

CLEARINGHOUSE FOR MILITARY FAMILY READINESS

Mobile App Vetting: Rapid Literature Review

Clearinghouse Technical Assistance Team

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Introduction

The Technical Assistance (TA) team at the Clearinghouse for Military Family Readiness at Penn State (Clearinghouse) conducted a brief, rapid literature review on the topic of vetting mobile health apps. Research examining mobile apps, primarily with a focus on health and wellness, was identified by searching peer-reviewed journal articles with an emphasis placed on research published between 2014 and 2020. Search queries included various combinations of the following terms: *apps*, *mobile applications*, *mHealth*, *vet*, *evaluate*, and *rate*.

This report provides the following elements:

- benefits and challenges of mobile app use and evaluation,
- strategies and guidelines for mobile app evaluation, and
- a brief description of identified app-vetting libraries identified in the literature and from an online search query.

Please note that this rapid literature review provides a preliminary examination of the research and databases identified as of the request date. It is not intended to serve as a comprehensive review of the literature.

Background

The use of mobile technologies to track and improve health outcomes, referred to as mHealth, is a rapidly expanding practice (Boudreaux et al., 2014). The advent of smartphone technologies that enable quick and easy access and tracking of information, interactive displays, and interventions have promoted adoption by users worldwide (Boudreaux et al., 2014). Additionally, when there is a good fit between users' needs and mHealth apps, continued use is likely to occur (Vaghefi & Tulu, 2019).

Notable Smart Phone and App Data Points:

- 81% of the U.S. population owns a smart phone, and 20% of American adults are “smartphone-only” internet users (Pew Research Center, 2019).
- 32% of Americans state that they have tracked their health statistics on a phone or tablet app (McCarthy, 2019).

With thousands of health apps in the marketplace, healthcare providers and healthcare organizations need guidance on identifying apps that are effective, provide accurate information, and are user-friendly (Boudreaux et al., 2014). Although mobile app markets such as iTunes and Google Play list hundreds of thousands of health apps, it is not always clear whether those apps are supported by credible sources (Choi & Stvilia, 2013).

Benefits of Mobile Health/Wellness Apps

- Mobile devices are typically accessible much of the day and night and are often continuously powered and functioning (Shore, 2014).
- Some mobile health devices can also determine the user's geographic location, which may allow for customized health information delivery (Shore, 2014).
- Mobile apps may be able to support behavioral interventions such as self-monitoring (Zaidan & Roehrer, 2016).
- Mobile apps may provide a community and offer a space for support and feedback (Zaidan & Roehrer, 2016).
- Mobile devices and mHealth provide new ways to access care and may improve the quality of care (e.g., communication enhancement, compliance improvement, enriching the available health care data, and patient engagement encouragement) (Shore, 2014).

App Drawbacks

- Many health apps are not well equipped to protect personal health information (Singh et al., 2016).
- The app company owns the rights to share, sell, and publicly market a user's private information including personal health data (Glenn & Monteith, 2014).
- Many health apps lack clinical evidence for effectiveness (Choi & Stvilia, 2013).
- Many health apps are not well equipped to keep users active and engaged; most users stop usage soon after initial use (Vaghefi & Tulu, 2019).

App Evaluation Challenges

The necessity of app evaluation is a result of the collaboration between increasing smartphone ownership, an interest in apps from patients, and the potential of mental health apps to influence health and behavior (Torous et al., 2018b). Despite the need for evaluation, challenges in app vetting exist. These challenges include:

- The overall lack of clinical evidence for mental health apps is compounded by privacy, security, usability, and care fragmentation concerns (Torous et al., 2018b).
- Since apps often update and change, a review is only valid until that app updates, which may occur after only a few weeks (Larsen, Nicholas, & Christensen, 2016).
- The use of an app in clinical care is a clinical decision that depends on the patient at hand and the relationship with that patient. One app may be very useful for one patient but not another- just as one medication or therapy may be very useful for one patient but not another (Powell et al., 2016).

- There is no standardized way of comparing, validating, regulating, or approving the specific apps developed to assist the health field (Chan et al., 2015).

Health App Reviews and Suggested Assessment Criterion

Published Literature Reviews

Chan et al., 2015

This study proposes criteria for both patients and providers to use in assessing smartphone apps, wearable devices, and smartwatch apps for mental health. Chan et al. (2015) suggest that patients and providers use three dimensions of evaluation criteria for mental health mobile apps as noted in the table below.

Dimension	Evaluation Criteria
Usefulness	<ul style="list-style-type: none"> • Validity and accuracy • Reliability • Effectiveness • Time and number of sessions
Usability	<ul style="list-style-type: none"> • Satisfaction and reward • Usability • Disability accessibility • Cultural accessibility • Socioeconomic and generational accessibility
Integration and Infrastructure	<ul style="list-style-type: none"> • Security • Workflow integration • Data integration • Safety • Privacy

Additionally, Chan et al. (2015) suggest that mobile apps be categorized to target one or more of the following stages in a provider's workflow:

- Education and training
- Reference
- History data input and output
- Physical data input and output
- Diagnosis
- Treatment and intervention
- Patient–provider communication

BanDimh et al., 2015

This review described the methodologies commonly used to assess the quality of smartphone health-related apps. Ten studies, covering a range of health topics, were assessed and scored for quality and risk of bias against an eight-question checklist. The checklist generated a quality score between 0 and 8 for each study, with a higher score representing a lower risk of bias and higher quality assessment.

Quality and Risk of Bias Checklist (BanDimh et al., 2015):

- Has the study clearly mentioned the data collection time frame?
- Does the study specifically mention that the reviewed app was downloaded and analyzed based on its content?
- Does the study clearly describe the methods undertaken to appraise the app's quality?
- Does the study clearly describe the methodology taken to search for appropriate apps, including key words and search restrictions?
- Does the study clearly mention the inclusion and exclusion criteria for app selection?
- Does the study identify the country in which the search was conducted?
- Does the study clearly identify the targeted group of users the app is intended for (e.g., consumers, healthcare professionals)?
- Does the study provide a list of the apps included in the review?

Evaluation Frameworks and Strategies

The following table lists nine frameworks, strategies and guidelines for mobile app evaluation that were identified in the review of literature. The table includes a brief description of the framework, evaluation criteria used to vet mobile apps, and other noteworthy information that has been discussed in the literature or on the framework website.

Evaluation Framework /Strategy	Description	Evaluation Criteria	Discussion
<p>American Psychiatric Association: App Evaluation Model (Torous et al., 2018a)</p>	<p>Reported to be the first operational app evaluation framework to be endorsed and made publicly available by a U.S.-based national medical association (American Psychiatric Association, n.d.).</p> <p>Serves as a tool for clinicians and patients to make informed decisions together, based on the specific app, clinical presentation, treatment plan, and patient preference.</p>	<p>The model presents a hierarchical assessment divided into four categories:</p> <ul style="list-style-type: none"> • Privacy and safety evidence • Usability • Interoperability <p>Each category is accompanied by a series of individual questions to help clinicians and patients consider important aspects related to that category.</p>	<p>Although clinicians and patients may not know the answer to every question posed, the process of considering these questions encourages discussion, information sharing, and more informed decision making.</p> <p>May help to identify apps that are potentially unsafe, ineffective, unengaging, and siloing (i.e., limit vital information sharing) (Torous et al., 2018b).</p> <p>Offers no scoring for individual categories.</p>
<p>American Society of Health-System Pharmacists eReport (Hanrahan, Aungst, & Cole, 2014)</p>	<p>This report provides an overview of app review methods, examines the relevance to the pharmacy practice, and offers scoring rubrics and checklists for evaluating medical apps.</p>	<ul style="list-style-type: none"> • Usefulness • Accuracy • Authority • Objectivity • Timeliness • Functionally • Design • Security • Value 	<p>The evaluation tools in this eReport have not been evaluated.</p>
<p>ASPECT Framework (Torous et al., 2016)</p>	<p>Based on software engineering, informatics, and clinical knowledge and experiences, the authors propose an evaluation framework to stimulate discussion about apps and to aid clinicians.</p>	<ul style="list-style-type: none"> • Actionable • Secure • Professional • Evidence-based • Customizable • Transparent 	<p>The authors acknowledge that not all features of the ASPECT checklist will apply to every app but considering each feature may ensure that none are overlooked.</p> <p>Framework is intended to start the right discourse with patients to ensure that more personalized, informed, and educated choices are made when selecting a health app.</p>
<p>Enlight Framework (Baumel et al., 2017)</p>	<p>A suite of criteria-based measurements aimed at enabling scholars to objectively rate eHealth interventions based on different quality concepts</p>	<ul style="list-style-type: none"> • Classification • Usability • Visual design • User engagement • Content 	<p>The tool shows potential to examine eHealth programs and the multimodal relationships between different aspects of program quality. More research is needed to</p>

Evaluation Framework /Strategy	Description	Evaluation Criteria	Discussion
	<p>regardless of their delivery medium or clinical aims.</p> <p>Identified criteria are grouped and organized into 10 constructs and three sections: Classification, quality assessment, and checklists.</p>	<ul style="list-style-type: none"> • Therapeutic persuasiveness • Therapeutic alliance • General subjective evaluation • Credibility 	<p>establish the tool's validity for predicting the efficacy of eHealth programs.</p>
Marketplace Evaluations	<p>Marketplace evaluation can be considered a combination of both star ratings and user reviews available where mobile apps are downloaded or purchased (i.e., Apple App Store, Google Play Store)</p>	<ul style="list-style-type: none"> • Star ratings • User reviews 	<p>The star ratings associated with apps appear to offer a proxy for usability or clinical utility, but researchers have found no correlation between app stores' star ratings and clinical usefulness (Singh et al., 2016).</p> <p>Recent evidence suggests user reviews on app stores may reflect greater consideration for apps that are perceived as helpful, supportive, and easy to use with lesser consideration for the evidence or effectiveness of that app (Nicholas et al., 2017).</p> <p>These evaluations often do not match up with clinical or research evaluations and may potentially expose users to dangerous apps (Torous et al., 2018b).</p>

Evaluation Framework /Strategy	Description	Evaluation Criteria	Discussion
<p>Mobile App Rating Scale (Stoyanov et al., 2015)</p>	<p>Mobile App Rating Scale (MARS) provides researchers, professionals, and clinicians with a brief tool for classifying and assessing the quality of mHealth apps.</p>	<p>The 23-item MARS contains four objective quality subscales:</p> <ul style="list-style-type: none"> • Engagement • Functionality • Aesthetics • Information quality <p>This measure also includes a subjective quality rating.</p>	<p>Existing criteria for the assessment of app quality were categorized by an expert panel to develop the new Mobile App Rating Scale (MARS) subscales, items, descriptors, and anchors.</p> <p>The MARS has demonstrated high levels of interrater reliability for evaluating the quality of mHealth apps on well-being and mindfulness (Stoyanov et al., 2016).</p> <p>Provides a reliable method to assess the quality of mobile health (mHealth) apps.</p> <p>Training and expertise in mHealth and the relevant health field is required to administer the scale.</p>
<p>uMARS (Stoyanov et al., 2016)</p>	<p>User version of the Mobile Application Rating Scale</p>	<p>Provides a 20-item measure that includes four objective quality subscales:</p> <ul style="list-style-type: none"> • Engagement • Functionality • Aesthetics • Information Quality <p>This measure also includes one subjective quality subscale.</p>	<p>The original MARS was simplified to remove complex terminology from its items and response scales. Three items requiring professional expertise, pertaining to evidence base, app goals, and accuracy of app description, were removed.</p> <p>The internal consistency and test-retest reliability of the uMARS was then examined in a second sample participating in a randomized controlled trial of a mHealth app. App ratings were collected using the uMARS at 1-, 3-, and 6-month follow up. The uMARS had excellent internal consistency with high individual alphas for all subscales. The total score and subscales had good test-retest reliability over both 1-2 months and 3 months.</p>

Evaluation Framework /Strategy	Description	Evaluation Criteria	Discussion
<p>NP MEDAPP (Golden & Krauskopf, 2016)</p>	<p>In an announcement about the development of a new department focusing on mobile apps and their use in health care, the <i>Journal for Nurse Practitioners</i> recommended the mnemonic device to use when determining the use of a new app as a clinician or for patient care.</p>	<ul style="list-style-type: none"> • Novel • Potential of benefit versus risk • Medically sound • Ease of use • Developer • Audience • Price • Platform 	<p>This recommendation has not been evaluated.</p>
<p>The Organization for the Review of Care and Health Apps (ORCHA-24) Framework (Leigh, Ouyang & Mimmagh, 2017)</p>	<p>The ORCHA-24 is a combination of 24 ‘yes’ or ‘no’ answered app assessment criteria regarding data privacy, clinical efficacy and user experience best practice standards.</p>	<ul style="list-style-type: none"> • Data privacy • Clinical efficacy • User experience 	<p>The ORCHA-24 could be used to highlight the risk–benefit profiles of health apps.</p> <p>The framework has been evaluated in assessing the quality of apps for chronic insomnia disorder.</p>

Online App-Vetting Organizations and Libraries

The following table outlines online databases and libraries identified in the reviewed literature and through an online search to help users and health care providers select vetted mobile apps. The table includes a description of the database, the app selection process and evaluation criteria if available, and additional noteworthy information.

Vetting Website	Description	Selection Process/Evaluation Criteria	Notes
Anxiety and Depression Association of America (ADAA) Mental Health Apps	<p>Housed on the ADAA website under the “Find Help” tab, each app review includes a summary, audience description, cost, rating, and a link to find the app.</p> <p>Website: https://adaa.org/finding-help/mobile-apps</p>	<ul style="list-style-type: none"> • Ease of use • Effectiveness • Personalization • Interactive/Feedback • Research Evidence for Treatment • Research Evidence for the App • Overall Rating for the App 	<p>Links to the PsyberGuide app review website.</p>
Health Navigator	<p>Funded by the Ministry of Health, the purpose of the library is not to recommend apps or approve them but to provide clinicians and consumers with a selection of apps and enough information to decide whether the app is likely to meet their needs (New Zealand Ministry of Health, 2017).</p> <p>The app library holds more than 100 reviews. Information about each reviewed app includes, the purpose of the app, the target audience, what features, and a list of pros and cons. A brief literature review also aims to identify: 1) if there is any relevant research or evidence for apps in the category being assessed; 2) has the app been reviewed by any other reliable organization.</p> <p>Website: https://www.healthnavigator.org.nz/apps/a/app-library/</p>	<ul style="list-style-type: none"> • Engagement • Functionality • Usability • Privacy and security • Clinical relevance • New Zealand relevance 	<p>Consumers or users are also able to review and rate apps.</p>
iMedical Apps	<p>iMedicalApps is an independent online medical publication written by a team of physicians and medical students who provide commentary and reviews of mobile medical technology and applications.</p> <p>Website: https://www.imedicalapps.com/</p>	<p>Reviews and commentary are based on the medical professionals’ own experiences in the hospital and clinic setting.</p> <p>Creative and content control are strictly managed by the medical professionals running the site.</p>	<p>Currently developing iPrescribeApps.com, a platform that will enable providers to prescribe health apps to their patients.</p>

Vetting Website	Description	Selection Process/Evaluation Criteria	Notes
National Health Service (NHS) Apps Library	<p>The NHS Apps Library offers users the ability to search for an app by category and by price. Each review includes a brief description, a gallery of images of the app, information for issue reporting, a disclaimer, and a review date.</p> <p>Each review also outlines answers to the following questions for each reviewed app:</p> <ul style="list-style-type: none"> • Who is it suitable for? • How does it work? • How do I access it? <p>Website: https://www.nhs.uk/apps-library/</p>	<p>Developers answer a range of digital assessment questions (DAQ) designed by experts from technical and policy backgrounds. These questions cover national standards, regulations and industry best practice.</p> <p>Technical Assessment and Standards:</p> <ul style="list-style-type: none"> • Available evidence on outcomes • Clinical safety • Data protection • Security • Usability and accessibility • Interoperability • Technical stability 	<p>The NHS website is the U.K.'s biggest health website.</p>
Our Mobile Health App Library	<p>The Our Mobile Health app library contains more than 200 apps that have been through an internal review process.</p> <p>Our Mobile Health works in partnership with health providers and organizations to the health app library.</p> <p>Website: https://www.ourmobilehealth.com/app-library.html</p>	<p>Developer completes a self-assessment questionnaire, covering areas including:</p> <ul style="list-style-type: none"> • Technical stability • Interoperability • Privacy policies • Patient safety • Usability <p>The questionnaire is then reviewed by a clinical expert. Recommended changes and improvements are sent back to the developer, if deemed necessary.</p>	<p>A list of detailed evaluation criteria was not identified.</p>

Vetting Website	Description	Selection Process/Evaluation Criteria	Notes
<p>PsyberGuide</p>	<p>PsyberGuide, established in 2013, is funded by One Mind, a non-profit organization in brain health research. PsyberGuide operates out of the University of California, Irvine and Northwestern University.</p> <p>Psyberguide.org offers the ability to review the evaluation of several different mobile apps and search for apps that relate to specific behavioral health needs. Several of the behavioral health app evaluations include detailed expert reviews.</p> <p>Website: https://www.psyberguide.org/</p>	<p>App Selection Process: Prioritize apps that have the most user reviews in the iTunes and Google Play app stores.</p> <ul style="list-style-type: none"> • Research papers and published reviews of apps • Searches on iTunes and Google Play app stores • Trending apps on social media and popular news • App developers • Through partner organizations and networks <p>Evaluation Criteria:</p> <ul style="list-style-type: none"> • Credibility • User Experience • Transparency 	<p>Does not offer a transparent method for selecting which apps they will review and which they will exclude.</p>
<p>RANKED Health</p>	<p>RANKED Health is designed to review and rank healthcare focused applications. It aims to provide independent, unbiased and accurate information to accelerate patient and provider adoption of clinically proven and high-quality digital health solutions.</p> <p>Website: http://www.rankedhealth.com/</p>	<p>Apps are selected for evaluation via a review of the currently available apps available from Android and iOS operating systems. Initial search strategies concentrate on chronic conditions common in the United States, and those targeting issues impacting large numbers of people (i.e., mental health, heart disease, diabetes, sleep disorders; fitness, medication adherence, symptom tracking, reproductive health, emergency/acute care).</p> <p>Apps are Scored based on:</p> <ul style="list-style-type: none"> • Clinical effectiveness • Functionality • Usability 	<p>RANKED Health is a project run by the Hacking Medicine Institute (HMi), a non-profit organization spun out of MIT's Hacking Medicine program.</p>

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