Mobile mental health interventions for trauma survivors

In our special issue exploring the applications of mobile technologies to the field of traumatic stress, we invited teams of authors whose work addresses some of the emerging potential for helping those exposed to traumatic events and highlights some of what we consider to be future critical challenges if that potential is to be realized. Those challenges include making sure that mobile tools reach the millions of individuals exposed to trauma, increasing evaluation efforts and improving methods of evaluating the process and outcomes of interventions, and finding ways to accomplish the widespread implementation of technology interventions in ways that effectively engage end users, mental health providers, and systems of mental health care.

The reach of trauma-related technologies

With the enormous increase in mobile phone ownership and anticipated rapid spread to those in low- and middle-income countries (1), there is increasing recognition that phones can, potentially, provide a platform to increase the wellbeing and mental health of large populations of those in need. Kuhn *et al.* (2) describe a foundational achievement in this field that offers encouragement for such a possibility. PTSD Coach was released in 2011 as an initial effort launched by the VA's National Center for PTSD and represented the first mobile app targeting post-traumatic stress problems. Although it was designed first and foremost to assist veterans and active duty personnel returning from war, it was also intended to help anyone experiencing traumatic stress reactions. One of the authors of this preface (JR) participated in the making of the app and served as director of the center leading its creation. At the time, the potential of technologies to advance care for trauma survivors seemed clear. But subsequent experience at the National Center for PTSD following the release of PTSD Coach demonstrated two important things. First, the app was popular with veterans. It was wanted, and it was downloaded by large numbers of those who could potentially benefit. At the time of writing of the Kuhn *et al.* paper, it had been downloaded more than 350,000 times in 106 countries. Second, it had international appeal and could serve as the basis for international collaboration around the development and spread of technologies for traumatic stress. PTSD Coach "around the world" thus far has seen collaborative efforts in 7 countries to improve and share improvements in the app. It forms the basis for ongoing collaboration and has spread across nations and various traumatized populations.

While Kuhn and colleagues focus on post-traumatic stress disorder, Price *et al.* (3) explore the potential for technology to push beyond psychological treatment into prevention of post-trauma problems. This is especially important given the fact that, if technologies are to increase reach to trauma survivors, they should explore ways of quickly engaging individuals soon after exposure to trauma to encompass prevention as well as treatment. Research suggests that PTSD and related problems can indeed be prevented (4), and mobile interventions can potentially help address the many challenges associated with developing effective prevention initiatives. These challenges include the reluctance of many individuals to engage with mental health services of any kind, the focus of health care providers on tertiary treatments for established problems, the need for adaptive interventions that address the dynamic nature of symptoms experienced by individuals during the first days and weeks after trauma, and the challenges of training those in a position to help traumatized persons soon after adversity. Price and colleagues argue that mobile technologies can reach trauma survivors throughout the acute post-trauma period and describe initial studies suggesting that individuals are likely to be capable and willing to use devices for their acute post-trauma care and perceive the process as useful and minimally burdensome.

Owen *et al.* (5) describe the broader program of work coming from the team that developed PTSD Coach and that has now expanded into a range of technological innovations. Most critically, this team represents one initial organizational experiment in bringing mobile technologies for trauma survivors into major healthcare organizations. If reach is to be accomplished, one important strategy will include embedding technology-based interventions in established systems of care, including governmental and community-based organizations. Owen and colleagues are creating tools as part of the larger effort at the Veterans Health Administration (the largest healthcare system in the United States) to help Veterans with PTSD. Technology and its integration with a comprehensive approach to mental health services presents major conceptual, technical, and management challenges that need to be overcome if the potential of technologies to improve wellbeing is to be realized.

The program of Owen can serve as one model for beginning to explore the array of development, evaluation/research, and training and implementation challenges now facing organizations.

Reinventing evaluation and research

A major challenge in mobile mental health for trauma-related problems involves establishing the evidence base for the interventions and ensuring that those with significant empirical support are widely used and achieve market share. With the explosion of commercial mobile products, there is significant risk that ineffective or minimally effective interventions might come to dominate. Research on mobile mental health interventions is increasing rapidly, but at present the evidence supporting them is very limited in regard to all mental health problems, including PTSD. Several of the authors highlighted in the special issue address core issues of evaluation and, together, suggest some important directions for research. The work of Kuhn *et al.* (2) summarized here has provided some of the first studies indicating both that these interventions can be systematically evaluated, and that they may help reduce symptoms and distress. Price and colleagues (3) argue that these technologies can be used to collect a wide range of data during the acute post-trauma period in more efficient manner than via traditional data collection strategies, and that passively collected streams of data hold promise to improve the usefulness of assessment processes while simultaneously reducing participant burden.

Two articles push to extend the reporting of evaluation efforts beyond a sole focus on measurement of outcomes. Yeager and Benight (6) suggest that research on mobile technology interventions will continue to fall short of current standards for evaluating the efficacy of behavioral and pharmacologic therapies in the absence of methodologically rigorous measures of intervention engagement. Lack of accurate measurement and reporting of engagement and use in some studies make the interpretation of outcomes difficult to interpret and highlight the need to separate intervention effectiveness from intervention engagement. Taylor, Ruzek, Fitzsimmons-Craft, and Graham (7) suggest that evaluation efforts should go beyond simple demonstration of intervention effectiveness with circumscribed groups, to enable a simultaneous assessment of treatment effectiveness, engagement, and reach as they effect entire populations. They posit that such an expansion of measurement focus will be needed as we turn to a population science approach and seek to fulfill the promise of technology-based interventions for reaching significant numbers of those affected by trauma.

Implementation and engagement

Four of the papers grapple with issues of use: what will need to happen to actualize the promise of technologies to reach out globally with effectiveness? Experience with PTSD Coach (8) indicates that, while an app may be downloaded by large numbers of persons, many will not open it, most will engage only in limited ways, and relatively few will achieve a "therapeutic dose" of exposure to the contents of the interventions. The challenge of "engagement" is now widely recognized and remains a primary obstacle to accomplishing widespread reach. Yeager and Benight (6) take on this issue. They note the many uses of the word "engagement" itself, and draw attention to the current absence of what is needed: a shared definition of the term, a developed model that is theoretically-based and has been subjected to empirical study, and a set of widely-accepted, methodologically sound measurement tools required to strengthen our understanding of the engagement construct. Their discussion helps to address these shortcomings by clarifying the engagement construct and differentiating it from other widely used similar concepts, reviewing and expanding newly emerging theoretical models, and enumerating a range of approaches to the measurement, objective and subjective, of engagement.

Related to engagement and implementation, and to effectiveness, is a fundamental challenge of reinventing the nature of mobile interventions, their content and process. Andersson and Holmes (9) illustrate the possibility of creating new kinds of intervention processes that both capitalize on the new functionalities made possible by mobile technologies and leverage new insights from the field of cognitive science. Their arguments fit with the position suggested by Schueller and colleagues (10) that mobile mental health will need not only to adapt existing face-to-face interventions for distribution via technologies, but to rethink intervention methods to avoid simply attempting to replicate face-to-face interventions ("skeuomorphism") and better fit the ways users engage with their technologies and exploit their capabilities and limitations.

Perhaps the most exciting aspect of mobile interventions for trauma survivors is their potential to assist those in low-

and middle-income countries in which traditional treatment approaches are likely to remain subject to extreme resource limitations for many years (11). The work described by Carswell and his colleagues at the World Health Organization (12) provides a first critical effort to actualize this potential. Their "Step-by-Step" initiative is designed to create a mobile phone-based intervention that can reach large international populations affected by adversity, across countries and cultures. Based on the face-to-face Problem Management Plus (PM+) cross-diagnostic intervention that has been demonstrated to be effective in randomized controlled trials conducted in Pakistan (13) and Kenya (14), their work with the Step-by-Step intervention illustrates an initial attempt to solve a range of possible problems critical to the task of helping trauma survivors globally. They describe creation of a simple, flexible technology-based intervention that can be used by low literacy individuals and groups and that can be easily modified for use across cultures and countries.

Finally, Muñoz and his collaborators (15) concern themselves with problems of guiding consumers and mental health providers to evidence-based tools in a world of explosive growth of commercial and non-commercial mobile interventions that address behavioral health. In a world of limited access to face-to-face mental health support, technologies might hold great promise for reaching large numbers of people and contributing towards reducing disparities in wellbeing internationally. To make this happen, they propose the development of online repositories of evidence-based digital interventions—"digital apothecaries"—with links to and evaluations of digital tools. They argue that such resource repositories might allow more people to access services, while generating large-scale datasets that could extend standard data sources (e.g., self-report) with, potentially, millions of data points.

Moving forward

With the burgeoning development of behavioral health interventions, rapid acceleration of research, and many conceptual advances now taking place, there is reason to hope for widespread improvement in mental health service delivery for those who have experienced traumatic events. The articles cited above illustrate advances now taking place, and strengthen our reasons to hope. Four additional issues seem likely to present obstacles. First, who will implement these technological solutions at scale? Mobile interventions will be developed by researchers and welcomed, gradually, by health care organizations and other groups charged with facilitating wellbeing. However, research teams that develop and test such interventions are unlikely to take up the larger task of expanding the use of their interventions and managing processes of delivery at scale. They may not be funded to maintain technological platforms nor incentivized to undertake delivery of routine services. There will need to be agencies and organizations that focus on marketing the interventions, training helpers in their use, and engaging in continuous process improvement. Such organizations do not currently exist.

Second, effective technological interventions will need to be continuously maintained and supported to assure operation of the technology itself, but also to keep up with rapid advances in technical capabilities. Most healthcare organizations or nonprofit organizations will not have the technological expertise and resources to maintain and upgrade the technological platforms on which the interventions depend. Perhaps technology companies can be persuaded to embrace this role as part of their contributions to societal health.

Third, there is a need to better establish research methodology as a collaborative enterprise. In particular, development of agreed systems for the sharing of data generated by digital health interventions; shared conventions for reporting of outcomes, engagement, and reach that will allow more useful comparisons across studies and interventions, and improve our ability to rigorously test these technological solutions. To facilitate this, there is a need to create an "open source" hub for global research on mobile technologies where interventions can be shared and tested, and replicated by independent teams for researchers working in different settings.

Finally, and even more broadly, there will be a need to devise systems to promote collaboration and limit competition between research and developer groups that are focused on similar problem areas, striving for market share, "branding" of interventions, and research funding advantages. The development of collaboration systems that enhance comparisons across interventions, stimulate mutual learning and speed up innovation, and help teams avoid "reinventing the wheel" and duplicating efforts will require some rethinking of the incentives affecting research teams in order to facilitate the creation of new technology platforms and online collaboration environments. Taken together, the various issues in optimizing development and delivery of mobile interventions for trauma survivors present big challenges, the solution of which will offer

a major chance to improve wellbeing on a global scale.

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