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Telepsychiatry in the 21st Century: Transforming Healthcare with Technology

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Abstract

This article describes the benefits and constraints of telemedicine, focusing primarily on the field of psychiatry in the United States with the current system of healthcare. Telepsychiatry is believed to provide better access and higher-quality care to patients who need psychiatric care and cost savings to providers of such care. Telemedicine has been successfully integrated into psychiatric facilities reaching rural areas, prisons, and urban facilities. It has increased the volume of patients that physicians can reach and diagnose, as well as allowing them to treat patients with limitations in mobility. While telepsychiatry has been shown to be beneficial, this technology does have some limitations. Concerns about reimbursement, licensure, privacy, security, patient safety, and interoperability have been identified and present current challenges that providers using telepsychiatry must overcome in order to provide the most effective patient care. As more insurance companies start to reimburse for telepsychiatry treatments at the same rate as for face-to-face visits, this evolving medical field has the potential to grow exponentially.

Keywords: telepsychiatry, telemedicine, cost, prisons, mobility

Introduction

Telemedicine has been defined as the intervention of a telecommunication device in the diagnosis and the overall care of patients that are separated from providers by a distance.[1] Telemedicine has been used to facilitate diagnosis, referral, monitoring, medical information interchange, and interventions to offset higher costs associated with hard-to-access patients.[2] This technology enables distant practitioners to recommend treatment of difficult or rare cases all over the country. 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.[3]

Patients who use these medical services can receive evaluation, diagnosis, treatment, consultation, and education about their condition.[4, 5] In recent years, there has been an ever-growing population of patients that would benefit from telemedicine for at-home medical services. These patients commonly have asthma, cardiac conditions, diabetes, or psychological disorders.[6, 7] With a big network of landline phone service as well as cellular phones in use in the United States, this form of treatment has far-reaching potential in mental health services.[8] Telemedicine can link a patient at home to a physician in an office, or a physician to another physician, or a patient in a remote office to a physician's office. Any number of such configurations are applicable. Telemedicine can be as flexible as the practitioner or patient may need it to be.[9]

Telemedicine first originated in the field of psychiatry and has been greatly utilized in this field for years, with the initial use at the Nebraska Psychiatric Institute in 1959.[10] Telemedicine focusing on psychiatric care holds great promise in healthcare as it has given an increased number of patients access to care.[11] Access to psychiatric care is not always limited by geographic area alone. School systems have begun to use counseling services for school-aged children while they are on their school's campus. It has been estimated that around 15 percent of school-aged children experience some mental illness and would benefit from psychiatric services.[12] Employing telepsychiatry in this particular manner has proved to be cost efficient as the school system pays for psychiatric care on an as-needed basis.[13]

Using telemedicine in the field of psychiatry has the potential to be both cost effective and structurally efficient due to the diminished fixed costs necessary for everyday operation. Remote monitoring of patients has allowed practitioners to check in with their patients more often because of the increased ease of observation.[14]

One issue that arises with the implementation of telepsychiatry is the start-up cost of establishing clinics with up-to-date electronics.[15] These clinics must provide interoperability between practitioners' and patients' systems. A common solution to this problem has been to use an intermediary between the systems that converts the necessary signals so that transmission can occur.[16] The goal of interfacing the transmitted data and creating an interoperable system is to allow for the use of various mediums that integrate to one final product. This integration creates an environment where multiple applications and systems can exchange information fluently to enrich the overall patient/practitioner experience.[17] Additionally, many regulations currently exist both federally and at the state level that have created barriers for the utilization of telemedicine.[18] The regulations have created barriers because there is no single, exhaustive group of federal laws governing telemedicine. This lack of federal regulation has allowed each state to have different laws; thus, providing telemedicine services across states has proved difficult at best.[19]

This article describes the benefits and constraints of utilizing telemedicine, primarily focusing on the field of psychiatry within the current healthcare system in the United States. The purpose of this research was to review the quality of care, patient access, and cost savings associated with the utilization of telemedicine in psychiatric care and identify its benefits and constraints.

Methodology

A literature review compiled findings published within the past 12 years. Sixty scholarly sources were used to assess the use of telepsychiatry in the United States. For the online search, the following search terms were used and combined to narrow the search criteria: *telemedicine*, *telepsychiatry*, *psychiatry*, *psychology*, *psychiatric*, and *prisons*. Subsequent reading within the search results revealed that *telemental health* was also a suitable search term, and this term was subsequently utilized in an expanded search of relevant journal databases. The chosen references were academic peer-reviewed journal articles or health information technology (HIT) practitioner literature, mostly from online sources. All of the relevant research that was used came from the electronic database EBSCOhost (including CINAHL [Cumulative Index to Nursing and Allied Health], MEDLINE, psycARTICLES, psycINFO, Health Source: Consumer Edition, and Health Source: Nursing/Academic Edition), PubMed, Google Scholar, or the American Telemedicine Association website.

References were reviewed and were determined to satisfy the inclusion criteria if the material provided accurate and reliable information about telemedicine with a particular focus on psychiatric care. Only articles that were written in English were included for review. In an attempt to stay current in research, all articles that were older than 12 years (starting from 2000) were eliminated from the search.

Results

The results presented were extracted from journal articles, case studies, and websites from diverse sources to illustrate several aspects of psychiatric telemedicine that should be considered, such as quality of care, access, cost, technology, and constraints.

Quality of Care

Many opponents have objected to this nontraditional type of medical care, primarily because it was believed that medical care cannot be adequately given unless the patient receives an exam in person.[20, 21] To address this concern, research on the utilization of telemedicine has examined the percentage of times when a physician has given the correct diagnosis versus when the doctor has not. In one study that investigated psychiatric care for rural individuals, it was found that only 1 to 2 percent of the patients received a wrong diagnosis when using telepsychiatry.[22] These authors established an ethics committee that approved strict methodology using current patient-accessible hardware and software, such as personal computers and videoconferencing hardware and software, to evaluate the validity of diagnosing mental disorders via telepsychiatry. A total of 37 patients were reviewed for this particular study, and all completed the intended assessments. The researchers found that 83 percent of patients who were diagnosed per the *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)* through the use of telepsychiatry were correctly diagnosed. This study was beneficial in showing the accuracy of diagnosis in telepsychiatry due to advances in technology and telecommunication devices. The researchers expected that further advancements in technology could increase the validity of noncontact diagnosis in psychiatric care.[23]

In addition to providing opportunities for practitioners to make appropriate diagnoses, telepsychiatry has had other positive effects on the continuity of care. For example, Grady and Singleton found that telepsychiatry could effectively be used by psychiatrists to provide coverage for peers who were on vacation or otherwise unable to attend to their patients in an inpatient psychiatric unit of a rural hospital.[24] This coverage maintained continuity and quality of care for patients when their treating psychiatrist was unavailable.

Other studies have supported the use of telepsychiatry when compared to face-to-face interactions for mental health treatment.[25–27] Ongoing randomized clinical trials have continued to explore the impact of telepsychiatry on quality of care through its effectiveness versus face-to-face psychiatric treatment. It has been hypothesized that telepsychiatry will continue to be found equivalent to face-to-face treatment.[28]

Telepsychiatry has been shown to be effective in maintaining quality of care across several different populations. For example, telepsychiatry has been an effective treatment option with children and adolescents.[29, 30] Rabinowitz et al. found evidence that telepsychiatry could be used to positively impact quality of care for the nursing home population.[31] Other studies have supported the use of telepsychiatry to provide quality behavioral health care to college students, rural residents, veterans, immigrants, and incarcerated individuals.[32–37]

Access

Telepsychiatry has demonstrated significant potential to increase access to mental health treatment for several populations who, in the past, may have lacked appropriate care. Barriers to mental health treatment have included geographic distances, high treatment costs, transportation difficulties, and time limitations.[38]

Research has supported the use of telepsychiatry to increase access to care for rural residents. Myers et al. examined a telepsychiatry program implemented as a means to reach rural communities in the northwestern United States. Using one central hub and seven remote sites, this program was found to be an acceptable means of treatment that increased access to mental health providers for children and adolescents in rural areas.[39]

Telepsychiatry has also been used to increase access to care for college students, particularly in rural areas. Researchers found that telepsychiatry increased access to effective, appropriate psychiatric care for students on campus, with minimal disruption to students' daily activities.[40] Inmates in correctional facilities are also an underserved population needing appropriate behavioral health treatment. Access to psychiatric treatment in correctional facilities is minimal.[41] As a significant number of incarcerated individuals have diagnosable mental diseases, effective treatment is imperative in efforts to prevent recidivism. Telepsychiatry has been found to be a viable option for reaching this population in a safe and secure manner.[42] The use of telepsychiatry in prisons is explored further in this article.

Cost

The effect of telepsychiatry on treatment costs has been examined with mixed results.[43] Rural areas have appeared to reap significant benefits in the reduction of costs for providing psychiatric treatment via telepsychiatry.[44, 45] In fact, Spaulding et al. found that the implementation of telepsychiatry reduced costs by more than 70 percent.[46] Other studies have found a 40 percent reduction in costs of providing psychiatric services via telepsychiatry versus face-to-face treatment.[47] Rabinowitz et al. likewise found a substantial savings, around $30,000, for 278 telepsychiatry visits to nursing home residents.[48]

Not all research has supported such impressive reduction in costs. One study found that, over the course of a year, telepsychiatry cost more than face-to-face treatment, per hour.[49] Clearly, further research is needed to obtain consistent results. (See Table 1.)

Technology

Psychiatry, as a subset of mental health services, has always relied on a relatively high degree of patient-provider interaction. Specifically, given that psychiatry often involves psychopharmacological treatment and analysis of nonverbal cues, it is necessary for patients and psychiatrists to have direct interaction because of the evaluation methods used by psychiatrists in today's medical field.[50] Thus, technologies providing mental health services at a distance must provide requisite levels of personal interaction to ensure the necessary quality and type of care. Because of this requirement, telepsychiatry has tended to rely on interactive audiovisual conferencing systems over high-bandwidth networks[51] with a typical telepsychiatry system including a video camera, a microphone, speakers, a headset, and one or two monitors at each end of the system.[52]

Table 2 summarizes the technologies and technological variables noted and discussed within the telepsychiatry literature. Hardware and software listed and described in the literature consist of technologies that are used to capture, encode, transmit, and receive data, audio, and video signals during sessions. The modes of transmission detailed are technologies that have served as or are emerging as channels for sending and receiving session data, audio, and video. The items listed as variables are attributes of the technologies that can support or even adversely affect a telepsychiatry session (see Table 2).

Bandwidth refers to the amount of data and information that can be transmitted or received; audio and video signals require a great deal of bandwidth. Because bandwidth is limited, technology is used to compress the signals. Thus, the main enabling component of a telepsychiatry system is the coder/decoder, or codec.[53] 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. A codec is required at both the patient and provider ends of the system. A codec can be a separate device, but as technology has improved, PC-based codecs have emerged. As network usage has increased, proprietary codecs have been replaced by standardized codecs aimed at maximizing interoperability of systems created by different manufacturers.[54]

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, the rapid diffusion and decreasing cost of Internet and Ethernet networks has led to the development of videoconferencing systems that can work over Internet Protocol (IP) networks.[55] While point-to-point systems are secure, security is a concern if a telepsychiatry application uses IP networks,[56] and steps must be taken to secure it. 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. The main advantage of IP networks is that they can be shared by multiple applications, such as Internet, e-mail, and local area networks (LANs), assuming that encryption is used.[57]

Responding to the demands for and opportunities presented by highly interactive systems for telepsychiatry over IP networks, companies have developed high-end audiovisual systems. In particular, Polycom, Inc., has been very successful in this area.[58] Polycom provides standards-based audio- and

videoconferencing systems, referred to as unified communications systems, that address the needs of both patients and providers. For patient access, a battery-powered, mobile cart can be taken to the patient within a healthcare facility and can support wireless communications as well as access to PC applications. For providers, systems exist that provide desktop videoconferencing and simultaneous access to other computer-based applications such as the electronic health record (EHR). They also provide for sharing of data and information with patient teams. The South Carolina Department of Mental Health has used Polycom systems to link physicians' offices to patient rooms in participating hospitals.[59] Mearian has pointed out that appropriate levels of encryption, along with freely available, low-cost hardware such as webcams, are helping bring telepsychiatry into widespread use.[60] The author described telepsychiatric systems that can be pieced together using videoconferencing software utilizing secure encryption and webcams. A connection that is considered highly secure can be achieved using a 256-bit Advanced Encryption Standard (AES) algorithm. The software and webcams are placed at the doctor's site and at a satellite office near the patient's home. The decrease in cost and increase in availability have been noted since the 1990s and have reached a level where many patients can afford to have the equipment at home. In fact, the cost of videoconferencing equipment has decreased by about 30 percent, enabling providers to set up a telepsychiatric practice without unreasonable start-up costs.[61]

Some key variables to consider in the setup of telepsychiatry systems have been the speed of transmission, the transmission method, and audio and picture quality.[62] Transmission speed is measured in kilobits per second (Kbps), with typical setups transmitting at between 128 Kbps and 512 Kbps. Transmission over land-based lines, such as phone lines and fiber-optic cables, is common, with fiber-optic cables less prevalent in rural areas. Such transmission can involve a delay (latency) of 0.5 to 1.0 seconds. The higher the transmission rate, the closer to "live" the session can become. Satellite transmission can be used but will almost always incur a delay of 0.5 to 1.0 seconds. Even microwave transmission can be used (within line of sight), but it is prone to interference from poor weather conditions. Although it is important, not many studies have reported on audio quality. Video quality has been the subject of comment and is measured in frames per second.[63] This measure refers to how often the picture is refreshed during transmission and how closely it will approximate a real-time image. These issues, along with security, are also important considerations for IP network–based telepsychiatry. Latency, poor image quality, and other possible quality problems experienced over IP networks can hamper or prevent proper diagnosis. For example, Myers and Cain caution that lower frame rates can produce flickering images, which can hamper assessments of abnormal movements and affective expression.[64]

Another aspect to consider in telepsychiatry is the rapid advancement in technology, as image quality and transmission speed are improving every day. It is likely that the same telepsychiatry interventions with better technologies will improve the current results.[65] Myers and Cain have suggested that the increasing availability of encryption protocols to ensure compliance with Health Insurance Portability and Accountability Act (HIPAA) regulations will result in IP networks being the preferred setup for telepsychiatric applications.[66] Finally, the acceptance of existing and emerging systems and applications is driven, at least in part, by the willingness of insurance companies and the Centers for Medicare and Medicaid Services (CMS) to reimburse providers for teleconsultations.[67]

With the new technologies available to providers, there is concern that efficacy of treatment or quality of care may suffer. As previously noted, several studies have found no difference in outcomes or patient satisfaction between patients receiving psychiatric services in a traditional, face-to-face manner and those using telepsychiatric services.[68–70] Thus, it appears that providers can confidently use telepsychiatry to effectively treat most mental illnesses.

Constraints

Reimbursement for Telemedicine and Telepsychiatry

Reimbursement may be seen as a barrier to the implementation of telemedicine in general. CMS, the Veterans Health Administration (VHA), and some third-party payers agree that telemedicine is a cost-effective choice for some types of medical care. CMS and the VHA have systems that allow them to bill and reimburse for services rendered by telemedicine technology. For example, both have suggested that providers should use the same Current Procedural Terminology (CPT) codes used in a typical in-office

consultation and add the Healthcare Common Procedure Coding System (HCPCS) modifier to show that services were provided using technology.[71] However, Medicare does limit reimbursement to only specific CPT codes, certain types of providers, and patients who are physically located in a nonmetropolitan service area or a rural area with a health professional shortage.[72] Reimbursement for telemedicine services under Medicaid must follow federal requirements, but states have been encouraged to be innovative in creating payment methods for telemedicine services. For example, providers at the distant site may be reimbursed by the state, and the originating site may receive a facility fee. Add-on costs such as technical support, transmission charges, and equipment can be included in the fee-for-service rate or reimbursed as an administrative cost.[73]

Medicare, Medicaid, and an increasing number of third-party payers have begun reimbursing for telepsychiatry treatment and consults under certain conditions.[74] Outpatient mental health facilities are now included as originating sites under Medicare. Private payers and state Medicaid programs have expanded payment for telepsychiatry services,[75] with each payer developing its own policies in the absence of state regulations. However, reimbursement is generally limited by private payers and CMS. As more insurance companies start to reimburse for telepsychiatry treatments at the same rate as for face-to-face visits, this evolving medical field has the potential to grow exponentially.[76]

Licensure across United States

Under the current regulations in the United States, health providers are required to obtain multiple state licenses and adhere to diverse state medical practice rules. This approach is deficient when applied to telemedicine and telepsychiatry because, with the advent of the Internet and modern HIT developments, differences in space and time are nearly meaningless.[77] Researchers have suggested a voluntary, regional geographic approach to be established by jurisdictions already demonstrating a commonality of interests, such as through the Southern Governors' Association or the Western Governors' Association. Other stakeholders take a much stronger position requesting a massive overhaul of the US medical licensure system, arguing that the US military and the Veterans Affairs (VA) Department have already acted to fix licensure barriers.[78]

Patient Safety, Security, and Confidentiality

Patients who have received therapy via telepsychiatry from their practitioners have run the risk of misunderstanding the instructions given by providers. During regular consultations, providers and patients engaged in a great deal of nonverbal communication.[79] Some of this communication can be transformed with telepsychiatry, decreasing the perceived value of the interaction between the patient and provider. Although most people who have used telepsychiatry use teleconferencing with video and audio support, cameras and microphones are not always identified as an equivalent substitute for face-to-face interaction; however, much research supports the use of telepsychiatry as being equivalent to face-to-face treatment.[80]

Telepsychiatry would not be an appropriate measure if safety is compromised or self-harm is imminent. It has been shown, however, that telepsychiatry has been effectively used to assess for suicidal threat, and, depending on the patient/provider relationship, patient safety contracts can be formed to prevent self-harm until further intervention is rendered.[81] Because little research was discovered on the topic, further studies would be beneficial in determining the impact of assessing threats of self-harm.

As with any therapeutic relationship, providers must follow the ethical guidelines set by the American Medical Association regarding the relationships that can form between client and practitioner on social networking sites, for example.[82] This information can be damaging to the practitioner and compromise not only the trust in the patient-physician relationship but the provider's professionalism as well.

Confidentiality in this mode of healthcare is one of the most important concerns providers must address. The utilization of telemedicine for patients runs the risk of leaving a "digital paper trail," allowing unwanted people to access personal information.[83] 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.[84]

Ethical standards for the use of telepsychiatry must be followed for the protection of both the patient and the provider. Patient confidentiality and informed consent are paramount to effective mental health services, and providers must ensure that both are attained and maintained.[85]

A continued concern for the utilization of virtual medicine is the overall safety of the patient's health and personal information. Unfortunately, despite the many advances in protecting patient privacy, there are many who wish to breach the confidentiality of those simply seeking help. Researchers have advocated that adding an organizational policy for employees to uphold the privacy of patient information would be a key element for safety.[86, 87] Additionally, it was believed that adding an electronic record of access with this policy would thwart the attempts of employees looking to negatively impact a patient's well-being. However, 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.[88]

In addition to privacy concerns, the ownership of and responsibility for the record of interaction of a telepsychiatry session has been called into question. In some cases, facilities may have arrangements with outside consultants, but the records ultimately belong to the facility. In some arrangements, the episode of care is actually owned by the psychiatrist's office, in which case the records are owned by the provider.[89] In many states, the basic rule of medical ownership is established by statute, and medical records in most cases are the property of the hospital psychiatrist or provider that maintains and possesses the records.[90, 91] Patients have the right to access health information, even mental health records, but with the exclusion of psychotherapy notes granted by the HIPAA Privacy Rule, federal law governing health information, and state law.[92] Thus, the responsibility for securing the record lies mostly with providers.

Telepsychiatry in Prisons

One concern with telepsychiatry is discovering how the technology and theory will play out in real-life applications. Much research is available to answer the applicability question, particularly in the area of corrections. The corrections environment provides an exceptional microcosm in which to study telepsychiatry. Participants are plentiful and the environment is controlled, yet many potential difficulties of implementing telepsychiatry are the same in correctional facilities as in the community. For example, confidentiality, security of the data, ownership of the record of treatment, and licensure to practice, as well as reimbursement difficulties, affect telepsychiatry providers in correctional facilities just as they affect providers in the community. Further, telepsychiatry is an up-and-coming area in corrections, and significant current research has been performed. Thus, a closer examination of the available research about telepsychiatry in corrections was performed.

The prison system is the ideal setting for telepsychiatry for many reasons. Although establishing a telemedicine system is costly in any setting, in prison the benefits can be seen immediately. Since many prisons are operated by the federal or state government, the prison administration or government can contract with the telemedicine provider.[93, 94] The initial savings to the prison can include the decrease in transportation costs from moving the inmate from incarceration to the healthcare facility, and public safety and security can also increase with fewer inmates being transported outside the correctional facility.[95] An additional benefit to utilizing telepsychiatry in prisons is the increase in provider security. Traditionally, providers have been reluctant to allow inmates to be treated in their private facilities. By adding telemedicine services, a provider can treat a patient without worrying about their security or the security of their facility and their other patients.[96]

Several states have successfully incorporated telemedicine, and telepsychiatry in particular, into their correctional facilities. Ohio, Texas, Arizona, and Georgia have telepsychiatry programs that exemplify its distinct advantages in the correctional setting.[97, 98]

The Ohio State University Medical Center in Columbus, Ohio, currently contracts with state correctional facilities throughout Ohio to provide telemedicine programs, including telepsychiatry. This program serves more than 4,000 inmates each year, providing appropriate psychiatric care to inmates housed within the Ohio state correctional program.[99]

Similarly, in Texas, the University of Texas Medical Branch (UTMB) and Texas Tech University have provided telemedicine and telepsychiatry to 80 percent of the state's inmate population, around 130,000 inmates. The program, in service since the 1990s, has grown to be one of the largest telemedicine programs worldwide, providing telepsychiatry services to inmates in correctional facilities at the county, state, and federal levels.[100] The occurrence of Hurricane Ike has led to significant shortages of staff and funding for this program.[101] UTMB is currently working to secure adequate funding to continue the program.[102]

The Arizona Telemedicine Program, a joint venture of the Arizona State Legislature and the Arizona Health Sciences Center, collaborated with the Arizona Regional Behavioral Health Authority to provide telepsychiatric services throughout rural Arizona.[103] This program has worked with St. Mary's Hospital and the University of Arizona in Tucson to provide telemedicine services to the Arizona Department of Corrections. Together with the University Medical Center and Maricopa Medical Center, the Arizona Telemedicine Program has served all 10 rural prisons in Arizona via telemedicine.[104] This has substantially improved relations between inmates and correctional services, as well as providing cost savings of more than $1,000,000.[105] Inmates filed fewer grievances because their healthcare needs were met more efficiently due to telemedicine. The decrease in paperwork and person-hours for grievance procedures, along with the decrease in transportation costs, led to a savings of more than $1,000,000 for the state of Arizona.[106]

In Georgia, around 70 percent of the telemedicine visits provided each month to inmates were psychiatric. According to Georgia prison officials, the lack of interpersonal intimacy in telepsychiatry might actually have encouraged more inmates to seek psychiatric care.[107] In Georgia's correctional facilities, the Augusta Correctional and Medical Institute is central to providing telemedicine to five Georgia prisons.[108]

Many states have recognized the advantages of telemedicine and telepsychiatry in correctional settings and have taken steps toward implementing far-reaching telepsychiatric programs throughout their correctional facilities. Twenty-five correctional systems in the United States currently use some form of telemedicine, and 80 percent of those systems use telepsychiatry.[109]

Discussion

The use of telemedicine in psychiatric care in the United States has had a beneficial impact on patient care in multiple ways. Its implementation has helped to counter the prejudice against medical diagnosis done via telemedicine. The utilization of video and audio transmission through computers via broadband and ISDN has altered the way psychiatric patients interact with their providers.

A significant benefit of telemedicine has been in giving patients who were previously unable to be treated a sense of freedom, confidence, and understanding of their psychiatric illness. When patients are satisfied with their level of care, they are more apt to follow treatment procedures and thus recover or at the very least acquire good care. Also, because technology has become more affordable in society today versus even a decade ago, the majority of patients are able to connect to their physician by using their own equipment at home.

Telemedicine appears to be on the forefront of healthcare in corrections, with telepsychiatry leading the way. The introduction of telepsychiatry in several correctional facilities across the United States has led to decreased spending and greater access to psychiatric services for inmates.

This literature review was limited by the restrictions in the search strategy used, and researchers' and publication bias may have affected the availability and quality of the research material identified during the search. Further, while much research exists about telepsychiatry in general, and a significant number of studies have examined telepsychiatry, the vast majority of those studies have examined practitioner acceptance or utilization and efficacy rather than costs and benefits or increasing access to effective care.

Telepsychiatry has the ability to show patients how to perform therapeutic techniques to overcome psychological difficulties such as stress, anxiety, and depression.[110, 111] Further, telepsychiatry has been

shown to reach populations such as veterans, the elderly, students, and rural residents. This greatly increases access to appropriate mental health care, with significantly decreased costs. While telepsychiatry has been shown to be beneficial, this technology does have some constraints. Concerns about reimbursement, licensure, privacy, security, patient safety, and interoperability have been identified and present current challenges that providers using telepsychiatry must overcome to provide the most effective patient care. Finally, despite the surprisingly long history of telepsychiatry, its potential and impact are still in the relatively early stages of understanding. With the decreasing costs of available systems and the wider availability of increasingly secure technologies, psychiatrists and patients may find this mode of service more acceptable. The reliable high-speed IP networks that are beginning to form the technological backbone of telepsychiatry are still limited in their reach, being clustered mostly around urban and suburban areas and less prevalent in the rural areas that telepsychiatry could benefit the most.

Conclusion

Telemedicine has been shown to be an effective, cost-efficient alternative to traditional psychiatric services that increases patient access to providers. Telepsychiatry is at the forefront of technological advances in the mental health field and has the potential to greatly benefit patients and providers. Further research will be instrumental in continuing to measure benefits and constraints in this field.

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Table 1

Studies Examining Cost for Providing Telepsychiatry versus Face-to-Face Treatment

Author	Sample Size	Population	Setting	Design	Outcome
Modai et al. (2006)[a]	81	Adults	Ambulatory settings	Cross-sectional	Telepsychiatry cost more per hour than face-to-face treatment.
Rabinowitz et al. (2010)[b]	278	Older adults	Rural nursing home	Cross-sectional	Utilization of telepsychiatry led to a savings of $30,000.
Spaulding et al. (2010)[c]	257	Children	Rural outpatient	Cross-sectional	Utilization of telepsychiatry led to a 70 percent reduction in costs.
Doolittle, Spaulding, and Williams (2011)[d]	6,178	Adults	Rural outpatient	Longitudinal	Utilization of telepsychiatry led to a 40 percent reduction in costs.

[a] Modai, I., M. Jabarin, R. Kurs, P. Barak, I. Hanan, and L. Kitain. "Cost Effectiveness, Safety, and Satisfaction with Video Telepsychiatry versus Face-to-Face Care in Ambulatory Settings." *Telemedicine and e-Health* 12, no. 5 (2006): 515–20.
[b] Rabinowitz, T., K. M. Murphy, J. L. Amour, M. A. Ricci, M. P. Caputo, and P. A. Newhouse. "Benefits of a Telepsychiatry Consultation Service for Rural Nursing Home Residents." *Telemedicine and e-Health* 16, no. 1 (2010): 34–40.
[c] Spaulding, R., N. Belz, S. DeLurgio, and A. R. Williams. "Cost Savings of Telemedicine Utilization for Child Psychiatry in a Rural Kansas Community." *Telemedicine and e-Health* 16, no. 8 (2010): 867–71.
[d] Doolittle, G. C., A. O. Spaulding, and A. R. Williams. "The Decreasing Cost of Telemedicine and Telehealth." *Telemedicine and e-Health* 17, no. 9 (2011): 671–75.

Table 2

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