Review of Veterans Health Administration Telemedicine Interventions

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The Veterans Health Administration (VHA) is a leader in developing and implementing innovative healthcare technology. We review 19 exemplary peer-reviewed articles published between 2000 and 2009 of controlled, VHA-supported telemedicine intervention trials that focused on health outcomes. These trials underscore the role of telemedicine in large managed healthcare organizations in support of (1) chronic disease management, (2) mental health service delivery through in-home monitoring and treatment, and (3) interdisciplinary team functioning through electronic medical record information interchange. Telemedicine is advantageous when ongoing monitoring of patient symptoms is needed, as in chronic disease care (eg, for diabetes) or mental health treatment. Telemedicine appears to enhance patient access to healthcare professionals and provides quick access to patient medical information. The sustainability of telemedicine interventions for the broad spectrum of veteran patient issues and the ongoing technology training of patients and providers are challenges to telemedicine-delivered care.

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For author information and disclosures, see end of text.

The Veterans Health Administration (VHA) is the largest and most comprehensive managed healthcare system in the United States and includes approximately 150 medical centers and more than 900 outpatient clinics serving 5.1 million veterans nationwide.[1] Among the many challenges facing the VHA is providing healthcare services to an increasingly diverse veteran population, many of whom are of advanced age, diagnosed with multiple disease conditions, and living in remote regions where transportation to VHA facility-based clinics is difficult.[2]

Given the pressures on an infrastructure with finite—albeit still considerable—resources, for more than a decade the VHA has explored cost-effective healthcare delivery alternatives. Since 2000, telemedicine has been a focus for VHA health service delivery funding. Telemedicine has been used to facilitate diagnosis, referral, monitoring, medical information interchange, and intervention to offset higher costs associated with hard-to-access patients.

There are multiple compelling reasons for a focused review of the empirical literature on VHA-sponsored telemedicine interventions. Early reports of managed care adoption of telemedicine have been geographically narrow, and evaluations of telemedicine outcomes in these contexts has been limited to groups of patients impacted by regionally specific healthcare delivery policies.[3] The national reach of the VHA establishes baseline commonalities that make it possible to compare and contrast the features of telemedicine studies across the United States. This reduces the problem of drawing general conclusions from widely disparate patient groups.

The subset of studies that were the focus of this review fit within the general classification of controlled clinical trials (ie, studies published in the scientific literature in which the goal was to address a specific set of patient health issues through means of an intervention group and a control group). Thus, the impetus for this review was similar to the rationale provided by Heinzelmann et al in their general review of telemedicine interventions: that there is a "dearth of sound methodological research in this area, a limited number of robust studies, and the need for randomized clinical trials to produce definitive information about clinical outcomes."[4]

We adopted relevant elements of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).[5] First, we exhaustively searched 4 commonly accessed journal databases: the PubMed portal, the Cumulative Index to Nursing and Allied

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This review provides evidence that telemedicine can be used to address healthcare service delivery demands in managed care.

- Telemedicine is most effective when it is used to monitor and respond to ongoing patient symptomatology, to facilitate information exchange across interdisciplinary teams, and to provide ready access to critical health information material.
- Barriers to telemedicine effectiveness are patient non-adherence to the treatment protocols and maintenance of intervention fidelity in the presence of the changing nature of technology.

Health Literature, the National Library of Medicine gateway, and the American Psychological Association's PSYCINFO database. We limited our search to studies published between 2000 and 2009. All articles that listed in the title or abstract the terms "telemedicine," "telehealth," "telecare," or "e-health" were linked through the Boolean operator "and" to VHA identifying terms including Veterans Health Administration, Department of Veterans Affairs, or when the word "veteran" appeared in the title or abstract. This search yielded 237 published reports, of which a subset were empirical interventions. We then hand-searched 2 specialized telemedicine journals—*Telemedicine and e-Health* and *Journal of Telemedicine and Telecare*—to determine whether the empirical intervention articles identified in our database were fully represented.

We then examined individual abstracts and selected only those articles that (1) described in replicable detail an intervention group and a control or usual care group and (2) included at least 1 outcome assessment administered at posttest and at a follow-up interval. Articles were further excluded if the outcome measures only consisted of patient or provider satisfaction ratings or if the focus was exclusively on cost parameters or diagnostic validation.

This selection process narrowed the number of articles to 46. We then obtained hard copies and enlisted 2 experts with extensive knowledge in telemedicine to examine each article to determine (1) whether the intervention was replicable, (2) whether the outcome assessment instruments were explicitly described, and (3) whether at least 1 credible follow-up assessment was reported after posttesting. This process yielded 19 articles that are summarized in the **Table**.

In this review, we addressed 7 general questions: (1) What were the patient characteristics and the intervention components that addressed these characteristics? (2) What were the outcome measures? (3) What was the overall quality of each intervention study? (4) What were the health outcome findings? (5) What were the advantages of the interventions? (6) What were the barriers to implementation? (7) What strategies emerged to address implementation barriers? Questions 1-4 are addressed in the Results section, and questions 5-7 are addressed in the Discussion section.

RESULTS

What Were the Patient Characteristics and the Intervention Components That Addressed These Characteristics?

The average age of recipients (all were male veterans) was 65 years (range, 49.7-73.1 years). In those studies where patients were younger than 60 years, the target issue was mental health (clinical depression or posttraumatic stress disorder [PTSD]). In those studies where patients were older than 60 years, the target issue was chronic disease management for multiple comorbidities.[6-8]

Common intervention components included monitoring or regular contact, often daily, which was facilitated through telemedicine. The goal of monitoring was to track chronic symptoms and health status through a telemedicine device, typically with human support on the back end, with the aim of maintaining current health status and early detection of disease exacerbations. The telemedicine programs for diabetes management are emblematic of these interventions. All 4 diabetes studies consisted of home-based monitoring through a telephone line.[9-12] In addition to monitoring, these interventions delivered daily or weekly text-based questions to track diabetes symptoms through the telemonitor device and to provide brief educational material about diabetic health. Patients' responses were monitored by clinic-based care coordinators who triaged responses, provided telephone support, and facilitated referrals.

Monitoring and intervention often were integrated, as in the Ross et al depression study where health technicians monitored depression symptoms over 8 weeks via telephone.[13] These brief calls consisted of administration of the Patient Health Questionnaire Depression Scale (PHQ-9), followed by a referral to telephone depression care management—a standardized VHA treatment protocol. The telephone depression care management was administered by a nurse under supervision of a psychiatrist and consisted of monitoring of depressive symptoms and submitting recommendations to the primary care provider about medication regimens.[13] When a patient expressed need for additional help beyond monitoring and telephone management, the patient was referred to a VHA facility for face-to-face care.

Of the minority of studies that targeted acute symptoms, 4 studies focused on mental health conditions such as chronic depression and PTSD.[14-17] These interventions applied more

Table. Characteristics of VHA-Funded Telemedicine Intervention Studies in Review

Study and Design (Rating)[a]	No.	Age, y	Population	Primary Aim	Technology
Barnett et al, 2006[11] Retrospective concurrent matched cohort (V)	782	67.8	DM	Compare healthcare use	MD & phone
Bendixen et al, 2009[6] Retrospective matched cohort (V)	230	72.1	2+ functional deficits	Compare healthcare costs	TM
Chumbler et, al, 2004[19] Retrospective matched cohort (V)	226	73.1	Frail chronic illness	Compare health-related outcomes	MD or 2-way audio-video TM or VF
Chumbler et al 2005[9] Retrospective concurrent matched cohort (V)	800	64.9	DM	Compare healthcare use	MD or 2-way audio-video TM or VF
Chumbler et al, 2007[23] Retrospective matched cohort (V)	125	63.1	Cancer	Compare healthcare use	MD with phone PRN f/u
Chumbler et al, 2009[10] Retrospective matched cohort (V)	774	68	DM	Compare survival rates	MD with phone PRN f/u
Fortney et al, 2007[17] Cluster RCT (II)	395	59.2	MDD	Compare healthcare costs	Interactive VF
Frueh et al, 2007[15] RCT (III)	38	55.5	PTSD	Compare the PTSD SX	VC
Hopp et al, 2006[4] RCT (III)	37	69.7	Home bound	Compare QOL and healthcare use	VF
Jia et al, 2009[12] Retrospective matched cohort (V)	387	67.6	DM	Compare healthcare use	MD with phone PRN f/u

sophisticated telemedicine devices including video and enhanced voice-based treatments. For example, Ruskin et al provided 8 individual sessions with a psychiatrist for depression via computer-based videoconferencing.[14] These appointments consisted of antidepressant medication management, focused psychoeducation, and brief supportive counseling. Frueh et al[15] and Morland et al[16] used videoconferencing to provide coping skills–focused group therapy for PTSD. Fortney et al provided graduated levels of depression care according to symptom severity through an interactive video and a Web site.[17]

Rehabilitation interventions focused on restoring or maintaining functional abilities in persons with physical limitations due to illness or injury. Only 2 studies were classified within this domain.[6,18] The study by Sanford et al involved 4 hour-long video instruction sessions by an occupational therapist delivered by a wireless televideo system. Rehabilitation focused on training patients in improving 3 transfer tasks (eg, getting out of bed) and 3 mobility tasks (eg, locomotion in the home).[18] Bendixen et al's intervention integrated occupational therapy and telemonitoring through the Low Activities of Daily Living Monitoring Program, where in-person and remote occupational therapy was used to assess functional needs, to train patients in the use of adaptive equipment, and to monitor functional status.[6]

What Were the Outcome Measures?

Measures of patient health outcomes were within 3 categories: (1) biological measures, (2) self-report measures of physical or psychological health, and (3) clinician assessments of patient health. The most common biological measure, reported in 4 studies, was glycosylated hemoglobin. Two studies reported mortality as an outcome, which was classified as a biological measure. One study measured low-density lipoprotein cholesterol. Of the 19 studies, 11 included some form of patient self-report. The range of self-report instruments was diverse, including the Beck Depression Inventory, PHQ-9, global quality of life inventories (eg, Quality of Well-Being Scale versions of the SF-36), and functional status measures including the Instrumental Activities of Daily Living Index

Intervention	Control Group and *Study Criteria*	Time	Major Results
Monitoring: daily questions about SX and health status; monitored by CCs	Routine care *3:1 control to subject match; randomly selected based on propensity scores*	24 mo	Reduction in likelihood of all-cause and DM-related hospitalizations and primary care visits
Remote OT skills training and monitoring	Routine care *1:1 match based on 4 variables from VHA database of 9862 patients*	24 mo	No significant differences in cost, rehabilitation, & ADL measures
Daily or weekly monitoring and education by CCs	Routine care *Matched by age from sample of 791 men enrolled in longitudinal aging study*	12 mo	Monitored group had better ADL & FIM scores
Daily or weekly monitoring and education by CCs	Routine care *3:1 control to subject match; randomly selected based on propensity scores*	12 mo	Treatment group had reduced need-based visits
Monitoring by CC with phone f/u as needed; skills training	Routine care *2:1 control to subject match from noninstitutionalized vets with new cancer diagnoses*	6 mo	Care coordination had significantly fewer preventable service needs
Monitoring by CCs; daily questions about SX and health status	Routine care *1:1 control to subject match; randomly selected based on propensity scores*	48 mo	Significantly lower mortality rate in intervention group in all cases
Cognitive skills training: provider and patient education; support from off-site mental health team	Provider and patient education *Clinic sites matched and each pair randomized to intervention or control*	12 mo	Intervention patients had larger gains in mental health status; more likely to adhere and respond to treatment
Monitoring and cognitive skills training through group therapy	In-room group therapy *Random assignment*	3 mo	No differences in clinical outcomes, satisfaction, attendance; same-room group more likely to complete homework
PRN monitoring and education through VF; routine clinical care for health needs	Nursing services with PRN phone calls *Random assignment*	6 mo	No significant differences between groups in health or utilization
Monitored by CCs; daily questions about SX and health status	Routine care *1:1 control to subject match; randomly selected based on propensity scores*	48 mo	In first 18 months, preventable hospitalization lower for telemedicine group; difference diminished after 4 years

(*Continued*

and the Mini Mental Status Exam. Clinician assessments of health and functioning were identified in 2 studies: Chumbler et al used the Functional Independence Measure, a clinician-rated measure of physical and cognitive disability,[19] and Ruskin et al[14] had clinicians rate patients' global assessment of functioning on a numeric scale.

Eleven studies also used utilization outcomes as indirect health outcome measures of intervention effects. The most common were frequency of unplanned emergency department or urgent care visits (all-cause and disease-specific) and bed days of care. Six studies reported frequency of outpatient primary or specialty care visits (all-cause and disease-specific). Hospitalization (all-cause and disease-specific) was reported in 5 studies.

What Was the Overall Quality of Each Intervention Study?

We used a previously published system, the Jovell/Navarro-Rubio rating scale,[20] which was part of the PRISMA checklist, to gauge the quality of each of the 19 interventions. This system for evaluation of interventions uses a conservative estimation of study quality with the randomized controlled trial (RCT) as a decisional standard. As noted in the Table, this taxonomy grades interventions on 9 levels of quality. Level 1 consists of meta-analyses of RCTs, level 2 includes large-sample RCTs, level 3 includes small-sample RCTs, level 4 includes nonrandom controlled prospective trials, and level 5 includes nonrandom controlled retrospective trials.[20,21] Of the 19 studies, 11 unequivocally met the RCT criteria: 1 was judged as providing level 2 evidence (multisite RCT), and 10 were classified as providing level 3 evidence. The remaining 8 studies did not meet the RCT criteria: 1 was classified as providing level 4 evidence, and 7 were classified as providing level 5 evidence.

What Were the Health Outcome Findings?

Several of the 19 studies reported on multiple outcomes beyond issues of patient health, including cost offset, patient-provider satisfaction, and system utilization. For this review, however, only health outcomes are detailed in the Table. Of

Table. Characteristics of VHA-Funded Telemedicine Intervention Studies in Review (Continued)

Study and Design (Rating)[a]	No.	Age, y	Population	Primary Aim	Technology
Meyer et al, 2002[22] Prospective quasi-experimental design based on data aggregated from multiple sites (IV)	1582	NR	High utilizers with 2+ chronic conditions	Compare healthcare use and health status	Multiple
Morland et al, 2004[16] RCT (III)	20	NR	PTSD	Compare PTSD SX	Video conferencing
Noel et al, 2004[7] RCT (III)	104	71	2+ chronic conditions	Compare healthcare costs and QOL	Telemonitoring, phone, camera
Powers et al, 2009[8] Cluster RCT (III)	744	64.1	Hypertension	Compare cholesterol and A1C	Phone
Ross et al, 2008[13] RCT (III)	223	59.2	MDD	Compare depression SX	Phone
Ruskin et al, 2004[14] RCT (III)	119	49.7	MDD	Compare depression SX	VC
Sanford et al, 2006[18] RCT (III)	82	62.3	Mobility rehab	Compare self-efficacy, functioning, and health status	Wireless VF
Wakefield et al, 2008[25] RCT (III)	148	69	HF	Compare self-efficacy and medication adherence	Phone; VF
Wakefield et al, 2009[26] RCT (III)	148	69	HF	Compare healthcare use, survival, and QOL	Phone VF

A1C indicates glycosylated hemoglobin; ADL, activities of daily living; BDOC, bed days of care; CC, care coordinator; DM, diabetes mellitus; ED, emergency department; FIM, Functional Independence Measure; f/u, follow-up; HF, heart failure; LDL-C, low-density lipoprotein cholesterol; MD, messaging device; MDD, major depressive disorder; NH, nursing home; NR, not reported; OT, occupational therapy; PRN, as needed; PTSD, post-traumatic stress disorder; QOL, quality of life; SX, symptoms; TM, telemonitor; VC, videoconferencing; VF, videophone; VHA, Veterans Health Administration.
[a]Description of levels of quality: I, meta-analyses of RCTs; II, large-sample RCTs; III, small-sample RCTs; VI, nonrandom controlled prospective trials; and V, nonrandom controlled retrospective trials.[19,20]

the 19 studies, 12 provided unequivocal support for the benefit of the telemedicine in facilitating patient health over usual care (or a comparison control).[7-13,16,17,19,22,23] Among those that did not report positive telemedicine outcomes, in 4 studies, the telemedicine intervention yielded no measurable advantages over the control or usual care comparison.[6,14,15,24] Three studies reported mixed results; namely, there was either marginal improvement on markers of health in both the telemedicine and control conditions,[25] or there was measurable improvement, but either it was not different from improvement in the comparison group[18] or group differences were difficult to interpret.[26] That was the case in the study by Wakefield et al, where the videophone group received more medication regimen adjustments than the comparison group.[26]

What Were the Advantages of the Interventions?

The advantages of using telemedicine as a VHA intervention documented in the 19 studies included (1) the ongoing monitoring capability of telemedicine technology, (2) enhanced patient access through telemedicine to healthcare professionals, (3) efficiency as a medium for provider-patient interaction, (4) quick access to electronic medical records and other computer-based information relevant to the patient's ongoing condition and treatment needs, and (5) facilitation of collaborative care models within an integrated service delivery system.

A critical element in any managed care model is the ability to use advanced technology to improve the consistency and frequency of ongoing monitoring of chronic health condi-

Intervention	Control Group and *Study Criteria*	Time	Major Results
Monitoring; varied clinical care interventions	Routine care *Randomly selected from stratified sample with similar diagnosis, age, and sex*	12 mo	40% reduction in ED visits, 63% reduction in hospital admissions, 60% reduction in hospital BDOC, 64% reduction in NH admissions, 88% reduction in NH BDOC; 5/10 SF-36 domains improved
Coping skills training group via VC	Face-to-face coping skills group *Random assignment*	8 wk	Attrition and PTSD SX higher in face-to-face group
Rehabilitation through home healthcare + nurse case management via telemedicine	Routine home healthcare + nurse case management *Random assignment*	6 mo	Telemedicine group had significant decrease in BDOC, urgent care visits, A1C; No difference in functional status, health status
Monitoring through calls every 2 months with education and instruction	Routine care *Random assignment*	24 mo	0.46% reduction in A1C compared with usual care; 0.9 mg/dL between-group difference in LDL-C
Weekly calls to monitor SX and PRN referral for phone care management	Usual care—letter with educational information *Clinicians randomly assigned to usual care or close monitoring*	6 mo	Telemedicine patients had fewer psychiatric diagnoses and improved overall health
Remote psychotherapy (8 sessions)	In-person psychotherapy (8 sessions) *Random assignment*	6 mo	No differences in depression, appointment adherence
1-hour mobility training sessions delivered via VF	Usual care or 4 in-person 1-hour mobility training sessions *Random assignment*	6 wk	Equivalent improvement in self-efficacy in both groups
Weekly monitoring of SX and reinforce discharge plan; skills training via phone or VF	Routine care *Random assignment*	12 mo	Mixed results, mostly no differences between telecare
Weekly monitoring of SX and reinforce discharge plan; skills training via phone or VF	Routine care *Random assignment*	6 mo	No significant differences in medication adherence, self-efficacy, or satisfaction; VF group more likely to have medications adjusted

tions. Telemedicine frequently has been used for closer monitoring than is typically available through usual care. Across the reviewed studies, telemedicine technology enabled frequent contact between the patient and a member of the treatment team, which allowed for multiple interchanges with the provider. Even with its system of extensive community-based outpatient clinics servicing a centralized comprehensive medical unit, VHA resources have not been sufficient to address the needs of veterans living in rural areas who must travel to a facility for care. This situation represents a large access barrier when frequent and ongoing care for a chronic condition is needed. Telemedicine is one way to address this issue.[27] For mental health issues, frequent contact between provider and patient fosters a stronger therapeutic alliance, which may improve a provider's sensitivity to the patient's dynamic health condition and increase a patient's willingness to participate in collaborative care.[28]

Several studies reported an interdisciplinary approach to treatment facilitated through the embedding of telemedicine within this collaborative approach. The Telemedicine Enhanced Antidepressant Management and Low Activities of Daily Living Monitoring Program interventions included a Community Care Coordination Service for establishing VHA linkages with local healthcare providers who could be employed as VHA subcontractors to meet patient needs.[6,11,17,27,28] In all cases, the telemedicine infrastructure made it possible for the patient to be directed to appropriate help for specific health issues consistent with established Community Care

Coordination VHA health intervention protocols.[29] Such models could be extended to other evidence-based intervention formats outside the VHA system. Several studies reported that without the telemedicine device, detecting such health changes would have been more difficult.[11,17,27,28] As the ability to monitor symptoms continues to evolve, this latter point may become one of the most important reasons to include a telemedicine infrastructure as a best-practices adjunct in medical intervention strategies where an acute condition increases the demand for a rapid response to patient symptoms.

What Were the Barriers to Implementation?

Two barriers to the implementation of telemedicine interventions consistently appeared across these VHA-supported studies: (1) issues of patient adherence to the technology and (2) maintaining up-to-date technology and the expert personnel trained to use telemedicine devices in care management. Across all studies, negotiating the telemedicine intervention required establishing links that had not been traditionally defined within the VHA system. A few of the studies noted that issues arose when interventions threatened VHA information security protocols. The more extensive the intervention and the greater the number of partners outside the VHA system, the larger this issue became. In 1 study this issue emerged when using proprietary monitoring of telemedicine devices.[7]

This challenge was compounded as businesses that were partnering with the VHA were sold or went out of business, as businesses discontinued production of specific telemedicine devices, or even when upgraded models became available that required learning new user routines. Such changes can cause major disruptions in care delivery even when there is ongoing fiscal support by the sponsoring organization (in this case the VHA) to maintain services. Reduced or severed services can create frustration for patients and providers, and can threaten the internal validity of controlled studies (eg, when a new device is introduced into an existing care regimen).

The second barrier is the challenge of maintaining ongoing resources and personnel who possess the training to provide care. For example, Chumbler et al described a telemedicine device that utilizes a simple format of 5 closed-choice response buttons that allows for easy coding of responses.[23] This device is set up to use only the telephone line. The response format constrains patient contact to essential health issues. This kind of technology, which has been labeled as "plain old telephone service" (POTS), is based on the philosophy that the simpler the system, the more likely ongoing maintenance will be achieved. More than half of the studies used a POTS device either as an adjunct or as the only medium for telemedicine intervention. Simple systems (the telephone) that use a pervasive delivery structure (telephone lines) provide many advantages, not the least of which is low cost and ease of use. However, the disadvantages of POTS become more apparent as the demand increases for systems that can (1) perform multiple functions simultaneously, such as managing electronic medical record data while at the same time providing care; (2) provide multimedia support as part of the care regimen, as in videoconferencing for mental health treatment; and (3) transmit data quickly across input modalities to facilitate timely shared communication between providers across disciplines and settings.

We anticipated that a common set of outcome measures specific to telemedicine care would emerge from these VHA-supported telemedicine studies. Surprisingly, there was little consistency in measures across studies. In all cases where self-report measures of physical or psychological health outcome were used, it was assumed that these measures could be adapted for telemedicine-mediated care. For example, several studies used electronic adaptations of standardized self-report depression measures. Whether such modified patient self-report instruments are valid and reliable in telemedicine settings is unknown.

What Strategies Emerged to Address Implementation Barriers?

Optimal telemedicine care requires provider and patient training. Providers must not only acquire technological expertise, but also stay up-to-date on best-practices telemedicine delivery procedures. As an example, The American Telemedicine Association recently published best-practices guidelines for telemental health.[30] These describe how to apply best-practices protocols and ensure ethical safeguards while engaging in telemedicine-mediated care. Patients must not only learn how to use in-home self-management devices, but also adjust their expectations about care using this new delivery medium. In a paradoxical twist between perceived patient satisfaction and objective health outcomes that underscores this point, Noel et al reported that although their telemedicine group improved on 12-month health status compared with the control group, patient ratings of satisfaction with care did not differ between the intervention and control groups.[7] Noel et al attributed this finding to the automated self-care prompts triggered by the telemedicine device. By compelling patient action through prompting, the telemedicine device may have diminished perceived satisfaction with care. Benefitting from telemedicine will necessitate that patients accept more proactive methods of health data collection. These could include in-home reminders and requirements for patients to provide personal health data with real-time monitoring of data entry.

The strategy of embedding telemedicine technology in an intervention that includes frequent patient contact with a mem-

ber of the treatment team was reported to facilitate adherence and better treatment in virtually every study that reported positive outcomes. Personal support to patients either through multiple orientation meetings or ongoing opportunities for face-to-face contact appears to optimize telemedicine-mediated care.

Telemedicine technology is evolving dynamically, especially in the for-profit medical device marketplace. Tension will always exist between healthcare services' need for trusted and long-term suppliers of telemedicine devices and the business sector press to generate innovative technology that responds to consumer demand. The most effective strategy for dealing with this potential barrier is for the VHA to form strong partnerships with businesses and negotiate to address these competing concerns. One study reported on this negotiation process.[22] Binding contracts that guarantee availability of a product for a specified time interval and within reasonable cost parameters are critically important for addressing the technology supply-and-demand pressures inherent in the telemedicine infrastructure.

CONCLUSIONS

For the majority of studies in this report, telemedicine was an effective care delivery tool, especially for chronic health and mental health conditions. The advantages of telemedicine were observed (1) when patient health issues were complex, as in chronic diabetes[8-11] or cancer,[23] and (2) when mental health care was provided.[13,16,17,28] In both situations, care needs were facilitated by efficient and quick access to health information from multiple sources and coordination of information across practice specialties, enabling provider responsiveness to changes in patient symptoms. Of the barriers noted, patient adherence was underscored,[24,25] and unique to telemedicine, technical difficulties were associated with mixed outcomes.[25,26]

An important practice implication for telemedicine within the VHA is whether it can deliver optimal healthcare to the broadest spectrum of veteran patients. Strategies for ensuring that patients know how to utilize personal in-home technology were identified in several studies as an area of future need.[6,14,15,18,24-26] A key issue was efficiently interfacing and negotiating with VHA security protocols. While one study detailed a specific data safety plan to meet VHA Intranet security demands,[7] standardized procedures for ensuring the security of patient data are an ongoing VHA concern. Identifying reliable business partners who can deliver telemedicine devices that can ensure data security and training providers and patients to use advanced healthcare technologies are critical public health issues underlying telemedicine. As a healthcare delivery tool, the Internet-based capability of telemedicine is substantial. The VHA's investment in telemedicine research and development is an important step in building a national framework that incorporates remote delivery technologies for improving healthcare access and efficacy in the 21st century.

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