data]. A survey of veterans receiving outpatient VA PTSD treatment found that 85% were interested in using apps as part of treatment, with 56% to 76% of respondents with access to technologies reporting interest in trying mHealth programs for such issues as anger management, sleep hygiene, and management of anxiety symptoms (55). U.S. Veterans with PTSD have reported high satisfaction with the PTSD Coach self-management app, perceiving it as being moderately to very helpful in managing acute distress, PTSD symptoms, and sleep difficulties, as well as helpful for learning about PTSD and explaining it to their family and friends (21).

Koffel *et al.* (56) conducted a pilot study of the feasibility and acceptability of CBT-I Coach, an app designed to facilitate in-person delivery of cognitive-behavioral therapy for insomnia. In terms of feasibility, the nine participants assigned to use CBT-I Coach during the therapy all reported using the sleep diary feature and most reported using other major features of the app (e.g., psychoeducational content, coping tool). They also found the app to be highly acceptable, with all participants reporting that they would recommend it to a friend or family member. Qualitative feedback suggested that clients appreciated the sleep diary feedback and the conveniences the app offered.

Mental health providers in the U.S. Veterans Health Administration (VA) appear receptive to incorporation of mobile technology into their practice. In a study of clinician attitudes towards the PE Coach app completed before release of the app, 163 VA mental health clinicians agreed that it could significantly improve their care, would not be too complex to integrate, and would not change the therapeutic relationship; three-quarters reported that they would use the app (57). Younger clinicians (<40 years old) rated PE Coach significantly more favorably than older clinicians and reported greater levels of intention to use the app. A second study investigated uptake and perceptions of PE Coach among 271 clinicians a year after the app was released (58). Half of those surveyed who were treating clients using PE reported using the app. Over 93% of these clinicians reported that they intended to continue using the app and overall had very favorable perceptions of it. Similar results have been found with the uptake and perceptions of CBT-I Coach, with nearly 60% of VA CBT-I trained clinicians reporting having used it in the 2 years after it became available and perceiving that it improved CBT-I homework adherence and outcomes (59). Clinicians working with civilians in the general community have also expressed a high level of interest in using mental health apps and websites (60).

## Reach

Perhaps the most compelling examples of the potential for mobile technologies to increase reach to large numbers of war and disaster survivors are related to use of social media to seek information and establish the safety of loved ones during and after large disasters. Since around 2005, a variety of social media platforms have been used during and immediately after disasters as a naturally-occurring community response [e.g., (61-65)], to increase agility in responding, strengthen community and individual resilience, and in some circumstances, to help transform users from bystanders or casualties into active collaborators or first responders (61,64). During the 2009 NH1N1 influenza pandemic, the U.S. Department of Health and Human Services provided public education via YouTube and iTunes video podcast, and the number of followers of the Centers for Disease Control and Prevention Twitter "emergency profile" increased from 65,000 to 1.2 million (61). Twitter is an important platform in terms of reach because it can be made available to almost anyone with a mobile phone; more sophisticated smartphones are not required. "Crisis-mapping" tools like that created by the non-profit company Ushahidi have been used in response to multiple

disaster/conflict events, including post-election violence in Kenya, the 2010 Haiti earthquake, and in disasters occurring in Chile, Pakistan, and Japan (64). Such crisis maps enable users to determine which geographical areas are facing specific problems, and enable responses to specific aid requests. Facebook, the largest social network in the world, is playing an increasingly important role in disaster response. It enables the families to reach their loved ones, enables widespread social support, and also is a powerful fund-raising mechanism for relief efforts. In the East Japan earthquake and tsunami, the Disaster Relief page created by Facebook was "liked" by more than 680,000 people (64). Recently, Facebook deployed its "Safety Check" feature (https://www.facebook.com/about/safetycheck/). In the event of a disaster, the app utilizes the location of the device to trigger notifications. Users in the area of the disaster are prompted to mark themselves as "safe" to let friends and loved ones know, and users can also monitor others who may be affected by the disaster. In the future, in addition to marking oneself as safe, users could also potentially be linked with appropriate, location-specific resources.

A concern with social media use during disasters is the transmission of inaccurate information or rumors. Re-tweets of wrong information are not uncommon, but although surveys of respondents in Japan indicated that lack of trust in information was the greatest perceived problem with use of social media during the event, 94% of users rated social media to be "helpful" or "extremely helpful" (64). A survey of primarily Australian users of Facebook sites related to flooding events in Queensland found that only a small minority (6%) of users relied solely on social media for information and that use of social media served to orient users to official sources of disaster-related information. Users were primarily seeking information, requesting help, offering help or practical assistance, and communicating support or sympathy, activities seen to support the principles of Psychological First Aid. These same survey respondents indicated that use of social media made them feel connected, useful, supported by others, actively involved, and less worried (62).

While the reach of such social media emergency information services is by now established, the ability to deploy apps that involve delivery of systematic coping and support tools to reach large numbers of survivors is less clear. The most used PTSD-related app at present is PTSD Coach (66), and its current download rate of 243,000 (in 96 countries) indeed suggests such potential. The app is designed to educate users about PTSD, enable self-assessment of PTSD symptoms, and increase self-management of symptoms by providing coping tools and promoting use of social support and community resources. A study of the use of PTSD Coach in the general population reported that PTSD Coach had reached its target population of those with significant distress and was associated with relatively strong use over time (41% of users continued to use the app one month after it was downloaded), and high levels of user satisfaction (24).

Mobile mental health interventions can be designed as stand-alone self-help interventions, or at the other end of the continuum, they can serve as augment clinician-delivered care. Between these two extremes is assisted self-help, in which individuals self-manage their problems but are offered human support that is less intensive than that likely to occur during face-to-face mental health treatment. While integration of web-based interventions into traditional clinical service might increase reach by reducing the amount of provider time required to treat each patient thus allowing more patients to be seen by a provider (19), it is self- or paraprofessional-administered interventions that can help reach war- and disaster-affected populations at scale. During disasters and other mass traumas, the demand for mental health care services will generally exceed supply. In places where traumas have recently occurred or are ongoing—active war zones, politically unstable countries or regions, areas acutely affected by natural and manmade disasters lacking basic necessities, and regions with uncontained contagious disease outbreaks (e.g., avian flu)—it may be unsafe for mental health providers to offer in-person support, and, in some emergencies, mobile technology may provide the only functioning system for communications (63). Perhaps most importantly, much of the international burden of trauma falls on individuals living in geographical regions in which access to trained mental health professionals is rare, so that traditional modes of service delivery are doomed to fail (12).

## Research needs

More research is needed to establish the efficacy of mhealth interventions for those affected by war and disaster. There have been almost no trials to date, and while research on conceptually- and procedurally-similar Internet interventions suggests the promise of mobile mental health, studies will need to investigate a range of interventions to determine their uptake and effectiveness. Research should also focus on identification of active elements and

core processes of change, determination of effective ways of increasing engagement, and exploration of ways of combining the various capabilities of mobile technologies to maximize their impact.

As research in this field develops, investigators should routinely assess the frequency and intensity of adverse effects of these interventions. A recent study indicated that, in four large clinical trials, 9.3% of patients receiving mental health-related web interventions reported some type of negative effects (67), and these same effects may be especially important related to mhealth technologies because of their potential reach. The potential for delivery of self-managed or paraprofessional-supported care that is needed to reach large numbers of individuals may at the same time present a risk that unsuccessful attempts at self-management will be perceived as a personal failure and lead to a conclusion that mental health treatment does not work. Such potential negative consequences should be routinely assessed, and the same kinds of recommendations offered by Rozental *et al*. (67) concerning negative effects of Internet interventions hold with regard to mhealth interventions: negative effects should be acknowledged and examined; a uniform classification of negative effects should be used; measurement of negative effects should incorporate methods from both quantitative and qualitative research; and factors associated with negative effects should be investigated in order to help delineate underlying mechanisms.

## Conclusions

There is much to be done if mobile mental health technologies are to be leveraged for the welfare of disaster- and war-affected populations across the globe. Widespread access to mobile technologies is needed if the mental health consequences of disasters and wars are to be better addressed, globally. While smartphones and other smart mobile devices are now being carried by a substantial and ever-growing minority of individuals world-wide (14), and by a majority of individuals in developed nations (68,69), there are still many who do not have access to them.

In addition to improved access and the need for increased development of technology tools and demonstrations of their effectiveness, acceptability, and feasibility of delivery, systems to monitor and ensure user safety in the contexts of remote services, self-managed recovery, and integration of paraprofessional helpers must be designed and tested (70). Information security must be addressed, to avoid breaches of client privacy or the compromising of safety for those using services in politically unstable regions or closed societies. Thus, data must be secure when transmitted (i.e., strongly encrypted) and protected when stored (e.g., behind a firewall). The American Psychological Association (71) has created guidelines that cover everything from security of patient data to informed consent and clinical boundaries for successful and legal implementation of telemental health care. Most apps that are currently available usually do not pass data to or from any existing dashboard structures that paraprofessional or professional clinicians, or indeed war and disaster survivors themselves, can access, limiting their ability to thoughtfully integrate these tools into care.

Mobile technologies will continue to evolve rapidly. They will increasingly enable the routine gathering of outcomes data to inform clinician decision-making, improve accountability of services, and enable a more comprehensive vision of measurement-based care. Evidence suggests that inclusion of outcomes monitoring in psychological interventions can itself improve outcomes (72), but a fundamental obstacle to routine measurement of mental health outcomes is a reliance on use of paper and pencil questionnaires to provide information that cannot easily be integrated into electronic health records or viewed by providers. The capacity of technologies for including assessments and passive data gathering means that mhealth interventions can significantly enable the collection of data, both in terms of user-entered information and automatically collected data, helping us move towards evidence-based decision-making and improving our ability to evaluate interventions and conduct research (73,74). Background sensing—from the frequency and duration of phone calls made on the phone to the geodiameter traversed within the course of a day—is rapidly being integrated into phone technology (75), and wearable sensors provide actigraphy data to better understand momentary biological signals (76). Capabilities like geospatial location (GPS) and psychophysiological monitoring might enable potentially powerful adaptations to improve effectiveness of apps in changing behavior and emotions. For example, war and disaster survivors often show increased rates of alcohol use disorder and smoking. The Addiction-Comprehensive Health Enhancement Support System (A-CHESS), a mobile app designed to improve continuing care for alcohol use disorders, incorporates GPS data to alert individuals to their proximity to risky drinking environments (75), and similar approaches could be adapted for the populations discussed in this paper. Given that Veterans, civilians exposure to war

 

traumas, and disaster survivors with PTSD often experience a range a physiological effects of PTSD symptoms and stress reactions, it is likely that sensors tracking heart rate, skin conductance, blood pressure, and other responses could be used to trigger interventions to reduce arousal. Although such technological innovations are promising, the current limitations of available devices in LMICs or the limitations of cellular data speed in the United States will impose a hard cap on disaster and war response solutions that rely on the latest and greatest engineering innovations (77,78).

As can be seen, the application of mhealth technologies with disaster and war survivors is in its infancy. There is as yet little research and development in this domain, and it remains to be seen whether interventions and delivery systems that are effective and acceptable can be developed and deployed at scale. While applications are being developed and tested, it will be critical to simultaneously address implementation issues. The task of bringing mobile products "to scale"—deploying them widely rather than under small-scope, often unrepresentative test conditions—is not only a technical infrastructure issue but one paralleled by the multifaceted implementation challenges of effectively incorporating disaster and war response systems into local conditions and existing service delivery option in usable and cost-effective ways (79). Implementation of systems that promote psychological recovery and wellbeing through mobile platforms represents an opportunity to address these challenges, and iteratively improve psychological interventions—some of which remain untested outside of academic workgroups—by basing their ongoing adaptation on evaluations of user experience and application of user-centered design principles. To increase acceptability and reach, it is likely that empirically supported mhealth interventions will need to be improved and rendered contextually compatible for specific intervention contexts and populations. Complementing core psychological interventions with context-specific, culturally relevant implementation may be a core condition for effectiveness and field implementation under what are guaranteed to be the most non-ideal of circumstances. Designing, deploying, and iteratively refining interventions and delivery systems that are mindful of context is in line with calls for pragmatic research endeavors that are intended to implement beneficial outcomes under real world conditions (80).

The human component of mhealth also requires much increased attention in the global context of war and disaster response. Even in developed countries, relatively little training exists for clinicians in how to include mobile mental health care in their practice (81). In LMICs, while "task-shifting"—in which supervised community or lay health workers, rather than mental health professionals, physicians, or trained nurses provide care—is increasingly being explored in mental health (82), there have been virtually no investigations to date of enabling paraprofessionals in these environments to better support others using technologies.

If developed, evaluated, and implemented effectively, mobile mental health technology tools can form a core element of public health interventions that can reach large numbers of war and disaster survivors and help them to better self-manage their challenges. They can also enhance delivery of face-to-face care by mental health providers and increase the effectiveness of peer helpers and mutual aid organizations. Given the anticipated spread of these technologies around the world in the next decade, they hold promise of making a significant contribution to reducing the global burden of mental health problems associated with wars and human-caused and natural disasters.

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## Footnote

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