ARTICLES

A Review of Mobile Applications for Facilitating EMDR Treatment of Complex Trauma and Its Comorbidities

Sylvia A. Marotta-Walters
Kshipra Jain
Jeffrey DiNardo
Paramjit Kaur
Shobila Kaligounder
George Washington University, Washington, DC

With the continued advancement in technology, there is a rise in the development and utilization of mobile health applications (mHealth apps) that claim to be using eye movement desensitization and reprocessing (EMDR) theory and techniques to facilitate the therapeutic process. However, there are concerns regarding the quality of these apps and the safety of clients who may be using them, particularly for those who may present with complex posttraumatic conditions and associated comorbidities. Hence, this study evaluates current EMDR apps to determine their purpose, potential benefits, and risks when used by clients and/or clinicians. Twelve apps were found to be eligible for evaluation and are rated on applicability, validity, accuracy, and usefulness. Currently, our review concludes that none of the EMDR apps are recommended for use by a client. Only 6 of the 12 apps would be recommended for use by a trained clinician as a tool to aid with EMDR treatment, provided the clinician were able to offer a safe environment that could adapt to the selected technology. Risks of using EMDR apps include safety concerns with unregulated use, particularly for clients with complex posttraumatic stress disorder (PTSD) and comorbid conditions, such as dysregulated emotions or cognitions, and concerns regarding cyber security and data privacy. Clinical implications for the use of technology and mHealth apps are discussed, and recommendations for the development of an ideal EMDR app for the future are provided.

Keywords: EMDR; complex trauma; PTSD; mobile health (mHealth) applications; technology

Eye movement desensitization and reprocessing (EMDR) therapy (Shapiro, 2001) is an evidence-based approach to the treatment of posttraumatic stress disorder (PTSD) and its complex variants. Recognized in many international PTSD treatment guidelines, such as those of the World Health Organization (2013), EMDR uses a standard procedure and addresses past, present, and future aspects of distressing memories. Originally developed for PTSD, EMDR treatment is now also used for many other presenting problems, such as depression and anxiety (Shapiro, 2014).

Overview of EMDR

The Adaptive Information Processing (AIP) model (Shapiro, 2002) underlying EMDR views symptoms of disorders as manifestations of unprocessed traumatic memories (Shapiro, 2001). Chen, Zhang, Hu, and Liang (2015) meta-analysis found significant reductions in trauma symptoms when using EMDR treatment for PTSD. Various designs of studies, such as systematic reviews and effectiveness studies, have been conducted on motor vehicle accidents (Boccia, Piccardi, Cordellieri, Guariglia, & Giannini, 2015), survivors of natural

disasters (Natha & Daiches, 2014), and victims of sexual violence (Regehr, Alaggia, Dennis, Pitts, & Saini, 2013).

EMDR therapy is guided by a protocol outlining eight phases of treatment as found in Shapiro (2001). These phases are described in chronological order, though there is no specified length of time for each phase and the phases can be recursive and nonlinear. The first phase focuses on obtaining a complete client history and the client and clinician work together to identify disturbing memories to be processed. The second phase, preparation, involves preparing a client for the processing phases of treatment. The third phase, assessment, identifies the perceptual, cognitive, emotional and somatic components of the memory which will be targeted in that session. Phases four through seven, which heavily benefit from the foundational work in earlier phases, tend to happen interactively. Phase four, desensitization, starts with the client holding the target memory in mind along with the negative cognition and then allowing the process to play out in a mindful manner. Phase five then shifts to reprocessing as there is an installation of a positive cognition to replace the formerly distressing negative cognition. Phase six, the body scan, serves as a check to make sure the distressing material has dissipated. Phases seven and eight are closure and reevaluation. These phases are presented here because mobile technology and applications may interact in varying ways depending on the phase in which they are used or may speak to certain needs within phases as opposed to a global EMDR treatment approach.

During the trauma processing phases of EMDR therapy, clients focus on aspects of a disturbing memory, while simultaneously engaging in horizontal eye movements or experiencing other bilateral stimulations (BLSs), such as tones or taps. The posited process underlying the use of BLS is that trauma processing is facilitated when a client holds dual attention on traumatic material and on sensory-based BLS. This dual attention effectively titrates the level of disturbance and keeps the client within the window of tolerance. Over the years, the original introduction of BLS as a mechanism of change was integrated into today's AIP model with emphasis on dual attention to facilitate resolution of disturbing material. A large body of research conducted in laboratory settings has studied the effects of having participants think of a memory while engaging in simultaneous eye movements guided by a moving dot on a computer screen. Participants report significant decreases in memory-related emotion and memory vividness, and no adverse reactions (van den Hout & Engelhard, 2012).

EMDR and Technology

EMDR therapy has been associated with technology from its earliest descriptions as a behavioral technique (Shapiro, 1989). Our use of the word "technology" in this context means the use of scientific knowledge translated to practical solutions. In this sense, Shapiro's use of her hand to supplement existing verbal therapies was a technological innovation to therapies that had historically been verbal. Over the years, various devices were created to assist with bilateral saccadic eye movements and other forms of sensory dual attention mechanisms, such as taps and sounds. In today's society, the most recent of such devices involves the use of mobile applications on smart phones.

The purpose of this study is to evaluate current mobile health applications (mHealth apps) that are based on EMDR techniques, or claim to be performing EMDR treatment. In particular, this study has been designed to evaluate the safety concerns of using mHealth apps for EMDR, especially as these pertain to their unregulated use for clients with complex trauma histories, emotional dysregulation, substance use problems, and/or who exhibit dissociative symptoms as part of their PTSD presentation. Therefore, this study aims to analyze the purpose, risks, and benefits of using these apps, with a particular focus on accessibility, applicability, efficacy, validity, and usefulness for clinicians who treat complex trauma and its variants with EMDR.

EMDR Treatment of Complex Trauma and Its Comorbidities

As EMDR therapy's efficacy for PTSD was established (e.g., World Health Organization, 2013), it began to be tested with more treatment-resistant disorders, such as PTSD with comorbid psychosis (de Bont et al., 2016), comorbid bipolar I and II disorders (Novo et al., 2014), and comorbid substance use disorder (Kullack & Laugharne, 2016). Case reports using EMDR for complex presenting problems such as borderline personality disorder (Mosquera, Leeds, & Gonzalez, 2014) and narcissistic personality disorder (Mosquera & Knipe, 2015) also show the utility of EMDR for complicated features involving emotional dysregulation and trauma-related attachment disturbances. Earlier cautions about limiting the use of EMDR to simple PTSD have been, thereby, relaxed with the accumulating evidence that supports the use of EMDR for more complicated clinical issues.

Some recent research suggests that no extended preparation is needed for clients with complex trauma and its variants, such as complex PTSD with comorbidities (Bongaerts, Van Minnen, de Jongh, Minnen, & Jongh, 2017), where the potential for dysregulated emotions, cognitions, and relationships could be high. Other research found that higher levels of dissociation predicted poorer response in EMDR treatment (Bae, Kim, & Park, 2016). Various adaptations to EMDR procedures have been proposed. For example, van der Hart, Nijenhuis, and Solomon (2010) emphasized the need to work directly with dissociation in trauma work, particularly with more chronic traumatic exposures. Other recommendations have included: a prolonged period of stabilization and resource development (Korn, 2009; van der Hart, Groenendijk, Gonzalez, Mosquera, & Solomon, 2013); situating EMDR within a phased treatment model (Korn, 2009); increasing the number of sessions (Maxfield, 2003); and/or focusing on specific maladaptive coping strategies, such as self-harming behaviors (Mosquera & Ross, 2016). Some therapists have warned that the incorrect use of EMDR could lead to decompensation in clients with histories of complex trauma and dissociation (Twombly, 2000). Further, there is some evidence that destabilization during treatment increases premature dropout rates and affects response to treatment (Schottenbauer, Glass, Arnkoff, Tendick, & Gray, 2008).

These treatment parameters are in line with the most recent revision of the Diagnostic and Statistical Manual (DSM-5; American Psychiatric Association, 2013), which added the dissociative specifier for those individuals with derealization and/or depersonalization in addition to the symptoms found in the PTSD clusters of previous DSM versions (American Psychiatric Association, 2013; Lanius, Brand, Vermetten, Frewen, & Spiegel, 2012). The addition of a dissociative specifier of PTSD has great clinical utility, providing greater clarity in the evaluation of the psychological correlates, course, and treatment of the disorder (Miller, Wolf, & Keane, 2014). Like the conditions mentioned above, where PTSD is associated with various co-morbidities or with dysregulated emotions or cognitions, individuals who experience dissociative symptoms may have difficulty benefitting from trauma-focused treatment modalities if the dissociation interferes with the crucial stage of processing traumatic memories (Lanius et al., 2010). Because EMDR-focused mobile applications are marketed as beneficial to the overall EMDR process or to various forms of symptom management, the clinical utility of these apps to trauma processing and/or symptom management warrants evaluation.

mHealth Apps

Smart phone developers tout the benefits of mobile health (mHealth) apps as providing increased accessibility and efficiency to therapeutic treatment (Boulos, Brewer, Karimkhani, Buller, & Dellavalle, 2014). Others note that mHealth apps have the potential to provide supportive resources for clients and families (Shen et al., 2015). mHealth apps are focused software applications developed to run on modern mobile devices such as smart phones and tablets, which are available to be downloaded from app stores such as Apple's App Store, Windows, and Google Play. These apps convert mobile devices into smarter devices that can perform specific tasks, and, in turn, have transformed the use of technology in everyday life. Increasingly, apps are designed to assist mental health practitioners to enhance help-seeking behavior among the public while opening up new avenues to monitor progress and/or provide better understanding of mental health conditions.

There are several forms of mHealth apps in the current environment. Some have been developed for symptom assessment, some for symptom or mood tracking, and some for treatment of various disorders, such as anxiety or mood disorders. For example, apps that address anxiety can have multiple purposes, including psychoeducation, clinical or self-assessment, and/or symptom monitoring. Real-time data collection using active strategies like keeping e-diaries, and passive ones such as calculating heart rates can assist with effective planning of treatment goals. More advanced apps can encourage behavioral change through games that help clients manage anxiety, or use reminders to help follow through with treatment goals (Van Ameringen, Turna, Khalesi, Pullia, & Patterson, 2017).

However, the lack of regulatory guidelines for mHealth apps is concerning. Most of the mHealth apps are developed without health-care providers' involvement and with no assurance of security and privacy of private health information (Boulos et al., 2014; O'Neill & Brady, 2012). Currently, there are no federal or state agencies with oversight responsibilities for safety and privacy of data collected by mHealth apps, which are distributed by app stores such Apple's App Store, Windows, and Google Play. The Federal Communications Commission (FCC), Food and Drug Administration (FDA), and

4

Journal of EMDR Practice and Research, Volume 12, Number 1, 2018
Marotta-Walters et al.

the Office of Civil Rights can only regulate mHealth apps when the apps interact or exchange personally identifiable data with Health Insurance Portability and Accountability Act (HIPAA) covered entities ("FCC Proposed," 2017). When a developer provides an app directly to the public, it is outside the scope of HIPAA. As such, data collected by these mHealth apps are not protected by law.

EMDR and mHealth Apps

EMDR mHealth apps were developed to provide an EMDR-based treatment to the user. The information that is provided in the marketing materials primarily focuses on BLS and the benefits to a clinician of technology-assisted ways of providing such stimulation. The apps give a cursory description of a potential mechanism of BLS using a sensory-based stimulus, but do not relate it to the theoretical basis for EMDR itself. A clinician can attach headphones to his or her phone, and then use the app to administer bilateral tones to the client. Other versions allow the clinician to play the app on a computer, providing the client with both visual and auditory BLS. While research has shown that eye movements have intrinsic value to the therapeutic change process, the complexities of those remain to be explored (Lee & Cuijpers, 2013).

Although some individuals may enjoy the independent self-administrative experience of mHealth apps, when clients present with dissociative symptoms or any form of dysregulation deficits, higher risks associated with using such apps can be anticipated. Thus, there is grave concern about unstable and/or dissociative clients accessing disturbing memories without the guidance of a trained clinician. EMDR therapy is a powerful treatment, and therapists are trained to assist clients who can experience intense reactions or who get "stuck" in the disturbing memory. Some clients are overwhelmed with strong emotions, while others dissociate and require therapeutic assistance for grounding and restabilizing. Others recall associated memories and/or have new insights, and clinicians are trained to work with this material and to optimize potential transformative changes to the targeted memory. It is possible that many individuals would not achieve this outcome without therapeutic guidance in the treatment session.

Additionally, despite having a structured protocol, EMDR therapy remains a highly relational process. According to common factors research, the therapeutic relationship has a significant influence on outcome (Hofmann & Barlow, 2014; Wampold, 2015). Although some EMDR research has shown that the therapeutic relationship is not important (Edmond, Sloan, & McCarty, 2004) or necessary (Bongaerts, Van Minnen, de Jongh, Minnen, & Jongh, 2017), other research has shown that some clients value it highly and attribute a substantial part of their change process to that relationship (Marich, 2012). In either case, it is important to explore further whether mHealth Apps for EMDR facilitate or obstruct the therapeutic relationship as well as the process of change itself.

Methods

The Research Team

The research team consisted of both experienced EMDR-trained clinicians, licensed professional counselors with no EMDR background, and doctoral students who are unlicensed but have clinical experience. Such a range of experience would help mitigate the effects of an unconscious bias towards any form of therapeutic service delivery.

Mobile App Selection Criteria

EMDR mobile apps were selected and evaluated by the research team over a period of 3 months. The inclusion criteria consisted of mHealth apps that referenced the terms EMDR, Eye Movement Desensitization and Reprocessing, BLS, and eye movements in their titles or descriptions. The research team searched for these apps on both iOS (iPhone, iPad) and Android operating systems, and initially discovered 17 iOS apps and 8 Android apps.

The inclusion criteria were as follows. First, the app had to claim that it was utilizing EMDR techniques or theory. For instance, one of the apps stated that it was inspired by EMDR, but did not claim to utilize any of the techniques or theory, so it was excluded. Second, apps needed to be accessible in order to evaluate them, so they had to be downloadable in the United States, the location of the research team. Three of the apps were not accessible in the United States, and had to be excluded as a result. Third, some apps had multiple versions, for example, there were four versions of EyeMove EMDR Trauma Therapy, so the research team decided to include only the latest and most updated version of each app. Finally, two of the remaining apps were present on both iOS and Android operating systems; hence, only the iOS versions of those apps were included in order to avoid repetition and redundancy.
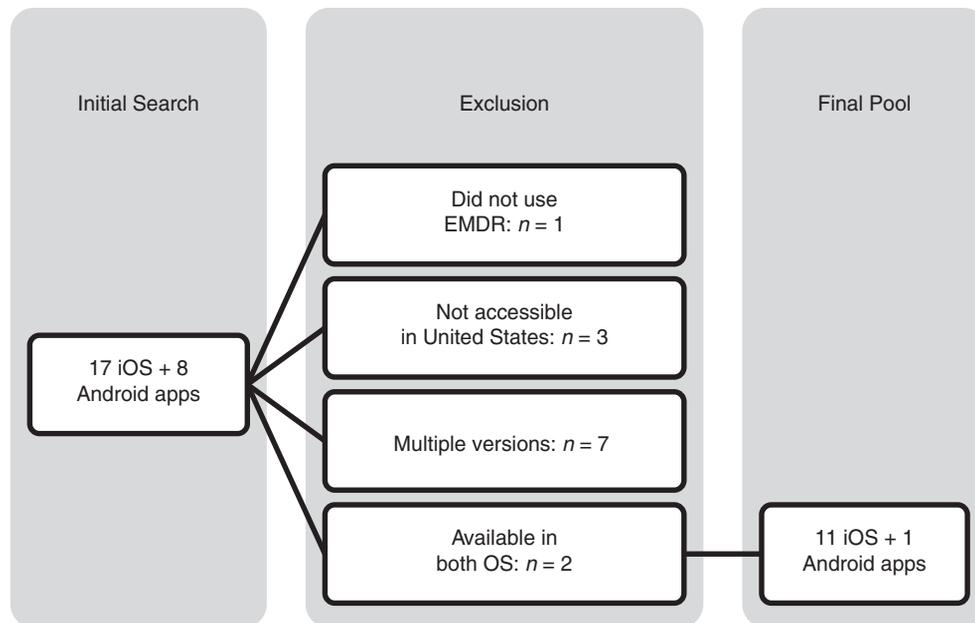
FIGURE 1. Selection process of apps to be evaluated.

Selection Process

The research team used a consensus deliberation model to select the final pool of apps to be evaluated. The team examined each of the 25 apps individually to determine whether they met the inclusion criteria for this study, and to determine their applicability. This resulted in a final evaluation pool of 12 apps in total, of which 11 were on iOS and 1 on Android (Figure 1).

Evaluation Criteria

Two divisions of the American Psychological Association (APA), Society for Media Psychology and Technology and Trauma Psychology (Dalenberg, Ardill, & Naish, 2016), conducted a study that rated mHealth apps based on the following criteria: (a) useful for which age groups, (b) easy to download, (c) easy to use, (d) beneficial to motivated user, (e) keeping with scientific literature or knowledge, and (f) reported efficacy evidence.

The original intent was for the team members to use the APA criteria to score the apps in dyads to determine inter-rater reliability; however, it was soon discovered that the APA scoring criteria were insufficient for our purposes. Thus, the research team met weekly to adapt the APA evaluation criteria, based on knowledge and clinical judgment, to include aspects such as the correct implementation of EMDR protocol and theory, additional safety measures, and information on privacy rights. In addition, we rated each of the 12 apps together as a group for both consistency and efficiency. Any disagreements in ratings were discussed as a team until they were resolved. Since the criteria are not numerical, reliability calculation does not apply. The complete set of evaluation criteria used in the current study can be found in Table 1.

Results

A total of 12 mobile apps were evaluated that claimed to provide EMDR treatment. Of the 12, the team would only recommend 6 of them as appropriate for trained and licensed clinicians to use. These six include the following: (a) *EMDR Therapy+*, (b) *EMDR Elite*, (c) *EMDR+*, (d) *The EMDR Helper,* (e) *EMDR for Clinicians Pro HD*, and (f) *EMDR for Clinicians Basic HD*. Interestingly, there was seemingly little connection between the price of the app and its features. In fact, the highest rated apps per the research team's evaluation were among the least expensive. Of the 12 apps evaluated, the team does not suggest any apps to be used by clients for EMDR treatment. However, one of the apps is sufficient for client use for symptom management, and that is *Anxiety Release Based on EMDR*.

Table 2 lists the seven apps that either stated they were intended for the treatment of PTSD and trauma, or did not specify what the app was useful for. Although these apps stated that they were recommended for clinician use, none of them had any security measures in place to ensure that the apps would only be used in the presence of a clinician.

6

Journal of EMDR Practice and Research, Volume 12, Number 1, 2018
Marotta-Walters et al.

TABLE 1. Criteria Developed for the Evaluation of EMDR Mobile Apps

1. Recommended user	Does the app clearly state who should be using this app?
2. Disclosure Statement	Is there an explicit disclosure statement on both the description of the app as well as the interface?
3. Customizability options	Are the sessions guided or is there an option to customize the interfaces based on client preference?
4. Bilateral stimulation	Does the app accurately provide auditory or visual stimulation?
5. Theory	Does the app provide information about EMDR or AIP theory?
6. Protocol	Does the app accurately follow EMDR protocol?
7. Symptoms and diagnoses	Which symptoms/diagnoses does the app claim to address?
8. Safety	Are any additional safety measures or precautions taken?
9. Appropriate use	Is this app appropriate to be used by a clinician, client, or both?

Note. AIP = Adaptive Information Processing.

Table 3 lists the five apps that were intended for symptom management, such as anxiety and other symptoms of trauma. Three of these were recommended for clinician use, one did not have any sort of a disclaimer, and one only had an end user legal agreement.

Additional Findings Based on Evaluation Criteria

Recommended User. Of the 12 apps that were evaluated, 9 were advertised as for clinician use. However, only five of these apps specifically mentioned that the app should only be used by a trained and licensed practitioner. All the apps were available to be downloaded by anyone who has access to the Google or iTunes stores.

Customizability. Most of these apps provide some degree of customizability, with options for speed, frequency, color, duration, and so on, and three of them had the provision for including session logs.

Bilateral Stimulation. Nine provided a means of both auditory and visual BLS while two provided only auditory BLS. Only five apps suggested the use of headphones to achieve auditory BLS, and one recommended the use of a large screen to achieve full visual BLS. In fact, the most frequent evaluation of the apps we reviewed was that if the app were to be used on a smart phone or iPad for eye movements, the full-range BLS could not be achieved without placing the screen uncomfortably close to the viewer's face.

EMDR Theory and Protocol. There was very limited information regarding recommendations to clinicians or clients about the proper use of EMDR or of the specific app to facilitate EMDR. With regard to EMDR practice, only six apps provided any basic information of EMDR or AIP as conceptualization for treatment. Ten apps did not address the EMDR protocol while one provided an inaccurate representation of the EMDR protocol. Three apps utilized guided sessions and one of these provided directions that are inconsistent with recommendations suggested by EMDR protocols. The apps seemed to equate EMDR with bilateral sensory stimulation and only *Anxiety Release Based on EMDR* clearly provided any information about AIP theory.

Symptoms and Diagnoses. In providing information on symptom relief, five apps identified specific symptom presentations, such as anxiety and mood. Only one of the apps addressed dissociative disorder, and suggested that a consumer experiencing this should seek professional help.

Safety and Confidentiality Measures. Six of the apps provided additional guidelines for safe and accurate use. However, the types of safety concerns that are typically presented at EMDR trainings were not addressed by any of the applications, including the risk of increased symptoms where there are skill deficits in regulation. None of the apps had any additional safety measures to prevent a client from using these apps without the presence of a clinician.

Disclosure Statement. Another significant finding when using these EMDR apps is related to data security and privacy. None of the apps included an informed consent. Further, there was little information provided on third party access or developer accountability. The apps neither disclosed information on business associates who will have access to the data collected nor what

TABLE 2. EMDR Apps That State Intention to be Used by a Clinician

Mobile App	Disclaimer for Clinician Use Only	Disclosure Statement	Customizability	BLS	EMDR Theory/ Protocol	Symptoms/ Diagnoses	Other Safety/ Accuracy Measures
EMDR Therapy+	Yes, on purchase page	None, and also gives option of uploading SOAP notes on iCloud	Options for background, dot style, tone, speed, frequency, movement shape, session logs	Auditory and visual	None provided	None provided	Recommends using headphones and viewing on a large screen
EMDR Elite	Yes, on purchase page	None provided	Options for dot size, color, tone, speed, frequency, movement shape	Auditory and visual	Provides some information on EMDR	None provided	None provided
EMDR+	Yes, but not explicit	None provided	Options to add own music or choose tone	Auditory	None provided	"Treatment of PTSD"	Requires headphones
EMDR 101	Yes, but not explicit	None provided	Options for dot size, color, tone, speed, frequency, movement shape	Auditory and visual	Implements inaccurate protocol in guided session	None provided	None provided
The EMDR Helper	Yes, on purchase page	None provided	Options for pattern, speed, size, tone, background color, dot image	Auditory and visual	Provides some information on EMDR	"Traumatic disorders such as PTSD"	None provided
EMDR for Expert	Yes, but not explicit	None provided	Options for duration, frequency, background color, and speed	Auditory and visual	None provided	"PTSD and trauma"	None provided
iEMDR	Yes, but not explicit	None provided	Options for background, size, color, speed, duration, logs	Auditory and visual[a]	None provided	None provided	States support of "TV screens or monitors"

Note. BLS = bilateral stimulation; SOAP = subjective, objective, assessment, plan.
[a] Visual BLS is not achievable because half of stimulation screen is shared by client data.

8

Journal of EMDR Practice and Research, Volume 12, Number 1, 2018
Marotta-Walters et al.

TABLE 3. EMDR Apps That Focus on Symptom Management

Mobile App	Disclaimer for Clinician Use Only	Disclosure Statement	Customizability	BLS	EMDR Theory/Protocol	Symptoms/Diagnoses	Other Safety/Accuracy Measures
EMDR for Clinicians Pro HD	Yes, on screen and purchase page	None provided	Options for tone, speed, duration, session logs	Auditory and visual	Provides scant information on EMDR	"Symptoms of trauma and other psychological issues"	Recommends headphones or speakers
EMDR for Clinicians Basic HD	Yes, on screen and purchase page	None provided	Options for speed	Auditory and visual	Provides scant information on EMDR	"Symptoms of trauma and other psychological issues"	Recommends headphones or speakers
Anxiety Release based on EMDR	Recommends clinician use, but claims to be suitable for clients, too	None provided	No options provided	Auditory	Provides scant information on EMDR; some protocol elements included	Anxiety	Cautions re: complex PTSD or mental health problems, multiple traumas or unstable neurological conditions
BSDR Player	None provided	Has end user legal agreement with a clinical disclaimer	Options for speed, frequency, tone duration	Auditory and visual	Provides scant information on EMDR	"Aid in the treatment of traumas, process upsetting situations, disturbing thoughts, improve future performance, or simply feel better"	Requires headphones to start
EyeMove EMDR Trauma Therapy (latest version entitled: EyeMove EMDR Therapy Free)	None provided	Disclaimer: "this app is not designed for treatment"	Options for speed, size, color, duration, amplitude, pattern, background, tone	None provided	None provided	"Symptoms of PTSD, trauma, panic disorder, phobia and so on"	None provided

Note. BLS = Bilateral Stimulation; PTSD = posttraumatic stress disorder.

happens to the information collected by the apps. *BSDR Player* was the only app out of the 12 apps evaluated to have an explicit end user legal agreement. The agreement states that the app's provider reserves the right to collect and use data and other related information for software updates and support reasons. The agreement also states that efforts will be made to anonymize the information.

Additionally, most of the apps did not collect information regarding session content directly although a few apps provided options for storing session data and sending emails directly through the app. Given that the consumer has to be registered with Google or iTunes stores in order to download the app, a direct link between the individual accessing the app and the account exists. This may enable a potential disclosure of identifiable data. Moreover, it was not possible to obtain any information regarding the development of apps or the background knowledge on efforts involved in creating the apps without reaching out directly to developers.

Overall Recommendation

The consensus of the research team was that none of the current EMDR apps should be utilized by clients due to the safety risks associated with their use. The risk of dissociation, emotional dysregulation, and/or decompensation may vary by individual, but even a low risk could be damaging without the presence of a trained EMDR practitioner. Moreover, we did not find any of the apps to be practical as a stand-alone tool for clinician use. A clinician would have to be able to provide a structured environment to administer the EMDR protocol with the appropriate equipment and technology. If the right environment and safety measures could be provided, we would only recommend 6 of the 12 apps as beneficial tools for clinician use.

Discussion

Clinician Recommendations for App Usage

Of the 12 EMDR mHealth apps that were reviewed, 6 were found to be beneficial for use by clinicians as a tool when providing EMDR treatment for clients. These six apps are available on iOS software, and one of the apps has an Android version. These six apps were found to adequately meet the requirements in facilitating dual attention if utilized with the aid of headphones and a large screen. The use of a large screen and seating the client at an appropriate distance is recommended to provide adequate range of motion for visual BLS, and the use of stereophonic headphones is necessary for auditory BLS. Clinicians choosing to use these apps should be trained in monitoring subtleties of emotional dysregulation or dissociative features to ensure that the client is not overwhelmed while using the apps.

It is also important that the clinician closely examines the policies of the provider to understand the utilization of client data collected by the app. It is recommended that the provider policies be disclosed to the client as part of the informed consent process for overall treatment. It is important to share with the client whether the app's provider has established a specific agreement around the use of identifiable information that is entered into the app (American Psychological Association Practice Organization, 2013). Additionally, the client should be informed that passive data collected by the app might have individually identifiable information that does not fall under the purview of HIPAA unless used by a covered entity (Secretary, 2008).

Concerns

Our review reinforced several concerns we had from the onset of the study about the use of apps in assisting EMDR delivery. mHealth apps can be downloaded by anyone even if the app states as clinician use only. When making a layperson their own change agent with no background knowledge in EMDR, there is the potential for a harmful increase in the symptoms of complex trauma and comorbidities, such as dissociation or the use of substances. These disturbances will be attributed to EMDR even though it is not EMDR that is being applied. Severe disturbances in the absence of clinician oversight have the potential to halt natural information processing both in and out of treatment settings and in the long run will prevent adaptive resolution of disturbing material. Without the theoretical foundation that underpins EMDR or lacking a supportive relationship with a therapist, there is currently no evidence to support the use of such an app to increase access to treatment or to facilitate therapy. Moreover, some of the apps included more detailed information on their purchasing page or website, but the same information was not contained directly in the app and could easily be overlooked by the user.

Cyber Security and Data Privacy Risks. The use of technology and mHealth apps raises important questions on privacy and security of health information collected by the apps. There are challenges involved in

safeguarding electronic health information, as the collected health information is being sold to companies for advertising, marketing, and behavior tracking purposes (U.S. Department of Health and Human Services, 2016). HIPAA security standards are not necessarily extended to the Internet of Things, in which mobile devices and wearable sensors are creating large databases of information on individual behavior. The recent repeal of FCC's privacy laws enables internet providers to use sensitive information, such as location, browsing history, app usage, and the contents of communications without explicit opt-in consent from consumers (Legislative Background, 2017). This repeal of privacy laws increases the cyber security risk, in which customers have no control over the privacy of personally identifiable sensitive data.

Additionally, to foster a seamless experience across devices for customers, companies like Google collect personal information and use it for cross device tracking. Since the information from wearable devices is not covered by HIPAA, the consumer can receive targeted health-related ads on all personal and work-related computers and mobile devices. There is very little transparency on such tracking activities; hence, denying consumers opt-out options serves to increase the risk of privacy violations (Park & Skoric, 2017). The Office of the National Coordinator for Health Information Technology has determined that security standards, such as encryption to maintain confidentiality of health data, identity proofing, risk assessment, and audit capabilities, can be consistently overlooked by noncovered entities, such as mHealth app developers (U.S. Department of Health and Human Services, 2016).

While no singular federal agency is currently responsible for oversight of mHealth apps, there are some policies at the federal and state level that govern the privacy of the individual's health information. The FCC's task force, Connect2HealthFCC, is charged with regulating biosensors and mHealth apps, but can only regulate apps used by HIPAA covered entities. The FDA has some oversight of the mHealth apps with overlapping responsibility with the FCC. However, the FDA does not regulate entities that distribute mobile apps, such as iTunes and Google Play store, as these entities are not considered to be medical device manufacturers. As noted earlier, the data collected by these apps are not protected by HIPAA. In case any of the identifiable information of the users is compromised, The Federal Trade Commission (FTC) must be notified and the FTC has 60 days to notify users of

any breach, which is the only body that seems to have any jurisdiction over the mHealth apps distributed by the app stores. To further complicate the national picture, every state has its own set of policies and regulations that monitor the use of mobile technology. State laws can be more rigorous than federal laws, but are complicated by interjurisdictional issues, such as the location of the user and the appropriate state agency.

Recommendations for EMDR App Development

On the basis of the aforementioned recommendations, the ideal EMDR app would include a clear description of policies related to privacy and security, which the clinician can share with the client as part of the informed consent process. The app would also include a clear disclaimer on both the purchase page (in the app store of either iOS or Android software) and the app's welcome screen, stating that the app is only meant for clinician use. To regulate this, the app should require a confirmation of provider status as a security measure prior to opening. This could include a fingerprint sign-in, National Provider Identifier (NPI) number, or license number. On launching, the app would include a clear reminder that for optimal visual BLS, the use of a large screen and seating the client at an appropriate distance is required, and for adequate auditory BLS, the use of stereophonic headphones is necessary.

The ideal EMDR app would be user-friendly with customizability options, such as options for dot color, size, shape, speed, frequency, duration, movement pattern, and options for sounds, background, and logs. The app should involve a certified EMDR practitioner in its development process to enhance the effectiveness of the app, so as to better regulate its adherence to the theory, purpose, and accurate application of the treatment protocol of EMDR. Moreover, the ideal EMDR app would include a description of the symptoms and diagnoses it addresses, and would ensure adequate BLS. It is important that the app also include a precautionary note about the possibility for increased symptom severity while using the application. The ideal EMDR app would include interactive features to provide a list of sources and additional resources for the clinician and/or client. Finally, the ideal EMDR app would present research evidence that it is effective in achieving its goal, which would require that the app have been tested using real clients and clinicians to study the effectiveness of the app in facilitating psychotherapy change.

EMDR mHealth apps need to be made clinically sound and socially responsible. They ought to include strategies to address the needs of those individuals with severe mental health issues. Protocols must be in place to deal with suicidal ideation, self-harm, and other crisis situations. Priority needs to be given to maintaining data validity, reliability, and the integrity of the information collected from the apps. If involved in cross device tracking, the provider must be transparent about the data collection and use practices, include opt-out choices, and ensure security of sensitive data (Federal Trade Commission, 2017). The FTC recommends the use of "Guiding Principles on the Privacy and Security of Personal Wellness Data" issued by Consumer Electronics Association, which should be mandatory for all noncovered entities.

Limitations of This Study

Limitations exist within the research design of this study. The study focused on a clinical understanding of the apps' usefulness according to clinical criteria. It may have been interesting to ascertain how, or even by which criteria, laypeople would have assessed the helpfulness of the apps, as it may be that laypeople have different motivations for pursuing technologically assisted help. Moreover, this review did not evaluate the clinical effectiveness of the apps as there is currently no literature that would have allowed us to do this. Further, it was not possible, with the information given, to assess the cultural implications of app use. Low cost and the ubiquitous availability of iOS devices have changed everyday life. The cohort of individuals who are natives of these devices have found ways to seamlessly incorporate them into their lives more readily than is true for cohorts who came of age before smart technology. There is a dearth of literature addressing the cultural aspect of technology pertaining to technology natives compared to technology adopters, and that is a significant research gap that should be addressed. Finally, the information that we obtained about the apps was limited to what was provided on the apps themselves. We did not contact any of the developers of these apps for further information. However, in doing it this way, we experienced the apps the same way that any individual with access to them would experience them.

Future Directions in Technology Usage for EMDR

Growth in mobile technology, wearables, sensor digital technology, and big data has enabled easy delivery of tele-healthcare. Given that wearable devices can automatically track sleep patterns, heart rate, respiratory rate, blood pressure, body temperature, and physical exercise (Munos et al., 2016), technology can be used to support clinician perspectives and to corroborate information shared by clients in session. The advent of Artificial Intelligence has helped humanity to overcome cognitive limitations in decision making, and Knowledge Acquisition research is attempting to develop thinking machines by using widely shared knowledge and heuristic knowledge (Dreyfus, 1987).

In the near future, technology may be used in EMDR treatment where clinicians can use high-resolution cameras to gather eye movement information, changes in skin tone, breath rates, and so on, to signal when clients are reaching their tolerance levels during treatment. Through trial and error, the mobile device or computer can be trained to learn from experience. The above-mentioned method could potentially be used in remote and in-person sessions by modifying the technology used. When using EMDR during online sessions or self-administration, a camera can be used to track eye movements along with other inputs, from wearable devices, to monitor dissociative features or dysregulated behavioral cues. To train the app for accuracy, clinician-initiated trials can collect data to record experiences of clients while they access traumatic material. Blood oxygen level activity in the brain (Felmingham et al., 2008) may be used as additional input to identify cognitive disturbances such as dissociation, assuming wearable devices are eventually designed to perform positron emission tomography (PET) and functional magnetic resonance imaging (fMRI) scans. In those cases, perhaps the mHealth app of the future could intervene with a grounding technique adapted for the client user during session providing an in-the-moment individualized treatment intervention.

Conclusion

The current state of development of mHealth apps that claim to facilitate EMDR treatment is rather concerning. Risks include easy accessibility of unregulated mHealth apps for the treatment of severe mental health issues such as complex PTSD, a lack of data privacy and security, inaccurate use of the apps by client and/or clinician, and, perhaps most importantly, the safety of clients, especially those who may present with complex clinical presentations. As a result, none of the current EMDR apps

are recommended for use by clients. However, some may be used by trained EMDR clinicians as a tool to facilitate EMDR treatment, with the caveat that the clinician be able to provide an appropriate and regulated environment to facilitate EMDR treatment. Additionally, clinicians need to educate themselves on the potential risks and benefits available through the use of technology in the delivery of EMDR treatment before implementing such methods.

References

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: American Psychiatric Publishing.

American Psychological Association Practice Organization. (2013). HIPAA: What you need to know now: The privacy rule: A primer for psychologists. *PsycEXTRA Dataset*.

Bae, H., Kim, D., & Park, Y. C. (2016). Dissociation predicts treatment response in eye-movement desensitization and reprocessing for posttraumatic stress disorder. *Journal of Trauma & Dissociation*, *17*(1), 112–130. http://dx.doi.org/10.1080/15299732.2015.1037039

Boccia, M., Piccardi, L., Cordellieri, P., Guariglia, C., & Giannini, A. M. (2015). EMDR therapy for PTSD after motor vehicle accidents: Meta-analytic evidence for specific treatment. *Frontiers in Human Neuroscience*, *9*, 213–213. http://dx.doi.org/10.3389/fnhum.2015.00213

Bongaerts, H., Van Minnen, A., & de Jongh, A., Minnen, A. V., & Jongh, deA. (2017). Intensive EMDR to treat patients with complex posttraumatic stress disorder: A case series. *Journal of EMDR Practice and Research*, *11*(2), 84–95. http://dx.doi.org/10.1891/1933-3196.11.2.84

Boulos, M. N., Brewer, A. C., Karimkhani, C., Buller, D. B., & Dellavalle, R. P. (2014). Mobile medical and health apps: State of the art, concerns, regulatory control and certification. *Online Journal of Public Health Informatics*, *5*(3), 229–229. http://dx.doi.org/10.5210/ojphi.v5i3.4814

Chen, L., Zhang, G., Hu, M., & Liang, X. (2015). Eye movement desensitization and reprocessing versus cognitive-behavioral therapy for adult posttraumatic stress disorder: Systematic review and meta-analysis. *The Journal of Nervous and Mental Disease*, *203*(6), 443–451. http://dx.doi.org/10.1097/NMD.0000000000000306

Dalenberg, C., Ardill, M., & Naish, B. (2016). Division 56/46 mental health mobile app database. Retrieved from American Psychological Association http://www.apatraumadivision.org/files/47.pdf

de Bont, P. A., van den Berg, D. P., van der Vleugel, B. M., de Roos, C., de Jongh, A., van der Gaag, M., & van Minnen, A. M. (2016). Prolonged exposure and EMDR for PTSD v. a PTSD waiting-list condition: Effects on symptoms of psychosis, depression and social functioning in patients with chronic psychotic disorders. *Psychological Medicine*, *46*(11), 2411–2421. http://dx.doi.org/10.1017/S0033291716001094

Dreyfus, H. L. (1987). From socrates to expert systems: The limits of calculative rationality. *Bulletin of the American Academy of Arts and Sciences*, *40*(4), 15–31. http://dx.doi.org/10.2307/3823297

Edmond, T., Sloan, L., & McCarty, D. (2004). Sexual abuse survivors' perceptions of the effectiveness of EMDR and eclectic therapy. *Research on Social Work Practice*, *14*(4), 259–272. http://dx.doi.org/10.1177/1049731504265830

Federal Communications Commission. (2017). FCC Proposed privacy rules: Choice transparency, and security of personal broadband data. *Congressional Digest*, *96*(5), 4–6.

Federal Trade Commission. (2017). Cross device tracking. Retrieved from https://www.ftc.gov/system/files/documents/reports/cross-device-tracking-federal-trade-commission-staff-report-january-2017/ftc_cross-device_tracking_report_1-23-17.pdf

Felmingham, K., Kemp, A. H., Williams, L., Falconer, E., Olivieri, G., Peduto, A., & Bryant, R. (2008). Dissociative responses to conscious and non-conscious fear impact underlying brain function in post-traumatic stress disorder. *Psychological Medicine*, *38*(12), 1771–1780. http://dx.doi.org/10.1017/S0033291708002742

Hofmann, S. G., & Barlow, D. H. (2014). Evidence-based psychological interventions and the common factors approach: The beginnings of a rapprochement? *Psychotherapy*, *51*(4), 510–513. http://dx.doi.org/10.1037/a0037045

Korn, D. L. (2009). EMDR and the treatment of complex PTSD: A review. *Journal of EMDR Practice and Research*, *3*(4), 264–278. http://dx.doi.org/10.1891/1933-3196.3.4.264

Kullack, C., & Laugharne, J. (2016). Standard EMDR protocol for alcohol and substance dependence comorbid with posttraumatic stress disorder: Four cases with 12-month follow-up. *Journal of EMDR Practice and Research*, *10*(1), 33–46. http://dx.doi.org/10.1891/1933-3196.10.1.33

Lanius, R. A., Brand, B., Vermetten, E., Frewen, P. A., & Spiegel, D. (2012). The dissociative subtype of posttraumatic stress disorder: Rationale, clinical and neurobiological evidence, and implications. *Depression and Anxiety*, *29*(8), 701–708. http://dx.doi.org/10.1002/da.21889

Lanius, R. A., Vermetten, E., Loewenstein, R. J., Brand, B., Schmahl, C., Bremner, J. D., & Spiegel, D. (2010). Emotion modulation in PTSD: Clinical and neurobiological evidence for a dissociative subtype. *American Journal of Psychiatry*, *167*(6), 640–647. http://dx.doi.org/10.1176/appi.ajp.2009.09081168

Lee, C. W., & Cuijpers, P. (2013). A meta-analysis of the contribution of eye movements in processing emotional

memories. *Journal of Behavior Therapy and Experimental Psychiatry*, *44*(2), 231–239. http://dx.doi.org/10.1016/j.jbtep.2012.11.001

Legislative Background. (2017). Broadband privacy: Recent action by congress on the FCC rulemaking. *Congressional Digest*, *96*(5), 9.

Marich, J. (2012). What makes a good EMDR therapist? Exploratory findings from client-centered inquiry. *Journal of Humanistic Psychology*, *52*(4), 401–422. http://dx.doi.org/10.1177/0022167811431960

Maxfield, L. (2003). Clinical implications and recommendations arising from EMDR research findings. *Journal of Trauma Practice*, *2*(1), 61–81. http://dx.doi.org/10.1300/J189v02n01_04

Miller, M. W., Wolf, E. J., & Keane, T. M. (2014). Posttraumatic stress disorder in DSM-5: New criteria and controversies. *Clinical Psychology Science and Practice*, *1*(3), 208–220.

Mosquera, D., & Knipe, J. (2015). Understanding and treating narcissism with EMDR therapy. *Journal of EMDR Practice and Research*, *9*(1), 46–63. http://dx.doi.org/10.1891/1933-3196.9.1.46

Mosquera, D., Leeds, A. M., & Gonzalez, A. (2014). Application of EMDR therapy for borderline personality disorder. *Journal of EMDR Practice and Research*, *8*(2), 74–89. http://dx.doi.org/10.1891/1933-3196.8.2.74

Mosquera, D., & Ross, C. A. (2016). Application of EMDR therapy to self-harming behaviors. *Journal of EMDR Practice and Research*, *10*(2), 119–128. http://dx.doi.org/10.1891/1933-3196.10.2.119

Munos, B., Baker, P. C., Bot, B. M., Crouthamel, M., de Vries, G., Ferguson, I., . . . Wang, P. (2016). Mobile health: The power of wearables, sensors, and apps to transform clinical trials. *Annals of the New York Academy of Sciences*, *1375*(1), 3–18. http://dx.doi.org/10.1111/nyas.13117

Natha, F., & Daiches, A. (2014). The effectiveness of EMDR in reducing psychological distress in survivors of natural disasters: A review. *Journal of EMDR Practice and Research*, *8*(3), 157–170. http://dx.doi.org/10.1891/1933-3196.8.3.157

Novo, P., Landin-Romero, R., Radua, J., Vicens, V., Fernandez, I., Garcia, F., . . . Amann, B. L. (2014). Eye movement desensitization and reprocessing therapy in subsyndromal bipolar patients with a history of traumatic events: a randomized, controlled pilot-study. *Psychiatry Research*, *219*(1), 122–128. http://dx.doi.org/10.1016/j.psychres.2014.05.012

O'Neill, S., & Brady, R. R. (2012). Colorectal smartphone apps: Opportunities and risks. *Colorectal Disease*, *14*(9), e530–e534. http://dx.doi.org/10.1111/j.1463-1318.2012.03088.x

Park, Y. J., & Skoric, M. (2017). Personalized Ad in your google glass? Wearable technology, hands-off data collection, and new policy imperative. *Journal of Business Ethics*, *142*(1), 71–82. http://dx.doi.org/10.1007/s10551-015-2766-2

Regehr, C., Alaggia, R., Dennis, J., Pitts, A., & Saini, M. (2013). Interventions to reduce distress in adult victims of rape and sexual violence: A systematic review. *Research on Social Work Practice*, *23*(3), 257–265. http://dx.doi.org/10.1177/1049731512474103

Schottenbauer, M. A., Glass, C. R., Arnkoff, D. B., Tendick, V., & Gray, S. H. (2008). Nonresponse and dropout rates in outcome studies on PTSD: review and methodological considerations. *Psychiatry: Interpersonal and Biological Processes*, *71*(2), 134–168. http://dx.doi.org/10.1521/psyc.2008.71.2.134

Secretary, H. O. (2008). The HIPAA Privacy Rule. Retrieved from https://www.hhs.gov/hipaa/for-professionals/privacy/index.html

Shapiro, F. (1989). Eye movement desensitization: A new treatment for post-traumatic stress disorder. *Journal of Behavior Therapy and Experimental Psychiatry*, *20*(3), 211–217. http://dx.doi.org/10.1016/0005-7916(89)90025-6

Shapiro, F. (Ed.). (2001). *Eye movement desensitization and reprocessing (EMDR): Basic principles, protocols, and procedures*. New York, NY: Guilford Press

Shapiro, F. (Ed.). (2002). *EMDR as an integrative psychotherapy approach: Experts of diverse orientations explore the paradigm prism*. Washington, DC: American Psychological Association

Shapiro, F. (2014). The role of eye movement desensitization and reprocessing (EMDR) therapy in medicine: Addressing the psychological and physical symptoms stemming from adverse life experiences. *The Permanente Journal*, *18*(1), 71–77. http://dx.doi.org/10.7812/TPP/13-098

Shen, N., Levitan, M. J., Johnson, A., Bender, J. L., Hamilton-Page, M., Jadad, A. A., & Wiljer, D. (2015). Finding a depression app: A review and content analysis of the depression app marketplace. *JMIR mHealth and uHealth*, *3*(1), e16. http://dx.doi.org/10.2196/mhealth.3713

Twombly, J. H. (2000). Incorporating EMDR and EMDR adaptations into the treatment of clients with dissociative identity disorder. *Journal of Trauma & Dissociation*, *1*(2), 61–81. http://dx.doi.org/10.1300/J229v01n02_05

U.S. Department of Health and Human Services. (2016). Examining oversight of the privacy & security of health data collected by entities not regulated by HIPAA. Retrieved from www.healthit.gov/sites/default/files/non-covered_entities_report_june_17_2016.pdf

Van Ameringen, M., Turna, J., Khalesi, Z., Pullia, K., & Patterson, B. (2017). There is an app for that! The current state of mobile applications (apps) for DSM-5 obsessive-compulsive disorder, posttraumatic stress disorder, anxiety and mood disorders. *Depression and Anxiety*, *34*(6), 526–539. http://dx.doi.org/10.1002/da.22657

van den Hout, M., & Engelhard, I. (2012). How does EMDR work? *Journal of Experimental Psychopathology*, *3*(5), 724–738. http://dx.doi.org/10.5127/jep.028212

van der Hart, O., Groenendijk, M., Gonzalez, A., Mosquera, D., & Solomon, R. (2013). Dissociation of the personality and EMDR therapy in complex trauma-related disorders: Applications in the stabilization phase. *Journal of EMDR Practice and Research*, *7*(2), 81–94. http://dx.doi.org/10.1891/1933-3196.7.2.81

14

Journal of EMDR Practice and Research, Volume 12, Number 1, 2018
Marotta-Walters et al.

van der Hart, O., Nijenhuis, E. R. S., & Solomon, R. (2010). Dissociation of the personality in complex trauma-related disorders and EMDR: Theoretical considerations. *Journal of EMDR Practice and Research*, *4*(2), 76–92. http://dx.doi.org/10.1891/1933-3196.4.2.76

Wampold, B. E. (2015). How important are the common factors in psychotherapy? An update. *World Psychiatry*, *14*(3), 270–277. http://dx.doi.org/10.1002/wps.20238

World Health Organization. (2013). *Guidelines for the management of conditions specifically related to stress*. Geneva: Author.

Correspondence regarding this article should be directed to Sylvia A. Marotta-Walters, PhD, ABPP, Professor of Counseling, George Washington University, 2134 G Street NW, Ste. 325, Washington, DC 20052. E-mail: syl@gwu.edu