

Telemental Health Care, an Effective Alternative to Conventional Mental Care: a Systematic Review

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ABSTRACT

Background and Objectives: Due to the high costs of conventional mental health care, there has been a rise in the application of web-based technologies in recent years, i.e., telemental health care. We conducted this systematic review in 2017, using high quality research articles on the applications, technologies, advantages and challenges associated with telemental health care published since year 2000. **Methods:** We used a combination of relevant key words to search four major databases, such as “Web of Sciences, Embase, PubMed and Science Direct”. From among 156 articles, which had been published since 2000, twenty five articles met all of the inclusion criteria and were selected for the final review. The information extracted from these articles were used to construct Tables 1 and 2. Also, the materials derived from 55 credible articles were used as further support and complementary facts to substantiate the information presented in the Discussion section. **Results:** The findings revealed that telemental health care is an extended domain supportive of conventional mental health services. Currently, telemental health care has multiple capabilities and technologies for providing effective interventions to patients with various mental illnesses. It provides clinicians with a wide variety of innovative choices and strategies for mental interventions, in addition to significant future potentials. **Conclusions:** Telemental health care can provide effective and adaptable solutions to the care of mental illnesses universally. While being comparable to in-person services, telemental health care is particularly advantageous and inexpensive through the use of current technologies and adaptable designs, especially in isolated communities.

Keywords: telemental health, applications, mental disorders, telemedicine, tele-psychiatry.

1. INTRODUCTION

In recent decades mental and behavioral disorders have been the fifth costly group of diseases in the U.S. (1). The provision of healthcare services to mental patients has been challenging due to limited access to the costly services (2). Distant areas with insufficient healthcare providers have difficulties providing basic services to the mental patients. Using information technologies, such as telemedicine in the management of mental patients provides them with easy access to modern and efficient healthcare services and reliable diagnosis while being cost-effective (3).

Telemedicine is a popular information and communication system to provide and support distant healthcare services, of which mental care is a major domain (3). Using telephone, video-conferencing and Internet, telemedicine provides a variety of health services to deprived areas. Studies have

demonstrated that telemedicine is a cost-effective solution to health care, where access to such services and the costs are prohibitive (4-8). Likewise, telemedicine can effectively facilitate mental care through computer-based interaction of patients with psychiatrists.

The healthcare industry is moving towards monitoring systems, patient's self-supervision, computer-mediated therapy and instructional videos (9). Results from the surveys of residents in many states have indicated that 80% of Americans use Internet to obtain mental health information. Moreover, patients increasingly take advantage of Internet for meeting their emotional and psychological needs (10). Telemental health care is a new multidisciplinary approach, based on information technologies and computer sciences, enabling psychiatric services rendered to patients. It also seeks to facilitate

mental health services at remote clinical sites. Major advantages of telemental health care are tele-psychotherapy, online psychology and networking (1).

We identified a large number of studies, reporting popular applications of telemental health care in various settings (1-8,11-28). However, we did not find a systematic review on all applications of telemental health care. Therefore, we conducted this systematic review of research published since 2000, identifying all of the existing applications of telemental health care. This review can significantly benefit mental healthcare clinicians, particularly those practicing in under-developed communities. It raises the awareness of the efficacy of telemental health care, and can serve as a useful guide for institutions that intend to upgrade their conventional mental health services.

2. METHODS

We searched four major health care literature databases, such as *PubMed*, *Embase*, *ISI Web Sciences*, and *Science Direct* (29). The key terms used to search these databases included: telemedicine, telemental health care, health informatics, and mental health consulting. We identified 156 relevant articles, 25 of which contained all of the following selection criteria:

Studied various applications of telemental health care, particularly in under-developed communities.

Were published between years 2000 and 2017 in reputable English journals and were available in full-text.

Were indexed by one or more of the selected databases.

The selected articles were primarily reviewed by an experienced psychiatrist-academician, who approved the final 25 articles for further review process. Each article was further reviewed by two members of the team independently. The reviewers also compiled the major findings of the selected articles and grouped them in specific categories and subcategories (Tables 1 and 2). The findings were deliberated collectively by the authors, with a focus on the significant merits of telemental health care, and were assigned for inclusion in the final manuscript.

3. RESULTS

For brevity and conciseness, the current applications of telemental health care, as extracted from the 25 reviewed articles, have been presented in Table 1. We found five categories and 25 subcategories of major findings about the various applications of telemental health care upon the completion of the review process. As presented in Table 2, the five categories relevant to telemental health care consisted of: a) Capabilities; b) Specific designs; c) Available technologies; d) Advantages, and e) Challenges. Of the 25 approved articles, there were 16 reviews, six case studies, an original research article, a 5-medical center research document, and an expert panel statement. The above topics and the associated sub-headings are elaborated in the “Discussion” section.

4. DISCUSSION

This review strongly suggests that using telemental health care for psychotherapy and other mental services improves patient satisfaction and reduces the costs of care. Almost all of the associated technologies can be effectively used to evaluate and analyze mental disorders while monitoring the quality of

service. Currently, telemental health care offers capabilities for imaging, synchronous and asynchronous psychotherapy, and consultation to clinicians in a variety of settings. This review presents its discussion under the following headings and subheadings.

STUDY	FINDING & SUGESSTION
Pantic M, 2000 (15)a	Provides for automatic facial expression analysis.
Critchley HD, 2002 (18)a	Enables study of bodily arousal versus cognition & motivational behavior.
Hilty DM, 2002 (5)a	Enhances clinical care, services, education, administration and research.
Hilty DM, 2004 (6)a	Improves clinical outcomes, predicts patients' satisfaction & reduces costs.
Nambu M, 2005 (12)b	Provides rapid mental diagnosis and reduces medical expenses.
Young KS, 2005 (8)a	Provides patients feedback on online counseling; guides distant treatment.
Luneski A, 2008 (17)a	Enables distant assessment, diagnosis and therapy of disorders influenced by emotion.
Sarasohn-Kahn J, 2008 (19)a	Is becoming a social and professional network for creating and exchanging mental health information.
Yellowlees P, 2008 (11)a	Reduces emergency room crowding; provides mental care in rural areas; improves access to care, and counseling in disasters.
Frantzidis CA, 2010 (4)b	Provides for independent platform with XML format for easy connectivity and information exchange.
Stone RT, 2011 (2)b	Provides for facial expression monitoring as an index of mental workload.
Tang L, 2011 (7)b	Provides for: 1) continuous medication monitoring, flexible management, context awareness and adaptive presentation; 2) adherence to medication schedules of patients, especially in the elderly.
Song I, 2012 (13)b	Can share key words to locate peers with similar mental health conditions.
Valstar MF, 2012 (16)a	Provides for the detection of highly accurate temporal AU based on geometric features.
Hilty DM, 2013 (20)a	Enables assessment and diagnosis of patients with cultural & language issues at various settings and collaborative primary psychiatric care.
Mohr DC, 2013 (24)d	Provides for: 1) validated video and audio conferencing for psychotherapy; 2) effective management of various mental cases, including anxiety and pediatric disorders.
Diederich J, 2014 (1)a	Can integrate research findings from computer science, neuroscience, psychology, and psychiatry with ample private and governmental support.
Lal S, 2014 (23)e	Enables: 1) assessing the gap between the identified needs for mental services & the limited capacity of mental care resources; 2) improved access, reduced costs, personalized interaction & patient engagement.
Tilaka AD, 2014 (14)c	Outperforms X-ray rating scales and has high inter-rater reliability in various ethnic populations.
Lindsay JA, 2015 (22)a	Enables external facilitation strategy to support providers as they establish clinics & make practice changes to deliver psychotherapy.
McWilliams JK, 2015 (21)a	Bridges the need for mental care and provides for variety of models to extend mental services to various primary care settings.
Olsen MR, 2016 (25)a	Improves efficiency and quality of ADHD therapy, and saves the cost.
Vernig PM, 2016 (26)a	Satisfies patients and clinicians with the services, and is comparable in quality to in-person care, despite minor concerns.
Crowe TV, 2017 (27)b	Is viable for treating deaf patients, allowing equitable mental care.
Moussa Y, 2017 (28)a	Is reliable for assessing dementia in older adults, similar to in-person mode.

Table 1: Applications and potential uses of telemental health care. XML: Extensible markup language; AU: Action units; ADHD: Attention deficit and hyperactivity disorder. a Review article. b Applied research article. c Case study article. d A 5-medical center research document.ve Expert panel statement.

Category*	Subcategory*
Capabilities	1) Automated evaluation; 2) Online information exchange and support services; 3) Psychiatric consultation in primary care and emergency rooms; 4) Asynchronous psychotherapy; 5) Home care & related interventions.
Specific Designs	1) Clients vs therapists; 2) Synchronous and asynchronous interactions; 3) Requirements of mental healthcare settings.
Available Technologies	1) Videoconference, telephone and messaging systems; 2) Web-based interactions; 3) Mobile phone technology; 4) Networking via social media & group discussions; 5) Simulated people and places; 6) Internet games.
Advantages	1) Improved access; 2) excellent results from individual and group therapies; 3) Social networks; 4) Flexible online interactions; 5) Automated questions & answers; 6) Enhanced profits & reduced costs; 7) Future innovative potentials.
Challenges	1) Costs of online services & equipment; 2) Communication quality control; 3) Limited professional skills for online communication; 4) Ethical and regulatory concerns; 5) Information privacy and reliability; 6) Other issues.

Table 2. Categories and Subcategories of Findings Concluded from the Reviewed Articles. * Categories and subcategories are discussed in detail under "Discussion" section.

Capabilities

1. Automated Evaluation: The majority of methods used in the evaluation of mental health conditions are time-consuming and costly. Several automated methods have been developed according to the type of data and the required analysis.

a) Imaging and Behavior Analysis: Image analysis methods have been developed to examine an individual's face, behavior, mood, and the associated symptoms. Little research has been conducted to analyze people's images, leading to or supporting mental diagnoses. This is largely due to complex image processing issues. Alternative studies have been undertaken to evaluate people's mental conditions by monitoring their behaviors, which are simpler than analyzing facial and body images. Mental health status can be evaluated in the elderly, using monitors and sensors attached to them while they are engaged in activities, such as watching movies (1, 2, 16).

b) Evaluating Biosignals: People's physical and mental conditions may be evaluated by examining their biological signals, such as electrocardiograms and electroencephalograms (EKG & EEG). Findings from other studies suggest that biological signals can be used to examine mental health disorders (6, 17). Travainen et al. (30) examined the galvanic current of skin to study people's emotional reactions. In another study (18), there was a significant relationship between the electrodermal activity (EDA) of the subjects and their mental and physiological state. Frantizidis et al (4) have suggested that EEG and EDA signals could be used to diagnose mood, emotional and mental disorders.

c) Language Use in Mental Disorders: Speech and language disorders (SLD) and incoherent speech occur in many mental disorders, and are evaluated to diagnose mental conditions. However, SLD methods are generally time-consuming and costly, therefore, automatic SLD methods are used instead (31). Also, among the common automated methods, there are statistical and latent semantic analysis, and machine-learning methods (13, 14, 31).

d) Acoustic Analysis: New technologies have reduced limitations of mental health evaluation and improved its preci-

sion. Audio analysis of speech provides useful information about people's emotional and psychological state, and can lead to mental state diagnosis. The acoustic features, such as speed and shorter-than-usual pauses are the key indicators of emotional symptoms (4, 32).

e) Knowledge-based Methods: Using patients' data and analysis algorithms can improve the evaluation and diagnostic methods in mental health care (33).

2. Online Information Exchange & Support Services: New advances have been made in mental health informatics, such as online healthcare, social media and networking (34). The latter facilitates data sharing and interactions among patients and clinicians (2, 13, 19). There is online support that offers public programs to meet the emotional and psychological needs of patients. These are mainly websites that provide counseling and distant learning to students with mental disorders (8).

3. Psychiatric Consultation in Primary Care & Emergency Rooms: Telemental health technology facilitates psychiatric consultation and therapy at primary care centers, resulting in promising outcomes comparable to in-person services (20). However, it is important that the efficacy of tele-psychotherapy in emergency consultation be evaluated and the detailed clinical guidelines established (11, 35).

4. Asynchronous Psychotherapy: Asynchronous tele-psychiatry can provide consultation and primary care interventions to mental patients, e.g., transmitting patient's record to the psychiatrist via video and text files from the primary care centers. Likewise, the psychiatrist can provide recommendations after evaluating the patient's medical reports. Nowadays, asynchronous psychotherapy has been designed so that the mental patients receive appropriate primary care locally (36). These programs resolve the access issues and enhance the quality of mental care programs at remote locations (36, 37).

5. Home Care and Related Interventions: Provision of mental care at home can reduce costs. This is particularly warranted when primary care provision at local clinics is limited or accessing the services is impractical. Such services have significantly improved the quality of care and the access. Online video conferencing via personal computers or mobile phones has enhanced the management or follow-up of many mental patients. Using the technology advances the application of tele-psychotherapy and may make the office visits for these patients obsolete soon. However, patient information privacy remains a concern according to HIPAA guidelines (38).

Specific Designs

1. Clients vs. Therapists: Successful client-centered services require the awareness of clients' mental health needs and their environmental constraints (39). Telemental health programs must be easy to use for clients, although those designed for therapists may be comprehensive and more complex. Most therapists are familiar and agreeable with the use of technology. However, they are still concerned about privacy, data security, work overload and the need for technological upgrades and providing support services (40).

a) Client Engagement: Appropriate communication between clients and therapists is essential for optimizing the process and the quality of care. The information technology

must be designed to improve the interactions and eliminates obstacles between clients and therapists. Appropriate interactions lead to a successful patient management and enhance the client-therapist satisfaction (41).

b) Client's Cultural and Social Background: Past and present medical history, cultural and social factors are regarded as factors influencing the development of mental health disorders. Some of the important social and cultural issues are: sex, social class, education, religious and non-religious beliefs, race and ethnicity. These factors may influence the therapy outcomes, hence the need for matching the system design and contents with the social and cultural background of clients (41).

c) Client's Learning & perception Issues: System designers should consider that mental health clients may have low learning and perception levels. It is, therefore, essential that appropriate caution be exercised with instrumentation when managing these patients (42).

d) Therapist's Skills, Perception and Working Style: Mental health therapists are generally concerned about introducing technologies into their practice, worrying that clinical programs might get disrupted, adversely altered, or face difficulty adapting to new protocols. The new changes may also affect the therapist's perception of the overall efficacy of the care.

e) Extra Demands and Responsibilities of Therapists: The new technologies are not supposed to impose added workload and time demand on the medical staff. In fact, they are expected to reduce work stress, save time and lead to efficient interventions. Therapists may also be concerned about introducing modern technologies into their practice, thereby raising their responsibilities for additional contact time with clients.

2. Synchronous vs. Asynchronous Interactions: Appropriate interventions, mental health condition of the client, and the need for distant versus in-person therapy sessions must be thoroughly evaluated before making a decision to offer synchronous or asynchronous interactions. Thoughtful therapy plans can significantly improve the outcomes.

3. Requirements of Mental Healthcare Settings: In designing new systems, the clinical guidelines and protocols of the mental health settings should be followed so that the system performance continues smoothly (43). These include:

- i. Abiding by the national and international regulations.
- ii. Basing system development on acceptable theoretical models of mental health care.
- iii. Creating a safe environment for storing patients' data.
- iv. Respecting client's privacy.

a) Creation of an Adaptable and Stable System: System adaptability to new technologies is the key requirement for designing new programs. New technologies are used for diverse clients from different socio-cultural backgrounds and for different mental disorders. Also, they are used by diverse population of therapists and patients. Therefore, such systems must be adaptable and stable enough to meet varying clinical circumstances (41).

b) Flexibility in Providing Support Services: The system design and access should be adaptable to divergent customer needs and applications. Therefore, each system should provide its support services through multiple user-friendly means.

Available Technologies

1. Videoconference, Telephone & Messaging Systems: Due to limited transportation and access to distant geographic locations, and the cost involved, video-conferencing and telephone messaging can facilitate patient access to mental health services (44). Video-conferencing omits the full-scale physical presence and some of the behavioral cues. Telephone excludes visual cues, and text messaging omits both sound and visual cues. E-mailing eliminates synchronous communication (45). Although communication technologies can widen the scope of healthcare services, certain concerns still remain.

The provision of mental services through multimedia reduces the need for physical presence of patients and therapists. However, it may not lead to the same therapeutic effect. Also, they may risk patient privacy or disrupt the management of critical cases. Research on the use of technologies in psychotherapy suggests that video-conferencing can provide effective services and has been received well by patients. Similarly, telephone and messaging systems have been effective, especially for clients residing in distant locations (46).

2. Web-based Interventions: Web-based services have a structure similar to face-to-face sessions, and can offer live opportunity for therapists to have successful interaction with patients. The service may include instructional components, evidence-based psychotherapy and opportunity for the clinicians to improve their clinical skills (47). Web-based interventions can be offered as textual, audiovisual or animated programs. They have interactive tools for feedback and supervision of the therapy sessions, and for enhancing patient learning experience (48).

3. Mobile Phone Technology: Mobile phones provide patients and therapists with an excellent communication means. They can send and receive text, voice and video messages, facilitating many forms of clinical interactions between therapists and patients (49).

4. Networking via Social Media & Group Discussions: Networking refers to the use of digital, web-based technologies and mobile phones to promote information transfer and communication among patients and therapists.

5. Simulated People and Places: Simulated methods refer to the use of three-dimensional, animated video presentations for mental health care purposes. One drawback in using simulators is the production cost; however, online virtual world is an excellent environment for providing mental health services. This environment was used for the first time to provide interactive and instructional programs via social media and chat rooms to promote healthy lifestyle among people with HIV infection (50). Using such technologies also help to extend sympathy and promote unity among social groups with similar conditions (51).

6. Internet Games: Fascinating games can motivate patients, promote therapies for mental disorders and can potentially lead to changes in abnormal behaviors. Using internet games in some cases can even serve as a remedy for some mental disorders, such as hyperactivity, autism and aggressive personality (52).

Advantages

Studies have suggested that telemental health care has promising potentials to fill the existing gaps between the

current needs and innovations for future within the expected constraints. The future innovations may fall under four major headings: data provision; screening and evaluation; interventions; and social support (53). Many of these services may be simultaneously offered at mental health centers.

Regarding data provision, it is essential that they are analyzed and the quality is assured before making them available to mental health care clinicians. Currently, screening and evaluation tools are Internet-based, facilitating information access and utilization by practitioners serving mental health centers in many nations. Findings from literature reviews suggest that web-based capabilities lead to excellent coherence and reliable results for mental health services. They provide comprehensive and up-to-date information for use by patients, either individually or in groups (54, 55).

Social support networks offered through telemental health care are available in different web-based formats, such as group discussions, commercial bulletins, weblogs, chat rooms and other networks. In general, telemental health care consists of three types: *a*) Based on disease phases (i.e., prevention, preterm intervention, active treatment, maintenance or preventing recurrences); *b*) Based on the type of relations (between clinician and client or among clinicians, or clients); *c*) Based on the therapy (i.e., behavioral or psychotherapy). Unlike conventional therapies, telemental health care is available for both individuals and groups. Recent studies suggest that the cost, efficacy, usefulness and profits on the investment, warrant establishing telemental health care services in many institutions (20, 46, 56, 57).

In summary, the major advantages of telemental health care include improved access, reduced costs, flexibility under most circumstances, and interactive sessions between clients and clinicians (54, 58). Telemental health care is particularly warranted for under-developed communities and nations where these services are not available locally.

Challenges

Key concerns about telemental health care are: *a*) necessary skills to use the technologies by both the clinicians and patients; *b*) necessary investment for establishing the equipment and periodic upgrades; *c*) subscribing to Internet services; and, *d*) regular evaluation of the service and its efficacy (59). Another concern is whether the service is covered by insurance coverage, which directly impacts the physicians' revenue and may lead to bias against some patients (60). Unclear quality control and standards, clinician's reluctance, anxiety and technophobia constitute other challenges to providing telemental health care (59, 60). Concerns also exist about marginalizing clients with physical and cognitive disabilities who are unable to use the equipment properly, making in-person services as the only feasible choice. Another concern is the lack of stable signals or access to Internet, that may make telemental health services unpopular (61). Lastly, ethical and regulatory concerns exist about the use of web-based services, since the patients' privacy might be at risk, and the physicians may not be sure who else may be hearing the conversation between the clinicians and patients (58, 59, 62-69). National and international authorities are in the process of developing standards for web-based professional and medical services (60, 61).

5. CONCLUSIONS

Our findings indicate that telemental health care is cost effective and can lead to efficient and adaptable solutions to the care of patients with mental illnesses, with promising outcomes. The institutions currently providing or planning to provide this service are strongly advised to benefit from the feedback collected from both clients and clinicians, if successful outcomes are expected. Since a large majority of studies have attested to the efficiency, low costs and usefulness, telemental health care is the next logical step to delivering a state-of-the-art care to mental patients alongside the conventional care, especially in under-developed communities and nations. Considering the potentials of telemental health care, further research is required to evaluate its current applications and to explore its future promises.

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