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Telepsychiatry: Technology Progress, Challenges, and Language and Transcultural Issues

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Abstract Patients with psychiatric disorders or problems need specialists to correctly diagnose and treat their psychiatric issues. However, a lot of psychiatric patients, especially the patients living rural and remote communities, cannot get timely effective treatment or they lack appropriate care because they cannot access to quality mental health treatment. Telepsychiatry is an effective means of delivering quality psychiatric care and services. Telepsychiatry patients benefit from reduced travel, less lost work time, shorter waiting time for specialist referrals, and reduced costs. Telepsychiatry has gained high levels of satisfaction in all age groups, including the elderly. It is especially useful in rural areas where access to quality psychiatric care is limited or non-existent. Telepsychiatry often uses two-way, real time, interactive and video based services on the network to deliver psychiatric care. This paper introduces several telepsychiatry service delivery models, advantages and applications of telepsychiatry, and the technology such as videoconferencing and variables such as bandwidth used in telepsychiatry treatment sessions. Some technology progress such as mobile telepsychiatry, telepsychiatry based on cloud computing, and telepsychiatry information security based on cryptographic technology or biometrics is presented in this paper. Issues about cultures and languages in telepsychiatry, and limitations and challenges of telepsychiatry in technology and services, ethical and legal considerations of the telepsychiatry, syndromes and patients groups at significantly increased risk in telepsychiatry, patient-psychiatrist relationship in telepsychiatry, and future or further research in telepsychiatry are also discussed.

Keywords: *telepsychiatry, telemedicine, transcultural telepsychiatry, forensic telepsychiatry, emergency telepsychiatry, videoconferencing, cloud computing, information security*

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1. Introduction

Telemedicine uses technological modalities that include but are not limited to voice, video, robotic, and remote-access technology to diagnose and treat individuals and allows patients and physicians to interact via teleconferencing software, Internet connections, or even telephones [1]. Educational and training initiatives have been delivered using telemedicine including patient and family education, continuing provider education, undergraduate and graduate medical education and clinical supervision. These initiatives are further strengthened by the use of the Internet for educational and training purposes. Telepsychiatry can be particularly useful to supervise trainees and for continuing education of professionals at distant sites [2]. Telepsychiatry is a branch of telemedicine that focuses on mental health care applications. It is also described as telemental health, e-mental health, or telepsychology [3,4,5]. It is defined as the use of electronic communication and information technologies to provide or support psychiatric services at a distance [4,6]. Telepsychiatry can connect patients and mental health professionals, allowing effective diagnosis, treatment, education, consultation, transfer of medical data, and other health care activities [7,8]. Telepsychiatry communication includes many modalities such as phone, fax, e-mail, the Internet, still imaging, and live interactive two-way audio–video communication. Live interactive two-way audio–video communication—videoconferencing—is the modality most applicable to psychiatry and has become synonymous with telepsychiatry involving patient care, distance education, and administration [6].

It has been estimated that around 15% of school-aged children experience some mental illness and would benefit from psychiatric services. Children living in nonmetropolitan communities are underserved by evidence-based mental health care and are underrepresented in clinical trials [9,10]. Mental health problems in children and adolescents affect academic performance and social interactions, may persist for years, and are often not adequately treated. This can result in poor outcomes such as higher suicide and homicide rates, increased use of emergency services, and more frequent hospitalizations and placement in mental health institutions [11,12,13]. These problems are also

associated with serious problems in adulthood (eg, unemployment, alcohol and drug abuse, and criminality) [14].

Barriers to mental health treatment have included geographic distances, high treatment costs, transportation difficulties, and time limitations [15]. Telepsychiatry has demonstrated significant potential to increase access to mental health treatment for several populations who, in the past, may have lacked appropriate care. Employing telepsychiatry has proved to be cost efficient as the school system pays for psychiatric care on an as-needed basis [1,16]. In a child and youth mental health system that is fragmented, underfunded, and with a critical shortage of specialists in rural areas, it is important to identify the factors that could enhance recruitment into telepsychiatry and contribute to the expansion of telepsychiatry services to rural and remote communities [17].

Rural patients want to be treated in their local hospitals; however, it is often difficult to recruit psychiatrists for rural communities. The reasons are their experience of professional isolation, increased community stigma regarding mental health diagnoses and difficulty with confidentiality in a smaller community. There are even greater challenges with retention [18,19]. Additionally, intervention for consumers in rural areas is delayed due to stigma, lack of education concerning mental illness, religious mores, lack of transportation, etc. Therefore at the point of access for care these individuals tend to be more acute [20].

India, with an estimated population of 10 million people affected by serious mental disorders, has only about 4,000 psychiatrists to provide for its mental health needs [23]. Mental illness is common in rural areas of the United States, but there is a shortage of specialty care in these areas. Access to mental health care in rural and remote parts of the US is significantly more difficult than in urban areas [21,22]. The problem is particularly bad in paediatric mental and behavioral health [24]. It is especially difficult for rural practitioners to obtain adequate consultations for conditions such as attention deficit hyperactivity disorder (ADHD) and autism [25,26]. Lack of access to mental health care is a significant reason why rural depressed patients have three times more hospitalizations and higher suicide rates [27]. Even if mental health professionals are available in some rural areas of the United States, lengthy waiting lists stall the treatment of urgent psychiatric problems. This situation also leads to overburdening of pediatricians and underrecognition of psychiatric conditions, with approximately 20% of children seen in primary care settings having identifiable mental health problems but less than half of them receiving care [28,29]. Moreover, surveys of family physicians and some pediatricians reveal only moderate levels of confidence in their ability to diagnose and treat many psychiatric disorders [30,31]. A two-session telepsychiatry consultation clinic, consisting of a psychiatric evaluation session and a recommendation session, was offered with patients located remotely in the rural area of the Georgia State, US [32]. Planning for a telepsychiatry program involves determining community and academic needs and finding areas of overlap. Additionally, open and consistent communication occurs between the partners to coordinate scheduling of appointments, reimbursement issues, the care, maintenance and running of the equipment, and the training of all required staff to work and communicate in a multidisciplinary and technology savvy manner [20]. There appear to be four core components necessary to a successful telepsychiatry program: psychiatrists who are interested in exploring new ways to reach underserved young people; clearly identified stakeholders who can collaborate with one another to make good use of the telepsychiatry service; a children's mental health 'champion' who represents these stakeholders and wants services for their community; and a stable administration that perceives telepsychiatry as valuable for their patients and their physicians [33].

2. Various Mental Illnesses and Models of Telepsychiatry Service Delivery

Telepsychiatry has been reported to be used for psychiatric assessment and follow‑up in patients from general health services and psychiatric services suffering from various mental illnesses such as depression, panic disorder, posttraumatic stress disorder, bulimia nervosa, and schizophrenia [34]. Table 1 [32] shows the frequency of each psychiatric disorder.

Table 1. Frequency of Psychiatric Diagnoses

Psychiatric Disorders	Frequency (percentage)
Attention Deficit Hyperactivity Disorder	25%
Generalized Anxiety Disorder	12%
Major Depressive Disorder	9%
Depression NOS	12%
Seasonal Affective Disorder	6%
Oppositional Defiant Disorder	6%
Anxiety NOS	6%
Other	24%

NOS: Not Otherwise Specified.

The telepsychiatry services include counseling and psychotherapeutic interventions with child and family, consultation and supervision of community based mental health providers, diagnostic assessment, medication management, case management, family meetings, individual psychotherapy and group psychotherapy [35,36].

The consultation model where the primary care physician is the principal provider and the collaborative model where both the psychiatrist and the primary care physician are involved have been applied in telepsychiatric services [4].

The most frequent reasons for scheduling the telepsychiatry consultations were: querying the existence of a psychiatric disorder, medication suggestions or reviews, and dealing with aggressive behaviors [37]. There are various types of psychiatric consultation used in telepsychiatry to deliver clinical care including direct patient care with patients referred to the psychiatrist, the consultation care model with the primary care physician as the principal provider of mental health services, and the collaborative care model with the mental health services provided jointly by the primary care physician and psychiatrist [2]. In the telepsychiatry consultation model, typically a primary care provider (PCP) can refer a patient to a consultant psychiatrist, who then conducts a psychiatric evaluation via conferencing and provides

recommendations for the referring physician and/or mental health providers to follow [32]. Telepsychiatric consultation may provide PCPs with technical assistance regarding medications, decision support, and avoiding referrals out of the rural community, perhaps that is why rural PCPs rated satisfaction higher than their suburban counterparts [38].

In the collaborative-care model, the PCP provides long-term care at the local clinic, while the psychiatrist provides evaluation and recommendations at a distant clinic through videoconferencing. The PCP is not present during the clinic visits and receives recommendations by fax or telephone. The consultative-care model differs from the collaborative-care model because the psychiatrist usually gives a single consultation and is not involved in ongoing care [39]

Many service delivery models for child and adolescent telepsychiatry have been researched. The following three models are examples among these models [40,41,42]:

- Model 1: Telepsychiatric consultation, with the primary care provider (PCP) managing the case (e.g., prescribing, taking phone calls) and occasionally calling/e-mailing the psychiatrist with a question; therapy locally, if available;
- Model 2: Telepsychiatric service with the psychiatrist managing the case as in usual practice;
- Model 3: Child and adolescent telepsychiatrist tutoring an adult psychiatrist at a distance.

The model of service delivery determines the responsibility for caring for, and responding to, patient and family needs. If care is done at a distance, additional clarity and caution are needed for all parties, since suicide is remarkably high in adolescents. Emergency procedures need to be in place, too for agitated and/or suicidal patients [43].

Telepsychiatric follow-up is considered to be an innovative model that may facilitate home care services for patients with mental disorders, and difficulties in patient care may be reduced by this method. Follow-up via telephone induces decrease in family burden, emotional expression and depressive symptoms for their caregivers and is a support for the family in the patient care [44].

3. Advantages of Telepsychiatry

Videoconferencing – a live two-way interactive video and audio communication system – is the most widely used technology in telepsychiatry. The introduction of videoconferencing reduced the probability of patients admitted with mental and behavioral disorders being transferred to the larger regional center. This has numerous benefits for the patients including: hastening access to mental health clinicians; enabling patients to stay within their community; and reducing the costs associated with travelling to a regional center. There appears to be much to commend the use of videoconferencing to enable improved examination of remotely located patients with mental and behavioral disorders. Videoconferencing is both a reliable and cost-effective method of administering mental health assessments and delivering patient care. It offers opportunities for clinical consultations, treatment, education, and other activities in the context of mental health care. There currently exists some evidence for the effectiveness, cost effectiveness, and acceptability of telepsychiatry among both service users and providers, in a variety of psychiatric settings including psychotherapy, general adult, old age, and child and adolescent psychiatry. Telepsychiatry is advantageous in situations where patients lack access to clinicians who would be able to treat their mental health most effectively. It would be particularly useful for patients living in isolated or rural areas with a shortage of psychiatrists or other mental health professionals, as well as in situations where a clinician fluent in the patient's native language is unavailable [18,45,46].

Telepsychiatry can make a significant impact on the delivery of mental health services, particularly to individuals with less access. Patient access is improved and satisfaction is high with telepsychiatric services and telemedicine in general. Other benefits include reduction of stigma associated with mental health services; reduced professional isolation and improved recruiting and retention of mental health professionals in underserved or rural areas; reduced geographic and socioeconomic health disparities, through improved access to mental health services; improved convenience and, consequently, greater likelihood of compliance with therapy, through reduced traveling; improved education of mental health professionals; and improved coordination of care across the mental health system [47]. Table 2 [47] shows some benefits and outcomes of teleconsultation services.

Table 2. Benefits and Outcomes of Teleconsultation Services at East Carolina University in USA

High patient satisfaction
Improved patient convenience
Reduced travel
Less time away from work and school
Decreased waiting time for specialist referrals
Improved patient compliance with therapy
Higher attendance rates for telehealth visits
Lower frequency of missed appointments for telehealth visits compared with traditional outpatient clinic
Improved continuity of care
Referring physician remains informed of the patient's condition
Faster receipt of consultant's findings

The strengths of telemental health include well-documented patient and provider satisfaction for a range of services; strong support for the reliability of clinical assessments (e.g., neuropsychological testing, clinical interviews, and mental status exams) relative to face-to-face assessments; and evidence that medical patients would choose to receive it if it was available and would improve their access to care. In addition, research has documented the effectiveness of telepsychiatry to treat specific mental health diagnoses such as depression and anxiety disorders, as well as its effectiveness with specific populations such as incarcerated patients and older adults [5]. Older adults who live in rural areas experience significant disparities in health status and access to mental health care. Older adults may benefit from telepsychiatry due to its: (1) utility to address existing problematic access to care for rural residents; (2) capacity to reduce stigma associated with traditional mental health care; and (3) utility to overcome significant age-related problems in ambulation and transportation [5]. Researchers found that telepsychiatry increased access to effective, appropriate

psychiatric care for students on campus, with minimal disruption to students' daily activities [1].

A major concern of caregivers and service providers alike focused on the need for further and more elaborate local support and medical services to oversee the implementation of treatment recommendations resulting from telepsychiatry consultations. Two key functions served by the availability of telepsychiatry services are enhanced capacity for service providers and reduced burden on caregivers. For service providers, the local availability of telepsychiatry services has resulted in access to a specific mental health expertise. This access has, in turn, increased their knowledge, their confidence, and their sense of competence in assisting their clients and has decreased the feeling of isolation. The availability of telepsychiatry services in or near their communities has led to reduced expenses associated with travel and a reduction in missed time at work for caregivers and missed days at school for the ill child and siblings. For many caregivers, an essential benefit of local services is that they are able to minimize the disruption to their paid employment caused by their child's illness [48].

Some rural hospitals are interested in telemedicine because they would no longer have to pay salaries for individual specialists, such as psychiatrists, to be physically located at their hospital. Because telemedicine patients do not leave their local area to receive their original diagnosis, any resulting follow-up work is more likely to end up at the local pharmacy or lab. The level of this increased income can be significant. Estimating this impact involves an analysis of typical psychiatric follow-up procedures and medications based on discussions with site physicians [49].

4. Some Applications of Telepsychiatry

Attention-deficit/hyperactivity disorder (ADHD) is one of the most prevalent psychiatric disorders diagnosed in children and adolescents. ADHD is equally distributed geographically, but services are not. Access to expert evaluation and treatment remains limited for youth with ADHD living in rural areas, as well as for ethnic and racial minority youth. Telepsychiatry is a service delivery model with the potential to reach these youth and to develop collaborative models of care among local primary care physicians, remote telepsychiatrists, and local families. Work to date indicates that ADHD is the most common disorder treated through telepsychiatry. Telepsychiatry offers the opportunity for psychiatrists and other specialists to collaborate through videoconferencing with local primary care physicians (PCPs) to provide evidence-based care and improve the health care and outcomes for underserved children diagnosed with ADHD. Because of telepsychiatry's capacity to bring services to the large population of youth with ADHD who are not adequately served in primary care, telepsychiatry programs are now sited in a diversity of settings, including medical centers, community mental health centers, urban day care centers, rural schools, correctional facilities, and private practice [50]. Professionals at different levels (teachers, school counselors, social workers, general practitioners, pediatricians, child psychologists and psychiatrists) should be targeted in diffusing efficacious interventions for child mental health problems worldwide. Telepsychiatry and the Internet seem to be the most promising strategies to diffuse knowledge with lower costs. Medical and allied professionals must incorporate child and adolescent mental health issues in their under- and postgraduate curricula [51].

Forensic telepsychiatry is defined by Merideth P. as ''the use of telecommunication technology to provide mental health services in a medicolegal context''. It provides opportunities for forensic evaluations, clinical consultations, and education in the context of forensic mental health. In addition its use may enable criminal justice agencies such as courts, prisons, and probation to have access to forensic expertise in a timely and efficient manner [52]. The UK experienced success with prison telepsychiatry, noting that although there are operational challenges, they can be overcome to produce a cost-effective method of health-care delivery [53].

Combat soldiers have interpersonal and family relationship disruptions that begin with predeployment preparations. Stresses continue with combat tour time away from families and then with reintegration into society and family life. Family interpersonal and relationship problems are exacerbated when post-traumatic stress disorder (PTSD) and traumatic brain injury (TBI) are involved. Nondeployed military spouses do not escape the consequences of the combat tours, as it is estimated that 33% have sought mental health treatment. Studies indicate that the caregiver burden for a partner living with a veteran suffering from PTSD can include depression and secondary traumatization. In secondary traumatization, the partners themselves begin to experience symptoms of trauma [54]. The efficacy of telepsychiatry and same-room treatment of combat-related PTSD using cognitive behavioral therapy in weekly, 90-min treatment sessions was compared. No group differences were found on clinical outcomes at three month follow-up. Satisfaction with treatment ratings was similar in both groups, with 'strong satisfaction' indicated by veterans in both modalities. Attendance and drop-out were similar in the two groups [55].

Telepsychiatry can be used in two kinds of psychiatric emergencies: one-time clinical events and public health situations associated with mass disaster. Psychiatric emergencies include the individual patient situation and national disasters such as the events of 11 September 2001 and Hurricane Katrina. In disaster situations, standard communication channels may be overloaded or inoperable. However, telepsychiatric services can be delivered via portable terminals (Figure 1 [56]), which can allow the exchange of patient data, medical images and videoconferencing. A portable telemedicine system can be stored for emergency use at existing health-care facilities or can be brought in to expand treatment access and aid in providing patient care in the event of a disaster. Emergency telepsychiatry can be very effective in providing improved patient care and satisfaction, as well as in reducing pressure on ill-equipped ED staff, and in improving the accuracy of diagnoses and appropriateness of admissions. In rural areas, emergency telepsychiatry may provide much more than a reduction in emergency room crowding, representing a link to wider treatment resources that would otherwise be unavailable to many patients. There is significant potential for the use of

emergency telepsychiatry in mass casualty and disaster situations to aid health-care systems in providing much needed care and minimizing the psychological suffering of surviving civilians and rescue personnel [56].

An international telepsychiatry service was established between Denmark and Sweden for cross-cultural patient groups, such as asylum seekers, refugees and migrants. Four telepsychiatry stations in Denmark were linked by videoconference to one station in Sweden. Clinicians who spoke Arabic, Polish, Kurdish and ex-Yugoslavian languages were available in Sweden to treat patients in Denmark [57]. The prevalence of depression in Chinese Americans in primary care settings is relatively high. Unfortunately, there are many barriers to the effective psychiatric treatment of this population, including low awareness or denial of depressive symptoms among patients themselves, as well as an under-recognition or misunderstanding of the presentation of Major Depressive Disorder (MDD) symptomatology on the part of the clinicians treating these patients. In addition, Chinese American patients with depression can be reluctant to characterize their depressive symptoms as a psychiatric illness due to their culture's stigmatization of mental disorders, leading them to underutilize the mental health resources that might otherwise be available to them. A model that seeks to improve the mental health care of Chinese Americans at several different levels was proposed. This multifaceted model involves: 1)screening patients for depression in primary care settings, 2) having PCPs deliver effective preliminary psychiatric care before a patient can be seen by a mental health practitioner, 3) interviewing patients via telepsychiatry using a culturally sensitive psychiatric interview protocol, 4) appointing a care manager to check in with patients by phone at regular intervals, and 5) constructing a collaborative group of practitioners involved with patients' mental healthcare about how best to treat the patient [46].

Figure 1. Physician assistant with a portable satellite terminal at a rural clinic

5. Telepsychiatry Technology and Progress

Telepsychiatry has been applied for direct patient care (diagnosis and management), consultation, and training, education, and research purposes. Both real-time, live interaction (synchronous) and store–forward (asynchronous) types of technologies have been used for these purposes. Synchronous services provide live, two‑way interactive transmission between patient and provider at distant locations. The interactive forms of communication include telephony, online communication, and videoconferencing, and these have the advantages of real‑time interaction. Store‑and‑forward mode of communication involves acquiring medical data and then transmitting this clinical information via e‑mail or Web applications for later review by a specialist. Asynchronous communication involves non‑real time or 'store and forward' interaction and does not require the presence of both parties at the same time. E‑mail is the most commonly used form of asynchronous communication. Use of telephone (for consultation, crisis management, psychotherapy, referral), cell phone text messaging, and two‑way closed circuit television have been integral in telepsychiatry communication, and are precursors to the more sophisticated and latest distance technologies applying the internet. E‑mail, instant messaging, online chat forums, professional advice via websites and blogs are amongst the different ways. Online and virtual chat rooms offer a forum where people interact with others including mental health professionals and share their experiences. Videoconferencing has become an important modality in the field of telepsychiatry as it permits live, two‑way interactive, full‑color, simultaneous video, audio, and data communication [4].

Table 3 [1] summarizes the technologies and technological variables. Hardware and software consist of technologies that are used to capture, encode, transmit, and receive data, audio, and video signals. Audio and video signals require a great deal of bandwidth. The main enabling component of a telepsychiatry system is the coder/decoder, or codec. The codec serves two functions: encoding audio and video for transmission as well as decoding for reception and playback of received audio and video, and synchronization of the audio and video. As technology has improved, PC-based codecs have emerged. Earlier, more expensive telepsychiatry systems used secure, point-to-point network connections, either as full or fractional T1 or Integrated Services Digital Network (ISDN) circuits. In recent years, videoconferencing systems that can work over Internet Protocol (IP) networks were developed. The use of encrypted codecs or the setup of a virtual private network (VPN) and/or virtual local area networks (VLANs) decreases the risk of security breaches. Polycom, Inc. has provided standards-based audio- and videoconferencing systems, referred to as unified communications systems that address the needs of both patients and providers [1].

Real-time telepsychiatry is primarily achieved with the use of videoconferencing. It is the use of live two-way interactive, full-color, audio, video, and data communication [58]. Nearly all telepsychiatric services are conducted using interactive videoconferencing.

Equipment selection is based on software applications, ease of use, image and sound quality, cost, and compatibility with other units to which one will link [59]. Videoconferencing primarily involves interactive audiovisual conferencing systems over high-capacity (high-bandwidth) networks. If a telepsychiatry application uses IP networks, security can be accomplished by using encrypted codecs [6]. The location of the local videoconferencing equipment does not have to be fixed, since mobile units can be used in clinic rooms, classrooms or conference rooms. The most important point is to ensure that the equipment is located in a room in which appropriate privacy can be ensured [35].

Table 3. Telepsychiatry Technology and Variables Used in a Treatment Session

Technology	Description
Hardware	
camera/webcam	Used to capture images for transmission to and from both ends of a session.
speakers/headphones	Used to deliver audio at both ends of a session.
monitor	Used to deliver video images at both ends of a session.
microphone	Used to capture audio for transmission to and from both ends of a session.
Software	
videoconferencing	Software that coordinates the capture, transmission, and playback of audio and video
encryption	Algorithms designed to specially encode signals to prevent interception of audio, video, and other data during transmission
codec	Software that encodes, compresses, decodes, and synchronizes audio and video signals. Most prevailing codecs are compliant with standards.
other	Note-taking software, electronic health records, etc. Not part of the videoconferencing software, but able to be used in conjunction with it.
Network	
ISDN (Integrated Services Digital Network)	Able to integrate and transmit audio, video, and data. Low- to high-speed, secure, point-to-point transmission.
T1	Multichannel telecommunication lines providing point-to-point, secure transmission
satellite	Channel utilizing satellite for signal transmission
microwave	Encoding of signals in microwave band
Internet Protocol (IP) network	Widely used network (Internet/web) utilizing protocol for transmission over public networks
Variables	
transmission speed	The rate at which signals and data can be transmitted. Measured in kilobits per second (Kbps).
video quality	Measured as the number of frames per second (FPS) and refers to the refresh rate of the video picture.
encryption algorithm	The software that is used to encrypt the audio, video, and other data sent during transmission. Common, public encryption standards use 128-bit to 256-bit encryption.
bandwidth	The amount of data (audio, video, etc.) that can be transmitted

Videoconferencing between recipient "far" sites and TeleLink "hub" site can occur by way of Internet Protocol (IP), (maximum bandwidth 384 Kbits/second). Two or more sites can be connected simultaneously; and videos, PowerPoint, and scanned documents may be transmitted. Polycom or Tandberg videoconferencing units enable the data transmission. Infrastructure support is provided by core staff at the hub and a designated telepsychiatry coordinator at far sites [17]. Using one central hub and seven remote sites was found to be an acceptable means of treatment that increased access to mental health providers for children and adolescents in rural areas [66].

Treatment sessions for the Telepsychology condition can be conducted using in-home videoconferencing technology. An analogue videophone (KMEA TV500SP, Figure 2 [5]) that operates via plain old telephone service (POTS) has been used. Apart from the video screen, this equipment appears and functions much like a basic touch-tone telephone. It is a "plug-and-use" product, with built-in camera, full duplex speakerphone, 4-inch LCD color screen (270 K pixels) with real-time motion display (18 frames per second), and oversized touch-tone buttons for easy use by all patients [5].

Figure 2. Videophone

The patient's comfort with videoconferencing is critical to the success of telepsychiatry. Patients' level of comfort with videoconferencing is related to their past experience with technologies such as videoconferencing, the Internet, computers and mobile phones. Younger patients and those with higher levels of education have had greater exposure to these technologies and are therefore likely to display greater comfort with telepsychiatry. A number of older American Indian veterans treated in the telepsychiatry service demonstrated a high degree of comfort with telepsychiatry. These veterans attributed this comfort to their experience with sophisticated communication systems during military service [36].

PTSD patients may experience increased negative emotions (anger, fear, sadness, etc.). Also, individuals with PTSD may feel detached or disconnected from friends and family, leading to depression. An automated, cloud-based Tele-PTSD Monitor (TPM) system utilizing multi-dimensional information was presented to remotely screen, monitor, and to provide assistance to clinicians in diagnosing a patient at high risk for PTSD. The system supports multiple types of client connections, including landline/cell phones through an Interactive Voice Response (IVR) server, apps on users' mobile platforms (Apple iOS and Android), and a web-based interface. Potential users include soldiers returning from war zones or other service men/women who may suffer from PTSD. It could also be applicable to other types of mental health screening and assessments, such as depression and suicide [60]. Figure 3 [60] shows utilizing the web portion of the TPM system in the cloud computing environments such as Amazon Elastic Compute Cloud (Amazon EC2). With Amazon EC2, people can simply launch as many instances (virtual machines) as needed with a variety of

operating systems to choose from, such as Windows Server and Linux.

Attention & memory deficit testing, acoustic feature and voice pattern analysis are also technology that can be used in telepsychiatry. Attention & memory deficits can be measured in for example, the Weschler memory scale, a neuropsychological test for measuring different memory functions in a person. Acoustic features include speech rate, pitch, intensity, voice quality, articulation, Gabor filter features, and Glottal features. Voice Pattern analysis has been used for detecting negative emotion and depression [60].

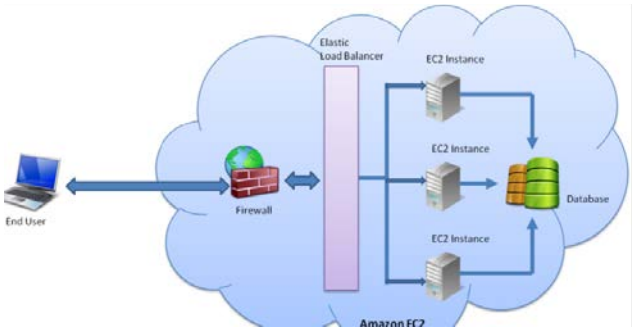

Figure 3. Schematic of cloud-hosting on Amazon EC2

6. Issues about Cultures and Languages in Telepsychiatry

Telepsychiatry may involve working with clinicians, patients and systems of care that are both geographically and culturally distinct. Culturally appropriate care is an important component of telepsychiatry. Two components of the outline are particularly relevant in telepsychiatry: (1) how the cultural background of patients (i.e. their cultural identity) influences their comfort with technology; and (2) the effect of cultural differences on the patient–provider relationship. Cultural differences between patient and provider are often highlighted in telepsychiatry by the patient and provider location (e.g. rural versus urban differences). Familiarity with the rural community, and regular contact and feedback are important. Telepsychiatry providers need to adapt their communication styles to suit the patient and cultural group in question [36].

The term transcultural telepsychiatry covers the delivery of culturally appropriate mental health care from a distance by the use of videoconferencing in real-time. Transcultural psychiatry demands a high standard of communication between the patient and the care provider, since linguistic, cultural or even racial barriers are likely to disturb the communication. It is well known that transcultural patients, such as asylum seekers, refugees and migrants, frequently face difficulties in accessing satisfactory health services. Several studies have found that language barriers are associated with lower rates of patient satisfaction and poor care delivery in comparison with care received by patients who speak the language of the care provider. Patients preferred telepsychiatry via their mother tongue, rather than interpreter-assisted care. The presence of a third person (i.e. an interpreter) in a confidential relationship affects patient satisfaction, as it influences both transference and countertransference between individuals involved, with unavoidable consequences on a physician-patient relationship [61]. Telepsychiatry via patients' mother tongue enhanced the quality of the therapeutic relationship. Communication in the patient's mother tongue versus interpreter-provided contact, prevented the lack of confidentiality and the loss of nuances of verbal communication. The restricted physical contact and non-verbal communication of telepsychiatry was compensated by the fact that the doctor and patient spoke the same language and had similar cultural and/or national references [57].

Linguistic features have been used to detect negative emotions and stress/deception. Depressed and suicidal individuals are more self-focused, and express more words related to negative emotions and death. Language features of depression and suicide can be markers of mental health [60]. The use of the telepsychiatry service improved access to bilingual psychiatrists by reducing waiting time and the need for travel. The use of bilingual clinicians with a similar ethnic and cultural background to their patients compensates for the distance and lack of physical presence [61].

Telepsychiatry affects the verbal and non-verbal communications between a physician and a patient. For example, with some Northern Plains American Indian elders, it is considered discourteous to have too much direct eye contact. A provider needs to be careful not to misinterpret lack of eye contact in such a patient as a clinical sign (e.g. of depression). Some providers, accustomed to direct eye contact with patients, find it more difficult to establish direct eye contact while using telepsychiatry [36].

Verbal information and visual cues are major and primary ingredients of psychiatric assessment. The sounds and images can be transmitted through video-conferencing. Other factors such as empathy and rapport are also crucial [62]. Some crucial indicators of patient satisfaction are [61]:

- Accessibility of culturally competent care via mother tongue;
- Ability to express intimate thoughts and feelings from a distance, without third person involvement;
- Perceived safety and comfort by the service;
- High quality of sound and picture.

7. Limitations and Challenges of Telepsychiatry in Technology and Services

There are a number of unresolved issues in relation to the practice of telepsychiatry – for instance, lack of guidelines regulating the practice of telepsychiatry and some practical considerations in relation to privacy, confidentiality, and uncertainty about how the use of video link may affect the therapeutic relationship [45].

Several obstacles make videoconferencing in the clinical examination difficult. These include transmission expenses, complex hardware in high-bandwidth modes, erratic video, delayed audio at low bandwidths, "echoes of motion" that appear at slow transmission speeds, and large image files that could incapacitate a network [3].

There are some challenges to assessing the mental status examination through videoconferencing. In particular, eye

contact may be difficult to discern due to camera placement, which may make participants appear to be looking to the side or looking down or up. Thus, the telepsychiatrist may obtain a skewed perception of the child's ability to make eye contact and must query the caregiver and child regarding the child's relatedness [50]. Qualitative studies have revealed the problematic nature of non-verbal communication via telemedicine. Visionary and auditory information may be lacking in richness. This information can be reflected in behaviors such as eye contact, posture, facial expressions, body positioning, voice quality and tone, and hesitations, all of which can be important in assessing emotion. The inability of a therapist to perform supportive gestures during videoconferencing sessions led to a perceived lack of empathy [58]. Some of problems encountered in telepsychiatry include lack of direct eye contact, poor sound quality, difficulties in hearing instructions, and poor image clarity. Most descriptions of remote psychological therapy have used a hybrid form of delivery with a face-to-face assessment followed by an interactive videoconference treatment [2].

Reimbursement is one of potential barriers to the dispersion and further growth of telepsychiatry. Reimbursement in telepsychiatry is typically provided for a diagnostic interview, pharmacologic management, and individual psychotherapy provided by psychiatrists and clinical psychologists. Services provided by other mental health providers are not currently covered in most states of the US. There are two suggestions regarding this issue. First, reimbursement for telepsychiatry services should follow customary charges for the delivery of the appropriate Current Procedural Terminology (CPT) code(s). Secondly, a structure for reimbursement of collateral charges, such as technician and line time, should be identified [2].

The lack of available specialists, insurance restrictions, appointment delays, and stigma are frequent problems. These obstacles are even more pronounced in rural areas, where access to child and adolescent psychiatric services is limited [3]. There were difficulties in gathering epidemiological and specific child and adolescent mental health policy data in almost all countries. There was a shortage of resources to provide training for child and adolescent mental health professionals, and the lack of training standards in the majority of nations. As expected, the problems were even worse in low income countries [51].

Lack of cooperation or willingness by family members and/or youth, the one time nature of the consultation and the lack of community resources, are barriers to the implementation of telepsychiatry [67]. The high "no show" rate is a problem in telepsychiatry. The cancellations were primarily because of personal issues of the patient or problems in completing the appropriate paperwork in time for the appointment. In other instances, families did not return the consent forms prior to the appointment [32].

Both family caretakers and service providers expressed profound frustration with the distinct limitations of the existing telepsychiatry services. Their primary concerns focused on whether a one-time consultation with no follow-up and little local expert support could really address the children's needs. Service providers and caregivers describe a two-pronged need, for both increased access to a wider range of telepsychiatry services and a larger cadre of well-trained mental health workers working within the rural communities [48].

8. Patient-psychiatrist Relationship, and Syndromes and Patients Groups at Increased Risk in Telepsychiatry

The cultural beliefs of the patient and the cultural aspects of the patient– psychiatrist relationship are issues of particular importance to telepsychiatry. The use of a shared language is an effective approach to ensure patient satisfaction and improve mutual comprehension between the patient and the psychiatrist [61]. Culturally competent care via mother tongue, expressing intimate thoughts and feelings from a distance, without third person involvement, and high quality of sound and picture based advanced technology are helpful to improve of the patient–psychiatrist relationship. The other major effect of telepsychiatry on the patient–psychiatrist relationship relates to establishing patient trust and rapport [36].

Psychosis, schizophrenics, the elderly, children, some adolescents, some disabled individuals, and anyone with delusions or violence are at significantly increased risk in telepsychiatry. These syndromes and patients can result in interaction or communication troubles, insufficient information to allow for appropriate medical decision-making by the psychiatrist and consultant(s), and delays, judgment errors or failures in medical evaluation and treatment. Minimal and maximal risk to these syndromes and patients groups should be studied.

The patient–psychiatrist relationship cannot be maintained using telepsychiatry for patients with deep psychosis. Psychiatrists may present a threat to the psychotic patient if using a computer/TV due to the nature of the psychotic symptom. The patient may completely lose touch with reality and not recognize the psychiatrist for his role but as an imaginary being. Further research in this area needs to be conducted.

9. Ethical and Legal Issues of Telepsychiatry

The use of telepsychiatry creates such ethical and legal issues as duty of care, role in crisis intervention and emergency situations, privacy and confidentiality, and security of data, etc. One of the most important issues is defining the duties and role of the provider at a site distant from the patient. This crucial ethical issue of duty of care can be addressed by consultant services rather than therapist services via telepsychiatry. The consultant does not directly assume responsibility (which may be difficult to carry out, e.g., in emergency situations), but at the same time provides support to the primary care professionals. In addition, comprehensive data security protocols must be defined and carried out to protect user confidentiality and privacy. Use of secure lines and servers and use of encrypted software have been recommended [4]. The laws that protect the confidentiality of medical information apply to telepsychiatry.

The main legal and ethical challenges are related to licensure, privacy, security, confidentiality, consent, and professional liability. The former is particularly relevant in the United States, where different states have different regulations concerning license to practice medicine, but

less of an issue in the United Kingdom, where practice guidelines throughout the country is regulated by a single body (the General Medical Council). The importance of obtaining consent from patients and informing them of the risks and benefits of telepsychiatry was emphasized [45]. Informed consent is required prior to conducting an interview by video link. The interviewee should be informed of the risks associated with telepsychiatry and of limits of privacy and confidentiality [52]. For the patient under age 18 in the U.S., the signature of a parent or legal guardian must be obtained to maintain the condition for ethical/legal implications during telepsychiatry.

Confidentiality in health care is one of the most important concerns. The utilization of telepsychiatry runs the risk of allowing unwanted people to access personal information [63]. Other breaches in confidentiality include poor security of transcribed medical information, improper storage of video or voice recordings of the session, spyware or malware on the practitioner's or patient's computer, and hackers who break into the systems [64]. Telehealth technology may actually decrease the possibility of malpractice suits by allowing better record keeping such as the recording of video-consultations. However, videotapes can be vulnerable to mishandling or tampering even though measures are taken to protect their security [58]. Traditional, ethical, and liability issues such as professional-patient confidentiality and compliance with HIPAA represent more complex telemedicine [11]. In recent years much advancement in the security and protection of patients has been achieved. For instance, implementing a protocol based on cryptographic technology and/or the application of biometrics enhances the safety of patient information [65].

The creation of legal instruments and formal professional guidelines is necessary to govern the practice of telepsychiatry. Confidentiality must be maintained during the videoconference as it is possible that outsiders may witness the consultation without being visible on the screen. It is recommended that informed consent is gained from the patient prior to the consultation. Practitioners could be held liable for errors relating to data storage and transmission which could lead to misdiagnosis. Alternatively liability could also be incurred where telehealth technology is available but not used leading to a delay in diagnosis and poorer health outcomes. Telepsychiatry poses many legal and ethical challenges and therefore the creation of legal instruments and formal professional ethical guidelines are needed. There have been a number of documents outlining standards, guidelines and laws in relation to telehealth [8].

Two of the major legal challenges in civil commitments initiated through telepsychiatry were illustrated in Oregon, USA. The first relates to whether or not a telepsychiatric encounter qualifies as a face-to-face interaction and whether it is acceptable in the legal system where the hold is being initiated. The second springs from the complex jurisdictional, regulatory and credentialing issues that exist and vary on a state-by-state basis [68].

10. Conclusions and Future Research

Telepsychiatry makes a significant impact on the delivery of mental health services, particularly to individuals with less access in remote rural areas. It has also been used in forensic mental health and forensic evaluations, combat soldiers' mental healthcare, and minimizing the psychological suffering of surviving civilians and rescue personnel after emergency disaster situations with mass casualty.

Telepsychiatry needs strong technology support. Videoconferencing has become the most widely used technology in telepsychiatry. Videoconferencing with good video and audio quality is based on network hardware and software and therefore depends on bandwidth and transmission speed, etc.

Telepsychiatry also delivers international mental health service for cross-cultural patient groups, such as asylum seekers, refugees and migrants, etc. Transcultural psychiatry demands a high standard of communication between the patient and the care provider. Transcultural patients preferred telepsychiatry via their mother tongue, rather than interpreter-assisted care. Also, the use of bilingual clinicians with a similar ethnic and cultural background to their patients compensates for the distance and lack of physical presence of telepsychiatry.

There exist some problems such as lack of direct eye contact in telepsychiatry. Reimbursement is one of potential barriers to the dispersion and further growth of telepsychiatry. Other challenges include lack of guidelines regulating the practice of telepsychiatry and some practical considerations in relation to privacy, confidentiality, and information security. Implementing a protocol based on cryptographic technology and/or the application of biometrics enhances the safety of patient information.

There are limitations of current research in ethical and legal threats of the telepsychiatry as well as in technology and services. The following aspects can be future or further research: (1) telepsychiatry based on mobile devices (such as smartphones and tablets), especially in remote rural areas; (2) telepsychiatry based on mobile cloud computing (MCC) that integrates the cloud computing into the mobile environment, extending mobile device battery lifetime, improving data storage capacity and processing power, and improving their reliability and information security; (3) telepsychiatry based on advanced technologies like 4G; (4) the influence of diagnostic status (i.e., schizophrenia vs. schizoaffective disorder), symptom severity, and family involvement on patient-psychiatrist communication and relationship in telepsychiatry; (5) minimal and maximal risk to the syndromes (such as psychosis and schizophrenics) and patients groups (the elderly, children, some adolescents, some disabled individuals, and anyone with delusions or violence); (6) the patient-psychiatrist relationship for these patients groups; (7) treatment and services for patients with deep psychosis; (8) the impact the availability of a full-service telepsychiatry program on school systems, mental health clinics, emergency rooms, and home care; (9) the validity and feasibility of home-based telepsychiatry; (10) diffusion of mental health skills to the periphery of the health service system, and thus the integration of telepsychiatry with primary health care in developing countries to avoid overburdening resources; and (11) mechanisms to tailor specific interventions to address rural health disparities because many rural residents may not utilize primary care services.

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