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Best Practices for Remote Psychological Assessment via Telehealth Technologies

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The use and capabilities of telehealth technologies to conduct psychological assessments remotely are expanding. Clinical practitioners and researchers need to be aware of what influences the psychometric properties of telehealth-based assessments to assure optimal and competent assessments. The purpose of this review is to discuss the specific factors that influence the validity and reliability of remote psychological assessments and to provide best practices recommendations. Specific factors discussed include the lack of physical presence, technological issues, patient and provider acceptance of and comfort with technology, and procedural issues. Psychometric data regarding telehealth-based psychological assessment and limitations to these data, as well as cultural, ethical, and safety considerations are discussed. The information presented is applicable to all mental health professionals who conduct psychological assessment with telehealth technologies.

Keywords: psychological assessment, telehealth, telemental health, video-conferencing, mobile devices

The use of telehealth technologies in psychological practice has steadily increased over the last decade and their use is expected to grow substantially in the years ahead (American Psychological Association, 2010a; Maheu, Pulier, McMenamin, & Posen, 2012). Psychological assessment is an integral component of telemental health (TMH) practice and is necessary for diagnostics, screening, symptom monitoring, and evaluations of treatment progress and outcomes. The use of telehealth technologies to conduct psychological assessments from afar can provide convenience, reduce costs (e.g., travel avoidance), and enable access to assessment services when they are otherwise unavailable.

There are many technologies available to clinicians who are engaged in TMH practice. These include traditional telephones and video-teleconferencing (VTC) equipment for synchronous (real-time) communication as well as asynchronous (store-and-forward) technologies such as fax or email to send and receive assessment materials. The Internet is also used to administer psychological tests and measures remotely on web pages. Internet-based testing and assessments can make use of technology-enhancements such as the use of multimedia content (i.e., pictures, videos, sounds, etc.), computer adaptive testing techniques, and automatic scoring and interpretation algorithms (see Barak & Buchanan, 2004). The Internet can also be used for VTC by using personal computers (PCs) and off-the-shelf webcams, which may be an affordable and highly accessible option for home-based TMH (Luxton, 2013a). More recently, smart mobile devices (i.e., smartphones and tablets) have emerged as a way to conduct psychological assessments. Assessment measures can now be in the form of an application or "app" on mobile devices or accessed via Internet connectivity. Traditional interview techniques conducted via VTC using webcams on PCs or mobile devices themselves may be augmented with electronic measures completed on the device with data uploaded to clinicians for review (Luxton, McCann, Bush, Mishkind, & Reger, 2011).

Given the numerous available telehealth technologies and their increasing use, practitioners who use them need to be cognizant of the factors that influence the psychometric properties of psychological assessments when administered via those technologies. Practitioners also need to know whether a given measure or

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assessment technique is appropriate for use and they need to be familiar with the proper administration procedures in order to assure competent and ethical practice. Our purpose with this article is therefore to review the specific issues that influence the validity and reliability of telehealth-based assessments and to provide best practice recommendations for practitioners. Although we focus primarily on psychological assessment and evaluation during treatment services (i.e., diagnostic and symptom assessment), the principles and procedures that we discuss are pertinent to other remote assessment and testing applications including neuropsychological/cognitive testing, forensic risk assessment, and occupational testing.

Reliability and Validity Considerations and Recommendations

Remote Physical Presence and Setting

The primary and most obvious difference between telehealth and in-person assessment is the fact that the patient is not in the same room as the clinician. The lack of in-person presence may influence how information is assessed as well as what can be assessed. Nonverbal information is useful for determining the patient's emotional state and, in some cases, risk behaviors. For example, olfactory sensory information can provide clinically relevant information regarding hygiene as well as the use of alcohol or other substances. Body posture, facial expressions, body language (e.g., foot tapping, hand wringing), as well as nonverbal emotional responses such as facial flushing, tearing up, and direction of eye-gaze, also provide important information. The observation of psychomotor and other medical symptoms are also important to observe during psychological assessments. Further, the observation of how an examinee approaches a test or measure may be critical for making an accurate assessment. The lack of physical presence, however, may limit the range of information available or how it can be observed. VTC assessments may be influenced by camera angle, screen size, room characteristics, or other technical factors (e.g., network bandwidth issues) that prohibit the observation of all behaviors. Further, the lack of physical presence in itself may influence a patient's clinical presentation. For example, patients who are socially anxious may underreport symptom severity when they are assessed remotely because the fear-evoking stimulus (i.e., the presence of the assessor) is physically distant (Grady & Melcer, 2005). Also, in the case of home-based assessments, symptoms of panic disorder, agoraphobia, or the hyper-arousal symptom cluster of PTSD may be less salient because the patient is able to avoid situations that may be perceived as threatening, such as driving to a clinic or being around strangers in a busy waiting room.

To help assure the validity and reliability of remote assessment, it is first necessary to make sure that the environmental conditions at the remote location are conducive to the assessment procedures. The location of the room for the assessment session should assure comfort and privacy. The assessment space should be large enough for the patient to feel comfortable in and assessments that involve groups and family interviews will require a space that is large enough to accommodate multiple people and, for some applications, may require a table and other supplies (Kramer, Ayers, Mishkind, & Norem, 2011). In the case of home-based assessment, the presence of roommates, family members, pets, unexpected phone calls, or other distractions may disrupt the assessment process. It is therefore important for the practitioner to work with the patient to plan for and schedule sessions during a time that is free of potential disruptions. These considerations are particularly important for home-based assessments because the practitioner will have less control of the environment than they may have in an office setting.

Given the potential limits of what and how information can be collected during remote assessments, it may be appropriate to modify typical in-person assessment procedures. However, careful review of the instructions or administration manuals for measures and tests should be conducted to assure that procedures or environmental conditions for standardized administration are not altered in a way that threatens the reliability and validity of the assessment. In the case of VTC-based assessment, it may be necessary to ask a patient to hold a paper-and-pencil assessment (e.g., self-report measures or therapy homework) up to the video camera for viewing or to use larger handwriting because of small screen size or poor image quality. In addition, it may be helpful t ask the patient to read their responses out loud in scenarios where synchronous video is not used or when the connection quality is inadequate. When nonverbal information is useful but is unavailable or limited, it may also be necessary to ask additional questions to improve the accuracy of the assessment. For example, if administering the Hamilton Rating Scale for Depression (Hamilton, 1967), it may be appropriate to ask the patient to self-report symptoms of psychomotor retardation and agitation with specific follow-up questions such as "Do you have problems sitting still for more than a minute or two" or "Do you move more slowly than your coworkers?".

It is important to note that the procedures for some assessments may not lend themselves to remote administration without physical presence. For example, the Wechsler Adult Intelligence Scale (WAIS-IV; Wechsler, 2008) involves hands-on interaction, such as administration of the Block Design, Matrix Reasoning, and Visual Puzzles subtests from the Perceptual Reasoning Index, which would be inappropriate and impractical to administer via VTC. In some cases, however, it may be feasible to administer assessments remotely, such as cognitive function testing (see Cullum, Weiner, Gehrmann, & Hynan, 2006), whereby an on-site staff member administers the assessment and then shares the results with a remote clinician who scores and interprets them. Also, some assessment instruments, such as the Minnesota Multiphasic Personality Inventory (MMPI)-2 or WAIS-IV, should be physically safeguarded (not made openly available to the public) to assure the validity of future administrations. It is therefore important for the practitioner to consider whether remote administration of assessment materials presents a risk to the integrity of the instrument (e.g., by patients being able to print items at home or share them via the Internet, etc.). Practitioners should also consider whether there is an increased risk for dishonest responses (e.g., responses obtained from the Internet or someone else taking the assessment) because control over the testing environment is reduced (Buchanan, Johnson & Goldberg, 2005; Reips, 2000).

Technology Issues

There are several technical issues associated with the use of telehealth technologies that may influence the quality of telehealth-based assessments. Eye gaze angle is the angle between the eye and the camera and the eye and the center of the display (Tam, Cafazzo, Seto, Salenieks, & Rossos, 2007). A potential problem when using VTC technology is that users often make eye contact with the image of the person on the screen rather than with the camera (Chen, 2002)—a phenomenon that gives the appearance that one person is looking down or away from the other person. Eye contact between a patient and a clinician is important because it provides visual cues to which the participants can respond (Grayson & Monk, 2003; Tam et al., 2007). Eye contact is also a source of clinical information that is useful for determining the presence of psychological states or particular disorders (e.g., autistic disorder). Interpretation of facial expressions and affect may be difficult when eye contact is misleading, and eye gaze angle may also influence satisfaction with using VTC (Tam et al., 2007). Cameras should be positioned in a way that allows the images of both parties to appear straight-on and centered in their respective monitors so that both appear to speak eye-to-eye with each other (Kramer et al., 2011). Tam et al. (2007) pointed out that improved eye contact can be realized by increasing the horizontal distance of participants from the videoconferencing unit. Sometimes, however, patients may shift position during a session, or the camera may be accidently be shifted from the optimal angle. It may therefore be necessary to ask the patient to make adjustments. It is also recommended to check-in with the patient to make sure they can see and hear clearly. The "picture in picture" function available on many VTC devices can be used to ensure that the provider is clearly in frame as well.

Network connection quality is another important factor that can influence assessment capabilities and quality. Connection problems can be caused by a variety of factors such as low quality equipment, an overloaded computer (e.g., too many programs running at one time), inadequate bandwidth, and user inexperience with VTC (Hyler, Gangure, & Batchelder, 2005; Jones, Johnston, Reboussin, & McCall, 2001; Luxton, Mishkind, Crumpton, Ayers, & Mysliwiec, 2012). Jones et al. (2001) found that inadequate audio quality can influence the ability to accurately gather information from the patient. For example, the observation of vocal properties (e.g., shakiness, inflection, and tone), as well as whether an individual may be crying, can be an important source of information regarding emotional states, and a low-quality audio connection may inhibit observation of this information. It is also important to consider that technological issues (e.g., bandwidth limitations, signal drop-outs, etc.) may influence how well the patient understands the clinician (not just how well the clinician understands the patient). It is therefore a best practice to test the quality of the connection at the beginning of the assessment session and to check in with the patient from time to time to make sure the connection quality is still adequate. Although there is some guidance available regarding minimum recommended bandwidth requirements for TMH (see American Telemedicine Association, 2009), what is or is not adequate in any given application will depend on a variety of factors, including requirements for the type of assessment, environmental conditions, and the technology itself.

Potential distractions caused by use of technology (e.g., web cam, personal computer, microphone, mobile device, etc.) may also introduce threats to the validity and reliability of remote psychological assessments. For example, when conducting a clinical assessment interview over a web cam, the patient may become distracted by inconsistent connections, error messages, or other technical anomalies (Germain, Marchand, Bouchard, Drouin, & Guay, 2009; Yoshino et al., 2001). Furthermore, technical malfunctions during telehealth sessions may become a source of frustration for patients (Luxton, Mishkind, et al., 2012; Luxton, Sirotin, & Mishkind., 2010). Persistent technical malfunctions that occur before or during remote assessment sessions may therefore influence motivation, agreeableness, and adherence to assessment procedures. It is thus important to have a plan to resolve technical malfunctions by expeditiously troubleshooting the problem, rescheduling the session, or conducting it with an alternative medium (e.g., over the phone) if necessary.

It is also important to consider potential cognitive and/or sensory deficits that patients may have that could impair their ability to use telehealth technology. Technological aides (e.g., headsets, screen magnification devices, speech to text translation software, etc.) or the involvement of family members or other care givers that can assist may be appropriate. Possible fatigue or physical discomfort caused by technology use (e.g., eye strain when viewing computer monitors) should also be evaluated before and during the assessment process, especially during lengthy assessment sessions.

User Acceptance

Generally, the validity of any psychological assessment is modulated by the degree to which the person being assessed accepts (i.e., is willing to participate in) the context of a given assessment including the setting and manner in which the assessment is conducted (Cronbach, 1970; Elhai, Sweet, Guidotti Breting, & Kaloupek, 2012). An individual's acceptance of a particular type of assessment is a multifaceted construct that depends on an individual's physical and emotional state, motivation, attention, personality, and temperament. Poor acceptance has been cited as a factor that reduces compliance and the motivation to engage in mental health assessments (Rogers, 2001). Inadequate acceptance of TMH by either the patient or practitioner can therefore be expected to have a negative influence on the validity and reliability of psychological assessments.

Several reviews that discuss overall acceptance and satisfaction with TMH provide insight into the factors that may influence acceptance of telehealth-based psychological assessments. For example, Modai et al. (2006) reported that patients and providers are generally satisfied with VTC and that regular use of VTC improves the overall degree of satisfaction with this medium. A review by Richardson, Frueh, Grubaugh, Egede, & Elhai (2009) showed that there are high levels of user satisfaction and acceptance with TMH across diverse clinical populations and services. In particular, the benefits of reduced travel time, wait times, and lost work time, as well as greater sense of personal control over sessions were specifically associated with higher satisfaction among patients (see Hilty, Nesbitt, Kuenneth, Cruz, & Hales, 2007; Simpson, Bell, Knox, & Britton, 2005). These benefits may be especially important when considering the need for multiple

visits for some psychological assessments (i.e., initial interview, assessment battery administration, and feedback/treatment planning).

Technological issues may also play an important part in the acceptability of telehealth-based assessments as well as rapport between the patient and practitioner (Glueck, 2013). A review by Backhaus et al. (2012) found that patient acceptability of VTC is generally on par with the acceptability of face-to-face contact, although the most common areas of dissatisfaction were associated with technical difficulties that interrupted sessions. In particular, problems with establishing a connection, connection speed, sound echo/feedback, and inability to transmit written material (e.g., a thought journal or activity log) in a way that allowed both the patient and the therapist to review it together were noted (Cowain, 2001; Folen, James, Earles, & Andrasik, 2001). Hyler, Gangure, and Batchelder (2005) found that both patients and providers preferred in-person assessment when compared to low-bandwidth VTC assessment, especially when detailed observation of patients was necessary; however, when high-bandwidth VTC was available, this method was preferred over in-person assessments. Also, the loss or distortion of nonverbal behavior and other patient characteristics may also negatively impact a clinician's acceptability of telehealth-based assessments (Grady & Melcer, 2005). Solutions to these technology-based issues are available (e.g., faster Internet speeds, head sets, adjunct technology such as fax/document scanner) but come with financial costs that may limit feasibility. Overall, it is important for practitioners to consider that the factors that may influence the acceptability of telehealth-based psychological assessments may not be consistent across all assessment sessions or settings.

Cultural Considerations

As with in-person psychological assessment and testing, practitioners and researchers who make use of telehealth technologies must attend to a broad range of cultural factors, including the patient's age, technological familiarity, and culture-specific norms to assure valid and reliable assessments. For example, the remote physical presence inherent in TMH may create a barrier that reduces a patient's engagement in the assessment process, especially among members of cultures or groups that emphasize interpersonal connectedness or that rely heavily on nonverbal interactions (Nieves & Stack, 2007; Savin, Glueck, Chardavoyne, Yager, & Novins, 2011). An essential component of this is the provider's ability to make use of whatever nonverbal communication is available. This is a skill that is essential when working with groups where the symptoms of mental illness may be minimized or stigmatized (e.g., Asian and Asian American populations, military populations; Yeung, Hails, Chang, Trinh, & Fava, 2011). Also, patients that are less comfortable or have less experience with technology, such as elderly or severely impoverished populations, may display a more drastic discrepancy between in-person and VTC assessments (Rohland, Saleh, Rohrer, & Romitti, 2000).

When working with specific populations, the provision of TMH services, including psychological assessment, should be tailored to the needs, resources, and technological infrastructure of the local community (Brooks, Spargo, Yellowlees, O'Neill, & Shore, 2013). Preliminary work suggests that the customization of TMH to the needs and features of the group that is being served has the potential to enhance access to psychological services within traditionally underserved populations (Dwight-Johnson et al., 2011). Shore et al. (2008) have also demonstrated that structured assessments provided via VTC were as acceptable as in-person assessments among an American Indian population and that the VTC use did not influence ratings of the perceived usability of the assessment, patient/provider interaction, or overall satisfaction. Also, individual backgrounds may present a strong contextual influence on whether and how technology is used (Brooks, Spargo, Yellowlees, O'Neill, & Shore, 2013). It is therefore important for practitioners to be sensitive to the capabilities and preferences of patients during TMH assessments and also recognize that telehealth-based assessments may not be appropriate for all individuals. The provision of a brief questionnaire or interview survey to evaluate previous experiences and preferences regarding technology may be helpful.

Ethical, Privacy, and Safety Considerations

Attention to general ethical principles, such as those specified in the *Ethical Principles of Psychologists and Code of Conduct* (American Psychological Association, 2010b), is necessary during psychological practice whether it is conducted in-person or remotely. Standard 9, Assessment, specifically addresses standards for psychological assessment and these too apply to all forms and mediums of psychological assessment. There are, however, aspects of telehealth-based assessments that require additional thought in order to assure ethical practice and optimal assessments. For example, it would be inappropriate practice to select, develop, or modify assessment instruments or alter procedures for remote administration without evidence of sufficient scientific validation or the appropriate disclosure of limitations. It is therefore necessary for practitioners to be familiar with what measures or techniques are supported by the scientific literature before using them. Moreover, the assurance of patient confidentiality is an example of ethical practice that may influence the validity and reliability of psychological assessments. If a patient does not feel that their privacy is respected and valued by practitioners, the patient may be less willing to disclose information (Rogers, 2001).

Both physical and electronic safeguards should be used to assure confidentiality during remote psychological assessments. For example, people may speak louder when using telehealth technology than when in-person and electronic speakers may amplify sound significantly. Thus, audio should only be loud enough at each end so that both the patient and practitioner can be easily heard but not so loud that the TMH session can be overheard by people outside the room (Kramer et al., 2011). In the case of home-based TMH assessments, practitioners should assess whether the patient has any extra concerns about their privacy (i.e., whether family members or others may overhear the assessment session).

Practitioners conducting psychological assessments with telehealth technology also need to be cognizant of the applicability of the Health Insurance Portability and Accountability Act, the Health Information Technology for Economic and Clinical Health Act, applicable state law, and local privacy and security requirements. The American Telemedicine Association provides specific practice standards and guidelines regarding this topic (American Telemedicine Association, 2009, 2013). Appropriate disclosure of safeguards and potential risks associated with privacy and electronic data should be addressed during the informed consent pro-

cess. As pointed out by Maheu and McMenamin (2013) however, the informed consent process or an agreement with patients may not be adequate in all situations, in all states, or in foreign countries. Moreover, the diversity in the types of technologies, network infrastructures, and procedures for their use requires careful review of data security risks and requirements (see Kramer, Mishkind, Luxton, & Shore, 2013; Luxton, Kayl, & Mishkind, 2012). Whether or not a particular technology platform or application meets standards for security and privacy of data can be complicated by complex issues such as whether and how digital data is stored on commercial servers, manufacturer agreements regarding ownership of transmitted data, and other potential technical risks to data security and privacy. Consultation with applicable legal or regulatory offices, information technology system administrators, equipment and software manufacturers, and other experienced experts in the field may be necessary when selecting telehealth platforms or when uncertainties regarding particular applications exist.

It is also important to consider the safety of the patient during TMH assessment sessions and to have a safety plan in place (Luxton, O'Brien, McCann, & Mishkind, 2012). A principal concern involves what to do if a patient becomes distressed or has a medical emergency during a remote assessment session. Safety plans should include procedures for contacting emergency services in the patient's locale, alternate contact methods in case the synchronous telehealth connection is lost (e.g., backup phone contact), and plans for resolving technical problems (American Telemedicine Association, 2013; Luxton, O'Brien et al., 2012). The identification and involvement of a local collaborator, such as a family member or friend of the patient that can assist with on-site technical problems or provide support to a patient during emergency situations should be considered (American Telemedicine Association, 2013; Gros, Veronee, Strachan, Ruggerio, & Acierno, 2011; Luxton, O'Brien et al., 2012). The use of a collateral person, as well as overall telehealth assessment procedures, risks, and benefits should be addressed during the informed consent process.

Patients with a history of adverse reactions during treatment (e.g., severe panic attacks), or those who are at high risk of harm to self or others (e.g., family members in the case of home-based TMH), may not be appropriate candidates for telehealth services provided to clinically unsupervised settings (Luxton, O'Brien et al., 2012). These issues should also be considered when conducting remote assessments, especially when providing assessment results. As noted by Pope (1992), the form of assessment results and the process of presenting them may influence how patients interpret their meaning. Given these concerns, it is important to consider whether providing assessment results remotely via telehealth technologies is appropriate for any given patient. Prior to engaging in remote assessments, review of the patient's history and potential risks, assessment of available technologies and the patient's familiarity with them, as well as discussion of preferences regarding engaging in remote assessments are recommended. Alternative options (e.g., in-person) may be necessary if patients are not appropriate candidates for telehealth-based services due to safety concerns, clinical contraindications, technological barriers, or personal preferences (Luxton, O'Brien, et al., 2012; Luxton, Sirotin, & Mishkind, 2010).

Selecting Assessment Measures: Psychometric Considerations

It is important for practitioners to consider that even if an assessment tool has been shown to be valid and reliable in the original paper form or in one particular modality (i.e., in-person interview or computer-based administration) it does not necessarily mean that the measure or tool will be valid or reliable when conducted remotely via telehealth technologies. Moreover, even if there is empirical support for the use of a particular measure in one telehealth technology medium, such as on an Internet web page, it does not necessarily mean that it will be valid or reliable when transferred to another medium, such as a mobile device. The differences in the physical format of these mediums and procedures for use may influence the psychometric properties of measures administered through them. As mentioned previously in this article, it is necessary for practitioners to be familiar with the available scientific literature regarding a measure or technique's appropriateness for use.

Several published reviews provide useful information regarding the validity and reliability of remote psychological assessment via various telehealth technologies. For example, Hyler et al. (2005) conducted a review and meta-analysis that included 14 studies that compared telepsychiatry to in-person psychiatric assessments. Five studies used objective assessment measures, two studies used subjective measures (i.e., satisfaction measures), and seven studies used a combination of objective assessment measures and subjective measures. The Brief Psychiatric Rating Scale (Overall & Gorham, 1962) was the most common assessment instrument. The meta-analysis results indicated that objective telepsychiatry assessments were similar to in-person assessments in regard to diagnosis or symptoms assessment. The Telemental Health Standards and Guidelines Working Group (Grady et al., 2011) also conducted a review of published data regarding the psychometric properties of remote telehealth-based psychological assessment. They noted several studies that have examined psychological assessment via clinical interviews or psychiatric interviews based on the Structured Clinical Interview for DSM Disorders (SCID; Spitzer, Williams, Gibbon, & First, 1990). Two studies (Ruskin et al., 1998; Shore, Savin, Orton, Beals, & Manson, 2007) demonstrated high reliability in the administration of the SCID. Comparability between face-to-face and VTC is also demonstrated for the Hamilton Depression Rating Scale for depression (Kobak, 2004; Kobak, Williams, & Engelhardt, 2008). Backhaus and colleagues (2012) conducted a systematic review of the research on psychotherapy using VTC and reported that 69% of the 42 studies that they reviewed used a well-accepted psychometrically validated (in-person) standardized measure for treatment outcomes. Of these, the most common assessment (24% of the 42 studies) was the Beck Depression Inventory (BDI-II; Beck, Steer, & Brown, 1996). Grady et al. also noted that there are not any psychometric data available regarding projective testing over VTC.

Grady et al. also noted evidence that demonstrates the feasibility of remote neuropsychological assessment (Hildebrand, Chow, Williams, Nelson, & Wass, 2004; Saligari et al., 2002) and comparability of scores between remote and in-person assessment (Cullum et al., 2006; Loh, Donaldson, Flicker, Maher, & Goldswain, 2007), as well as some research that has demonstrated differences on test scores (Ball, Tyrrel, & Long, 1999; Loh et al.,

2004; Montani et al., 1996). Cognitive assessments that have been examined and validated include the cognitive section of the Cambridge Mental Disorders of the Elderly Examination (Ball & Puffett, 1998), the Mini-Mental State Examination (Grob, Weintrau, Sayles, Raskin, & Ruskin, 2001), the National Adult Reading Test, and the Adult Memory and Information Processing Battery (Tschirch, Walker, & Calvacca, 2006). The development of new norms has been recommended so that the thresholds used for impairment are valid when compared with face-to-face administration (Grady et al., 2011; Kirkwood, Peck, & Bennie, 2000).

Evidence of equivalence as well as differences between Internet-based questionnaire assessments and paper-and-pencil administrations of standardized measures has also been reported in the literature (Barak & English, 2002; Barak, Hen, Boniel-Nissim, & Shapira, 2008; Buchanan, 2002; Naglieri et al., 2004). For example, evaluation of online versions of BDI-II have shown that psychometric properties differ across testing modalities of psychometrically validated assessments, even when comparisons are made between equivalent samples, and that online BDI-II scores tended to be higher (Glaze & Cox, 1991; Peterson, Johannsson, & Carlsson, 1996; Schulenberg & Yutrzenka, 1999). Also, some evaluations of personality inventories administered online have shown differences in item loadings compared to paper-and-pencil versions (Buchanan, 2001; Buchanan, Johnson, & Goldberg, 2005). These differences may be due to the lessened impact of social desirability, an increase of self-disclosure in online assessment, or as the result of the technology-based presentation itself (Buchanan, 2003).

In sum, the literature base regarding the psychometric properties of telehealth-based assessments is growing; however, there are gaps in the literature that practitioners should consider when selecting particular assessment instruments and mediums. In particular, the vast majority of available measures and assessment tools are based on norms that were established by employing traditional in-person procedures. The reevaluation of these tools with diverse populations, clinical presentations, and telehealth mediums is necessary to assure the validity of assessments conducted via telehealth technologies. It is critical for practitioners to be cognizant of assessment measure limitations and to appropriately disclose and document them in their practice. Keeping up with the scientific literature as well as publications by organizations such as the APA and American Telemedicine Association is recommended.

Discussion

The validity and reliability of psychological assessments conducted via telehealth technology is influenced by factors that are both common to in-person assessment and unique to telehealth-based assessments. Although the psychometric characteristics and standardized procedures of traditional in-person psychological assessments provide useful information about how they may translate to other mediums, practitioners would be remiss to simply assume equivalency between in-person and remote administration of psychological assessments. It is therefore important for practitioners who already use or are considering the use of telehealth technologies to be familiar with these factors and to use appropriate administration techniques when conducting remote psychological assessments. It is feasible to assure reliable and valid remote psychological assessments with appropriate knowledge, preparation, and practice.

The use of telehealth technologies for remote psychological assessment has several benefits for both patients and practitioners. For example, telehealth-based assessments allow practitioners to conveniently monitor symptoms and other health variables between in-person or telehealth treatment sessions. Further, telehealth-based psychological assessment may improve care satisfaction and overall health outcomes by providing services that are specialized for the patient's needs. In particular, telehealth technologies may provide access to clinical specialty assessments (e.g., neuropsychological assessments) that are not available in the patient's locale. Telehealth-based psychological assessment may also increase access to services among patients who speak different languages. For example, a non-English speaking patient could engage in mental health assessment and treatment with a clinician who speaks their native language, regardless of physical location, which may minimize potential misunderstanding and misdiagnosis of a patient's symptom report (Yeung et al., 2011). This would also be true for the use of American Sign Language and would remove the need for a third-party translator who may unintentionally change the meaning of a communication during the translatic process. The use of telehealth technologies also allows patients to connect with providers that are trained in specialized assessments and who also have experience working with particular cultural groups (e.g., military culture, the elderly, specific ethnic groups, etc.).

Current and emerging technologies not only allow remote administration of traditional assessments but may also offer new or improved capabilities and methods of assessment. In particular, the growing field of mobile device apps has created opportunities for self-care assessments and symptom screening that were not possible just a decade ago (Luxton, McCann et al., 2011). Assessment apps on smartphones and tablet PCs can also be useful for measuring the dynamic characteristics of a person. For instance, subjective mood or anxiety levels can be tracked in real-time and data from bio-feedback equipment can be tracked and analyzed remotely. The small size and touch screen features of smartphones and tablet PC devices are factors that may influence the psychometric characteristics of assessments provided on these devices. Preliminary data, however, have suggested that these devices may be a feasible platform for assessments that is comparable to paper and-pencil and computer-based assessments (Bush, Skopp, Smolenski, Crumpton & Fairall, in press). More research is needed, however, regarding the psychometric properties of psychological assessments administered via mobile devices.

Assessments conducted with computer-simulated virtual reality environments are another emerging capability (Holloway & Reger, 2012; Parsons, Silva, Pair, & Rizzo, 2008; Riva, Wiederhold, & Molinari, 1998). Assessments can be built into the virtual environment so that measures appear virtually while a patient is in the virtual environment or to simulate real-world conditions that are useful for the assessment of particular variables. For example, virtual environments have been tested as a way to create environmental or social cues for assessment of emotional and behavioral responses among patients being treated for addiction or anxiety related behaviors (see Bordnick, Carter, & Traylor, 2011). The application of artificial intelligence technologies to conduct clinical interviews, psychological assessments, and evaluations is also

a promising area (Luxton, 2013b). Virtual intelligent agents capable of human-like social interaction can be designed to conduct clinical interviews, analyze results, and provide feedback to patients. These types of systems have already been developed for clinical training and some treatment services (DeAngelis, 2012; Parsons, Kenny, et al., 2008). Artificial intelligence-enabled technologies that use advanced sensing and language processing capabilities are also being developed to assess physiological and psychological variables. These advances in technology have the potential to increase the reliability and validity of psychological assessment, improve clinical care, and reduce costs for both patients and practitioners.

In conclusion, the use of telehealth technologies provide an opportunity for psychologists and other health care professionals to expand the capabilities of their practice, provide quality services, and meet the health care needs of care seekers. The increased user demand for technology as well as the continued growth of TMH services will push the need for telehealth-based psychological assessments. The adherence to best practices and competencies for psychological assessment via telehealth technologies is the responsibility of psychologists and others who provide such services. Practitioners must remain familiar with available research and guidelines before engaging in remote assessments. Moreover, practitioners must consider the applicability to specific populations and appropriateness of any assessment measure or technique on a case-by-case basis. Ultimately, the decision to conduct psychological assessments from afar should depend on both the practitioner's and patient's comfort level with the process.

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