SPECIAL REPORT

Telehealth

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Telehealth, a term used interchangeably with telemedicine, has been defined as the use of medical information that is exchanged from one site to another through electronic communication to improve a patient's health.[1] The purpose of this article is to present policy-relevant trends in telehealth adoption, to describe the state of the telehealth evidence base, and to assist physicians, other health care professionals, and researchers in identifying key priorities for telehealth research. Such research is necessary to fully realize the promise of telehealth to address socially desirable goals such as the quadruple aim in health care: improving the patient experience of care, improving the health of populations, reducing the per capita cost of health care, and improving the experience of providing care.

Telehealth technologies, tools, and services are becoming an important component of the health care system (Fig. 1). The Department of Health and Human Services estimates that more than 60% of all health care institutions and 40 to 50% of all hospitals in the United States currently use some form of telehealth.[2] Late in 2016, Kaiser Permanente of Northern California reported that its virtual (e-mail, telephone, and video) communications exceeded in-person visits.[3] Other health systems, such as Geisinger Health System, Intermountain Healthcare, Partners HealthCare, the University of Virginia Health System, and the Veterans Health Administration, report using telehealth interventions for purposes such as filling gaps in care that result from provider shortages and providing access to services after normal clinic hours, reducing patient and family travel burdens, facilitating services such as appointment scheduling and refilling prescriptions, and responding to business challenges and consumer expectations.

Private insurers increasingly provide reimbursement for telehealth, as evidenced by the prediction of the National Business Group on Health that virtually all large employers will cover telehealth services for their employees by 2020.[4] In 31 states and the District of Columbia, parity laws require commercial health insurers to provide equal coverage for telehealth and in-person services.[5] Medicaid has no restrictions for state coverage of telehealth services. Currently, all states cover teleradiology, 49 cover telemental health, and 36 cover various home-based telehealth services.[6]

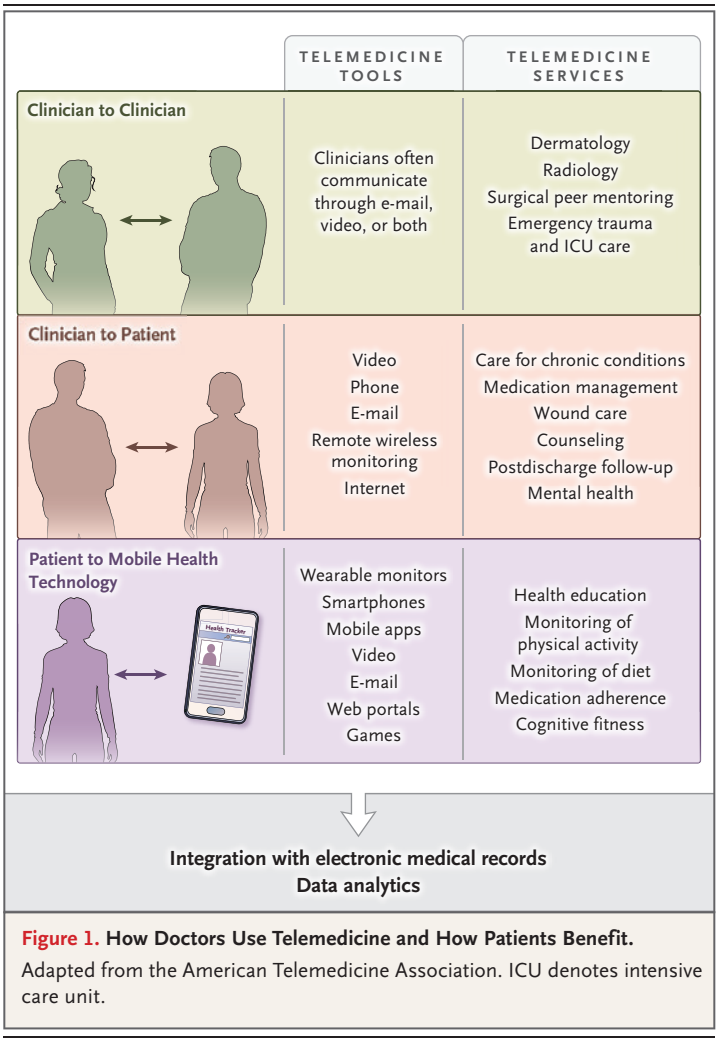

Figure 1. How Doctors Use Telemedicine and How Patients Benefit.
Adapted from the American Telemedicine Association. ICU denotes intensive care unit.

Table 1. Five Key Trends That Will Influence the Growth of Telehealth Care Delivery.

Trend
Continuous innovation in the consumer technology market (e.g., with respect to applications, wearable sensors with wireless monitoring capabilities, and related digital capabilities), which will continue to attract financial capital for product development[12]
Continuous advancement in electronic health records and clinical-decision support systems, which has the potential to better integrate telehealth services into care-delivery processes and thus make care delivery more efficient for clinicians[13]
Projected shortages in the health professional workforce, which will increase the need to provide access to primary and specialty care for rural and underserved urban populations[14]
Reorganization in the delivery and financing of medical care, as a result of private-sector initiatives and the Affordable Care Act, toward value-based reimbursement, which provides an incentive for service delivery in lower-cost care settings outside of traditional hospital facilities[15-17]
Growth of consumerism in health care, with increasing public expectations for convenient and real-time access to health services, personal health information, prescription refills, and other health interventions in a manner similar to other sectors of the economy[18-20]

Medicare has been more restrictive, reimbursing only when the beneficiary is in a rural originating site. However, reimbursement is expanding under the Medicare Access and CHIP (Children's Health Insurance Program) Reauthorization Act of 2015 (MACRA) and is included in the new bundled-payment formulas for cardiac care and joint replacement as well as in the Next Generation Accountable Care Organization payment model.[5,7-11] In addition, the 21st Century Cures Act requires the federal government to study the effect of telehealth on Medicare beneficiaries.

We believe that the five trends identified in Table 1 have the potential to accelerate telehealth adoption into the delivery of clinical care. However, this ultimately depends on the evolving business and policy context that shapes these trends, especially the integration of telehealth data into electronic medical record systems and the penetration of value-based reimbursement formulas that influence decisions about technology investment. Other determinant factors in telehealth adoption, as described below, include the penetration of clinician training combined with progress in enhancing the usability of telehealth technologies in daily workflows; success in navigating evolving relationships between patients and their physicians; and the availability of evidence-based clinical guidance.

There is an urgency for enhancing the evidence for telehealth technology applications as clinicians and consumers expand their use in numerous areas[21,22]: real-time video consultations with off-site specialists in fields such as cardiology, dermatology, psychiatry and behavioral health, gastroenterology, infectious disease, rheumatology, oncology, and peer-to-peer mentoring; telephone, e-mail, and video visits for primary care triage and interventions such as counseling, medication prescribing and management, and management of long-term treatment for diabetes, chronic obstructive pulmonary disease, and congestive heart failure; technologies for transferring imaging data for off-site radiologic review; hospital-based services, such as emergency and trauma care, stroke intervention, intensive care, and wound management, that are supported by specialty consultations through videoconferencing and securely transmitted high-resolution images; postdischarge coordination and management of chronic and other illnesses in home and community-based settings, supported by remote-monitoring capabilities, improved resolution of smartphone cameras, and growing consumer familiarity with video interactions; and wellness interventions, in areas such as health education, physical activity, diet monitoring, health risk assessment, medication adherence, and cognitive fitness, that use video channels, smartphone apps and texts, and Web portals.

A recent technical brief prepared for the Agency for Healthcare Research and Quality (AHRQ) provides a valuable assessment of the evidence supporting telehealth interventions and of the gaps in the available evidence.[22] The map of 58 systematic reviews, covering 965 individual studies published between 2007 and 2015, provides evidence of effectiveness for uses in remote monitoring of patients, communication and counseling for patients with chronic conditions, and psychotherapy support for behavioral interventions. The brief noted that additional systematic reviews are needed to more thoroughly evaluate the available primary evidence for telehealth consultation, the deployment of telehealth technologies in intensive care settings, and applications in maternal and child health. Finally, the report noted the limited availability of even primary evidence regarding the use of telehealth in triage for urgent and primary care beyond telephone-only interven-

Table 2. Recommendations for Telehealth Research.

Topic	Recommendation
Physician leadership	Physicians should seek to enhance telehealth care delivery through collaborations with telehealth technology and service providers and contribute to the evidence base by comparing telehealth outcomes with usual care.
Reimbursement	Current Procedural Terminology codes should be updated to facilitate reimbursement-related research in fee-for-service settings, and the effect of alternative payment models that use bundled telehealth services should be studied to determine purchaser returns on investment.
Licensure	The necessary facilitation of interstate licensure should be supported by ongoing research regarding any quality-of-care issues that may arise.
Liability	Evidence is necessary to better understand what, if any, quality and safety risks may differentiate telehealth service delivery from traditional in-person care.
Human factors	Research on user-centered design is needed to facilitate the integration of telehealth into clinical workflows and to optimize patient engagement.
Device interoperability and data integration	Evidence-based best practices and standards that support the most effective integration of devices and data streams from clinician and patient telehealth engagement should be widely shared.
Privacy and security	Standardized guidelines are necessary and should be based on evidence and best practices to support appropriate safeguards and regulatory oversight.
Performance measurement	Enhanced evidence is required to address gaps in existing telehealth-related clinical performance measures and enhance those currently available.
Patient engagement and the evolving patient–physician relationship	Evidence-based guidance is needed to support health professional counseling and engagement with patients and caregivers across the full spectrum of telehealth services and technologies.
Research design and methods	Telehealth research in real-world settings requires alternative research designs, new research methods, and innovative analytic techniques that supplement traditional randomized, controlled trials and should be supported with enhanced funding and an expanded workforce.

tions; management of serious pediatric conditions; teledermatology; and the integration of mental and physical health care delivery. Especially noteworthy was the observation of limited evidence regarding the effect of telehealth on health care costs and utilization and the consequences of new payment models.

KEY ASPECTS OF TELEHEALTH SERVICE DELIVERY

At least nine key aspects of telehealth service delivery require enhanced research and evidence production if clinicians and patients are to optimize telehealth interventions. As such, we make a number of recommendations about research priorities (Table 2).

PHYSICIAN LEADERSHIP

Physicians define care culture and, as such, require confidence in the care standards regarding settings, appropriateness criteria, and reliability for the deployment, or not, of telehealth tools in diagnosis and therapeutic interventions. Because software developers often lack sufficient understanding of the nuances of health care delivery,[23] physicians should be prepared to engage with innovators of telehealth technology throughout product life cycles. As directed by the American Medical Association (AMA) Council on Ethical and Judicial Affairs, "through their professional organizations and institutions, physicians should support ongoing refinement of technologies and the development of clinical standards for telehealth and telemedicine." The council further suggests that "physicians collectively should advocate for access to telehealth and telemedicine services for all patients who could benefit from receiving care electronically. Professional organizations and institutions should monitor telehealth and telemedicine to identify and address adverse consequences as technologies evolve and identify and encourage dissemination of positive outcomes."[24] Evidence is essential to accomplish this goal.

REIMBURSEMENT

Reimbursement is a key determinant in the use of clinical interventions. The movement toward value-based reimbursement that provides incentives for care delivery in the lowest-cost care settings, the identification of and interaction with high-risk persons before disease onset, and the efficient use of integrated care teams all provide incentives for telehealth growth. Understanding the effect of reimbursement within the context of alternative payment models, such as those included in MACRA, is a particular priority. The Centers for Medicare and Medicaid Services continues to reconsider its limited definition of telehealth-reimbursable services as it develops a plan for implementing provisions of MACRA,[7] offering an important opportunity to support clinicians in meeting the goals of new value-based payment models. Although the trajectory of value-based reimbursement is uncertain, efficiency in care delivery will inevitably be a priority under any scenario. A related issue is ensuring that these technologies are used for patients who meet the appropriate clinical requirements.

Currently, gaps in the Current Procedural Terminology (CPT) codes that document telehealth encounters frustrate payment for services such as remote monitoring of patients and the use of online services for patient care. In 2015, the CPT Editorial Panel of the AMA, which oversees maintenance of the CPT code set, formed a workgroup to support the integration of emerging telehealth services into clinical practice with new coding solutions. In addition, the AMA recently formed a multistakeholder body called the Digital Medicine Payment Advisory Group, which is focused on coding and payment, among other issues (Ahlman J: personal communication).

A more complete set of codes will also provide more precise data to address the paucity of systematic economic evaluation of the benefits of telehealth in both fee-for-service and value-based models of care and payment.[21,22] Filling this gap is essential to support public and private purchasers of care, technology purchasers, and technology investors as they make decisions about return on investment in this field.

LICENSURE

Because telehealth service delivery often crosses state lines, telehealth providers confront a complex, time-consuming, and financially burdensome labyrinth of conflicting state licensure requirements. Beginning in April 2013, the Federation of State Medical Boards (FSMB) spearheaded the creation of the Interstate Medical Licensure Compact (IMLC), which is intended to increase efficiency in multistate licensing of physicians.[25] Currently, 21 state legislatures have enacted the compact into state law, thereby enabling their participation in the IMLC,[26] and federal funding from the Health Resources and Services Administration (HRSA) is helping the FSMB to recruit more states. Research is needed to better understand the relationship between facilitating interstate licensure and quality-of-care outcomes to protect against any adverse consequences.

LIABILITY

The results of a recent AMA survey indicated that liability coverage was a "must-have" for physician adoption of digital tools such as telehealth.[27] The Physician Insurers Association of America (PIAA), the trade association representing the medical and health care professional liability insurance industry, reports that there is not a "typical" liability insurer for telehealth. According to an August 15, 2016, e-mail message from Michael Stinson, J.D., vice president of government relations and public policy at PIAA, liability insurance issues regarding telehealth are, generally, taken on a case-by-case basis with each policyholder, depending on the frequency with which the physician sees patients through telehealth and the practice specialty. From a public policy perspective, most liability carriers lean toward using the physician's state of licensure rather than the patient's location to define coverage. There is a need for new knowledge to understand the distinctions, if any, in the quality and safety risks that differentiate telehealth service delivery from traditional in-person care.

HUMAN FACTORS

Important lessons for telehealth integration can be learned from the implementation of electronic health records (EHRs), particularly the importance of usability design and clinician training to enhance productivity, quality, and safety.[28,29] User-centered design that facilitates the integration of telehealth into workflows and clinical routines is essential,[30] especially with respect to remote physical examination.

Ease of use is equally important for consumers of telehealth interventions. For example, a recent study involving multiple smartphone-enabled sensors required patients to set up and log into a third-party portal. One of three participants submitted help-desk requests, which suggests that the system was not consumer-friendly and was unnecessarily burdensome.[31] Telehealth interventions must be informed by more research on their usability by both providers and patients.

DEVICE INTEROPERABILITY AND DATA INTEGRATION

As telehealth clinical tools proliferate, clinicians require that such tools work seamlessly together and are supported by data streams that are integrated into electronic records.[32] Devices remain suboptimally integrated; for example, most EHR systems are unable to integrate patient-generated data from remote self-monitoring devices.[32,33] This issue is especially important given the need to find solutions to the tsunami of patient-generated data that, if not coordinated and made actionable, threatens to overwhelm clinicians.

To address this challenge, the American Telemedicine Association (ATA) and other industry groups have advocated for EHRs to begin to incorporate patient-generated data from remote-monitoring apps and devices.[34] One promising approach is shown by the SMART Health IT platform, in which standards-based, open-source application programming interfaces (APIs) such as Fast Healthcare Interoperability Resources (FHIR) allow clinical apps to run across health systems and integrate with EHRs.[35] Research that informs these efforts is a priority.

PRIVACY AND SECURITY

As software and devices become more interoperable, data become more integrated and patients generate and interact with more data. These trends ensure that privacy and security will become more complex and important. Currently, federal and state guidelines for telehealth security and privacy are not standardized, leaving considerable gaps.[36] Several medical specialty societies have suggested administrative, physical, and technical safeguards to enhance security.[37-40] It has also been suggested that a comprehensive regulatory framework enforced by a single federal entity will be required to increase and maintain patient and provider trust and to fully realize the benefits of telehealth.[41] Research that informs solutions in this area is a priority.

PERFORMANCE MEASUREMENT

As articulated by the Vital Directions for Health and Health Care initiative of the National Academy of Medicine, a health system that performs optimally must be able to address the demands for accountability and information on the quality, cost-effectiveness, and patient satisfaction of system performance.[42] Performance measurement is essential for new technologies such as telehealth, as public and private purchasers concerned with appropriate use, and capital investors concerned about return on investment, require continued demonstration of value in actual clinical experience. The National Quality Forum recently launched the Telehealth Framework to Support Measure Development 2016–2017, a 1-year project to identify existing and potential telehealth metrics and prioritize a list of concepts and guiding principles for telehealth measurement.[43]

Several national medical specialty societies have also developed or will be developing clinical guidelines and position statements addressing telehealth.[39,44] In addition, the ATA accreditation program evaluates the quality of real-time, online patient services to promote patient safety, transparency of pricing and operations, and adherence to provider credentialing and laws and regulations.[45] Performance measurement requires an evidence basis and is a critical priority that must be addressed.

PATIENT ENGAGEMENT AND THE EVOLVING PATIENT–PHYSICIAN RELATIONSHIP

Wireless monitoring, mobile health applications, social media, and smartphone video capabilities, among others, offer innovative possibilities to extend care relationships well beyond the traditional in-patient visit. The relationship between patients and physicians will inevitably be affected by patients' use of these new sources of clinical information and guidance, as they engage in their own health management. These tools will produce a large amount of new data and information and will change provider workflow, work culture, and interpersonal boundaries, resulting in new challenges to evolving patient–physician relationships. Clinicians will be espe-

cially challenged in assisting their patients in the use of consumer-directed health apps. For example, a recent Commonwealth Fund report stated that although mobile applications are a "potentially promising tool for engaging patients in their health care," only about 43 percent of iOS apps and 27 percent of Android apps appeared likely to be useful.[46]

Recent guidance from the AMA Council on Ethical and Judicial Affairs notes that new technologies and new models of care will continue to emerge, but physicians' fundamental ethical responsibilities will remain the same as long as physicians have access to the information they need to make well-grounded recommendations for each patient. According to the guidelines, physicians using telehealth should inform patients about its technology and service limitations, advise patients how to arrange for follow-up care, encourage patients to let their primary care physicians know when they have used telehealth, and support policies and initiatives that promote access to telehealth services for all patients who could benefit from receiving care electronically.[24] All these actions must be informed by evidence-based guidance.

IMPLICATIONS FOR FUTURE RESEARCH

Throughout this article, we have indicated key areas that require greater research attention and support. In addition to these, there are important methodologic challenges that must also be addressed by the health services research field.

For example, the clinical care setting for telehealth medical and surgical services can be complex. The interventions often involve one or more technical methods (e.g., Web portal, smartphone, and wearable sensors) and are frequently delivered by members of comprehensive care teams who engage patients throughout the stages of care intervention. As a result, the specificity and generalizability of research findings, and the translation of research into guidance for different members of integrated health teams, can become complicated.[22] The multicomponent and personalized nature of these interventions, the pace of change in mobile technology, and the relatively nonstandardized, context-sensitive application of these tools in the clinical setting present research challenges.

Although randomized, controlled trials are the standard to establish intervention efficacy in health care delivery, they may be limited in their generalizability and unable to account for intervention adaptations or contextual factors that may influence outcomes in different settings and for different populations. Fortunately, an increasing array of rigorous study designs are now available to assess a broad range of such complex interventions.[47] These include cluster randomization, pragmatic trials, large, simple trials, factorial designs, and stepped-wedge designs. The Patient-Centered Outcomes Research Institute has begun to establish methodologic standards for these alternative designs.[48] Innovative analytic techniques and tools are becoming available to evaluate multicomponent interventions that integrate data from EHRs, claims, laboratories, imaging, pharmacies, and other sources.[49,50] In addition, new methods from implementation science, such as rapid evidence reviews, and the increasing presence of researchers who are employed by health systems show promise for faster and better research on telehealth implementation, including workflow, protocols for care coordination, and management of organizational change to support team-based care and shared decision making.[51]

Federal funding of telehealth research from traditional sources such as the AHRQ and HRSA is, unfortunately, uncertain. As such, other sources of funding are essential. Health systems should continue to fund research on telehealth implementation and support the dissemination of findings. Philanthropic organizations such as the Commonwealth Fund, the Pew Charitable Trusts, and the Robert Wood Johnson Foundation should continue to play a role in funding telehealth studies. Finally, the developers of telehealth products and solutions should be active in validating their tools by sponsoring independent research and publicly reporting their findings.

CONCLUSIONS

The emergence of new telehealth-related capabilities and their integration into care-delivery systems presents exciting opportunities to enhance value-based clinical care, health promotion, and disease prevention. They also present challenges as health professionals adapt to innova-

tions in consumer technologies, integrate these solutions into clinical workflow, seek evidence-based guidance for decision making, and manage the evolving relationships between care teams and their patients. Clinicians deserve access to a more complete body of evidence on telehealth care as they make important decisions with, and on behalf of, their patients.

The opinions expressed in the article are those of the authors and should not be interpreted as American Medical Association policy.

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