Telerehabilitation: Policy Issues and Research Tools

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Abstract

A number of experts recognize the importance of public policy as a complementary framework for telehealth, telemedicine, and by association, telerehabilitation. The purpose of this paper is to report on the current state-of-the-science on telerehabilitation (TR) policy and research methodology and make recommendations about future research needs. We conducted an extensive search of the literature via search terms grouped into the main topics of telerehabilitation, policy, population of users, and policy specific issues such as cost and reimbursement.
The availability of rigorous and valid evidence-based cost studies emerged as a major challenge to the field. Existing cost studies provide evidence that tele-homecare may be a promising application area for TR. Cost studies also indicate that tele-psychiatry is a promising telepractice area. Notably, the literature did not reference the International Classification on Functioning, Disability and Health (ICF).
We concluded that outcome studies characterized by rigorous and comprehensive TR assessment and evaluation are required to generate confidence among providers, payers, clinicians, and end users. Study criteria must comprehensively assess consumer satisfaction and participation via medical, functional, and quality of life items such as assistive technology and environmental factors.

Introduction

The importance of public policy as a complementary framework for telehealth, telemedicine, and by association, telerehabilitation, is recognized by a number of experts (Weinstein et al, 2008, Wipf and Langner, 2006). Government health policy objectives address quality, cost, and access to health service resources, and both the US government and the research community employ policy analysis and evaluation to determine the efficacy and efficiency of policies as a basis for decisions about resource allocations. The purpose of this paper is to review literature on telerehabilitation (TR) policy and research methodology, to report on the current state-of-the-science, and to make recommendations about future research needs.

The population of interest for this review is people with disabilities across the age span. While few data systems identify people with disabilities as a subpopulation, research shows that this group requires enhanced healthcare services. Indeed, Healthy People 2010 (U.S. Centers for Disease Control, n.d.), described people with disabilities as a possible underserved population with larger-than-average health services utilization. People with disabilities were more likely to evidence excess weight, reduced physical activity, increased stress, and less frequent mammograms for women over age 55 years.

Because the percentage of the population that is disabled and has chronic disease increases sharply with age, the number of persons needing health care assistance because of a disability is projected to increase dramatically (Cruise & Lee, 2005). In turn, unless society adopts innovative strategies that curb costs, a heightened demand for health services threatens to increase healthcare spending to unsustainable levels. Therefore, the aging and disability demographic may provide an incentive for the adoption of new and innovative health care delivery approaches such as telerehabilitation (TR) (Waters, 2005, Waters, 2008a, Waters, 2008b).

Background

Definitions

This review uses the term telehealth as a generic designation for the telehealth fields that include telemedicine and telerehabilitation. Practitioners have long recognized the potential contributions that telehealth might make to equitable access to services, especially to rural and remote populations (Scalvini, Vitacca, Paletta, Giordano, & Balbi 2004). TR policy is largely, but not exclusively, embedded in telehealth and telemedicine policy. In response to evolving telepractice, the U.S. government agencies that administer telehealth, telemedicine, and telerehabilitation programs developed operational definitions of these terms.

Telehealth refers to the use of electronic information and telecommunications technologies to support long-distance clinical healthcare, patient and professional health-related education, public health and health administration (U.S. Department of Health and Human Services Health Resources and Services Administration n.d). Telehealth delivery systems involve a complex set of elements that show considerable variability by technology, organizational models, clinical practice and assessment and evaluation tools. Technologies typically used in telehealth include videoconferencing, the Internet, store-and-forward imaging, streaming media, and terrestrial and wireless communications (Center for Information Technology Leadership, 2007).

Telemedicine is the use of telecommunications technologies to help deliver healthcare services such as patient care and telemonitoring (Telemedicine Information Exchange, 2005). Individuals with disabilities access health care using a variety of delivery systems ranging from acute medical/surgical hospital units to systems of care located in the home (Cruise & Lee, 2005). Telemedicine applications might include use of computers to transmit data and images and/or use of two-way interactive video; these applications would enable isolated rural patients to receive medical advice from a doctor hundreds of miles away (U.S. Department of Health and Human Services Health Resources and Services Administration, 1994). The practice of telemedicine includes devices that serve a myriad of clinical and patient objectives such as monitoring, diagnostics, communications, and patient records. Current public policy does not offer standard guidelines for the coverage of devices that may include video cameras, phones, pagers and decision support tools (Waters, 2007).

Telerehabilitation (TR) has been defined by the Rehabilitation Engineering Research Center on Telerehabilitation (2007) as the remote delivery of rehabilitation and home health care services. TR services may include applications such as consultations, homecare, monitoring, therapy, and direct patient care delivered to various locations including home, community, health facility and work settings (RERC on TR, 2007, Rosen, 2004, Winters, 1999). The TR literature shows a broad appreciation of TR's capacities to serve populations that traditionally require physical rehabilitation (e.g., persons with stroke, spinal cord injury, traumatic brain injury or multiple sclerosis) as well as persons with communication, swallowing, hearing disorders and/or psychiatric disorders (Baron, Hatfield & Georgeadis, 2005, Theodorus and Russell, 2008, American Telemedicine Association Special Interest Group, 2006, Galea, , Tumminia & Garback, 2006, Baron, Brooke & Georgeadis, 2005, Demiris, Shigaki & Schopp, 2005 ; Egner, Phillips, Vora & Wiggers, 2003, Kinsella, 1999, DeLisa, 1998 McCarthy & Fox,2007). TR may optimize the timing, intensity and sequencing of intervention and provide opportunities for individuals to continue to receive rehabilitation in their own social and vocational environments. While a literature review of policy and methodological publications will be discussed later, it is appropriate now to note that resolution of policy and methodological issues are made more challenging by their relationship to complex and often-unresolved health care systems and a myriad of technical and professional issues that often lie outside the public policy domain.

System Complexity and Technical and Professional Issues

Telemedicine systems vary by population served, location, organizational model, technology, clinical protocols and evaluation frameworks. This diversity creates challenges for the design and conduct of cost and other studies that have "real world" reliability. Bashshur and colleagues (2005) observed that because the telemedicine field is in constant flux, it is difficult for researchers to conceptualize and measure operating systems. Technological systems and configurations are dynamic and telemedicine organizational program models diverse, ranging from a single specialty service within a single delivery system, such as telerehabilitation, to multispecialty, multisite network that offers a full range of medical and diagnostic services. Jennett and Andruchuk, (2001) identified key factors necessary to the successful integration of telehealth in the Canadian system: (a) needs analysis; (b) business plan; (c) equipment; (d) evaluation; and (e) technical and professional policy standards. Theodorus and Russell (2008) noted that some barriers and issues are generic to telehealth, such as professional portability and training. Other issues are more specific to the advancement of TR, such as degree of physical contact required in rehabilitation therapy, patient characteristics, and the availability of assessment and treatment tools that can replicate face-to-face practice. Researchers employ assessment and treatment tools to collect data for the outcome studies that are necessary to assess costs and benefits. In turn, evidence about costs and benefits is important to decisions about reimbursement.

History

While the term telerehabilitation is relatively new, applications of telemedicine have a longer history going as far back as the 1880s when some physicians experimented with telecommunication technologies after the invention of the telephone in 1876 (Scalvini, et al, 2004). The U.S. government first supported telemedicine through services provided by agencies such as the U.S. Department of Veterans Affairs (VA), (U.S. Department of Veterans Affairs). The first recorded use of telemedicine in the VA was in 1957 for a telemental health project in Nebraska (Cooper et al, 2001). During the 20 years that ensued, other projects followed and flourished, leading the VA to begin its major systematic implementation of telemedicine in 1997. The VA began using the broader, more encompassing term telehealth in place of telemedicine in 2003. Telemedicine is now a subset of VA telehealth, with VA telehealth incorporated as one part of the wider rubric of VA care coordination. As of 2005, many of the Veteran's Health Administration's (VHA) twenty-one Veteran's Integrated Service Networks (VISNs) were using some sort of TR technologies at VA medical centers and healthcare systems. These facilities use TR to augment services to community-based outpatient clinics (CBOCs) and Vet Center programs. They also connect to each other to provide both intra- and inter-VISN TRH referrals and specialty consultations, thereby providing rehabilitation care with direct services to veterans at home via videophones and remote health-monitoring devices (Department of Veterans Affairs).

In 1998, the National Institute on Disability and Rehabilitation Research (NIDRR) in the U.S. Department of Education, funded the nation's first rehabilitation engineering research center on TR. NIDRR initiated research on TR as a complement to telemedicine and in response to a service delivery gap that emerged when managed-care policies truncated the length of inpatient rehabilitation stays. NIDRR also recognized the potential benefits of TR in areas of primary and secondary prevention for people with disabilities across the life span, health cost containment, and vocational rehabilitation.

For the past 15 years, most non-veteran, federally funded telehealth programs have targeted rural populations, often with an emphasis on older adults (U.S. Department of Health and Human Services Health Resources and Services Administration). For example, the Office for the Advancement of Telehealth (OAT) in the Health Resources and Services Administration (HERSA) supports the Telehealth Network Grant Program's efforts to develop capacity for telehealth in rural areas for the medically underserved areas to improve and coordinate healthcare services. The Office of Rural Health Policy, HRSA, supports Rural Health Care Services Outreach Grant programs. The U.S. Department of Agriculture supports the Rural Development Distance Learning and Telemedicine (DLT) Loan and Grant Program (U.S. Department of Agriculture).

Methodology

As a preliminary step, we queried telerehabilitation researchers at the Rehabilitation Engineering Research Center on Telerehabilitation to determine the policy issues that were important to their research and development projects. We also examined the websites of special interest groups on telerehabilitation, telemedicine, and telehealth (i.e., American Telemedicine Association and the Rehabilitation Engineering and Assistive Technology Society of North America) to identify TR policy issues and research approaches. Using the results of these inquiries for guidance, a literature search strategy was developed and implemented. The searches resulted in close to 1,000 citations, approximately 10 percent of which pertained to telerehabilitation but not necessarily to public policy. The titles and abstracts were reviewed, and approximately 325 abstracts selected for further consideration. Of these, we reviewed approximately 70 full articles.

The search began with Ovid Medline (1950-2008 file) since it is the premier medical database and has the controlled vocabulary MeSH (Medical Subject Headings). CINAHL (Cumulative Index to Nursing & Allied Health Literature), covering 1982 to 2008, and PsychINFO, covering 1967-2008, were also searched using the Ovid interface.

The Advanced Ovid Search mode (with the "Map Term to Subject Heading" feature) was used in each of the above databases. This provided the user with suggestions for a possible subject heading when a non-subject heading term was entered. Additional search terms were located using the scope notes and the vocabulary trees for the controlled vocabulary. The terms were grouped into main topics: telerehabilitation; policy; population of users; and a final one whose terms incorporated licensure, liability, and reimbursement. Known authors as well as known institutions make up the last two sets. These sets were then used in different combinations. When available, the terms were searched as subject headings, and when not available, they were searched as keywords using the .mp. command. Institutions were searched using the field code .in., for institution, as well as .mp.

The Scopus database contains citations from the scientific, technical, medical, and social sciences disciplines. The bulk of the references in Scopus ranged from 1996 to the present with some going back to the 1800s. A list of all the terms searched (e.g., subject headings, keywords, institutions) was created in MSWord, and are included in the Appendix. Using the Advanced search box in Scopus the field code ALL was used for each term. In Scopus the ALL field command searches the abstract, affiliation, source title author, title, references, index terms and others. Again, the terms were placed into groups, such as policy and population. Each set was saved and used in various combinations. While Scopus gives results from reference lists, websites

and patents, only those from the main result tab were examined. These included citations from journals, conferences, books and dissertations.

The University of Pittsburgh has the ability to perform a federated search of databases in a particular discipline. The subjects of economics, government, international affairs, law and legal studies, sociology, and Western European studies were searched with the same terms used in the previous databases. Finally, a search was performed in the Telemedicine Information Exchange (TIE) produced by the Association of Telehealth Service Providers. While the TIE is only current up to 2006, it provided a check on the legislative, law and policy information already gathered.

Articles included for review, had in the title or abstract, an actual mention or association with public policy and policy evaluation and research methods. Associational terms included: licensure, payment structure (particularly reimbursement), law, legislation, or regulation. Articles that mentioned Medicare, Medicaid and other government programs or agencies were also selected from the retrieval. Initially the retrieval was limited from 1996-2008. In Scopus, where the retrieval was rather large, the dates were narrowed to 2001-2008 and review articles. Exclusion criteria included articles dealing with engineering and technology, medical and clinical interventions, adults under the age of 65 and children (unless they had a disability), and articles not in English.

Results

While there was a modest body of telerehabilitation literature on policy and policy methodology issues, there was a larger body of telehealth and telemedicine literature. Policy issues were often subsumed in sections within articles and other publications that address other topics. These articles routinely identified the following as important policy issues: cost, reimbursement, privacy and informed consent, fraud, liability, licensure, and systems security. With the exception of cost and reimbursement studies, the policy literature was largely descriptive and practical, often providing perspectives on strategies to generate a more supportive policy framework for telehealth, telemedicine and telerehabilitation.

Telehealth literature originated from locations around the world, particularly resource-rich countries such as the United States, Canada, Australia, Singapore and those located in Europe. The literature spans jurisdictional and interjurisdictional levels including global systems, regional, country and local or even multiple levels (Pak et al 2008, Scott, Chowdhury & Varghese, 2002). In the United States, the Center for Telemedicine and e-Health Law (CTeL) (2005) and the American Telemedicine Association (2008) are among the organizations that have provided leadership in stimulating the generation of literature addressing research and practical perspectives on telehealth law, legislation, regulation and policy issues on the federal and state levels.

Literature Addressing General Policy Issues and Their Context

Theodorus and Russell (2008) provided an overview and perspective on the current state of telerehabilitation. They observed that while it may be possible to deliver rehabilitation services around the world, many key policy issues must be addressed. These issues, representative of those identified in other articles are: a) licensure and certification across state and national borders; b) equivalence of international clinical standards; c) regulation on privacy issues and the access and protection of patient health information; d) issues on costs and remuneration of services; e) liability and accountability; and f) unification of international rules effecting clinical consultations. Theodorus and Russell noted that while a number of international organizations, such as the World Health Organization and the World Trade Organization, are entering the debate, there is a lack of leadership and focus on e-health policy.

Jennett, Scott, Affleck, Hailey, Ohinmaa, Anderson, C. et al (2004) reviewed the policy implications associated with the impact of telehealth on socioeconomic and health systems in Canada. They argued that telehealth cannot be viewed simply as an add-on service. Telehealth must be sensitive to not only cost and reimbursement issues but also issues such as social isolation, life stress, and poverty. Dena Puskin (2001, Puskin & Urka 1999) a U.S. telehealth policy specialist, observed that patients and clinicians living in rural and underserved areas will benefit from Telehealth and Telerehabilitation. However, adoption is slow because of policy and methodological barriers, such as standards and evaluation and policy lags caused by technical standards and requirements of the Health Insurance Accountability and Portability Act (HIPAA). Also reaching back to 1999, Jack Winters elaborated on the now familiar litany of policy issues and barriers as follows: a) payment structures and reimbursement mechanisms do not support telehealth services; b) liability and whether or not the clinician, the provider or the telecommunications company is liable; c) quality standards for devices; and d) licensure and practice across U.S. state lines. In a later review, Whitten and Sypher (2006) observed that the field has common barriers, especially the HIPPA requirements, with severe financial penalties for violations.

A number of articles employed ethics and the socio technical aspects of telehealth as a “portal” to address policy issues. The content of these articles tended to be more philosophical. Authors were particularly sensitive to the vulnerability of disabled people and older adults, groups that require accessible technology to access health information (Powell & Lowe, 2005) and enhanced protection when serving as research subjects and as patients (Lehoux & Blume, 2000, Marschollek, et al, 2007, Marziali, Dergal, & McCleary , 2008). The homecare ethics literature reflected a general appreciation of the potential of remote delivery of homecare services to increase

equitable distribution of health care resources, while also expressing concerns about the impact of a shift in service location on accountability and reportage, privacy (including family privacy), and the potential for a shift of workload from professionals located in health facilities to caregivers located at home. Authors also expressed the need for policy guidance that addresses functional and quality of life factors in clinical assessments, and recommended that technical and clinical systems be held accountable through reports about services delivery and technology performance. Kaplan and Litewka (2008), for example, identified the following policy-related problem areas: a) abridgement of privacy by inducing combining and mining data and implications of new technology on informed consent; b) inaccurate and obsolete data; c) security breaches; d) usability and user friendliness; e) data standards and integration for linking patient and personal information to achieve interoperability of individual records, personal health management and public health; f) systems design and deployment decisions; and, g) tradeoffs between social isolation and enhanced care, especially in the realm of homecare.

Literature Addressing Cost and Reimbursement

Cost

Cost and reimbursement were among the most frequently named policy issues in the literature. Roine, Ohinmas & Hailey ((2001) conducted a systematic review of telemedicine literature using economic assessment as one of their inclusion criteria. Of the 50 articles reviewed, they identified few comprehensive economic analyses, and the quality of the analysis was described as relatively poor. With few exceptions, they reported that studies often lacked empirical background about the costs and benefits included in the studies. Because costs varied considerably among studies (due the diverse universe of technological and clinical options), the authors concluded that comparison of the cost estimates might not be feasible in many cases.

Cusack, Pan, Hook, Vincent, Kaelber, and Middleton (2008) at the Center for IT Leadership noted that the lack of clarity about the value of telehealth is a frequently cited reason for slow adoption. The Center performed a study of telehealth encounters in which there was a provider both with the patient and at a distance from the patient, using store-and-forward, real time video and hybrid systems. Findings showed that the hybrid model was the most cost-effective and that its implementation in emergency rooms, prisons, nursing homes and physician offices in the U.S. would save $4.3 billion per year. Factors that most affected costs and savings were the cost of a face-to-face visit, the cost of a telehealth visit, and the success rate of the telehealth visit, (i.e., the proportion of telehealth visits that avoided the need for face-to-face visits).

Another study (Rumberger & Dansky, 2006) investigated the impact of telehealth on home health agencies (HHAs) in Pennsylvania. Findings indicated that telehealth could have a positive impact on HHA's financial position. In a randomized trial of telehealth interventions among people with mobility impairments resulting from spinal cord injury (Phillips, Vesmarovich, Hauber, Wiggers, & Egner, 2001), patients received one of two telehealth interventions, or standard care. Findings indicated that telehealth interventions may be cost saving if program costs are more than offset by reduction in re-hospitalization. In a report on preliminary data from small telehealth initiatives, Vo (2008) at the AT&T Center for Telehealth Research and Policy, reported promising results. The study used a combination of "store-and-forward' technologies that transmit and interpret medical data with real-time video consultations linking the patient to one or more physicians such as the primary care physician and a remote specialist. This process eliminated the need for separate, follow up consultation with the patient and redundant laboratory tests ordered by multiple providers. Reduced consultations and numbers of lab tests ordered were significant sources of cost savings.

The Office for the Advancement of Telehealth (OAT) has funded a number of telehealth studies in areas such as mental health (Department of Health and Human Services, HERSA, 2006) and general patient health delivery (McCarthy & Fox, 2007). The mental health study did not conduct rigorous outcome research, however program evaluations suggested that telemental health programs improve continuity of care for rural consumers, increase family and consumer involvement in treatment, and reduce lengths of stays and re-admission rates in state psychiatric facilities. A case study at the University of Tennessee Health Science Center's Telehealth Network (McCarthy & Fox, 2007) which received seed money from OAT, with shared cost savings, reported that it was able to transition projects to sustainability within the network because of demonstrated impact on access, quality and cost. Patients experienced reductions in waiting time, time away from work, and travel time. Third party payers were able to reduced reimbursement for travel and provide more timely and appropriate treatment that averts costly complications. Efficiencies in the care process reduced providers' costs. This network has received reimbursement for telehealth services by 35 third-party payers, including Medicaid, Blue Cross Blue Shield and commercial insurers at rates the same as, or in some cases higher than, in-person visits (McCarthy & Fox, 2007) .

Reimbursement

The Center for Telemedicine and e-Health Law (CTeL) has a long history of looking at telehealth reimbursement, and published an independent sourcebook related to reimbursement for telemedicine. The CTeL Reimbursement Sourcebook and State Telemedicine Reimbursement Guide addresses a broad range of legislative and regulatory issues involving telemedicine reimbursement policies through a variety of mechanisms at the federal and state levels, including, for example, Medicare, Medicaid, and private insurance -- all of which pay for telehealth to varying degrees.

According to Robert Waters (2007), telemedicine reimbursement in the U.S. may be provided by: a) public payers, Medicare and Medicaid; b) private payers, fee for service; c) managed care, both public and private; and d) special payers such as government and worksite. Medicare reimbursement-related issues include the need to expand eligible sites, geographic coverage and services; store and forward technology; facility fees and co-payments and home health DME (durable medical equipment), (Waters, 2007).

Hersh, Hickam, Servrance, Dana, Krages and Helfand, (2006) prepared a report on telemedicine and the Medicare population for the U.S. Agency for Healthcare Research and Quality. Their goal was to inform decisions about coverage. Using a systematic but limited literature review of the efficacy of telemedicine services and usages for three categories of telemedicine services, the report concluded that "the promise of telemedicine is not matched by the strength of its evidence base" (p.36). Areas where telemedicine were most promising included home health settings and specialties where care can be delivered via interactive videoconferencing such as psychiatry and neurology. Hersh et al. observed that the introduction of broadband connections to the home will impact future research. The report asserts the need for evidence showing patient outcomes and any harm caused by telemedicine usage. It also acknowledged that there are instances when reimbursement or other incentives are not amenable to innovation, technical or otherwise.

In a study of private payer reimbursement for telemedicine services based on surveys of payers, Whitten and Buis (2007) found expanded private reimbursement for telemedicine services, with 58 percent of responding organizations who provide potentially billable telemedicine services receiving private reimbursement. Whitten and Buis also reported that 81 percent of those who receive private pay reported no differences between reimbursements for telemedicine services as compared to traditional face-to-face consultations. While this data shows increases in private coverage, the authors deemed it insufficient to generate widespread adoption of telemedicine services.

In a study of telehealth system use in nursing homes (Daly, Jogerst, Park, Kang & Bae, 2005) the authors noted the lack of reimbursement for services from a nursing facility. The study also identified other restrictions including current procedural terminology (CPT) codes and location of the nursing facility. The CPT codes covered for telehealth services do not include the usual codes for nursing facility physicians and nurses.

Kinsella (2008) observed that the Centers for Medicare and Medicaid Services (CMS) as well as most other health insurers require patients to be homebound, which has a negative impact on home health services professions.

Stein (2005) commented on a study of the use of virtual reality (VR) in telerehabilitation as a new treatment approach. He emphasized the importance of factors such as cost-effectiveness to show whether VR can reduce the burden of disability and/or reduce reliance on high-cost one-on-one human therapy sessions. Stein added the caveat that clinicians need to make certain that the less tangible benefits of human-provided therapy including social support and companionship, are retained.

Gayle et al (2006) performed a survey of state Medicaid health information technology reimbursement policies, and presented a case study of Idaho's deliberations to establish telehealth and telemedicine reimbursement policy. Findings show that a lack of adequate provider reimbursement significantly slowed the growth of telemedicine in Idaho.

In one of the more methodologically sophisticated policy studies retrieved for review, Schmeida, McNeal and Mossberger (2007) assessed the influence of traditional policy determinants on the extent of telehealth program implementation at the state level. The main dependent variable was the extent of telehealth program implementation at the state level across 29 medical specialty areas. Results suggested that state legislative professionalism, partisanship of state legislators, government resources and severity of need, are important factors. Nursing was positively related to telehealth implementation and physician networks negatively associated. While procedural policy does not usually attract public interest, in this case, it did. Interest groups such as providers that must carry out the policy were mobilized. Palsbo (2004) did a study of current payment practice for telerehabilitation in state Medicaid programs using a telephone survey. Findings indicated that the primary reason for reimbursing for telemedicine is to make services available when there is no local practitioner. Seven states reimbursed telepsychology and four states reported reimbursing for telespeech and language pathology, physical therapy or occupational therapy. Consultation and evaluation and management services were most likely to be reimbursed. Study conclusions included the observation that TR is not enjoying widespread use, despite its potential benefit to people with disabilities who cannot travel to a clinic for rehabilitation.

Literature Addressing Research Tools and Methods

Krupinski et al. (2006) reported on the results of an expert panel convened at the request of the American Telemedicine Association to formulate a research agenda for the ATA. The report commented upon the inconsistent quality of the existing body of literature, which ranged from "purely anecdotal accounts of telehealth applications through well-controlled randomized clinical trials." The inconsistent quality of the literature was thought to slow the speed of adoption of telemedicine into the health care continuum. The article identifies four areas in which research is critically needed, including the area of economic analysis. The authors commented on analytic tools, such as evaluation and research. They excluded telehealth program assessment and/or evaluation, a process applied to an individual project, because such evaluations can rarely be generalized. Research was included because it refers to investigations that are generally hypotheses driven (e.g., quantitative studies and qualitative designs, such as Grounded Theory) and generate results that can be generalized to the broader telehealth community.

Applying these guidelines to economic analysis, Krupinski et al (2006) called for incorporating more robust analysis techniques into the field. They emphasized the importance of framing the question and then creating a study design that parallels the question, and the need to account for all cost elements. The authors asserted that the analysis should flow from technology to ergonomics to clinical outcomes to economics. For example, once technology performance has been validated and ergonomically optimized, the clinical outcomes can determine whether patients are better maintained and avoid visits to the hospital. Economic analysis could then examine the long-term impacts of patient improvements on avoiding or delaying patient disability and the cost this has to society, Social Security and other programs.

Grigsby, Brega and Devore (2005) argued that Health Service Research (HSR) provides a valuable analytical framework for the assessment of telemedicine. The scope of HSR is broader than that of clinical trials and can thus focus on system of care, end-user acceptance, and outcomes, costs and access. However, the field needs appropriate measures for each of these factors, and small sample sizes pose significant obstacles to the analysis and interpretation of findings. These authors acknowledged that risk-adjustment is essential because of variables that may affect outcomes at different levels ("policy, system, technology, provider and patient risk factors" p. 327). Grigsby, Brega and Devore acknowledged that randomized clinical trials may prove unfeasible but observe that appropriate quasi-experimental designs, such as case-control studies, can ascertain the possibility of specific outcomes. Using home healthcare as an example, they pointed to the availability of data from Centers for Medicare and Medicaid Services on utilization and outcomes.

Bashshur, Shannon and Sapci (2005) also pointed to the inadequacies of scientific rigor in evaluation studies. To address these problems, they posited two strategies that are not mutually exclusive. Their first strategy is to fund large-scale experimental telemedicine programs and projects that are designed to collect data sufficient to test specific dimensions and effects of the technology. This strategy assumes, among other factors, the availability of financial resources to support clinical trials. A second strategy is to use theoretical triangulation as one basis for assessing the impact of telemedicine, to integrate results from both quantitative and qualitative research designs. The new strategy would combine established theory with cumulative data from research studies even though the latter may be based on imperfect designs. Hirsh, Hickam, Sevrance, Dana, Krages and Helfand (2006) argued that continued small or methodologically weak studies are unlikely to add to the evidence base for telemedicine. They recommended well-designed random clinical trials (RCTs), longitudinal observational studies and demonstration projects. Acknowledging the time and expense associated with RCTs, they recommended alternatives such as the use of electronic health records, wherein selective data could be extracted on patients with telemedicine interventions to assess them longitudinally.

Scheideman-Miller, Clark, Moorad, Post, Hodge & Smeltzer (2002) reported on INTEGRIS, an Oklahoma-based telemedicine program, initially supported by HERSA/OAT. The program has conducted a large randomized controlled study and small studies of groups of patients to assess effectiveness. The authors strongly supported the need for a comprehensive telerehabilitation database of evidence on which to base studies to demonstrate the efficacy of telerehabilitation services to people with disabilities. They hope to create a nation-wide database looking at both clinical and efficacy criteria.

Conclusions and Recommendations for Future Research

This literature review provides a snapshot of the current state of the science in policy analysis for a fledgling telepractice area—telerehabilitation—as well as telehealth. The literature search did not identify a significant body of TR or even telehealth policy-related literature. The policy literature identified was routinely descriptive with little empirical evidence to support observations. Policy was most often relegated to a summary section on barriers to adoption late in a research-related publication committed to a different subject. Within the literature, the following policy issues were most frequently named: costs, reimbursement, licensure, privacy, security, liability and fraud. In the areas of traditional policy research such as legislative behavior, decision-making and interest groups, the literature provided some evidence to support the need for further study, because professional groups and legislators can create formidable barriers to adoption of telehealth.

Clearly, the field of telehealth, including TR, must meet the challenge of more clearly delineating cost items, irrespective of the scope of the study. Medicare and Medicaid and other public programs that make decisions about service reimbursement, require cost calculations based on evidence (generated by rigorous outcome and efficacy studies) that show improvements in function and reduced utilization of health care services. Among the various telehealth applications areas, homecare may be particularly promising for TR research. While our review did not identify studies in rehabilitation counseling, they, too, should be pursued based on the promising evidence from studies of telepsychiatry and mental health.

Even with the burgeoning older adult demographic, rehabilitation research continues to be vastly underfunded. Rehabilitation research has routinely suffered from small sample size, in part due to inadequate research support for large-scale studies. Strategies to compensate for traditional research inadequacies can adopt triangulation of quantitative and qualitative research and cross-institutional collaboration. TR case studies should more rigorously explore the effectiveness and efficacy of delivering services at home to traditional rehabilitation populations, including those with chronic illness, and employ large databases such as Medicare and state Medicaid patient records, when available.

It is notable that the literature did not reference the International Classification on Functioning, Disability and Health (ICF). To fully evaluate consumer satisfaction and participation, assessment criteria must include medical, functional and quality of life items such as assistive technology and environmental factors.

Researchers and practitioners are familiar with the traditional degree of physical contact required in physical rehabilitation therapy, patient characteristics, and the availability of assessment and treatment tools used in face-to-practice. They must now develop protocols and generate studies that compare face-to-face practice outcomes with those generated via the remote delivery of services.

Telepractice operates worldwide and responds to ever-increasing demands for the delivery of expert consultations and other services. TR practitioners must thus be knowledgeable about both general telehealth policy and the policy issues that are specific to rehabilitation. They must also be actively engaged in promoting policy development that will ensure quality TR practice and fair reimbursement. While these challenges are great, they are far exceeded by the potential to realize a future with more available, accessible, and affordable high-quality rehabilitation health care, especially for underserved populations.

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Appendix

The terms for each section were ORed together and the resulting set was used in combination with the other sets.

Tele Terms

Rehabilitation AND telemedicine
Rehabilitation AND remote consultation
Telehealth
Telecommunications AND home care services
Home care services AND remote consultation
Telemedicine AND home care services
Telepractice
Telemonitoring
Teletherapy
Teleservices
Telemetry
Telecommunications AND (public health practice OR delivery of health care OR health practice)
Telecommunications AND clinical care
Telecommunications AND health care
Telecommunications AND healthcare

Policy Terms

Public policy
Health policy
Social policy
Policy
Resource allocation
Health care rationing
Material allocation
Service allocation
Policy evaluation
Healthcare policy
Health care policy

Population Terms

People with disabilities
Persons with disabilities
Person with disabilities
(disabled persons OR amputees OR disabled children OR hearing impaired persons OR mentally disabled persons OR mentally ill persons OR visually impaired persons
Physically challenged
Physically handicapped
Physically disabled
Handicapped
Aged
Older adults
"Aged, 80 and over"
Elderly
(stroke OR brain infarction OR brain stem infarctions OR lateral medullary syndrome OR cerebral infarction OR dementia, anterior cerebral artery OR infarction, middle cerebral artery OR infarction, posterior cerebral artery)
(brain injuries OR brain concussion OR post-concussion syndrome OR brain hemorrhage, traumatic OR brain stem hemorrhage, traumatic OR cerebral hemorrhage, traumatic OR brain injury, chronic OR diffuse axonal injury OR epilepsy, post traumatic OR pneumocephalus)
(Spinal cord injuries OR central cord syndrome)
(Traumatic brain injury OR traumatic brain injuries)
(spinal cord injury OR spinal cord injuries)

Licensure and Other Terms

(licensure OR licensure, hospital OR licensure, medical OR licensure, nursing)
(credentialing OR accreditation OR "joint commission on accreditation of healthcare organizations OR certification)
("quality of health care" OR guideline adherence OR program evaluation OR quality assurance, health care OR benchmarking OR clinical audit OR medical audit OR guidelines as topic OR "codes of ethics" OR practice guidelines as topic OR quality indicators, health care)
(insurance, health, reimbursement OR reimbursement mechanisms)
Privacy
Personal space
Confidentiality
(computer security OR system security)
(liability, legal OR insurance, liability)
Interoperability
Ethics

Author-based Terms

(Speedie sm OR Stuart M Speedie OR speedie s OR stuart speedie)
(Doolittle gc OR gary c doolittle OR Doolittle g OR gary doolittle)
(Winters jm OR jack m winters OR winters j OR jack winters)
(Rosen m OR Michael rosen)

Institutional Terms

"department of agriculture"
Rural development distance learning
"office for the advancement of telehealth"
("health resources and services administration" OR HRSA)
Telehealth network grant program
"office of rural health policy"
Rural health care services outreach
"national academy of sciences"
("centers for medicare Medicaid services" OR "centers for medicare Medicaid services" OR cms hhs)
("agency for healthcare research and quality" OR ahrq)
"rehabilitation engineering research center on telerehabilitation"
American telemedicine association
(resna OR "rehabilitation engineering and assistive technology society")
Veterans administration medical center
Veterans administration
"department of veterans affairs"

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