Telemedicine Today: The State of Affairs

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I. Introduction

Imagine if financial transactions were different every time that you went to the bank and rules differed from state to state, program to program, and agency to agency. For consumers, the complexity would make no sense. No one would want a system in which, for example, it was possible to withdraw money remotely only in certain states without seeing a teller face to face first or to transfer funds remotely only upon authorization by particular programs.

For telemedicine, the state of play in 2015 resembles this hypothetical banking scenario. As telecommunications technologies continue to transform multiple industries, medical interventions using electronic devices and interconnectivity are creatively disrupting the practice of medicine, presenting a need to rethink many of the traditional rules that were developed for in-person interactions, procedures, policies, and payment. But because medicine is largely governed by state rules, the changes are creating a patchwork of rules and standards that are difficult to follow for both practitioners and consumers.

Amidst an evolving array of regulations, entrepreneurs are trying to reshape (and, in many cases, succeeding in reshaping) the delivery of medicine by providing virtual care via phone, video, email, and combinations thereof. Guidelines are far from settled, but the body of evidence on the efficacy, safety, and cost-effectiveness of virtual care is growing. This paper will review both scientific research and policy positions regarding telemedicine and describe some of the challenges confronting practitioners and policymakers as they work to improve access to health care, improve practice protocols, and fuel further innovation in this rapidly evolving field.

II. Background

Telemedicine is rapidly expanding to serve millions of consumers. With the prospect that its interventions and innovations will multiply as phones and handheld devices feature expanded platforms and capabilities, telemedicine is generating keen interest in both the public and private sector. Numerous definitions of telemedicine exist, with some using the terms "telemedicine" and "telehealth" interchangeably and others setting distinctions between the two, often arguing that telemedicine is a subset of telehealth. Definitions differ with regards to which technologies are included and which providers are involved. Using the broadest definition, telemedicine is "the use of medical information exchanged from one site to another via electronic communications to improve a patient's clinical health status."[1] Telemedicine includes phone- and video-based consults between doctors and patients, remote monitoring of patient status via phone lines, image-based "store and forward" analysis and diagnosis, team-based collaborations between practitioners conducting surgeries and other complex treatments, communication via secure email and instant messaging, mobile phone health applications, and more. These applications have expended dramatically in recent years.

Concurrently, expanding insurance coverage in the United States associated with implementation of the Patient Protection and Affordable Care Act and the aging of the general population will place unprecedented demands on the health and social service delivery systems in the 21st century. In turn, this will continue to exert pressure on practitioners to achieve greater efficiency in delivering quality care, combined with pressure to hold down costs. Longstanding concerns about projected trends

associated with rising medical spending, as well as the need to finance and deliver services to a much larger population of older adults, will continue to shape national health care policy through the mid-21st century. Additionally, geographic provider shortages and limited access to services for rural consumers forces communities to consider other mechanisms of health care delivery, including telemedicine.

Consumer demand for more timely and convenient access to their practitioners and to evidence-based information and education that can help them manage their care is also fueling growing public interest in telemedicine.[2] Looking ahead, development of better-defined care protocols and more integrated technology platforms spanning multiple settings appears certain to open up opportunities for expanded application and wider adoption of electronically delivered care from a distance.

Against this backdrop, this paper reviews evidence of telemedicine and its performance to date in providing access to good medical care, with a focus on telemedicine delivered to patients seeking primary care through different modalities (e.g., phone-only, video, store-and-forward, remote monitoring). Additionally, we review policy guidelines and regulations currently shaping telemedicine. A search of the health care literature (see Appendix) found that while additional research and evaluation is needed to clearly establish the safety and efficacy of different forms of telemedicine, overall, most evidence suggests that telemedicine can be as effective as in-person care. With regard to evolving policy and regulatory discussions, at the national level, Congress appears interested in seeing the uses of telemedicine expanded in Medicare, while discussions at the regulatory level are more cautious, and state coverage of telehealth-facilitated care in the Medicaid program continues to vary widely.

III. Brief Review of Key Telemedicine Developments

Historically, the use of the telephone in health care delivery has encompassed a variety of uses, including summoning emergency assistance, obtaining second opinions, scheduling health care activities, providing health care advice, and monitoring patients' conditions remotely. One of the first widely recognized uses of telemedicine occurred in the late 1960s, when a closed circuit television system was set up at the Nebraska Psychiatric Institute and a remote state mental health hospital to provide distance education and teleconsultation.[3] Managed care plans were also early adopters, with the first nurse triage call center established by Kaiser Permanente in the late 1960s.[4]

During the 1970s and 1980s, additional uses of telemedicine were developed for certain remote populations needing health care. For example, the National Aeronautics and Space Administration (NASA) turned to telemedicine for monitoring the health status of astronauts on missions. Other sponsors included employers of workers stationed on oil rigs, organizations sponsoring research expeditions in Antarctica, and the U.S. military.

Interest in telemedicine for the general population took off first in Norway during the 1980s and 1990s, which had both a universal health care system that could subsidize telemedicine development and a significant portion of its population located in remote areas with few medical specialists. The two-way audio and visual links established in that country resulted in findings that diagnosis using telemedicine was equivalent to in-person care, that it was safe and reliable, and that it saved on transport costs.[5]

In the United States, telemedicine has been promoted and financed by the federal government to expand access to care for certain populations, including prisoners and residents of medically

underserved rural areas. The Telecommunications Act of 1996 expands the definition of universal communications service to include rural health care providers and provides funds for rural health care centers through the Rural Health Care Program for telecommunications and broadband services.[6] The federal government has also made major investments in development of a technological infrastructure suitable for delivery of telemedicine services. For example, since the enactment of the Health Information Technology for Economic and Clinical Health Act in 2009, an estimated $30 billion has been earmarked for allocation in the form of incentive payments to physician practices across the country that meet "meaningful use" criteria and standards of use for electronic health records. In 2010, the Federal Communications Commission released the National Broadband plan, which made a number of recommendations around encouraging the use of telehealth through greater broadband expansion.[7] Elsewhere in the federal government, the Department of Veterans Affairs (VA) made a major investment in telemedicine starting in 2003 in three areas: home telehealth, clinical video telehealth, and store-and-forward telehealth. As a result, the number of Veterans served through one or more of these modalities in 2013 was estimated to be nearly half a million in fiscal year (FY) 2012 and projected to reach 820,000, or about 15% of the Veteran population, in FY 2013.

Broadly speaking, several types of telemedicine exist today, as briefly summarized below. (Note: This white paper does not cover mobile apps and mobile medical apps.)

Type of Telemedicine and Their Uses

Phone-Only Consultations: Plain old telephone service is frequently used for telehealth between physicians and patients. Additionally, Integrated Services for Digital Network (ISDN) is a system of digital phone connections that can transmit voice, data, and video simultaneously.[8] Telephonic consults can be through landlines or wireless devices for both regular phones and smartphones. Telephone consults occur far more than video consults and have been used over many more years to support regular care and communication between physician and patient. As explained by Adam Darkins, the former chief consultant for telehealth services at the VA, "for many patients, the telephone is often their entrée into the health care system. Data from primary care suggests that 66% of patients call their doctors for reassurance, explanation of a worrying symptom, or advice. Sixteen percent of calls are for medication and are made because patients want to be seen immediately…. Typically, women are much more likely than men to call a doctor for a telephone consultation."[9] Today, Teladoc is one of the largest telehealth providers in the United States, offering real-time telephone and online video consultations through a secure Internet connection to about 6 million members.[10] Numerous other purveyors of telephone consultations exist, including MD Live and DermatologistOnCall.

Interactive videoconferencing involves a patient in one location and a provider in another using real-time, two-way transmission of digitized images. Videoconferencing networks may be sponsored by hospitals, managed care plans, academic health centers, physician practices, and states using federal grant funds in order to establish networks for treatment of vulnerable, hard-to-reach populations. Typically, this type of telemedicine relies on high-speed Internet connection or broadband with sufficient bandwidth to enable all connections to send and receive large amounts of complex data quickly and accurately. There is also a need for security measures to be in place to ensure that data is transferred only to intended recipients.[11]

Store-and-forward technology is a type of encounter or consult that uses digital images of a patient for the purpose of opinion or diagnosis. The digital images are captured at the patient's site of care

and forwarded to a clinician at another site for interpretation. This form of telemedicine is increasingly used in radiology and dermatology. The process is usually asynchronous. This form of telemedicine is used in some consults; for example, patients can send photos of a skin rash or of the back of their throat to the treating primary care physician.

Remote monitoring is a form of telemedicine technology that involves the use of devices to remotely collect and send patient data to a monitoring station for interpretation. It covers a range of activities, including passive observation and recording of vital signs, use of alarms, sending of information to a practitioner, and support for self-management of care. Among the most well-known uses of remote monitoring is the VA's program for in-home telehealth, which supported nearly 117,000 Veterans in FY 2012, reducing hospital admissions by 30% and producing savings of $2,000 per patient.[12]

IV. Telemedicine Literature Review

This literature review was done with EBSCOhost by using the search terms "remote monitoring," "telemedicine," "cost savings," "telehealth," "outcomes," and "efficacy" and further narrowing by the type of telemonitoring. This resulted in 1,659 articles, which were then filtered for results by measured outcomes. A total of 99 articles were read and used to draw concluding observations. Results of the review are presented in Appendix A. Overall, some research shows that telemedicine offers benefits in health outcomes and effectiveness of care. There are also some studies showing cost savings as compared to usual care. While this is quite promising, additional well-designed research is needed to definitively demonstrate the magnitude of cost savings on a per-episode basis compared to in-person care, as well as how large integrated systems, such as managed care plans, can achieve cost efficiencies over time.

Telemedicine Treatment Findings

The majority of telemedicine services evaluated to date focus on identified health conditions which, absent good management, typically lead to acute episodes of illness or exacerbation requiring substantial care or hospitalization.

For telemedicine in primary care settings and utilized for individuals with chronic illnesses, several positive health outcomes were identified, including better self-management of disease, reduced mortality, and high patient satisfaction. A comprehensive review of telemedicine studies showed positive health outcomes among patients with various conditions for health services offered in rural locations.[13,14,15] In a systematic review by Krishna, telemedicine was shown to provide clinically significant results for management of diabetes and smoking cessation.[16] A review of diabetes management found the utilization of telemedicine led to an improvement in self efficacy and glycemic control.[17] In a systematic review of the VA home telehealth program, Darkins and colleagues found a reduced mortality rate among telemedicine participants.[18] Several studies have found that telemedicine can improve the ability of individuals in self-care and health management.[19,20] Finally, there have been studies which show that telemedicine can be utilized effectively to treat minor conditions as compared to regular in office visits.[21,22]

Other positive outcomes for telemedicine include improved clinical outcomes such as reduced emergency room (ER) visits and improved quality of life. Kleinpell and Avitall demonstrated overall

positive outcomes of telemedicine for patients with chronic heart failure (CHF), including a decrease in ER visits, reduced costs, and improved quality of life.[23] Bashshur and colleagues found, when reviewing stroke, CHF, and chronic obstructive pulmonary disease, that benefits of telemedicine included reduced hospital admissions, length of stay, and reduced ER visits.[24] Sloan and colleagues found that telemedicine treatment for post-traumatic stress disorder (PTSD) was effective, while Pratt and colleagues showed better management of psychiatric symptoms.[25,26] For homebound low income disabled adults, telemedicine was as effective as in person care for treatment of depression.[27] Among oncology patients, the use of telemedicine was associated with better clinical outcomes, increased patient satisfaction, and improved access to care, particularly among those who have more difficulty traveling to seek care.[28,29] A VA study using video conferencing for pain management showed high patient satisfaction and saved time traveling to doctors' appointments.[30] Another review by Chan and colleagues found positive health outcomes for telemedicine utilization for children with asthma.[31] However, while benefits for specific health conditions and high patient satisfaction have been documented, telemedicine interventions are not always more effective than face-to-face care.[32,33,34,35]

When comparing telemedicine technologies, it is important to note that no single intervention has been shown to be more effective than another in disease management. A major review of 20 years of telemedicine in management of chronic disease found no advantage of telemonitoring or videoconferencing over telephone support.[36] The review examined a range of telemedicine interventions (e.g., telephone support, telemonitoring, videoconferencing) in five major chronic diseases, assessing the value of each intervention in terms of the outcomes specified by the investigators in that trial against a control group; these included hospitalizations, mortality, quality of life, cost to society, and ER visits. Finding the evidence base "weak and contradictory," the study recommended that future studies be designed "carefully, in order to identify the true value of distance support," and that outcomes measures be based on a standardized "minimum dataset."

Possible Cost Savings

In some analyses, telemedicine shows cost savings through reduced use of additional and more costly health care services such as office visits, ER visits, and hospitalizations for both treatment of minor health conditions and management of chronic illnesses. In cases where telemedicine substitutes low-cost visits (under $50 per encounter) for more-expensive office or ER visits (sometimes hundreds or thousands of dollars), there is potential for significant cost reduction.

Telemedicine has demonstrated the potential for cost savings in the primary care setting. For example, during the 12-month study for the VA's home telehealth care program, participants had statistically significant lower health care costs compared to those not enrolled in the telemedicine program.[37] Baker and colleagues found that telehealth intervention among those with chronic illnesses had significant cost savings and lower mortality rates when compared to usual care.[38] Finally, a systematic review of video telemedicine concluded that the technology is a cost-effective approach for home care for use by practitioners communicating remotely with on-call hospital specialists, and is a cost-effective method for linking practitioners and patients in regional and rural health care systems.[39]

With regard to management of chronic diseases, some research has found that telemedicine is cost effective. In a study by De San Miguel and colleagues, for example, investigators found that those patients with chronic obstructive pulmonary disease (COPD) receiving telemedicine services saved on average $2,931 per year through reduced use of office visits, fewer hospitalizations, and shorter hospital stays.[40] In a meta-analysis of COPD patients, researchers similarly found a significant

reduction in ER visits and hospitalizations for those participating in telemedicine.[41,42] A study looking at managing renal failure using telemedicine produced significantly decreased cost for intervention group participants.[43] Results from a systematic review of the use of telemedicine in patients with CHF identified a decrease in hospital admissions and readmissions in several studies, while several others found a reduction in overall health care costs.[44,45,46,47,48] Similar reductions in primary care visits and urgent care use can be found in a Pratt and colleagues study using telemedicine for mental health disorders.[49]

Importantly, studies show telemedicine can reduce costs for patients seeking standard primary care in certain geographic areas where there is known overuse of urgent care clinics or ERs.[50,51] Another aspect to consider in evaluating possible cost savings associated with telemedicine is that more advanced technologies typically have higher operational costs. For example, when using specific in-home devices, two studies found that more sophisticated technology was less cost effective than using lower-technology devices (e.g., phone only). Furthermore, some research has shown that using lower technology devices is more cost effective than usual care.[52,53] In summary, a growing body of evidence demonstrates that urgent care visits, office visits, and hospitalizations have decreased with the use of telemedicine.

However, not all studies show telemedicine interventions to be cost-effective, and some find that the initial startup costs associated with installing telemedicine technology and training in its use are high, but worthwhile in the long run. Others find no significant improvement in cost effectiveness when comparing telemedicine to usual care.[54,55,56] A study by Pearl and colleagues, for example, found that telemedicine visits are less costly on a per-visit basis than office visits but do not decrease the overall number of office visits across the system.[57] Some meta-analyses have reported economic savings and cost-effectiveness of a telemedicine intervention but note that many of the studies exhibit poor methodologies for properly evaluating cost efficiencies.[58] Among the challenges of designing analyses that can prove cost effectiveness are that results may "depend on the geographical, lifestyle, or other characteristics of the patients."[59] In addition, an analysis by Whitten and colleagues concluded that small sample sizes and short time frames have also limited the ability of many studies to establish clear evidence of cost-effectiveness.[60] A systematic review of real-time telemedicine delivery published in 2010 found mixed results, with some studies showing cost savings and others showing higher costs.[61] As the field develops and as telemedicine is more commonly used to diagnose, treat, and manage a range of conditions, additional rigorous research will be needed to clarify the cost savings of particular telemedicine interventions and the overall efficacy of remote health care versus face-to-face care.[62]

The Value of Telephone Consultation

In a study published in the February 2014 edition of *Health Affairs*, the California Public Employees' Retirement System employees using a physician telemedicine service (in this case, Teladoc) were found to have fewer follow-up visits after a telemedicine encounter compared to other enrollees who visited emergency departments and primary care offices, suggesting very little evidence of misdiagnosis or treatment failure. For future research, the study's authors recommend additional analysis to assess quality of care outcomes and impact on costs. They also note that additional analysis will be required to determine whether the intervention "might be improving access for patients with lower incomes and those in rural areas and, if not, whether it could be positioned to do so in the future."[63] Noting that "providers saw patients with many diagnoses that typically require a physical exam, diagnostic testing, or both," the study cautions that without the use of additional technology, Teladoc will continue to be limited in its ability to support the diagnosis and management

of many conditions. Additional research is needed to address questions about the quality of care, such as rates of antibiotic prescribing across settings."

The experience of Kaiser Permanente Northern California (KPNC) is also instructive. For more than a decade, the nonprofit managed care plan has offered telephone visits of 10–15 minutes with a physician. In 2013, KPNC estimated the number of telephone visits to be more than 2.3 million, a substantial rise from the 640,000 in 2008. KPNC has also invested in expansion of uses for video visits to treat conditions ranging from substance abuse in pregnant women to adolescent acne. By 2016, KPNC projects that "the number of virtual visits—including secure email, telephone, and video encounters—…will surpass the number of in-person office visits."[64]

With regard to patient satisfaction, research shows consumers frequently report high satisfaction with their telemedicine experience.[65,66] However, overprescribing may be a concern. One study found a 98% antibiotic prescription rate in e-visits for urinary tract infections, compared with 49% for office visits.[67]

Telemedicine has other important positive impacts, including reduced travel time and absence from work, greatly improved access to specialty health care for rural populations, and a narrowing of the "digital divide" among hard-to-reach populations.[68,69,70] For example, results of a systematic review of health care delivery via cellphones, published in 2009, concluded, "This the first technology where industry has documented a trend toward a digital divide in the reverse…. Sending cellphone text messages has been helpful for patients in reducing missed physician appointments and for staying in touch with their physician for follow-up questions or consults…. Since, compared to computer technology, the ownership and use of cell phones is more prevalent among persons of low socioeconomic status, use of cellphones may reduce the impact of digital divide inherent in Web-based health interactions."[71]

There is also a natural limitation to telemedicine in that not all people have access to phones, utilize the Internet, or have access to higher-quality Internet connection (broadband). While approximately half of Americans have both a broadband connection and a smartphone,[72] there are still those who do not own cellphones (9%), and approximately 15% of Americans do not use the Internet. The majority of those who are not online and do not own a smartphone are over age 65 and have low incomes.[73,74] These factors have implications when it comes to utilizing the various modes of telemedicine, particularly for those over the age of 65, who are more likely to benefit from chronic disease management.

V. Evolving Regulation

As federal work in telemedicine has expanded, definitions of the terms "telemedicine" and "telehealth" have proliferated, and new terms such as "mHealth" "telemonitoring" and others have come into their own. Today, various definitions of these terms are used by different agencies, and there are additional interagency variations among programs.[75] Reimbursement approaches also vary significantly. In Medicare, for example, with the exception of Alaska and Hawaii, coverage of telehealth services is limited by statute to services furnished to beneficiaries located in rural areas and to synchronous video communication between certain originating sites and a remote site.[76] In 2013, less than $12 million was reimbursed for telemedicine services by Medicare.[77] Regulatory flexibility is tightly constrained in this context. However, in a recent "burden reduction" final rule, the Centers for Medicare & Medicaid Services (CMS) stated that physicians practicing remotely in Rural Health Centers, Federally Qualified Health Centers, and Critical Access Hospitals would no longer be

required to visit in person every 2 weeks.[78] CMS also released a rule in 2014 inviting comments on how to waive certain telehealth payment requirements for accountable care organizations (ACO).[79]

Elsewhere in the U.S. Department of Health and Human Services (HHS), efforts to improve cross-agency federal collaboration are now accelerating under the leadership of the Health Resources and Services Administration (HRSA), which convened a federal workgroup on telemedicine in 2011 composed of 26 partners. Known as "FedTel," the group convenes bimonthly and works to try to reduce organizational silos and to share information about telemedicine initiatives across agencies. In a recent study that surveyed FedTel officials about the definition of telemedicine, officials from HHS provided the following: "the use of electronic communication and information technologies to provide or support clinical care at a distance. Included in this definition are patient counseling, case management, and supervision/preceptorship of rural medical residents and health professions students when such supervising/precepting involves direct patient care."[80]

HRSA Administrator Mary Wakefield discussed various aspects of telemedicine policy during a June 2013 speech, citing its potential to improve quality by maximizing the "functionality" of electronic health records, registries, and databases to generate "clinically valid feedback."[81] Wakefield also noted, "Licensure requirements and barriers to cross-state practice should be seen as part of general considerations around the mobility of health professionals in order to address workforce needs and improve access to care." In this regard, within the U.S. Department of Defense's health care system, legislation enacted in 2012 now allows credentialed health care professionals to serve members of the active-duty military across the country without having to obtain a new license. Similar legislation was also introduced in the 113th Congress to enable physicians in the VA to serve Veterans anywhere in the United States. The policy, which has not yet been enacted, defines telemedicine as "the use of telecommunication technology and information technology to support the provision of health care in situations where the patient and health care professional are separated by geographic distance."[82]

At the state level, significant variation in approach exists with regard to whether and how telemedicine is reimbursed by private insurers, as well as how it is treated under Medicaid. As of February 2015, 22 states and the District of Columbia have insurance parity laws that mandate comparable coverage and reimbursement for telehealth services in private insurance plans.[83] In general, live video predominates in Medicaid reimbursement, with 10 states now also offering program reimbursement for store-and-forward telemedicine and 13 covering remote monitoring.[84] Alaska, a leader among states in telemedicine, reimburses for all three modalities, and the state recently passed a law to allow physicians to diagnose and prescribe by using telephone and online consultations.[85] Rules dictating telemedicine vary widely; in fact, no two states are alike in how it is defined and regulated. However, because the field is evolving, interest in regulating and defining telemedicine and how it is practiced is strong: As of September 2014, 36 states and the District of Columbia had pending legislation regarding telemedicine, many to establish or change different aspects of reimbursement of telemedicine for private payers, Medicaid, or both.[86]

In April 2014, the Federation of State Medical Boards (FSMB) approved nonbinding model guidelines defining telemedicine for practitioners as "the practice of medicine using electronic communications, information technology, or other means between a licensee in one location and a patient in another location with or without an intervening health care provider." The guidelines further state, however, "Generally, telemedicine is not an audio-only telephone conversation, email messaging conversation, or fax. It typically involves an application of secure videoconferencing or store-and-forward technology to provide or support health care delivery by replicating the interaction of a traditional encounter in person between a provider and a patient."[87]

In a release accompanying the guidelines, FSMB president and CEO Humayun J. Chaudhry explained that the guidelines "are designed to provide flexibility in the use of technology by physicians—ranging from telephone and email interactions to videoconferencing—as long as they adhere to widely recognized standards of patient care."[88] Reaction to the guidelines has been mixed, with opposition expressed by some telehealth providers, some researchers, and patient advocacy groups. In a letter dated May 1, 2014, a coalition of patient and provider groups wrote to FSMB expressing concern that the guidelines do "not account for many of the safe, secure ways patients are accessing health care today, including 'audio-only telephone.'"[89]

In a more extensive report focusing on live, on-demand primary and urgent care that was published on December 15, 2014, by the American Telemedicine Association (ATA) observes that "there is a growing body of evidence regarding the effectiveness of video- and audio-based interventions for a variety of acute and chronic conditions seen in primary care such as diabetes, asthma, heart failure, and hypertension."[90] Focusing on the use of real-time, interactive technologies, the clinical practice guidelines discuss certain "acute conditions that may be managed effectively by video-based telemedicine and as appropriate other interactive technologies supported by peripheral devices and ancillary tests necessary to establish a diagnosis." With regard to acute medical conditions, these include "uncomplicated cases of allergy/asthma, chronic bronchitis, conjunctivitis, genitourinary conditions, low back pain, otitis media, rashes, and upper respiratory infections," according to the report. For management of chronic medical conditions, live interactive telemedicine is appropriate for "mental illness and behavioral health, chronic obstructive pulmonary disease, congestive heart failure, diabetes, and hypertension," ATA says. The report adds that "the virtual medium" may be effective "for consultations regarding prevention and wellness services such as immunizations, smoking cessation, diet, and physical activity."

While the initial draft guidelines on urgent and primary care that were issued by ATA in May 2014 included side-by-side examples of various acute and chronic medical conditions, along with recommendations about whether they would be best managed by telephone only or video telemedicine (or either), the final report omits these comparisons. Instead, it states: "In general, conditions that are not suitable for telemedicine are those for which an in-person visit is required to evaluate the patient due to the severity of presenting symptoms, the necessity of haptic information, the need for protocol-driven procedures, or the need for aggressive interventions." The guidelines caution against using telemedicine for "some patients with cognitive disorders, intoxication, language barriers, emergency situations that warrant escalation to an ER visit or 911, or when patients do not have the requisite technology to complete a virtual visit."

The final guidelines advise that audio-based consults "may be used for consultation if and only if the evaluation, diagnosis, and treatment of conditions can be made reliably on the basis of complete medical history, full understanding of presenting symptoms reported by the patient or caregiver and be consistent with established clinical protocols, state and federal laws, and regulations related to audio-based evaluations, in particular when such evaluation results in prescribing." The report further recommends that patient evaluations be supported by clinical history, access to patient medical records, diagnostic data, and laboratory test results. In the case of both telephonic and video consults, ATA emphasizes, "To reduce the risk of overprescribing, the provider shall follow evidence-based guidelines and all federal, state, and local regulations. In particular, "providers shall determine the appropriateness of telemedicine on a case-by-case basis, whether or not a telemedicine visit is indicated, and what portion of the examination must be performed and documented in conformance with appropriate standards in evaluating the patient." The report concludes "Wherever possible,

diagnostic interventions should be supported by high-quality evidence," but also gives significant latitude to providers in using "their professional judgment, experience, and expertise" where evidence is lacking. Other practice guidelines developed by ATA include telemental health, tele-ICU, home telehealth and telerehabilitation.

VI. Growing Congressional Interest in Telemedicine

At the national policy level, legislation introduced last year by Reps. Doris Matsui (D-CA) and Bill Johnson (R-OH) proposes to define telehealth as health care "that a health care professional is authorized to deliver to an individual in person under State law…not in person; from any location to any other location; and by means of real-time video, secure chat or secure email, or integrated telephony."[91] The FSMB, the ATA regulations, and the pending federal proposal support the notion that a patient care relationship can be established remotely—a clear step forward relative to policy enacted in some states that require a physical encounter to establish a doctor-patient relationship. In addition, legislation introduced in September 2014 by Reps. Diane Black (R-TN) and Peter Welch (D-VT) would allow certain ACOs to provide "store-and-forward" and remote patient monitoring services as means of encouraging emphasis on health outcomes over volume of services performed.[92] Similarly, the House Energy and Commerce Committee's recently released discussion draft of the 21st Century Cures Bill would require the implementation of a methodology to provide coverage of telemedicine services under Medicare. It would also expand the definition of telehealth under Medicare to include store-and-forward technology.[93]

In recognition of the expanding uses of telemedicine, some health care analysts have adopted the term "connected health" in order to encompass a broad range of direct patient care, education, and remote monitoring.[94] Consumers are increasingly expressing interest and enthusiasm for telemedicine as well: A PricewaterhouseCoopers survey published in late 2013 found that 69% of respondents said they would be willing to communicate with their doctor or nurse using email, 49% said that they would be willing to do so via an online chat feature or a Web portal, 45% indicated that they would text, and 40% said that they would use a mobile health application. By comparison, only 27% of physicians are encouraging consumers to use mobile applications, even though 59% believe them to be inevitable in the future.[95]

Congressional interest in the potential of telemedicine to give health care consumers the necessary information to take greater control of their health and health care has been growing, which was evident during a hearing conducted by the House Energy & Commerce Subcommittee on Health in 2014. Rashid Bashshur, director of the e-Center at the University of Michigan's School of Public Health, testified that "telemedicine has the potential for transforming the current system of health care by creating seamless and ubiquitous health care with continuous care management in integrated systems with empowered patients as partners in every phase of care…. The technologies that can be used to promote adoption of healthy lifestyles—with enormous implications for cost savings—are wearable sensors, smartphones, and mobile devices (likely to become the dominant telemedicine technology). These technologies have produced efficiencies in the delivery of service to the point of need in entertainment, banking, commerce, and education. The same applies to health care."[96]

Another witness, Kofi Jones of American Well, similarly observed, "Mobile devices can significantly mitigate time and distance barriers, regardless of location, socioeconomic status, or mobility issues…. It is the epitome of patient-centered health care."[97] Sounding a more cautionary note, Thomas Beeman, president and CEO of Lancaster General Health, an integrated nonprofit health system, testified, "As an organization that has committed hundreds of millions of dollars to connect and

integrally link health information, telehealth, and digital medicine infrastructures, [we have found that] successful implementation of health technologies requires a compelling and measurable clinical or preventive health model for a defined population aligned with strong partnerships among information technology, operations, and leadership. Institutions should consider investments in pilots or proofs of concepts with strong evaluation metrics for success and return on investments, in order to identify potential scalability of telehealth tools."[98]

VII. Concluding Observations

The Growing Role of Quality Measurement in Telemedicine

Decades of research has firmly established that telemedicine expands access to health services for individuals living in remote and rural areas. Evidence is beginning to accumulate that telemedicine may be "especially appealing" for those "who are infrequent users of health care and to those who are relatively resistant to usual outreach methods and vulnerable to untreated chronic conditions in the long run."[99] Equally important, development of telemedicine is now intersecting with rapid and ongoing changes in the health care system's organizational structure toward provision of more integrated care models and toward payment protocols that aim to shift reimbursement toward payment for value. These trends are accelerating even as different forms of telemedicine are being used in a complementary fashion; as electronic health records become mainstream; and as shared electronic record systems are extended to independent practitioners, community hospitals, and providers of various community-based services.

For policymakers and stakeholders, these findings suggest that a prudent approach may be to balance the need for regulatory development in such areas as practice standards and scopes of practice in a manner that does not impede the further development of telemedicine services and better-integrated health information technology platforms. At an August 2012 workshop on telehealth sponsored by HRSA and convened by the Institute of Medicine, Spero Manson of the University of Colorado's Centers for American Indian and Alaska Native Health suggested that the idea of a driver's license could serve as a useful concept for possibly reconsidering the notion of licensure at both the state and federal levels.[100]

Just as with medical practice broadly defined, telemedicine has a mixed record with regard to outcomes and cost-effectiveness. Use of the most appropriate modality for various circumstances is essential. While evidence to restrict a specific modality does not exist, practice guidelines are essential. The enlarging role of quality management in telemedicine is reflected in the development of guidelines by ATA and medical organizations, including the American College of Radiology, the American Dermatology Association, and the American Medical Association. The need for evidence guidelines and quality management were mentioned by several experts at the 2012 Institute of Medicine workshop.[101]

For large integrated health systems such as the VA and Kaiser Permanente, which have made a commitment to embed telemedicine interventions into many clinical processes, the challenges associated with quality and standardization of telemedicine protocols are multifaceted. In the case of the VA, the agency has established three telemedicine training centers that develop and disseminate standardized training and resource materials and a system of performance metrics for local medical centers, regional administrative units, and the national system. Internal accreditation processes, called "Conditions of Participation," are used in biannual assessments, the results of which are reflected in scorecard reports. Data on quality management are reviewed internally every 3 months.[102]

This practice suggests that accelerated development of practice guidelines that inform both practitioners and consumers about the uses and outcomes of various forms of telemedicine may represent a sound investment for purposes of informing public policy and regulatory protocols. Careful, ongoing evaluation of the quality and cost-effectiveness of telemedicine is clearly warranted, along with evaluations of whether the interventions provide wider access to consumers without increasing unnecessary utilization.

In an influential book published in 2000, *Telemedicine and Telehealth: Principles, Policies, Problems, and Pitfalls*, Adam Darkins argued, "The best way to establish the framework for training and education in telehealth is to use the guidelines and protocols developed by the clinicians who are actually teleconsulting. Telehealth programs can support clinicians in developing guidelines by establishing a culture to support setting standards, devising protocols/guidelines, and instituting training and education." Expanding on this theme, in a 2012 systematic review of the use of telemedicine in treatment of chronic disease, Richard Wootton of the Norwegian Centre for Integrated Care and Telemedicine urged that stakeholders develop "a minimum dataset" with "quantitative indices, from which pooled estimates of effect can be calculated and which are applicable across all disease groups, [including] quality of life (as measured on the scale appropriate to the disease in question), cost to society, emergency department visits, days in hospital, [and] mortality."[103]

Choice Among Modalities

Given the diversity of populations, conditions, and circumstances to which telemedicine is applied and the medical evidence to date, it is premature to declare any one modality more or less appropriate. Different modalities are preferable depending on specific medical, technologic, and access-to-care situations. Standards of practice will certainly continue to evolve, based on evidence and experience, to guide preferred avenues of communication and care delivery. However, given that individuals on the low-technology end of the digital divide may be limited in their access to Internet-based or high-speed network devices, the simple telephone may be the only choice for many for some time to come.

Good decisions about the "right" type of telemedicine delivery thus require careful balancing challenges of medical access, technology availability, practitioner discretion, and consumer preference rather than adhering to rigid notions of being limited to an ideal modality under ideal circumstances. Part of the challenge is to understand and distinguish varying patient needs and how telemedicine applies to those circumstances specifically. Virtual treatment of hay fever, for example, differs markedly from home monitoring of congestive heart failure and cannot be evaluated as the same intervention. To date, policies appear to have consensus that telephonic telemedicine is safe and (in some cases) cost effective in treatment of acute, minor illnesses. As conditions become more serious and complex and technologies become more expensive and complex, cost reduction and cost-effectiveness are less consistent.

Future Drivers of Telemedicine

As consumers of varying ages are exposed to telemedicine, many are likely to find it useful for accessing health care practitioners and for receiving information and advice about managing their chronic conditions and other challenges. In terms of public interest and further development of "person-centered care" models, informed consumers are likely to increasingly engage in shared decisionmaking with their doctors based on the best available evidence—a dynamic that is well-suited for telemedicine. The ability of organized telemedicine systems to offer superior information and care to those who might otherwise base health care decisions on advice from family and friends, as well as information from the Internet when in-person care is not available or not chosen by the patient, is already clear.

It is possible that as telemedicine interventions become more widespread, they can be tailored to broaden access among those who are less mobile and those who cannot be seen during hours convenient to providers. It is also conceivable that more convenient access to evidence-based health information and personal health care records will benefit family caregivers. As the U.S. health care and social services systems look ahead to the "age wave" era that will become apparent after 2020, when demand for services starts to surge, it seems probable that telemedicine will play a vital role in deploying interventions that are aimed at supporting tens of millions of frail elders living in the community.

Issues concerning the utilization of telemedicine as compared to in-person care are broader and warrant careful evaluation, as with all health care interventions. Since evidence shows that telemedicine has significantly improved access to health care among rural and other isolated populations, the potential for telemedicine to reach additional hard-to-reach populations, including individuals with disabilities and functional limitations and socioeconomically disadvantaged populations, should be explored further. For policymakers and payers, keeping an eye on the purse as consumer-fueled demand for health care services rises will be paramount. A question of continuing interest will be whether and under what circumstances use of telemedicine can exceed results achieved through traditional in-person care at a lower per capita cost.

Appendix: Literature Review Results

Citations	*Cost Savings Evidence*	*Health Outcomes Evidence*	*Effectiveness Evidence*
Phone Only			
Whitten, P., Holz, B., & LaPlante, C.[60]	Meta-analysis of cost for phone-only interventions shows mixed results of cost-effectiveness. Some say that as the technology improves, savings will increase; others say that there is no sufficient evidence to claim cost-effectiveness. More research needs to be done.		
Böhme, S., et al.[35]			Telephone counseling for CHF patients was proven an effective approach to improving patient's health status, but it was not proven whether the content of the calls or the social support provided had the greater impact.
Cassimatis, M., & Kavanagh, D. J.[17]		In a review of telehealth and type 2 diabetes, telehealth interventions have been shown to be a promising approach for self-care of diabetes and shows better management of glycemic control.	
McLean, S., et al.[40]		For those with COPD, a review of studies show a reduction in the numbers of ER visits, hospitalizations, and flare-ups for telehealth participants.	
Audiovisual			
Darkins, A.[12]	For VA patients enrolled in telehealth, health care costs decreased due to decreased ER visits and inpatient admissions.	The study also found that participating in telehealth led to an almost 10% decline in mortality.	
Nazareth, S., et al.[14]		For those in rural and remote locations in Australia, videoconferencing helped achieve a standard variable rate that allowed them to receive treatment that otherwise probably would not have been obtained.	
Henderson, C., et al.[52]	There is a low probability that telehealth is a cost-effective addition to standard support and treatment for people with long-term conditions.		

Wade, V. A., et al.[13]	Delivery of health services by real-time video communication was cost effective for home care and access to on-call hospital specialists, showed mixed results for rural service delivery, and was not cost effective for local delivery of services between hospitals and primary care.		
Pratt, S., et al.[25]		For patients with serious mental illness, significant improvement was found in self-efficacy in medication management. In patients with diabetes, decreases in mean blood glucose levels and primary and urgent care health visits were found.	
Wright, J., Purdy, B., & McGonigle, S.[15]		A pilot study for cancer patients found improved clinical outcomes, increased patient satisfaction, improved access for patients in remote locations, and reduction of travel costs and isolation due to rural living.	
Udsen, F. W., Hejlesen, O., & Ehlers, L. H.[59]			While a review of studies of COPD patients revealed fewer hospitalizations and cost savings, the general quality of economic data was poor, and its effectiveness overall is cautioned for large-scale implementation.
Wakefield, B. J., et al.[33]		Home telehealth can facilitate detection of key clinical symptoms that occur between regular physician visits.	A randomized trial for those with chronic conditions receiving telehealth found no quality-of-life improvement or psychological improvement compared to those receiving standard care.
Sloan, D., et al.[26]		For those with PTSD, telehealth had a similar impact on mental health to that of usual care.	
Choi, N. G., et al.[27]			Tele-problem-solving therapy was demonstrated to be efficacious compared to in-person problem-solving therapy for low-income, homebound older adults and had longer-lasting effects.
Desko, L., & Nazario, M.[30]	A study of the VA clinical video telehealth pain management clinic found that the VA saved $2,317.51 due to averted travel reimbursement. There was a 90% satisfaction rate with the service.		

Rowell, P. D., Pincus, P., White, M., & Smith, A. C.[29]		A retrospective review of pediatric orthopedic patients consulted via telehealth at the Royal Children's Hospital in Queensland over a 10-year period found that 40% of patients seen via telehealth in pediatric orthopedics had documented cerebral palsy, an intellectual disability, or congenital syndrome. Lower limb malalignment was the most common presenting complaint. About 58% of patients were seen exclusively via telehealth and did not require in-person consultation or operative therapy.	
Store-and-Forward			
Smith, M. W., et al.[53]	Store-and-forward has been shown to have significant cost savings over video and telephone interventions due to its low costs of technology and labor.		
Kleinpell, R., & Avitall, B.[44]		For 216 patients with CHF, those who were randomized to telemanagement for 3 months after hospital discharge had fewer heart failure-related readmissions with shorter lengths of stay compared to patients who received home health visits.	
Chan, D., et al.[31]			Internet-based store-and-forward video assessment of children's use of asthma medications and monitoring tools in their homes appeared effective and well-accepted. The use of this tool may improve adherence to asthma medications, especially those requiring careful technique.
Remote Monitoring			
Baker, L. C., et al.[42]		A review of high cost Medicare beneficiaries with complex chronic medical conditions revealed decreased mortality and inpatient admissions among telehealth participants	

Cartwright, M., et al.[32]		This large cluster randomized trial of second generation, home based telehealth for patients with chronic obstructive pulmonary disease, diabetes, or heart failure found no main effect of telehealth on generic health related QoL, anxiety, or depressive symptoms over 12 months.	
De San Miguel, K., Smith, J. & Lewin, G.[40]	Patients with COPD and defibrillators saw an annual savings of almost $3,000 per patient.		
Gellis, Z., et al.[45]		There were significant positive outcomes with regard to depression, quality of life, and numbers of ER visits from the teleHEART intervention within the older population.	
Ciere, Y., Cartwright, M., & Newman, S.[20]		A review of several studies of heart failure patients showed some benefit for self-efficacy but no other benefits for participants in telehealth interventions.	Widespread integration of telehealth into health care services will be realized only if the effectiveness and cost-effectiveness can be improved in carefully selected clinical groups.
Minatodani, D. E., & Berman, S. J.**Error! Bookmark not defined.**	There were significant cost savings for telehealth renal failure intervention participants engaging with remote monitoring via a nurse.	There were fewer hospitalizations and days in the hospital for those renal failure intervention patients.	For high-risk dialysis patients, the number of medical and technical occurrences dramatically decreased, requiring fewer nurse contacts. The significance of the findings makes a strong argument for home telehealth with nurse oversight to improve health outcomes by preventing hospitalizations in select patients with chronic illnesses.
Bashshur, R. L., Shannon, G. W., & Smith, B. R.[24]		The benefits include reductions in use of service: Hospital admissions/readmissions, length of hospital stay, and emergency department visits typically declined. It is important that there often were reductions in mortality.	Telemedicine changes the inputs of the traditional medical care process. Patients consequently are engaged in managing their own health in an increased number of phases of the care process. They are encouraged to adopt healthy lifestyles and manage their medications and are provided with coordinated remote and local continuous care management. The capacity for early intervention and rapid response associated with telemedicine—plus empowered, educated, and engaged patients—can have significant effects on the outputs.

Baker, L. C., et al.[38]	Study found evidence that intervention of telehealth reduced spending by 7%–13% over 2 years compared to matched control group.	The study found significant differences in mortality between the intervention and control groups, suggesting noticeable changes in health outcomes.	
Whittaker, F., & Wade, V.[48]	Based on evidence suggesting that completing a formal rehabilitation program significantly reduces the risk of a secondary event and readmission, the net present value was calculated to be $4,008 per patient. Taking into account the cost of the telehealth program, $1,633, this would equate to a savings in health care costs of $2,375 per patient.		
Telehealth Research Methodologies			
Law, L. M., & Wason, J. M. S.[58]			There is potential to address the flaws discussed in the telehealth literature through the adoption of adaptive approaches to trial design. Such designs could lead to improvements in efficiency, allow the evaluation of multiple telehealth interventions in a cost-effective way, or accurately assess a range of endpoints that are important in the overall success of a telehealth program.

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