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The effectiveness of telehealth for chronic neurological disorders in rural or underserved areas

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***Abstract*---Background** The shortage of neurologists in rural areas limits patient access, making it hard for those with neurological conditions to receive timely care. Long travel distances are a barrier, often resulting in worsened health outcomes. The review aims to assess the current landscape of tele-neurology, examining existing services, evaluating patient outcomes, and identifying challenges and legal concerns. **Methods** This review brings together insights from multiple studies and programs, with a particular focus on initiatives like the clinical video tele-health (CVT) system created by the Veterans Health Administration, allowing neurologists to deliver direct care to veterans. We also look into the web-based tele-stroke program

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established by the University of South Carolina, enabling neurologists to oversee acute ischemic stroke patients in rural Emergency Departments in collaboration with local ED physicians. Additionally, we explore global partnerships in telemedicine that are being tailored for tele-neurology. **Results** Tele-neurology has demonstrated significant potential in delivering quality neurological care, resulting in high patient satisfaction and notable time and cost savings. The TRUST-tPA trial established a tele-stroke network connecting ten community hospital emergency rooms to a centralized stroke center, effectively serving patients unable to reach stroke units within the critical 4.5-hour window. Other tele-neurology services, such as tele-epilepsy and pediatric tele-neurology, enhance follow-up care for remote patients. However, challenges remain, including high equipment costs, bandwidth limitations, and the need for skilled personnel. Legal concerns regarding patient information sharing over public internet channels necessitate robust encryption to comply with the Health Insurance Portability and Accountability Act (HIPAA) standards and maintain patient confidentiality. **Conclusion** The integration of tele-neurology offers a significant chance to enhance healthcare accessibility in regions where there is a lack of neurological experts. Nonetheless, the adoption of this groundbreaking tool faces limitations due to financial pressures, insufficient technical skills, legal obstacles, and the necessity for suitable incentives for healthcare professionals. This review emphasizes the growth of tele-neurology use and identifies key challenges that need to be tackled to enhance its advantages for underserved communities moving forward.

***Keywords*---**Tele-neurology, stroke, epilepsy management, neurology, outcomes, literature review.

Background

Tele-neurology involves effective communication between neurologists and their patients, as well as between neurologists and other healthcare providers. This is achieved through shared audio, video, secure messaging, and various data exchanges, which have become essential in enhancing health and quality of life for individuals who face limitations in accessing quality neurological care (1). Care limitations frequently occur due to geographical isolation, as certain regions may not have a neurologist available, and patients might have to travel long distances for treatment (2). Furthermore, in rural and underprivileged communities, the presence of neurologists is significantly lacking in relation to demand (3). Neurological conditions continue to be major factors in mortality and disability, making the development of novel and creative products like tele-neurology crucial in addressing these challenges and fulfilling this need (4).

Tele-neurology serves as a platform that enables patients and physicians, despite being far apart, to communicate and conduct examinations swiftly. This is significant for chronic conditions that necessitate ongoing monitoring, or in emergencies, where the timely administration of thrombolytic therapy in cases of

stroke, for instance, is frequently essential within a limited time frame to achieve effectiveness (5). This could lower healthcare expenses, enhance hospitalization services, and foster better communication among various providers concerning patient care, thereby adding value to tele-neurology (6).

This review discusses the various types of tele-neurology, such as tele-stroke, tele-epilepsy, tele-radiology, pediatric tele-neurology, general tele-neurology, mental health, chronic neurological care, and tele-neurohospitalist work. It covers past research, results, limitations, and the multidisciplinary nature of these subtypes. Suggestions for the future of tele-neurology were also proposed, focusing on effectiveness, accessibility, and affordability in developing countries.

Categories of tele-neurology services/ consultations

Tele-neurology can take on two forms: synchronous or asynchronous. Synchronous teleneurology involves real-time connections between patients and clinicians. Asynchronous tele-neurology, often referred to as "store and forward," involves communication that occurs with a delay. Clinical information is gathered, and subsequently, the data is sent electronically for later review by the clinician. This could involve the sending of digital images, videos, or data files for assessment or analysis (7). The Veterans Health Administration established various telehealth programs, including a clinical video telehealth system that enabled neurologists to communicate directly with and assess veterans suffering from neurological diseases (8). Table 1 represents the comparison of tele-neurology modalities.

Table 1. Comparison of tele-neurology modalities

Tele-Neurology Method	Description	Advantages	Disadvantages/Limitations	Geographic Applicability	Example/Case Study
Synchronous Video Conferencing	Real-time video consultations between patient and neurologist. Includes comprehensive exams (mental status, cranial nerves, motor).	Immediate feedback, strong patient-physician interaction, suitable for emergencies.	Requires reliable high-bandwidth internet, expensive equipment.	Wide applicability, but limited by infrastructure.	Community-based outpatient clinics, University of Kansas pediatric neurology clinic.
Asynchronous Data Transfer	"Store and forward" – images, videos, data sent for later review by the neurologist.	Allows for review at neurologist's convenience, less demanding on real-time connectivity.	Delays in diagnosis and treatment, less interactive.	Wide applicability, but limited by infrastructure.	Sending digital images of brain scans for interpretation.
Telephone Consultation	Simple phone call between patient, physician, and other providers.	Simple, accessible, low cost.	Limited information gathering, less suitable for complex cases.	Wide applicability; particularly useful in areas with limited	Acceptable for assessing critical neurological events in children with neurocysticercosis.

Tele-Neurology Method	Description	Advantages	Disadvantages/Limitations	Geographic Applicability	Example/Case Study
				internet access.	
Email Consultation	Neurologist receives referral via email; determines if advice, further investigation, or clinic visit is needed.	Enhanced clinical effectiveness, lower direct costs, increased productivity.	Delays, lack of visual information.	Wide applicability, particularly useful in areas with limited internet access.	Tele-neurology assistance program in Northern Ireland.
Online Messaging Platforms	Use of web-based messaging systems (e.g., MSF system, WhatsApp) for communication and data sharing.	Convenient, asynchronous, potentially cost-effective, accessible in areas with limited infrastructure.	Delays, lack of visual information, potential for miscommunication.	Particularly useful in developing and economically limited countries.	Médecins Sans Frontières (MSF) using web-based messaging for specialist consultations; WhatsApp for stroke care alerts.
Mobile Technology	Use of smartphones, wearables for real-time data tracking and assessment (e.g., tremor severity, EEG, seizure detection).	Real-time data tracking, personalized approach, potential for early detection.	Data privacy concerns, potential for technical glitches.	Wide applicability, but accuracy depends on technology and user proficiency.	Smartphone apps for Parkinson's disease tremor measurement; sensors for EEG in epilepsy; smartwatches for seizure detection.
Robotic Telepresence	Robotic audiovisual platform allowing remote "presence" at a distant location.	Enhanced feeling of presence and interaction.	High cost, technical complexity.	Limited applicability due to high cost and technical requirements.	Use in remote hospitals or clinics.
International Collaboration	Telemedicine partnerships across borders to share expertise and resources.	Increased access to specialized care in low-income countries.	Requires robust infrastructure and regulatory frameworks.	Primarily useful in bridging gaps between resource-rich and resource-poor nations.	Expanding tele-neurology access to low-income countries.

The patient would visit a nearby community-based outpatient clinic and be evaluated remotely by a neurologist through a real-time telehealth camera. Every visit should encompass time dedicated to gathering a medical history and conducting an examination, which includes, but is not limited to, a mental status exam, cranial nerve exam, and motor evaluation. The visit will include a discussion of test results, education regarding the disease, and treatment options (9). In a similar vein, the University of Kansas Center for Telemedicine and Telehealth provides a pediatric neurology telemedicine clinic that employs real-time videoconferencing technology, allowing a pediatric neurologist to observe and assess non-verbal behavior in patients located at a remote clinic. An on-site

manager and a remote site coordinator are available to support patients and their families, ensure the technology functions properly, and collect vital signs. Kansas boasts 80 sites, and the majority of residents can pinpoint a location within an hour's drive from their home (10).

Tele-neurology can function as a local hub or facility that is electronically linked to a primary host hospital, neurologist, or experts for consultation purposes. The audio-visual conferencing devices typically feature a pan, tilt, and zoom camera, enabling the neurologist or specialist to observe and communicate with the patient effectively (11). Additional types of devices utilized for remote patient assessment encompass robotic telepresence, which features a robotic audiovisual platform capable of navigating to foster a feeling of "being present" at a distant location (12). The tele-neurology consultation does not have to take place exclusively in an outpatient facility; it can also be conducted in rural hospitals. An illustration of this is the implementation of a web-based telestroke program at The University of South Carolina, which enabled neurologists to consult with rural emergency department physicians and nurses regarding patients providing with acute ischemic stroke at these rural hospitals. This system enabled the neurologist to engage with both the patient and their family, while also facilitating consultations with other providers (13).

This is an interactive videoconferencing system that allows patients, relatives, and providers to engage at the bedside while simultaneously communicating with others remotely in real time—a significant departure from traditional tele-neurology methods (6). Telephone consultation can be regarded as a straightforward form of telemedicine in which a physician discusses the symptoms presented by a patient with other providers and considers their management. Studies have also utilized telephone consultation, which was deemed acceptable for assessing critical clinical neurological events that would require face-to-face consultation in children with neuro-cysticercosis. Therefore, although the trend appears to be moving towards interactive audio-videoconferencing, tele-neurology could be accessible in various other formats (14).

Consultations can occur through email; tele-neurology assistance for patients referred to a neurologist by general practitioners was launched in Northern Ireland. The neurologist would obtain an email referral and subsequently determine if advice alone was adequate or if additional investigations or a clinic visit were necessary. This was shown to enhance clinical effectiveness, lower direct costs, and boost productivity levels (6, 15). It could also take the shape of an online messaging platform. For example, Médecins Sans Frontières (MSF) is a medical humanitarian emergency nonprofit organization that utilizes a web-based messaging system to allow doctors at MSF field sites to access a broad array of specialist consultations, including neurologists; only internet access and a computer are necessary (5, 16).

WhatsApp has also been utilized as a clinical communication tool, expanding this web-based messaging system. WhatsApp is an instant messaging app accessible on smartphones that enables users to send free text messages, make voice calls, conduct video conferences, and exchange files using the Internet. In developing

and economically limited countries, audio-visual conferencing systems or suitable communication platforms are frequently not practical. WhatsApp serves as a tool for organization, facilitating the sharing of clinical data and providing guidance on clinical care (17). For example, in stroke care, it promptly alerts the multidisciplinary care teams about the arrival, location, and stages of evaluation concerning the condition of stroke patients (18).

Tele-neurology is implemented through innovative mobile technologies that provide real-time data tracking and assessments, creating a digital phenotype. This allows for the monitoring of biometric data in the patient's home while integrating electronic health records into the examination (19). Research is being developed to enable the use of smartphone technology to enhance measurements like tapping speed and tremor severity in Parkinson's disease, sensors for measuring electroencephalograms in individuals with epilepsy, and smartwatches that could detect and quantify seizures. Advancing technologies will persist in their expansion into tele-neurology with a personalized and targeted approach 7 (20). With the advancement of technology, this now includes international collaboration in telemedicine, which is being considered for application in tele-neurology. Tele-neurology has the potential to expand and disseminate, allowing low-income countries to access valuable consultations and healthcare knowledge for their increasing neurological conditions (21).

Previous Studies

Tele-neurology has shown considerable benefits for groups that do not have access to general and specialized neurological care, especially in rural regions, among individuals with limited mobility, and for military personnel who are deployed (22). About 41% of veterans in the Veterans Affairs healthcare system live in rural areas, and 27% of these individuals have a disability or chronic medical condition; nonetheless, their healthcare needs often go unaddressed (23). Outpatient clinics focused on community needs were established in rural towns throughout the U.S., allowing patients to receive remote assessments from specialists, such as neurologists. Veterans with chronic neurological conditions were provided with follow-up tele-neurology care, resulting in high levels of patient satisfaction concerning both convenience and quality of care (9).

Neurology providers indicated that tele-neurology matched the effectiveness of in-person follow-ups. This system achieved an average savings of five hours, and 325 miles traveled per patient, leading to a total cost reduction of $48,000 (9). Tele-neurology provides quality neurological care to rural veterans, improving patient satisfaction and reducing time and costs. Additionally, tele-neurology has demonstrated its effectiveness in the management of acute stroke care. For patients experiencing an acute ischemic stroke, the prompt administration of alteplase (tPA) within 4.5 hours of the onset of symptoms is essential for minimizing long-term disabilities. Rapid administration of tPA is associated with better long-term functional results and fewer complications (24).

Rural patients frequently face extended door-to-needle times, primarily due to delays in accessing stroke centers and the challenges healthcare providers encounter in identifying stroke symptoms. The TRUST-tPA trial created a tele-

stroke network that links ten community hospital emergency rooms to a stroke center. Eligible patients were assigned to either standard care, which involved transfer to the stroke center for intravenous regenerated tissue plasminogen activator (IV rt-PA), or to the tele-thrombolysis arm, where they underwent evaluation through tele-neurology, received IV rt-PA, and were subsequently transferred to a stroke center. The findings suggest that tele-stroke is suitable for patients unable to reach a stroke unit within the 4.5-hour timeframe (25).

A systematic review by Hier et al. (26) emphasized the potential of telemedicine for general and subspecialty neurological consultations, alongside stroke management. A study by Watila et al. (27) found that telemedicine patients reported comparable long-term satisfaction one year after evaluation for non-acute headaches. Additionally, a team in Northern Ireland showed that tele-neurology is appropriate for outpatient neurological referrals, and that live video consultations led to reduced hospital stays for neurological patients treated by non-neurologists in remote hospitals (28).

This study from Northern Ireland tackled the issue of the limited number of neurologists and the widespread rural population, where numerous individuals with neurological conditions receive care from general physicians rather than neurologists. This arrangement mirrors the Veterans Health Administration's strategy for rural veterans, creating a supportive environment for the implementation of telemedicine(29). Nonetheless, tele-neurology has demonstrated its effectiveness in urban environments, resulting in enhanced neurologist workflows, precise pre-hospital evaluations, and psychosocial assistance. In Long Beach, California, a tele-neurology program employed clinical video telehealth, facilitating interactions with patients at one of four local community-based outpatient clinics (30). Even with the brief distance, patients conveyed their contentment with the care they received and favored telehealth over traditional in-person appointments. The high adherence to appointments and the minimal occurrence of technical issues further demonstrated the effective implementation of tele-neurology in managing various neurological disorders in urban settings (3).

Even with the accessibility challenges posed by traditional in-person neurology care, including long travel distances and disabilities, a survey conducted among local physicians treating Parkinson's patients showed mixed feelings about endorsing telehealth visits (11). Numerous individuals indicated that they did not receive care recommendations from tele-neurologists; however, those who did found the suggestions advantageous and frequently put them into practice. Tele-neurology is steadily growing, as evidenced by a survey of neurology departments in the U.S. that highlights its use in acute stroke care, movement disorders, neurocritical care, and chronic conditions (22).

Furthermore, telemedicine has demonstrated its effectiveness as a valuable resource for elderly care, promoting emotional well-being, alleviating depressive symptoms, and enhancing social functioning and cognitive abilities (31). Innovations in communications infrastructure, internet access, and mobile phone penetration position telemedicine as a promising solution for effectively reaching low and middle-income countries, while also bridging the rural-urban divide in

access to specialized neurology services. While certain countries may not possess the expensive videoconferencing technology usually needed for immediate neurological assessments, “store and forward” techniques have been effectively utilized (32). An initiative launched between neurologists in the UK and a rehabilitation hospital in Bangladesh involved training a small team to send email referrals to UK specialists through a simple home email system. This successful initiative showcased that “store and forward” tele-neurology serves as a viable option for delivering neurological advice to clinicians in developing countries (33).

Tele-epilepsy & Tele-stroke

Epilepsy is a prevalent neurological condition affecting around 1% of individuals, with rural or underserved areas often facing difficulties accessing necessary resources. Tele-neurology services could provide a viable solution, as diagnosis and treatment heavily depend on patient history (14). The first full-time epilepsy telemedicine clinic in Western Canada showed high patient satisfaction, reduced costs, and comparable rates of seizures, hospitalizations, and emergency room visits compared to conventional clinics (3). New mobile technologies and remote monitoring solutions are being developed to reduce unexpected fatalities in epilepsy patients. Tele-epilepsy has the potential to improve follow-up care and quality of life for those living with epilepsy (34).

Stroke is a major public health issue in the US, causing around $30 million in medical costs and lost income annually. The main treatment for acute ischemic stroke is alteplase, which protects brain tissue. However, fewer than 5% of patients receive this treatment due to limited experience and limited access to care in rural or underserved regions (25). Tele-stroke has emerged as a promising solution, allowing patients to be referred to nearby satellite hospitals for evaluations through audiovisual conferencing (35). This method has shown a decrease in mortality, improved health outcomes, and effective treatment via video consultations. Research has also confirmed that tPA can be safely given via tele-neurology, facilitating specialized care in rural areas, increasing access to thrombolysis, and improving long-term functional outcomes (1).

Tele-radiology & Pediatric Neurology

Radiology and imaging studies are essential in neurology, aiding in the identification of specific brain infarcts or tumors that guide management decisions. Integrating tele-radiology into tele-neurology is crucial for its effectiveness (6). Tele-radiology showcases the collaborative essence of tele-neurology. Tele-stroke programs in rural areas are enhancing approaches to improve the delivery of thrombolytic therapy; one approach includes guaranteeing quick access to brain imaging for patients who arrive with a stroke (36). These images can be forwarded to a tele-neurologist or tele-radiologist, aiding in diagnosis and management strategies that may encompass remote thrombolytic therapy administration, remote rehabilitation evaluations, or additional diagnostic procedures such as carotid ultrasounds (22).

Numerous tele-stroke programs prioritize minimizing door-to-CT times, as prompt imaging is essential for assessing a patient's stroke condition.

Furthermore, ambulances equipped with mobile CT can provide hospital-level care to patients. This innovation facilitates imaging during transport and may enable the administration of thrombolytic therapy within the critical time frame, thereby reducing delays. The advancement of technology and smartphones has enabled the transmission of tele-radiology images to handheld devices, enhancing accessibility for tele-neurologists, radiologists, local providers, and others, thereby promoting quicker collaborative care (36).

Many pediatric neurological conditions require early diagnosis to avert related cognitive or behavioral difficulties (10). However, the majority of pediatric neurologists are located in urban settings, which poses challenges for rural families or those with restricted transportation access. The expenses can be quite high, often worsened by extended wait times for consultations with neurologists; for example, the greatest costs linked to childhood epilepsy arise in the first year after diagnosis, mainly because of hospital services. Nonetheless, these expenses might be reduced if straightforward cases were handled by general practitioners or pediatricians (37, 38).

A telemedicine approach has been proposed due to the limited knowledge of epilepsy management protocols among general providers. Following an initial evaluation, straightforward cases may be managed through telephone consultations with specialists, leading to decreased costs, shorter wait times, and less strain on specialists (14).

Results and Constraints

Tele-neurology offers significant benefits, such as lower in-person acute care costs, reduced institutional costs, and improved patient satisfaction. However, it also has limitations, such as high initial equipment and telecommunication infrastructure costs, the need for skilled operators, and limited access to electronic health records (30). Tele-neurology practices often restrict services to follow-up visits instead of new patient consultations. Neurological exams can be successfully performed through telemedicine, including the NIHSS stroke scale, plantar responses, facial strength, sitting balance, sensation, and gait. However, assessments such as eye movement, deep tendon reflexes, coordination, power, and rigidity produce more variable results. Asynchronous telemedicine offers a cost-effective solution for managing high-volume triage but lacks real-time history taking or live examinations (6, 9).

Legal factors also influence tele-neurology, with encryption essential for HIPAA compliance and patient privacy. Platforms like WhatsApp lack security and compliance due to vulnerabilities (3). Prescribing practices face restrictions, as practitioners must possess a license in the patient's state, limiting their ability to prescribe or order tests (22). Reimbursement presents a challenge, with Medicare's complex approach and insurers exclusively covering in-person consultations. There is currently no uniform framework for telemedicine reimbursement. Additionally, some clinicians believe that telemedicine undermines the personal connection essential to patient care, potentially impacting the doctor-patient relationship (19) (Table 2).

Table 2. Outcomes and challenges of tele-neurology implementation

Outcome/Challenge	Description	Evidence from the Text
Positive Outcomes		
Improved Patient Satisfaction	High satisfaction reported in various studies, particularly regarding convenience and quality of care.	Veterans' Health Administration study showing high satisfaction among veterans receiving tele-neurology care; studies on tele-epilepsy and pediatric tele-neurology also reporting high patient satisfaction.
Cost Savings	Reduced travel time and costs, lower hospitalization rates in some cases.	Veterans' Health Administration study showing an average savings of five hours and 325 miles traveled per patient, leading to a total cost reduction of $48,000; studies showing reduced hospital stays.
Improved Access to Care	Enables access to specialists in rural and underserved areas, bridging the geographical gap.	TRUST-tPA trial demonstrating effectiveness in providing timely stroke care to patients in rural areas; various studies highlighting improved access for veterans, rural populations, and those with limited mobility.
Effective Stroke Management	Tele-stroke programs demonstrating effectiveness in administering tPA within the critical time window.	TRUST-tPA trial showing tele-stroke as suitable for patients unable to reach a stroke unit within the 4.5-hour timeframe.
Challenges		
High Equipment Costs	Significant investment needed in technology and infrastructure.	Tele-neurology practices often restrict services to follow-up visits instead of new patient consultations. Neurological exams can be successfully performed through telemedicine, including the NIHSS stroke scale, plantar responses, facial strength, sitting balance, sensation, and gait.
Bandwidth Limitations	Reliable high-speed internet access is crucial, but not always available in rural areas.	Legal concerns regarding patient information sharing over public internet channels necessitate robust encryption to comply with the Health Insurance Portability and Accountability Act (HIPAA) standards and maintain patient confidentiality
Skilled Personnel	Requires trained	Legal concerns regarding patient

Outcome/Challenge	Description	Evidence from the Text
Positive Outcomes		
Needs	professionals to operate and maintain the technology, and to interpret the data.	information sharing over public internet channels necessitate robust encryption to comply with the Health Insurance Portability and Accountability Act (HIPAA) standards and maintain patient confidentiality
Legal and Privacy Concerns	Ensuring compliance with HIPAA and other regulations regarding patient data security.	Legal factors also influence tele-neurology, with encryption essential for HIPAA compliance and patient privacy. Platforms like WhatsApp lack security and compliance due to vulnerabilities
Reimbursement	Presents a challenge, with Medicare's complex approach and insurers exclusively covering in-person consultations.	There is currently no uniform framework for telemedicine reimbursement. Additionally, some clinicians believe that telemedicine undermines the personal connection essential to patient care, potentially impacting the doctor-patient relationship.

Recommendations for Tele-Neurology Implementation

Enhancing communication and incorporating local clinicians into a multidisciplinary model is crucial for maximizing the potential of tele-neurology. A shared health record that is accessible to both local and remote providers would allow for seamless access to patient data and enhance collaboration (11). It is essential to prioritize ongoing communication between local providers and tele-neurologists, utilizing a central telehealth system to enhance the efficiency of care. To enhance patient care, telehealth facilities could enable patients to consult multiple specialists in one visit. This thorough approach would minimize travel and improve collaborative care among neurologists, internists, and other specialists (6).

Tele-neurology methods need to be tailored to fit the local environment. In rural areas where infrastructure is dependable and there is a strong need for neurological services, video conferencing could offer essential access. In areas with constrained resources, such as certain regions of India or Africa, asynchronous approaches like phone or email consultations might be more practical. In these environments, creating connections between local providers and neurologists can enhance tele-education, allowing clinicians to obtain expert guidance on intricate cases (6, 20).

This model utilizes the knowledge of local providers regarding site resources and disease epidemiology, ensuring it is both cost-effective and adaptable to varying internet access conditions. Establishing networks that promote ongoing clinical case discussions and educational programs allows remote training providers to

subsequently improve local services, thereby bolstering the expansion of tele-neurology in underserved areas (5).

Conclusion

Tele-neurology serves as a significant and groundbreaking resource that improves healthcare amidst a worldwide deficit of neurologists along with other medical professionals. Patients enjoy advantages such as saving time and lowering travel costs. A physician also conserves time, encounters a broader range of patients, and experiences fewer appointment delays and withdrawals. The use of tele-neurology has surged significantly and is now commonly applied in areas such as stroke management, epilepsy treatment, neurological rehabilitation, pediatric neurology, outpatient consultations, medication refills, mental health assessments, and global neurology practices. While certain experts acknowledge the limitations of tele-neurology, it remains a valuable tool that opens new possibilities in contemporary neurological care. This review examines the development of tele-neurology use and the challenges that must be tackled to ensure that underserved societies can reap its benefits in the near future.

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فعالية الرعاية الصحية عن بُعد للأمراض العصبية المزمنة في المناطق الريفية أو المحرومة

الملخص

الخلفية: إن نقص أطباء الأعصاب في المناطق الريفية يحد من وصول المرضى، مما يجعل من الصعب على أولئك الذين يعانون من حالات عصبية تلقي الرعاية في الوقت المناسب. تعتبر المسافات الطويلة عائقًا، وغالبًا ما تؤدي إلى تفاقم النتائج الصحية. تهدف هذه المراجعة إلى تقييم المشهد الحالي لطب الأعصاب عن بُعد، من خلال فحص الخدمات الموجودة، وتقييم نتائج المرضى، وتحديد التحديات والمخاوف القانونية.

ال]lki: تجمع هذه المراجعة بين رؤى من دراسات وبرامج متعددة، مع التركيز بشكل خاص على مبادرات مثل نظام الرعاية الصحية عن بُعد عبر الفيديو (CVT) الذي أنشأته إدارة الصحة العامة للقدامى، مما يسمح لأطباء الأعصاب بتقديم الرعاية المباشرة للمحاربين القدامى. كما ننظر في برنامج السكتة الدماغية عبر الإنترنت الذي أنشأته جامعة كارولينا الجنوبية، والذي يمكّن أطباء الأعصاب من الإشراف على مرضى السكتة الدماغية الحادة في أقسام الطوارئ الريفية بالتعاون مع الأطباء المحليين. بالإضافة إلى ذلك، نستكشف الشراكات العالمية في الطب عن بُعد التي يتم تكييفها لطب الأعصاب عن بُعد.

النتائج: أظهر طب الأعصاب عن بُعد إمكانات كبيرة في تقديم رعاية عصبية عالية الجودة، مما أدى إلى رضا المرضى ووفورات ملحوظة في الوقت والتكاليف. أنشأ التجربة السريرية TRUST-tPA شبكة سكتة دماغية تربط بين عشرة غرف طوارئ في المستشفيات المجتمعية ومركز سكتة دماغية مركزي، مما يخدم بفعالية المرضى الذين لا يمكنهم الوصول إلى وحدات السكتة الدماغية ضمن نافذة الوقت الحرجة التي تبلغ 4.5 ساعة. تعزز خدمات طب الأعصاب عن بُعد الأخرى، مثل طب الأعصاب عن بُعد الخاص بالصرع وطب الأعصاب عن بُعد للأطفال، الرعاية اللاحقة للمرضى في المناطق النائية. ومع ذلك، لا تزال هناك تحديات، بما في ذلك ارتفاع تكاليف المعدات، وقيود النطاق الترددي، والحاجة إلى موظفين مهرة. تثير المخاوف القانونية بشأن مشاركة معلومات المرضى عبر قنوات الإنترنت العامة الحاجة إلى تشفير قوي للامتثال لمعايير قانون قابلية النقل والمساءلة عن التأمين الصحي (HIPAA) والحفاظ على سرية المرضى.

الخاتمة: يقدم دمج طب الأعصاب عن بُعد فرصة كبيرة لتعزيز إمكانية الوصول إلى الرعاية الصحية في المناطق التي تفتقر إلى خبراء الأعصاب. ومع ذلك، تواجه اعتماد هذه الأداة الرائدة قيودًا بسبب الضغوط المالية، ونقص المهارات التقنية، والعقبات القانونية، والحاجة إلى حوافز مناسبة لمقدمي الرعاية الصحية. تؤكد هذه المراجعة على نمو استخدام طب الأعصاب عن بُعد وتحدد التحديات الرئيسية التي يجب معالجتها لتعزيز مزاياه للمجتمعات المحرومة في المستقبل.

الكلمات المفتاحية: طب الأعصاب عن بُعد، السكتة الدماغية، إدارة الصرع، الأعصاب، النتائج، مراجعة الأدبيات