REVIEW

A Re-conceptualization of Access for 21st Century Healthcare

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Many e-health technologies are available to promote virtual patient–provider communication outside the context of face-to-face clinical encounters. Current digital communication modalities include cell phones, smartphones, interactive voice response, text messages, e-mails, clinic-based interactive video, home-based web-cams, mobile smartphone two-way cameras, personal monitoring devices, kiosks, dashboards, personal health records, web-based portals, social networking sites, secure chat rooms, and on-line forums. Improvements in digital access could drastically diminish the geographical, temporal, and cultural access problems faced by many patients. Conversely, a growing digital divide could create greater access disparities for some populations. As the paradigm of healthcare delivery evolves towards greater reliance on non-encounter-based digital communications between patients and their care teams, it is critical that our theoretical conceptualization of access undergoes a concurrent paradigm shift to make it more relevant for the digital age. The traditional conceptualizations and indicators of access are not well adapted to measure access to health services that are delivered digitally outside the context of face-to-face encounters with providers. This paper provides an overview of digital "encounterless" utilization, discusses the weaknesses of traditional conceptual frameworks of access, presents a new access framework, provides recommendations for how to measure access in the new framework, and discusses future directions for research on access.

KEY WORDS: access; e-health; digital; connectivity; veterans.
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INTRODUCTION

It has been argued that the most important ingredient to effectively managing chronic illnesses is communication between patients and providers.[1] Yet, our current healthcare system is fragmented, delivering episodic face-to-face treatment with negligible communication between encounters, and minimal care coordination over time.[2] Given the current level of innovation in e-health technologies and recent legislation to reform the U.S. healthcare system, it seems inevitable that the paradigm of healthcare delivery will evolve rapidly. One example is the Patient Centered Medical Home, a model of care that emphasizes, among other things, enhanced patient access through digital channels of communication.[3] As the paradigm of healthcare delivery evolves, it is imperative that our theoretical conceptualization of access undergoes a concurrent paradigm shift. Based on supposition of how healthcare might be delivered in the digital age, we present some preliminary thoughts about a new framework for conceptualizing access to healthcare services for the 21st century. The ideas outlined in this paper are not intended to be definitive, but rather to inspire a dialogue about how access should be re-conceptualized to make it more relevant for the digital age.

Healthcare in the future may be delivered and reimbursed as coordinated bundles of services around episodes of care rather than discrete payments for single encounters. While traditional face-to-face encounters will likely remain the cornerstone of healthcare delivery, changes in reimbursement policies may create financial incentives for providers to communicate digitally with their patients in-between face-to-face encounters. Also, the increased demand for healthcare services resulting from universal health insurance coverage may well exceed the supply of providers, thereby necessitating a shift to more efficient digital encounterless exchanges of clinical information between patients and providers. Our current conceptualizations of access are not well suited to measuring access to health services that are delivered digitally outside the context of the traditional face-to-face patient–provider encounter.

We explicitly adopt a patient-centered[4] view, and conceptualize access to care as the fit between an individual and the healthcare system.[5] Thus, access should be measured individually for each patient and should depend on both the characteristics of the patient and the structure[6] of the healthcare system. For a conceptual framework for access to facilitate improvements in care, it must be applied to a

healthcare system that has the capacity to adapt itself to accommodate the characteristics of individuals that result in poor access to care such as poverty, poor health literacy, and rural residence.[7] Therefore, it is critical to contextualize the conceptual framework within a system of care. The conceptual framework discussed in this paper was designed specifically for the Department of Veterans Affairs (VA) healthcare system. Because VA is a national leader in the implementation of personal health records, interactive video, and remote monitoring technologies, it is a natural context for discussing the re-conceptualization of access for the digital age.

The remainder of this paper is divided into the following sections: 1) overview of digital "encounterless" utilization, 2) weaknesses of traditional conceptual frameworks of access, 3) new framework for access, 4) measuring access in the new framework, and 5) conclusions and future directions for research.

UTILIZATION

One cannot re-conceptualize access without re-conceptualizing utilization in the digital age. In contrast to traditional face-to-face patient-to-provider encounters in which patients and providers are in close physical proximity to one another, "virtual" encounters involve the use of digital systems to facilitate communication among patients and providers separated by distance and/or time. Table 1 describes four categories of virtual healthcare utilization that should be considered in addition to traditional encounters: 1) synchronous digital patient-to-provider encounters, 2) asynchronous digital patient-to-provider communications, 3) digital peer-to-peer communications, and 4) synchronous digital interactions between patients and computer health applications. Digital communication modalities currently include cell phones, smartphones, interactive voice response, text messages, e-mails, interactive video, web-cams, personal monitoring devices, kiosks, personal health records, web-based portals, social networking sites, secure chat rooms, and on-line forums. These e-health technologies enable synchronous and asynchronous digital communications between patients and their formal providers, informal caregivers, peers, and computer applications and allow face-to-face patient-to-provider encounters to focus on medical procedures requiring physical proximity and tactile contact.

WEAKNESSES OF TRADITIONAL CONCEPTUALIZATIONS OF ACCESS

The traditional conceptualizations of access focus almost exclusively on patient-to-provider face-to-face encounters and do not consider digital encounterless utilization. For example, traditional measures of access such as travel time to nearest provider or visit copayments do not capture the ease of digital encounterless communications. There are also fundamental problems with many of the traditional conceptualizations of access and the term is unfortunately often used interchangeably with similar constructs such as utilization, quality, and clinical outcomes. While access, utilization, quality, and outcomes are interrelated constructs, we argue that access should be thought of as a distinct concept specifically representing the opportunity to engage in care. Access is a necessary, but not sufficient condition for utilizing services, receiving high quality care, and experiencing optimal outcomes. Below we discuss the differences between access, utilization, quality and outcomes, and why we believe that measuring access using utilization, quality or outcome indicators is inadvisable.

Utilization. Anderson and Aday's notion of "realized access" is essentially a measure of utilization, or "appropriate" utilization operationalized as the ratio of utilization to need.[6,8–11] However, utilization is distinct from access because it depends on both access to and need for services. Therefore, measuring access based on utilization metrics will underestimate access to care whenever there is a lack of perceived need for treatment. Moreover, we argue that defining access as the "appropriate" utilization unnecessarily complicates the measurement of access because the need for treatment can rarely be measured with precision.[10]

Quality. Some have interpreted Donabedian's structure-process-outcome conceptualization of quality to suggest that access should be considered a facet of quality (i.e., a structural component) rather than as an independent construct.[12] However, Donabedian himself specifically states (p.22) "In all these ways, accessibility and quality are closely related. But this is not to say that they are the same thing. I believe that it is more appropriate to separate the two phenomena, defining accessibility of care as the ease with which it is initiated and maintained…."[12] Donabedian goes on to argue that increasing access does not always improve quality of care.[12] For example, due to the positive correlation between volume and quality in surgery,[13] surgical programs are often regionalized, which reduces geographical access, but improves quality for those who receive it.

Outcomes. The Institute of Medicine (IOM) defines access as "the timely use of personal health services to achieve the best possible health outcomes."[14] The IOM justifies the inclusion of clinical outcomes in their definition of access by arguing that one can only judge whether access has been achieved by measuring whether outcomes are optimal. The IOM suggests that access should be measured according to outcomes that could potentially be influenced by access such as infant mortality rates, incidences of diseases preventable by vaccine, percent of cancer patient diagnosed in late stages, and hospital admissions for ambulatory sensitive conditions.[14] However, clinical outcomes depend on many factors besides access, and thus clinical outcomes are too distal to be good indicators of access. Moreover, increasing access will not necessarily improve outcomes (e.g., if services are ineffective).

ACCESS REDEFINED

Following the lead of Penchansky and Thomas, we conceptualize access as a set of specific dimensions that characterize the fit between the patient and the healthcare system.[5] As described in Figure 1, we propose the following dimensions of access: geographical, temporal, financial, cultural and digital. We also propose the following definition of patient-centered

Table 1. Types of Virtual Healthcare Utilization

Type of Utilization	Explanation
Synchronous digital patient-to-provider encounters	Include visits conducted using audio-only or audiovisual technologies in which the patient is located in a different geographic location than the provider. Audiovisual technologies include clinic-based interactive video units,[39] home-based web-cams[40,41] and mobile smartphone two-way cameras. These video visits typically substitute for traditional face-to-face encounters between patients and providers while minimizing travel burden for the patient and/or provider. Audio-only synchronous digital patient-to-provider encounters can also be conducted via telephone, cell phone or smartphone. These encounters tend to be more focused (e.g., to discuss side-effect or assess treatment response).
Asynchronous digital patient-to-provider communication	Include interactive video,[42] interactive voice response,[43] text messaging,[44,45] e-mails, and secure chat rooms hosted by healthcare organizations in which there is a time lag in communication between the patient and the provider. These encounters, by the nature of the technology, tend to be more focused than synchronous patient-to-provider encounters. For example, such communications could focus on treatment adherence such as reminders to take medications, monitor blood glucose, or complete psychotherapy homework. A review of cell-phone interventions involving reminders and recommendations for patients with chronic disease found that 92% of the interventions improved clinical outcomes.[46] Another important type of asynchronous digital patient-to-provider encounter includes remote monitoring involving the entering/forwarding of clinical information by the patient to their provider via smartphones, kiosks, web-based portals hosted by the healthcare organization (e.g., MyHealtheVet[47,48]) or personal electronic medical devices (e.g., HealthBuddy®,[49,50] Intel® Health Guide). Clinical information might include vital signs (e.g., weight, blood pressure), photographs (e.g., wounds[51], rashes, swelling, etc), self-reported symptoms (e.g., depression and pain severity[52]) or medication side-effects for the provider to review in order to assess treatment tolerability and response. Personal monitoring devices including wearable monitoring devices[53] (e.g., the Corventis PiiX cardiac monitor), portable monitoring devices (e.g., AreoTel® Heartview™), and sensors integrated into automobiles or homes that can collect clinical information such as vital signs, blood glucose, weight, falls,[54] problems with gait,[55] and automatically upload data to the provider via wireless (e.g., Bluetooth devices such as MedApps® HealthPAL) or wired technologies.
Digital peer-to-peer communications	Include discussions between patients who exchange information and practical advice about their shared illness experiences, and provide mutual support to one another. A peer who is in recovery can often better relate and provide more authentic empathy to patients than can a formal health provider. Digital communication modalities for synchronous or asynchronous virtual peer-to-peer communication include social networking sites (e.g., Facebook), on-line forums (e.g., Depression and Bipolar Support Alliance), phones, text messaging and e-mail. Although not traditionally recorded in medical records, peer-to-peer encounters could be captured in PHRs. Likewise, peer-to-peer communications are also not traditionally included in measures of utilization, but with the growing reliance on digital social networking, it is important to begin capturing these types of encounters, especially for patients with mental health and substance use disorders.
Synchronous digital interactions between patients and computer health applications	Include personal computer-based applications, web-based applications, and smartphone-based applications that present information in a user-friendly format or deliver therapeutic treatments. The number of computer health applications is growing exponentially. For example, as of February 2010, there were 5,805 health, medical, and fitness applications available for the iPhone in the Apple AppStore.[56] There are currently many computer health applications designed to provide information to patients including the Mayo Clinics' web-based Symptom Checker and smartphone-based Mobile Symptom Checker.[57] Other web-based and smartphone-based applications help patients make decisions about treatment options (i.e., preference-based weighting of risks and benefits) or facilitate self-monitoring of symptoms and promote adherence to treatment (e.g., MedsLog). There are also a growing number of web-based[58,59] and personal computer-based applications[60] that deliver therapeutic treatment to patients like cognitive behavioral therapy that have been shown to be clinically effective in randomized trials.[61] As the functionality of smartphones increases, a growing number of health applications are likely to be developed for this platform.

access to care updated for the digital age, along with two sub-definitions for actual and perceived access:

- Access to care represents the potential ease of having virtual or face-to-face interactions with a broad array of healthcare providers including clinicians, caregivers, peers, and computer applications.
  - Actual access to care represents those directly-observable and objectively measurable dimensions of access.
  - Perceived access to care represents those self-reported and subjective dimensions of access.

Perceived access is no less valid than actual access and may be a stronger predictor of utilization than actual access. A patient's perceived access to care may change over time (even in the absence of changes in actual access) as the individual uses services and their perceptions are updated to more accurately reflect the ease of using those services. As depicted in Figure 1, a patient's utilization, quality and outcomes experience will influence their satisfaction with care. Because satisfaction with utilization represents the patient's ability to obtain enough of the type of services they prefer, it will in turn influence their perceived access to care. Similarly,

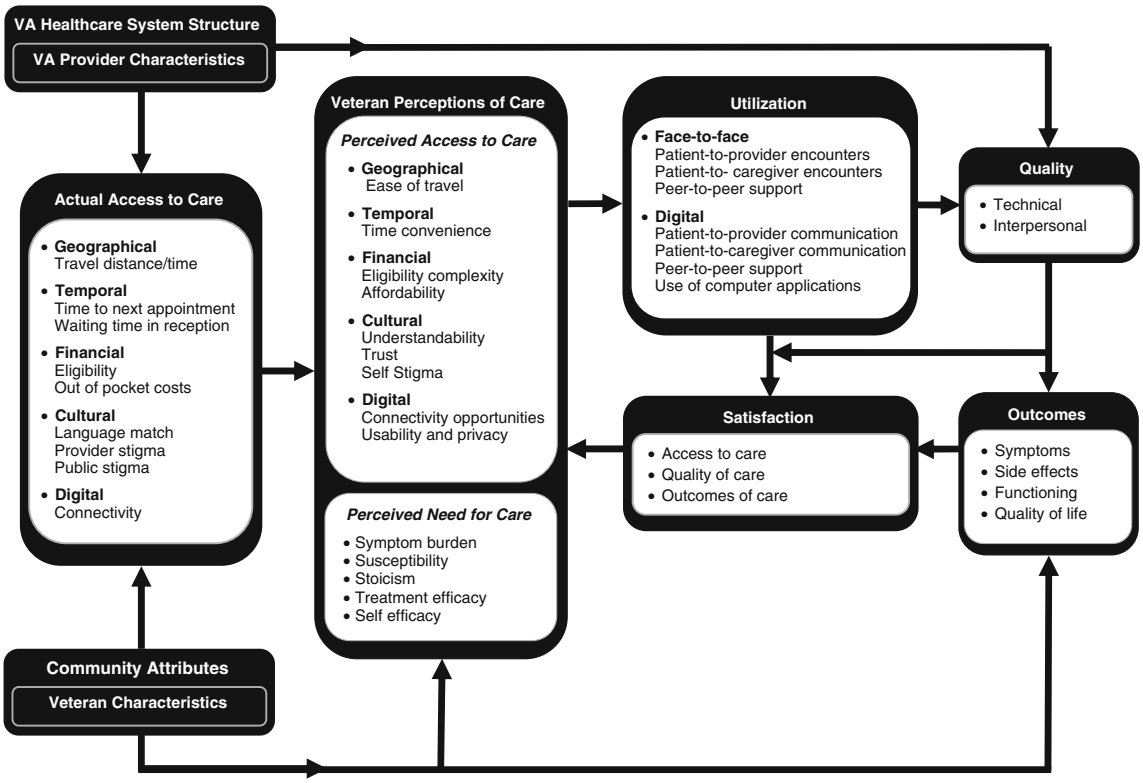

Figure 1. Conceptualization of access.

satisfaction with quality and outcomes influences the patient's perceived need for care. Thus, over time, the patient's satisfaction with utilization, quality and outcomes will feedback to modify their perceptions about need and access.[15] As patients gain more experience with a new sector of the healthcare system, their perceptions of access should become more accurate.[15] Consequently, perceived access can actually be lower for those who use services compared to those who do not if the difficulties associated with accessing services are under-estimated by those who have never attempted to use them.[16] Similar to Aizen's notion of "actual behavioral control", there may be actual access problems unknown to the individual (e.g., waiting list) that impede service utilization, but are not factored into current perceptions about access.[17]

INTERACTION BETWEEN PERCEIVED ACCESS AND PERCEIVED NEED

There are many theories of treatment seeking in the literature and nearly all include a construct representing perceived access (or barriers) to care. For example, Rosenstock's Health Beliefs model posits that the utilization of services is jointly determined by perceived barriers to care and perceived need for and effectiveness of care.[18] Perceived need is broadly conceptualized here as perceptions about symptom burden, susceptibility, stoicism, self efficacy, and treatment efficacy.[19,20] Although many researchers model perceived access to care and perceived need for care in an additive manner, the demand for services really depends on the interaction between perceived need and perceived access. This conceptualization is supported by the fact that access problems (such as long travel distance) tend to have less of an adverse impact for illnesses that are associated with high levels of perceived need for care (e.g., cardiac disorders).[21] For illnesses associated with low levels of perceived need (e.g., substance use disorders), individuals often make a proverbial "mountain out of a mole hill" when it comes to seeking services.

DIMENSIONS OF ACCESS

Geographical. The geographical dimension of access represents the ease of traveling to healthcare provider locations. The geographical dimension of access is of particular importance to rural populations, although travel can also be an important issue for congested urban areas and for those who lack personal forms of transportation. Actual geographic access includes the road travel distance and time to the nearest provider[22] or to the nearest facility with telemedicine equipment.[23] The degree of local provider choice (e.g., number of providers within 30 minutes) may also be an important dimension of actual geographical access.[24]

Perceived geographic access represents the self-reported ease of traveling to healthcare providers and tele-providers.

Temporal. The temporal dimension of access includes the time required to receive services and the opportunity cost of that time. Another temporal dimension includes the time delay between when the services are needed and how long it takes to get an appointment or to communicate digitally with the provider. Actual temporal access includes time spent waiting in the reception area, the time spent receiving treatment, and the time spent on subsequent self-care activities, as well as the wait-time for the next available appointment or digital communication. Perceived temporal access represents the self-reported time burden and temporal convenience of receiving services. If services and communications are only available when the patient has other responsibilities (e.g., work or childcare), the perceived time burden will be associated with higher opportunity costs.

Financial. The financial dimension of access includes healthcare system eligibility issues and the cost of utilizing healthcare services. Actual financial access includes eligibility (e.g., entitlement to VA services), insurance premiums, out-of-pocket costs for face-to-face and digital encounters, opportunity cost for lost work time (for those without paid sick leave), as well as the cost of digital connectivity, and the cost of remote monitoring devices and computer health applications. Perceived financial access represents misinformation about eligibility and the complexity of the application process, as well as the affordability of out-of-pocket costs and opportunity cost relative to household annual income. Perceptions about financial access will be greatest for those with low incomes, unpaid sick leave, as well as those living or in rural areas where digital connectivity is more expensive.

Cultural. The cultural dimension of access represents the acceptability of health services. Actual cultural access includes whether services are offered in a language in which the patient is comfortable communicating (e.g., native language). For stigmatizing illnesses, actual cultural access also reflects whether services are offered by providers who do not discriminate against the patient. Perceived cultural access represents whether patients report that they understand their provider, agree with the diagnosis, and trust their treatment plan. Both patient health literacy and provider cultural competency are critical factors impacting understandability.[25] The mode of communication (e.g., face-to-face, interactive video, text message, etc.) may also influence understandability. For stigmatizing illnesses, perceived cultural access may also include the degree to which a patient internalizes any provider discrimination or public stigma.

Digital. The digital dimension of access includes the connectivity that enables synchronous or asynchronous digital communications with formal providers, informal caregivers, peers, and computerized health applications. The digital dimension must consider patients uploading information to providers and providers downloading information (e.g., lab results, tailored health information) to patients. Actual digital access includes whether patients own or have the right to use digital channels of communication, remote monitoring devices, and computer health applications. It also includes whether the patient's providers and peers have access to digital channels of communication. Perceived digital access represents perceptions about the opportunity and simplicity of interacting digitally with providers. It also represents usability problems, provider responsiveness, as well as security and privacy concerns associated with digital communications.

CONSEQUENCES OF IMPROVING DIGITAL ACCESS

Table 2 presents the individual, community, provider, and health system characteristics that impact each of these five domains of access. As discussed previously, for a conceptual framework of access to facilitate improvements in care, it must be applied to a healthcare system that is capable of modifying its characteristics to fit the needs of the patients it serves.[26] By adopting e-health technologies, the VA can improve digital access to care in order to overcome geographical, temporal and cultural access problems experienced by some veteran populations. For example, geographic access can be improved by offering more services via synchronous digital encounters. Temporal access can be improved by encouraging asynchronous digital patient-to-provider communications at times that better suit patient schedules. Cultural access can be improved by facilitating digital peer-to-peer communications and developing computer health applications that provide education about disorders and treatment options, and accurately assess treatment preferences. However, improving access does not necessarily improve quality or clinical outcomes and there may even be unintended negative consequences of improving digital access. For example, unless efficient and effective methods are developed to filter and prioritize the clinical information uploaded by patients, asynchronous digital communications could overwhelm providers with information and possibly increase their exposure to medical malpractice.

MEASURING ACCESS

Indicators of actual access should be directly observable, objectively measurable, reliable, and have good predictive validity with regards to utilization (for those in need). Examples of actual access measures include distance to nearest provider or tele-provider (geographical), appointment wait-time (temporal), copayments (financial), linguistic match between patient and provider (cultural), and web-based access to health records (digital). Indicators of perceived access should capture patient perceptions about the opportunity and ease associated with seeking treatment. They should also have good reliability, and good predictive validity with regards to utilization (for those in need). Examples of perceived access measures include self-reported ease of travel (geographical), convenience of available appointment times (temporal), complexities of the eligibility application process (financial), trust in the treatment plan (cultural) and usability of computerized health applications (digital). The empirical work required to determine predictive validity is complicated by the fact that while there

Table 2. Patient, Community, Health System and Provider Determinants of Access

Access Dimension	Individual Characteristics	Community Characteristics	Health System Characteristics	Provider Characteristics
Geographic	Residential location Employment location Available modes of transportation	Physical geography such as terrain, and weather Built environment such as road quality, traffic conditions and public transportation	Service locations Outreach programs Telemedicine services Contracting with non-VA providers	Willingness to practice in remote locations Circuit riding
Temporal	Opportunity cost of time (depends on responsibilities at work and home)	Work hour flexibility of local employers Availability of childcare services	Hours of operation Wait-times	Stays on appointment schedule
Financial	Household annual income Service-connection Private insurance status	Health benefits offered by insurance companies and public programs	Eligibility policies Coinsurance rate Charges	Orders unnecessary tests Conducts unnecessary procedures Prescribes generic medications
Cultural	Age Race and ethnicity Marital status Health literacy Coping style Religiosity and spirituality Social support Community embeddedness	Social norms Public stigma	Provision of services tailored to special populations (e.g., VA women's clinics)	Cultural competency Multilingual capabilities Communication style Provider stigma
Digital	Availability and sophistication of personal communication technologies Computer literacy	Broadband availability Satellite coverage Public use computers	Synchronous patient-to-provider communication systems Asynchronous digital patient-to-provider communication systems Digital peer-to-peer communications Computer health applications	Computer literacy Willingness to communicate digitally Receives reimbursement or workload credit for encounterless digital communications

are many potential access indicators, different patients will face different access problems. This will necessitate the development of scales that assess the cumulative effect of access across multiple domains.[27]

While we argued earlier that measuring access using quality indicators is inadvisable, that is not to say that one should not take quality into consideration when measuring access. We recommend that the optimal approach to measuring access is to first measure the quality of services and then measure access to services of different levels of quality. Likewise, because all individuals do not need all types of services, we recommend that appropriate target populations should be specified when measuring access (e.g., access to geriatric services should only be measured for older veterans). Importantly, because different individuals have different preferences for different types of providers and services, we also recommend that patient preferences be taken into consideration when measuring access. Specifically, *patient-centered access* should be measured to the type of services that are preferred. For example, for patients with mental health disorders, access to psychotherapists should be measured for those with a preference for counseling, and access to prescribers should be measured for those with a preference for pharmacotherapy. Therefore, we recommend first categorizing services according to type, preference and quality and then measuring access to the types of services that are relevant and preferred, and to services of varying levels of quality.

We have argued that for this re-conceptualization of access to facilitate improvements in care, it must be applied by a healthcare system that has the capacity to adapt itself to better accommodate the characteristics of individuals.[28] However, this is not to imply that improvements in access should be

measured from the perspective of the healthcare system (e.g., number of new clinic locations). Because we have defined access from the perspective of the patient, we argue that the impact of improvements to the healthcare system should be determined by aggregating the individual effects on patients (e.g., average travel distance before and after opening new clinics).[29] A complicating factor is that we have also argued that access depends on the characteristics and treatment preferences of the individual. Therefore, from a methodological perspective, the challenge will be to aggregate access measures that have been customized to each individual patient. A good example is the VA wait-time performance measure which is determined by asking each patient when they would like to schedule their next appointment, calculating how many days beyond that they must wait for an appointment and aggregating that number across all veterans sampled. Another complication of the patient-centered perspective is that the healthcare system must also consider access to services outside their system (e.g., non-VA clinicians, peers).

DISCUSSION

As innovations in e-health technologies transform the way healthcare is delivered, digital communications between patients and their providers, peers and computerized health applications have the potential to drastically improve access to many types of healthcare services. Although more and more patients have broadband internet access and are using smartphones, the digital divide may create connectivity barriers for low income, minority, rural, and older adult patients. If up-to-date technologies are not available to certain populations, connectivity will be low. Moreover, patients from some cultures, as well as those with lower education levels may have lower comfort levels with e-health technologies,[30,31] and experience greater usability problems if they lack the skills to engage digitally with their provider and to interface with computer health applications.[32] Thus, although e-health has the potential to improve access, a potentially growing digital divide could create greater access disparities for some patient populations.

The Secretary of VA, Dr. Eric Shinseki, has made access one of his three major themes.[33] In addition, two major initiatives within VA focus on improving access for women veterans and rural veterans.[34] Although VA is a leader in technological innovations in the delivery of healthcare services, VA researchers and practitioners should continue to develop and evaluate innovative interventions that improve digital access to care. These interventions should build on existing technological platforms such as interactive video, home monitoring devices, electronic medical records, and personal health records, as well as expand to new platforms such as kiosks, smartphones, home-based telemedicine systems, computerized health applications, personal monitoring devices, and social networking sites. These new technologies will need to be private and secure. Technology-based interventions will also need to be tailored to the cultural needs of the target populations (e.g., rural veterans[35], minority veterans[36], women veterans[37]) to ensure they are acceptable and user-friendly. Of equal importance will be the development and evaluation of educational programs designed to improve veterans' computer literacy, as well as the implementation of policies designed to increase veterans ownership of relevant technological platforms (e.g., broadband internet, smartphones). Likewise, VA providers will need to be trained to use these emerging technologies and provided with tools to filter/prioritize the digital information transmitted to them by their patients. Measuring provider perspectives and attitudes toward these emerging technologies will also be an important area for future and research.

In addition to developing and validating measures of access for research purposes, VA policy makers will need to develop performance indicators in order to compare regional variations in access and to monitor changes in access over time. Performance measures for access should be developed and implemented across all the access domains (geographical, temporal, financial, cultural and digital). Measures of *actual* access could be based on existing administrative/clinical data, but to measure access in many of the proposed domains, it will be necessary to start collecting new data during clinical encounters. For example, an indicator for actual digital access might require clinicians to record in the medical record whether the patient was given a remote monitoring device. Measures of *perceived* access should be developed for veteran surveys such as the Survey of Healthcare Experiences of Patients (SHEP).[38]

Performance measures for actual and perceived access should be used by the VA to evaluate the impact of policies pertaining to eligibility and purchased care (i.e., contracting with private sector providers) and programs such as the expansion of community-based outpatient clinics, deployment of mobile clinics, and community outreach initiatives. These performance measures and indicators should also be used to identify veteran populations with poor access to care in order to develop new outreach programs. As a patient-centered healthcare organization, having validated access measures that are relevant for the digital age will allow the VA to monitor and adapt itself in order to better accommodate the needs of veterans in the 21st century.

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REFERENCES

1. **Kvedar JC, Herzlinger R, Holt M, Sanders JH.** Connected health as a lever for healthcare reform: Dialogue with featured speakers from the 5th Annual Connected Health Symposium. Telemed J e Health. 2009;15:312–9.
2. **Bashshur RL, Shannon GW.** National telemedicine initiatives: Essential to healthcare reform. Telemed J e Health. 2009;15(6):600–10.
3. **Rosenthal TC.** The medical home: Growing evidence to support a new approach to primary care. J Am Board Fam Med. 2008;21(5):427–40.
4. **Berwick DM.** What "patient-centered" should mean: Confessions of an extremist. Health Aff. 2009;28(4):w555–65.
5. **Penchansky R, Thomas JW.** The concept of access: Definition and relationship to consumer satisfaction. Med Care. 1981;19(2):127–40.
6. **Donabedian A.** Evaluating the quality of medical care. In: **White KL, Frenk J, Ordonez C, Paganini JM, Starfield B, eds.** Health Services Research: An Anthology. Washington, DC: Pan American Health Organization; 1992:345–65.
7. **Ricketts TC, Goldsmith LJ.** Access in health services research: The battle of the frameworks. Nurs Outlook. 2005;53(6):274–80.
8. **Andersen R, Aday LA.** Access to medical care in the U.S.: Realized and potential. Med Care. 1978;16(7):533–46.
9. **Howell EM.** Low income persons' access to health care: NMCUES Medicaid data. Public Health Rep. 1988;103(5):507–14.
10. **Davis K, Gold M, Makuc D.** Access to health care for the poor: Does the gap remain? Annu Rev Public Health. 1981;2:159–82.
11. **Akinbami LJ, LaFleur BJ, Schoendorf KC.** Racial and income disparities in childhood asthma in the United States. Ambul Pediat. 2002;2 (5):382–7.
12. **Donabedian A.** *Explorations in Quality Assessment and Monitoring (Volume 1). The Definition of Quality and Approaches to its Assessment.* Ann Arbor, MI: Health Administration Press; 1980.
13. **Donabedian A.** Volume, quality, and the regionalization of health care services. Med Care. 1984;22(2):95–7.
14. **Millman M.** Access to health care in America. Washington, D.C.: National Academy Press; 1993.
15. **Fortney J, Booth BM.** Access to substance abuse services in rural areas. In: **Galanter M, ed.** Recent Developments in Alcoholism, Services Research in an Era of Managed Care Volume XV. New York: Kluwer Academic/Plenum Publishers; 2001:177–209.
16. **Fortney J, Tripathi S, Walton M, Cunningham R, Booth BM.** Patterns of substance abuse treatment abuse treatment seeking following cocaine-related emergency department visits. J Behav Health Serv Res. In press 2010.
17. **Ajzen I.** The theory of planned behavior. Organizational Behavior and Human Decision Process. 1991;50:179–211.
18. **Rosenstock IM, Strecher VJ, Becker MH.** Social learning theory and the Health Belief Model. Health Educ Q. 1988;15(2):175–83.
19. **Rosenstock IM, Strecher VJ, Becker MH.** Social learning theory and the Health Belief Model. Health Educ Q. 1988;15(2):175–83.
20. **Bandura A.** Self-efficacy mechanism in human agency. Am Psychol. 1982;37(2):122–47.
21. **Fortney JC, Lancaster AE, Owen RR, Zhang M.** Geographic market areas for psychiatric and medical outpatient treatment. J Behav Health Ser Res. 1998;25(1):108–16.
22. **Fortney J, Rost K, Warren J.** Comparing alternative methods of measuring geographic access to health service. Health Services and Outcomes Research Methodology. 2000;1(2):173–84.
23. **Shannon GW, Buker CM.** Determining accessibility to dermatologists and teledermatology locations in Kentucky: demonstration of an innovative geographic information systems approach. Telemed J e Health. 2010;16:670–7.
24. **Fortney J, Thill JC, Zhang M, Duan N, Rost K.** Provider choice and utility loss due to selective contracting in rural and urban areas. Med Care Res Rev. 2001;58(1):60–75.
25. **Ayotte BJ, Allaire JC, Bosworth H.** The associations of patient demographic characteristics and health information recall: The mediating role of health literacy. Neuropsychol Dev Cogn B Aging Neuropsychol Cogn. 2009;16(4):419–32.
26. **Ricketts TC, Goldsmith LJ.** Access in health services research: The battle of the frameworks. Nurs Outlook. 2005;53(6):274–80.
27. **Shannon GW, Bashshur RL.** Accessibility to medical care among Urban American Indians in a large metropolitan area. Soc Sci Med. 1982;16 (5):571–5.
28. **Ricketts TC, Goldsmith LJ.** Access in health services research: The battle of the frameworks. Nurs Outlook. 2005;53(6):274–80.
29. **Fortney JC, Maciejewski ML, Warren JJ, Burgess JF Jr.** Does improving geographic access to VA primary care services impact patients' patterns of utilization and costs? Inquiry. 2005;42(1):29–42.
30. **Yellowlees P, Marks S, Hilty D, Shore JH.** Using e-health to enable culturally appropriate mental healthcare in rural areas. Telemed J e Health. 2008;14:486–92.
31. **Shore JH, Savin DM, Novins D, Manson SM.** Cultural aspects of telepsychiatry. J Telemed Telecare. 2006;12:116–21.
32. **Randeree E.** Exploring technology impacts of Healthcare 2.0 initiatives. Telemed J e Health. 2009;15(3):255–60.
33. **Shinseki EK.** Shinseki delivers 'State of VA' message to Congress. Washington; 2009 Oct 14.
34. **Shinseki EK.** Shinseki delivers 'State of VA' message to Congress. Washington; 2009 Oct 14.
35. **Wallace AE, Weeks WB, Wang S, Lee AF, Kazis LE.** Rural and urban disparities in health-related quality of life among veterans with psychiatric disorders. Psychiatr Serv. 2006;57(6):851–6.
36. **Saha S, Freeman M, Toure J, Tippens KM, Weeks C, Ibrahim S.** Racial and ethnic disparities in the VA health care system: A systematic review. J Gen Intern Med. 2008;23(5):654–71.
37. **Washington DL, Yano EM, Simon B, Sun S.** To use or not to use. What influences why women veterans choose VA health care. J Gen Intern Med. 2006;21(Suppl 3):S11–8.
38. **Wright SM, Craig T, Campbell S, Schaefer J, Humble C.** Patient satisfaction of female and male users of Veterans Health Administration services. J Gen Intern Med. 2006;21(Suppl 3):S26–32.
39. **De Las CC, Arredondo MT, Cabrera MF, Sulzenbacher H, Meise U.** Randomized clinical trial of telepsychiatry through videoconference versus face-to-face conventional psychiatric treatment. Telemed J e Health. 2006;12(3):341–50.
40. **Shea S, Weinstock RS, Teresi JA, et al.** A randomized trial comparing telemedicine case management with usual care in older, ethnically diverse, medically underserved patients with diabetes mellitus: 5 year results of the IDEATel study. J Am Med Inform Assoc. 2009;16(4):446–56.
41. **Woodruff SI, Conway TL, Shillington AM, Clapp JD, Lemus H, Reed MB.** Cigarette smoking and subsequent hospitalization in a cohort of young U.S. Navy female recruits. Nicotine Tob Res. 2010;12 (4):365–73.
42. **Yellowlees PM, Odor A, Parish MB, Iosif AM, Haught K, Hilty D.** A feasibility study of the use of asynchronous telepsychiatry for psychiatric consultations. Psychiatr Serv. 2010;61:838–40.
43. **Mundt JC, Bohn MJ, King M, Hartley MT.** Automating standard alcohol use assessment instruments via interactive voice response technology. Alcohol Clin Exp Res. 2002;26(2):207–11.
44. **Holtz B, Whitten P.** Managing asthma with mobile phones: A feasibility study. Telemed J e Health. 2009;15(9):907–9.
45. **Terry M.** Text messaging in healthcare: The elephant knocking at the door. Telemed J e Health. 2008;14(6):520–4.
46. **Krishna S, Boren SA, Balas EA.** Healthcare via cell phones: A systematic review. Telemed J e Health. 2009;15(3):231–40.
47. **Chumbler NR, Haggstrom DA, Saleem J.** Implementation of Health Information Technology in Veterans Health Administration to Support Transformational Change: Telehealth and Personal Health Records. *Med Care* 2010.
48. **Nazi KM, Hogan TP, Wagner TH, et al.** Embracing a health services research perspective on personal health records: Lessons learned from the VA My HealtheVet system. J Gen Intern Med. 2010;25(Suppl 1):62–7.
49. **Darkins A, Ryan P, Kobb R, et al.** Care Coordination/Home Telehealth: the systematic implementation of health informatics, home telehealth, and disease management to support the care of veteran patients with chronic conditions. Telemed J e Health. 2008;14(10):1118–26.
50. **Chumbler NR, Neugaard B, Ryan P, Qin H, Joo Y.** An observational study of veterans with diabetes receiving weekly or daily home telehealth monitoring. J Telemed Telecare. 2005;11(3):150–6.

51. **Martinez-Ramos C, Cerdan MT, Lopez RS.** Mobile phone-based telemedicine system for the home follow-up of patients undergoing ambulatory surgery. Telemed J e Health. 2009;15(6):531–7.
52. **Dobscha SK, Corson K, Pruitt S, Crutchfield M, Gerrity MS.** Measuring depression and pain with home health monitors. Telemed J e Health. 2006;12(6):702–6.
53. **Naditz A.** New frontiers: The virtual reality of telemedicine. Telemed J e Health. 2009;15(1):19–23.
54. **Giansanti D, Morelli S, Maccioni G, Costantini G.** Toward the design of a wearable system for fall-risk detection in telerehabilitation. Telemed J e Health. 2009;15:296–9.
55. **Naditz A.** Telemedicine at the VA: VistA, MyHealtheVet, and other VA programs. Telemedicine Journal and e-Health. 2008;14(4):330–2.
56. **Sarasohn-Kahn J.** How Smartphones are Changing Health Care for Consumers and Providers. CA: Oakland; 2010.
57. **Sarasohn-Kahn J.** How Smartphones are Changing Health Care for Consumers and Providers. CA: Oakland; 2010.
58. **Clarke G, Kelleher C, Hornbrook M, Debar L, Dickerson J, Gullion C.** Randomized effectiveness trial of an Internet, pure self-help, cognitive behavioral intervention for depressive symptoms in young adults. Cogn Behav Ther. 2009;38(4):222–34.
59. **Spek V, Cuijpers P, Nyklicek I, Riper H, Keyzer J, Pop V.** Internet-based cognitive behaviour therapy for symptoms of depression and anxiety: A meta-analysis. Psychol Med. 2007;37:319–28.
60. **Proudfoot J, Ryden C, Everitt B, et al.** Clinical efficacy of computerised cognitive-behavioural therapy for anxiety and depression in primary care: Randomised controlled trial. Br J Psychiatry. 2004;185:46–54.
61. **Kaltenthaler E, Parry G, Beverley C, Ferriter M.** Computerised cognitive-behavioural therapy for depression: Systematic review. Br J Psychiatry. 2008;193:181–4.