

# **Neurosurgery and Telemedicine in the United States of America: Assessment of the Risks and Opportunities**

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## **ABBREVIATIONS:**

CMS, Centers for Medicare and Medicaid Services

MSAs, Metropolitan Statistical Areas

Rt-PA, recombinant tissue plasminogen activator

US, United States

VHA, Veterans Health Administration

WHO, World Health Organization

## INTRODUCTION

Telemedicine—remote care of patients, aided by Internet-based or telephone-based telecommunications technology—has seen substantial growth in the last 20 years following technological advancements, evolving reimbursement policies, and increasing consumer demand. The risks and opportunities of neurosurgical telemedicine are both immense and complicated. Despite technological development, growing interest, and increasing reimbursement opportunities, telemedicine's utilization remains limited due to an unclear or unidentified need for telemedicine services, uncertain reimbursement policies, absence of interstate licensure reciprocity, lack of universal access to necessary technology, concerns about patient confidentiality, and limited precedent regarding liability issues.

The Veterans Health Administration (VHA) represents a healthcare system or organization where these concerns are largely eliminated. The VHA has established a prototypical model for telemedicine best practices. Results from the VHA demonstrate substantial cost savings and patient satisfaction with remote care. The VHA has developed a tele-management system for chronic neurological conditions. Two randomized controlled trials demonstrated that outcomes of tele-stroke care are comparable to standard stroke care, and prospective studies of neurosurgical "tele-trauma" have demonstrated reduced costs and comparable clinical outcomes (10,11,23). Overall, telemedicine is effective in many healthcare scenarios. The economic and clinical benefits of telemedicine will likely come from (a) diminished travel times and lost work time for patients, (b) remote consultation by sub-specialty experts such as neurosurgeons, and (c)

remote consultation to assist with triage and care in time-sensitive scenarios, including acute stroke care and tele-trauma.

## **BACKGROUND**

The United States (US) Health Resources Services Administration defines telemedicine as “the use of electronic information and telecommunications technologies to support long-distance clinical healthcare,” aided by technologies that include “video conferencing, the Internet, store-and-forward imaging, streaming media, and terrestrial and wireless communications” (16).

While early accounts of telemedicine practices include the transmission of electrocardiograph data over telephone wires in 1906, the advent of the Internet and the widespread availability and advancement of information and telecommunications technology has resulted in the substantial growth of telemedicine in recent years (34). Clinicians now have the ability to interact directly with patients in real time, in remote locations, and in a variety of contexts via high-definition audio and video.

Recent legislative efforts have supported the wider adoption of telemedicine practices. The Patient Protection and Affordable Care Act (a.k.a. Obamacare) includes provisions that attempt to develop telemedicine in several ways. In part, the law directs the Center for Medicare and Medicaid Innovation to investigate opportunities for innovation in the realm of telemedicine, and develops tele-homecare through the Independence at Home Demonstration Program. Further, the law encourages accountable care organizations (ACOs) to incorporate telemedicine practices. H.R. 2, the bill responsible for repeal of the Sustainable Growth Rate, included a provision

directing the Government Accountability Office to study barriers to telemedicine and remote patient monitoring services.

## **RISKS**

Despite these legislative efforts and technological advancements, widespread adoption of telemedicine has not been fully realized (6). In its landmark report on quality in healthcare published in 2001, the Institute of Medicine identified integration of information technology in general—and telemedicine in particular—as an area in which the US healthcare system had not met its potential. The authors wrote that information technology had a role to play in achieving each of their “six aims”—safety, effectiveness, patient-centeredness, timeliness, efficiency, and equity (19). And yet, in a review of all 2009 Medicare claims, there was a total of only 38,000 telemedicine visits, or about 1 visit for every 1,100 Medicare beneficiaries (15). There are several commonly cited reasons for telemedicine’s limited utilization. These include an apparent lack of need for telemedicine services (15), lack of widespread reimbursement (15,17,20,30), lack of interstate licensure reciprocity (15,17,20,30), lack of universal access to necessary resources and technology (15,17,30), concerns about maintaining patient confidentiality (15,20), and concerns and limited precedent regarding liability issues (6,15,20,30). These represent the risks to implementation, and we will address each of them in turn.

### **Apparent Lack of Need for Telemedicine Services**

Some researchers have expressed concerns that adoption of telemedicine is premature, that it is being employed despite a lack of quality evidence (18). Studies of both cost-effectiveness and

clinical-effectiveness have been quite mixed, with few firm conclusions (13,31). A review of 80 relevant studies conducted between 1966 and 1996 concluded that telemedicine is beneficial in the areas of preventive care and the management of osteoarthritis, cardiac rehabilitation, and diabetes care (5). A more recent large systematic review found that in some contexts telemedicine is shown to be effective, in others it is promising, and in others still evidence is limited or inconsistent (13).

Well-designed studies addressing neurosurgical care protocols in telemedicine , particularly its safety and efficacy, are certainly lacking. To date, relevant literature relates mostly to tele-trauma and tele-stroke. There is some evidence of cost savings and comparable outcomes in these contexts. For most neurosurgical applications, however, economic analyses are difficult as they may apply to a relatively small number of patients, and those patients that stand to benefit the most from telemedicine may lack easy access to researchers who wish to evaluate outcomes such as quality-of-life measures.

### **Lack of Widespread Reimbursement**

The Balanced Budget Act of 1997 requires that healthcare providers—including neurosurgeons—be reimbursed for remote telemedicine consultations provided to Medicare beneficiaries (15). Several restrictions were imposed, however, including that patients be located in *rural* Health Professional Shortage Areas, the assumption being that these individuals generally have limited access to specialist physicians such as neurosurgeons. In 2001, the Benefits Improvement and Protection Act relaxed some regulations on telemedicine, increased payments, and expanded the services covered (15). In 2006, 2008, and 2011, the Centers for

Medicare and Medicaid Services (CMS) again expanded the types of telemedicine services covered by Medicare (15), and in 2014, CMS re-defined *rural* to not only include rural areas outside of Metropolitan Statistical Areas (MSAs) but also the smaller rural areas within MSAs. Despite these efforts to broaden services, reimbursement through Medicare is not universal at this point, with specific checks placed on payment for services provided to urban-dwelling patients. Furthermore, to date, Medicare only reimburses services initiated in designated health centers.

The Medicare Telehealth Parity Act of 2015 (H.R. 2948), introduced in Congress in July 2015, would, if passed, expand reimbursement to patients residing in MSAs with populations of up to 100,000 individuals. The bill would also allow reimbursement for certain services initiated in a patient's own home.

With respect to state-level policies, which affect reimbursements for Medicaid beneficiaries and privately insured patients, the medico-legal environments related to telemedicine are widely variable (7,27). It is worth noting that some states have adopted "parity laws," which effectively require private health insurers to cover telemedicine services by banning face-to-face contact as a requirement for reimbursement. The American Telemedicine Association has published a thorough online synopsis of telemedicine reimbursement policies at the state-by-state level, which may serve as a resource for any provider interested in developing a telemedicine practice (2).

### **Lack of Interstate Licensure Reciprocity**

Currently, each state is unique and independent with respect to medical licensing of physicians, and reciprocity of licensure does not exist between states. This represents a major barrier to the growth of telemedicine. In his review of the medicolegal implications of telemedicine, John Blum noted that “there have been no opinions issued by state boards that electronic diagnosis and treatment is not a form of medical practice,” implying that medical licensure in a particular state is a prerequisite to providing telemedicine services in that state (7). Blum also noted that “in states that have taken actions against physicians for Internet prescribing violations, the actions were directed against out-of-state physicians, based on the fact that these individuals were engaged in a form of medical practice, namely writing prescriptions, without a license” (7). It seems likely that telemedicine services involving diagnosis and treatment that are provided across state lines would mandate licensure in two states—the state in which the patient is located and the state in which the physician is located. (Medical *consultation* is a common exception and the requirements for tele-consults are somewhat less clear.)

The Interstate Medical Licensure Compact is an effort to alleviate some of the barriers presented by the existing licensure environment. The initiative expedites the process for a physician licensed in one participating state to become licensed in another participating state. Participation in the Compact requires legislation to be passed at the state level. While specific language of the relevant legislation may vary from one state to another, in general the Compact “adopts the prevailing standard for licensure and affirms that *the practice of medicine occurs where the patient is located at the time of the physician-patient encounter*, and therefore, requires the physician to be under the jurisdiction of the state medical board where the patient is located”

[emphasis added] (14). To date, 11 states have passed and 9 additional states have introduced Compact legislation.

At the federal level, the TELE-MED Act of 2013 (H.R. 3081) and the TELE-MED Act of 2015 (S. 1778) have been introduced in Congress and, if passed, would allow providers licensed in one state to provide telemedicine services to Medicare patients in a different state, thus eliminating the need for neurosurgeons and other physicians to obtain licenses in multiple states in order to provide diagnostic and treatment services via telemedicine. It is worth noting that the precise definition of *telemedicine* as it applies to this bill has not yet been determined. Establishing such a definition is a provision of the bill. The House bill was referred to the House Subcommittee on Health in September 2013 and the Senate bill was introduced in July 2015.

As legislative activity proceeds, it is very likely that licensure-related barriers to the practice of telemedicine will become less relevant over time, and opportunities for neurosurgeons will increase.

### **Lack of Universal Access to Necessary Resources and Technology**

The process of establishing a telemedicine practice varies depending on the setting, but recommended steps include site assessment to determine space utilization, equipment selection, network design, installation of telemedicine equipment and lines, training of key personnel, providers, and staff, continuing education and technical services and support to address any technological issues (8). In short, the process involves substantial initial and ongoing investment of time and resources.



Many healthcare providers may be reluctant to invest in the resources necessary for startup and maintenance of a telemedicine service, given the fact that Medicare payment for remote services is equal to payment for face-to-face care. This may be one reason that non-physician providers—including nurse practitioners and psychologists—initiate many of the current telemedicine services to Medicare patients; the opportunity costs are lower for these providers as compared to physicians, especially neurosurgeons (15). Neurosurgeons working within large hospitals or health systems may be more likely to develop telemedicine practices due to economies of scale and the opportunity to share resources across their institution. Some large health systems even have support teams specifically dedicated to helping physicians develop telemedicine practices.

### **Concerns about Maintaining Patient Confidentiality**

Both patients and providers may have concerns about patient confidentiality in the telemedicine context. There are several essential components of a routine telemedicine encounter that help to ensure confidentiality as well as assuage concerns. First, it is important that the provider obtain consent that is specific to the telemedicine encounter. Included in the consent process should be an explanation of the potential uses of any electronic medical record or video recording of the encounter and who will have access to it (28). Second, each telemedicine encounter should begin with confirmation of the identity of both provider and patient, perhaps even to include the display of photo identification. Third, the provider is responsible for ensuring the secure transmission and storage of electronic data and media, at least at the provider's end of the network. The provider should also inform the patient of the significance of a secure versus unsecure network, despite the fact that the provider may have no control over the security of the

patient's end of the network. Ideally, both patient and provider devices and equipment would be appropriately secure. Special considerations may be applied to emergency telemedicine care, but the same basic principles apply (25). The American Telemedicine Association publishes detailed technical and privacy guidelines (1).

### **Concerns and Limited Precedent Regarding Liability Issues**

There are two important legal principles that apply to telemedicine, and these were considered in detail by Blum in a 2003 paper on law and "Internet medicine." First, "the courts do not require physical presence as a prerequisite for a legal relationship to be established between physician and patient," and second, the use of telecommunications technologies "for diagnosis and treatment, can be classified as medical practice" (7). At the very least, therefore, neurosurgeons providing care via telemedicine are exposed to liability equivalent to that of traditional care providers. In the absence of comprehensive tort reform, liability is likely to remain a major concern. For neurosurgeons with inherent high medical liability risk, participating in telemedicine consultations without the opportunity for substantial reimbursement may not be worthwhile.

### **OPPORTUNITIES**

The economic and clinical benefits of telemedicine will likely come from (a) diminished travel times and lost work time for patients, (b) remote consultation by sub-specialty experts, such as neurosurgeons, and (c) remote consultation to assist with triage and care in time-sensitive scenarios (15), such as acute stroke care and neurosurgical tele-trauma, including opportunities

to determine whether expensive transfers from community hospitals to tertiary or quaternary care centers are required. The VHA has reported success with providing remote care for chronic neurologic conditions to patients living in rural areas, including patients with movement disorders who had undergone deep brain stimulation (9). Ninety-two percent of surveyed patients reported that the telemedicine service saved them time, money, or both, and the authors estimated total savings of over \$48,000 in time and travel costs for 354 patients. Patient response was overwhelmingly positive, with 95% of patients reporting that they wished to continue their neurological care via telemedicine.

Several studies in the US have demonstrated cost reductions without compromising outcomes when using telemedicine to manage neurosurgical emergencies, including intracranial hemorrhage and neurotrauma (4,12,24). For the most part, cost savings were achieved by avoiding unnecessary, expensive transfers to tertiary care centers from outlying hospitals. Similar results with emergency neurosurgical consultations have been demonstrated internationally (3). Findings are not entirely consistent, however. For instance, a study at a Hong Kong hospital in which emergency neurosurgical consults were randomly assigned to tele-radiology, telephone-based consultation, or video-based consultation did not demonstrate significant differences between the 3 groups with respect to transfer rates, favorable outcomes, or costs, though the tele-radiology group did experience reduced mortality (33).

The feasibility of telemedicine services in the evaluation and management of acute ischemic stroke is well-established. Tele-stroke care allows for live video communication with patients and referring physicians and is particularly applicable to making time-sensitive decisions with

respect to thrombolysis. Two randomized controlled trials have investigated the practice, comparing tele-stroke care to telephone-based consultation (10,23). A pooled analysis of the trial results demonstrated improved decision-making with respect to administration of recombinant tissue plasminogen activator (rt-PA) and an overall rt-PA use of 26% with tele-stroke. There were no significant differences between the two groups with respect to mortality rates, outcomes, or hemorrhage (11).

### **Case Study: The Veterans Health Administration**

The VHA was an early adopter of telemedicine and operates robust remote services for its patients (22,29). The system is a good example of how telemedicine can develop in the absence of barriers related to licensure, start-up, and malpractice liability (22,29). For VHA providers, the infrastructure for telemedicine has already been developed. VHA physicians are able to treat patients at any VHA hospital throughout the country, regardless of where they are licensed. Consequently, in 2013 the VHA conducted 202,823 video consultations and provided services to 90,000 patients in their own homes (29). Studies of VHA patients have found that telemedicine resulted in a 25% reduction in hospital days, a 19% reduction in hospital admissions, and is a cost-effective method of improving patient satisfaction (26). While little has been published about neurosurgical telemedicine within the VHA system, the characteristics noted above mean that the telemedicine environment within the VHA system is as friendly to neurosurgeons as it is to other providers, and could provide the perfect context to explore the utility and efficacy of neurosurgical telemedicine.

## **BEYOND THE UNITED STATES: TELEMEDICINE ACROSS THE WORLD**

Akin to telemedicine practice in the US, challenges to implementation and durability exist throughout the world. The World Health Organization (WHO) cites several specific barriers (32). In the developing world, technological limitations include the lack of reliable Internet access outside of large cities, inadequate bandwidth for high-resolution images or videoconferencing, and the fact that tropical climates may not suit the necessary technical equipment. Start up and maintenance costs also represent a barrier—both real and perceived—in low-income contexts. The WHO further cites several human and cultural factors that apply particularly to low-income countries. These include resistance to a system that disrupts traditional or indigenous medical practices, lack of technological literacy, and linguistic and cultural differences between patients and remote providers. In high-income countries, barriers to development of telemedicine practices overlap significantly with those barriers identified in the US. In particular, the WHO cites a shortage of studies demonstrating the economic benefits and cost-effectiveness of telemedicine, and insufficient policies and legal statutes governing telemedicine practice within and across international borders.

Clearly the barriers to telemedicine are having a greater impact in the developing world than in high-income countries, as evidenced by a 2010 WHO report noting that only 10-15% of responding countries in the Eastern Mediterranean, South-East Asian, and African Regions reported having a national telemedicine policy, whereas 40% of European countries reported having such a policy. In general, African countries were the least likely to report established

telemedicine programs, at only 10%. Meanwhile 50% of European countries and 75% of Southeast Asian countries reported established programs (32). That said, technological advancements and decreasing costs of basic telemedicine technologies have made the practice of telemedicine feasible even in many low-resource settings.

The opportunities presented by telemedicine internationally include those benefits applicable to the US—namely, the potential to reduce costs to patients and improve quality and accessibility of care, particularly for patients in remote or underserved settings—as well as some benefits that are uniquely applicable to low-resource settings. For instance, Zbar and colleagues argued for telemedicine as an educational tool, a “university without borders” (35). Potential learning opportunities go both ways. Providers in low-resource settings can learn from remote world-class specialists. Conversely, students and providers at medical centers in the developed world gain exposure to diseases that may be uncommon or neglected in their context, such as malaria or tuberculosis. Others have argued that telemedicine might counter loss of human capital—or “brain drain”—from low-resource settings by overcoming geographic barriers and enhancing international collaboration (32). Martinez et al. also advocate for telemedicine and its associated technologies as an aid to epidemiological surveillance (21).

Some of the most advanced telemedicine practices have been developed outside of the US. For instance, Norway’s teleECG program was developed in the 1990s as a means of transmitting ECG data to cardiologists from ambulances and patients’ homes. The specialists are therefore able to make a diagnosis and recommend initial treatment—including thrombolytic therapy—prior to the patient’s arrival at treating hospital. The program’s success was due in part to proper

training, careful attention to roles and responsibilities of each participating provider, and clarity regarding liability (32).

## **RECOMMENDATIONS**

Though telemedicine is not proven to be beneficial in every context, its successful application in multiple settings is evident. There are many good reasons to continue to reduce the barriers to its widespread application. At this point, there is no strong indication that broader adoption would put patients at risk. Rather, history suggests that providers will implement the practice judiciously. Market forces are likely to refine telemedicine's scope as questions are answered about overall cost-effectiveness, clinical-effectiveness, and patient satisfaction. In large part, these questions can only be definitively answered in the context of real-world practice. To this end, in the United States, H.R. 2948 should be adopted into law in order to expand reimbursement opportunities for telemedicine practices. Whether through an expansion of the Interstate Medical Licensure Compact, passage of H.R. 3081 and S. 1778, or a combination of the two, lawmakers should pass legislation that will allow physicians to treat patients across state borders, at least in the context of telemedicine. CMS should develop registries to study outcomes, cost-effectiveness, and adverse events associated with telemedicine. These should include data not only from Medicare patients but also from Medicaid patients, which would allow for comparative evaluations of state-level policies. These evaluations would in turn inform the utility of more consistent adoption of telemedicine practices by individual states and private insurers. State medical boards and medical professional organizations should develop guidelines for safe but progressive use of telemedicine. Finally, neurosurgeons and other providers should

look for opportunities to implement telemedicine practices when these practices best serve the needs of their patients. We caution our neurosurgical colleagues in particular not to interpret the paucity of data related to neurosurgical patient management as a sign that telemedicine does not have a role in our specialty. Many of the potential benefits of telemedicine apply just as well to our patients as to those being cared for by other specialists.

## **CONCLUSIONS**

Telemedicine is effective in many healthcare scenarios and will only become more relevant to neurosurgical patient care. Adam Darkins, a neurosurgeon and director of the VHA's national telemedicine programs, has said of telemedicine: "It will be the way healthcare is provided. I don't think we'll call it anything. It will just be healthcare" (29). Implementing legislation to reduce barriers to telemedicine's growth is an appropriate step in this direction. As applications expand, however, it behooves neurosurgeons to consider the sentiment emphasized by Sokol and Molzen—namely, that physicians should implement telemedicine and other new technologies judiciously and in ways that meaningfully affect patient care (27). Published standards of care and technologies in isolation do not determine the best care for every patient, and the legal liability standard should not be premised on such an assumption. As physicians and as neurosurgeons, we recognize that medicine is both an art and a science. With this in mind, through the integration of telemedicine and other health information technologies we will be better able to provide safer and more effective, efficient, and patient-centered healthcare.



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