CASE REPORT

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

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Abstract

Between July 2003 and December 2007, the Veterans Health Administration (VHA) introduced a national home telehealth program, Care Coordination/Home Telehealth (CCHT). Its purpose was to coordinate the care of veteran patients with chronic conditions and avoid their unnecessary admission to long-term institutional care. Demographic changes in the veteran population necessitate VHA increase its noninstitutional care (NIC) services 100% above its 2007 level to provide care for 110,000 NIC patients by 2011. By 2011, CCHT will meet 50% of VHA's anticipated NIC provision. CCHT involves the systematic implementation of health informatics, home telehealth, and disease management technologies. It helps patients live independently at home. Between 2003 and 2007, the census figure (point prevalence) for VHA CCHT patients increased from 2,000 to 31,570 (1,500% growth). CCHT is now a routine NIC service provided by VHA to support veteran patients with chronic conditions as they age. CCHT patients are predominantly male (95%) and aged 65 years or older. Strict criteria determine patient eligibility for enrollment into the program and VHA internally assesses how well its CCHT programs meet standardized clinical, technology, and managerial requirements. VHA has trained 5,000 staff to provide CCHT. Routine analysis of data obtained for quality and performance purposes from a cohort of 17,025 CCHT patients shows the benefits of a 25% reduction in numbers of bed days of care, 19% reduction in numbers of hospital admissions, and mean satisfaction score rating of 86% after enrolment into the program. The cost of CCHT is $1,600 per patient per annum, substantially less than other NIC programs and nursing home care. VHA's experience is that an enterprise-wide home telehealth implementation is an appropriate and cost-effective way of managing chronic care patients in both urban and rural settings.

Key words: *home telehealth, chronic care, outcomes, patient satisfaction, veterans*

Introduction

The Veterans Health Administration (VHA) within the U.S. Department of Veterans Affairs is a large integrated healthcare system. VHA currently delivers healthcare services[1] that serve 5.6 million unique veteran patients annually. A total of 7.6 million veterans are enrolled to receive VHA care.[1] The number of veteran patients aged 85 years or more that VHA treats is set to triple by 2011 compared to 2000 (*Fig. 1*).

As the U.S. population ages, people are living longer,[2] staying healthier,[3–5] and choosing to live independently at home.[6,7] Responding to these same societal changes has heightened the emphasis Congress[8] and VHA place upon developing noninstitutional

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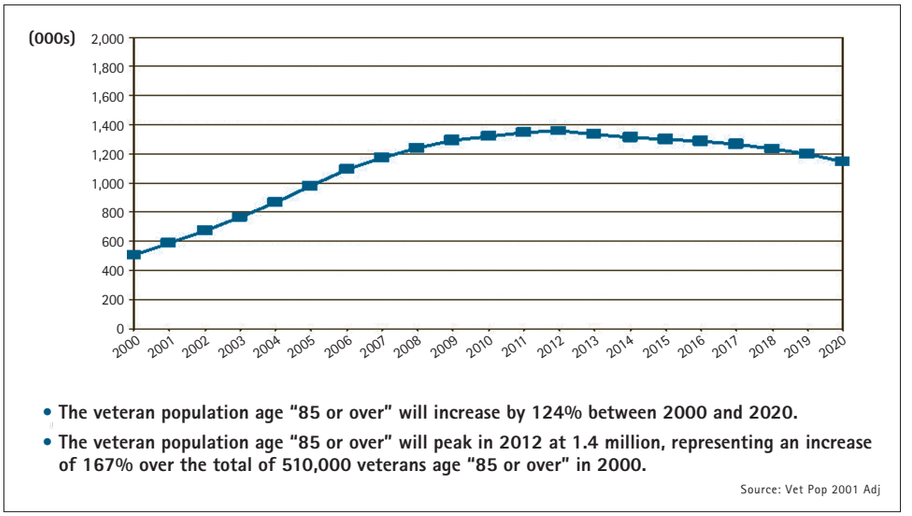

Fig. 1. VHA veteran population for treatment age 85 or over in 2000–2028.

care (NIC) services since 1999 for the rising number of aging veterans with chronic care needs (*Fig. 2*).

Between July 2003 and December 2007, the Veterans Health Administration (VHA) implemented a national home telehealth program, Care Coordination/Home Telehealth (CCHT). CCHT is now a routine NIC service that supports the care for veterans with chronic conditions in their homes as they age. It involves the use of home telehealth and disease management technologies in care management as adjuncts to VHA's existing health information technology (HIT) infrastructure. Since 1995, VHA's enterprise-wide implementation of HIT helped transform the organization from a predominantly hospital-based provider of care to one with a primary and ambulatory care focus. In 1995, 2.9 million unique veteran patients received VHA care at a time when VHA's complement of hospital inpatient beds was 53,200 and 30 million patient encounters were outpatient visits.[1] By 2005, 5.3 million unique veteran patients received care. The complement of VHA inpatient beds had reduced to 18,199 and the number of outpatient encounters rose to 50 million.[1] VHA's computerized patient record system (CPRS) supported the transition of care from hospital inpatient to outpatient settings. CCHT builds on VHA's routine use of CPRS by extending the reach of HIT supported services directly into the home. VHA's development of its HIT platform for CCHT was based upon CCHT's ability to meet predefined patient needs.

An internal VHA needs assessment[9] in 2002 outlined the scope for CCHT implementation and recommended its initial focus on managing the care of between 21,000 and 32,000 NIC and chronic care management patients. Additional opportunities were identified to expand CCHT to cover acute care management and health promotion/disease prevention. Thirty-two percent of the veteran population VHA treats lives in rural areas.[1] This poses challenges in providing them with timely access to specialty care. Therefore, VHA's CCHT program was charged with ensuring it offered support to care for veterans needing NIC in rural areas.[10]

This case report outlines VHA's rationale for adopting CCHT, traces its evolution between July 2003 and October 2007, provides outcomes information from routine quality/performance management data, assesses how well CCHT meets the needs of the veteran patients VHA serves, and comments on the applicability of CCHT to other healthcare systems.

Materials and Methods

VHA commenced implementation of its national CCHT program in July 2003. The program's primary mission was to provide routine NIC and chronic care management services to veteran patients with

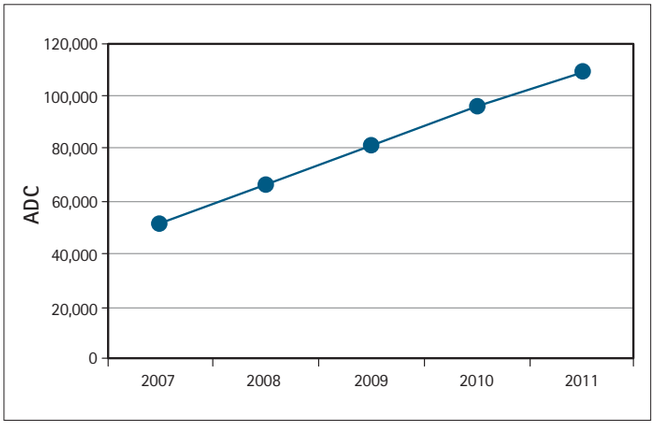

Fig. 2. Projected noninstitutional care provision FY2017–2011. ADC, Average Daily Census.

diabetes mellitus (DM), congestive heart failure (CHF), hypertension (HTN), posttraumatic stress disorder (PTSD), chronic obstructive pulmonary disease (COPD), and depression. CCHT was designed as a flexible and cost-effective way to augment VHA's preexisting traditional NIC[9] programs and support patient care in the least restrictive setting possible. VHA's design for its CCHT model of care refined the Community Care Coordination Service (CCCS), a precursor program[9] piloted by VHA between 2000 and 2003, and combined this with elements of other exemplary VA home telehealth pilot programs.[11,12] This model incorporated the necessary clinical, information technology (IT), business, and logistic elements required to project-manage the enterprise implementation of CCHT and sustain it thereafter. A core component in the design of CCHT was to define CCHT. In 2004, an expert group of care and case managers was convened within VHA to arrive at a definition. Their consensus definition of CCHT was:

> The use of health informatics, disease management, and home telehealth technologies to enhance and extend care and case management to facilitate access to care and improve the health of designated individuals and populations with the specific intent of providing the right care in the right place at the right time.

VHA's definition of CCHT embraced the role of HIT in supporting the coordination of patient care across the continuum from the hospital to the home. With VHA's CCHT model, care is actively coordinated across this continuum by a dedicated cadre of care coordinators. Care coordinators are healthcare professionals, usually nurses or social workers. Every CCHT patient is formally assessed by their care coordinator upon enrollment in the program. Explicit enrollment criteria determine whether the purpose of CCHT-supported care for any individual patient is for NIC, acute care management, or chronic care management services. After a patient is enrolled into the program, his or her care coordinator selects the appropriate home telehealth technology, gives the required training to the patient and caregiver, reviews telehealth monitoring data, and provides active care or case management (including communication with the patient's physician). Typically, an individual care coordinator manages a panel of between 100 and 150 general medical patients or 90 patients with mental health–related conditions. Dependent upon a patient's underlying chronic condition and guided by the enrollment assessment, their care coordinator selects the appropriate vital signs, other objective parameters (e.g., blood glucose), or disease management data to acquire from the home for ongoing monitoring and disease management purposes.

The care coordinator then decides which technology is best-suited to collect these telehealth transmitted data. VHA established national contracts for commercial-off-the-shelf (COTS) devices for CCHT. A technology algorithm,[13] that is based upon a patient's health needs, the complexity of disease/condition, and ability to use technology, helps determine which CCHT device is most suitable and cost-effective to use for each individual patient. The technology selection in the algorithm includes: videophones, messaging devices,[14] biometric devices,[15] digital cameras, and telemonitoring devices.[16] Messaging devices present disease management protocols (DMPs), which contain text-based questions for patients to answer. These DMPs require responses from patients that help assess their health status and disease self-management capabilities. Biometric devices record and monitor vital sign data. Videophones and videotelemonitors[17] support audio–video consultations into the home that replicate face-to-face examinations. Due to ongoing technology convergence, messaging, monitoring, video, and digital imaging functions can increasingly coexist on the same device. Video and telemonitoring data from home telehealth devices are primarily communicated to VHA's national HIT platform for CCHT via plain-old-telephone lines.

VHA's CCHT HIT platform provides care coordinators with vital sign and other disease management data from their panel of patients. Each individual patient within the panel is risk-stratified each day according to preset thresholds (e.g., out of range blood pressure). The routine daily assessment of their patient panel by the care coordinator provides color-coded alerts that indicate significant changes in any patient's symptoms, knowledge, and health factors that may require proactive recognition and management. Once patients are identified as "at-risk," care coordinators intervene accordingly, e.g., by helping patients self-manage their condition, assessing their biopsychosocial needs and instituting care/case management, usually by telephone to the patient's home.

Promoting patient self-management is a fundamental underpinning of VHA's CCHT model. VHA's precursor programs to CCHT found that the functionality within home telehealth devices that best supports this is the capability for messaging. Messaging devices help identify adverse symptoms, knowledge deficits, and negative health-related behaviors that alert care coordinators and initiate interventions that can deal with health problems, thereby obviating hospital admissions and emergency department visits. Analysis of objective data (i.e., pulse, temperature, blood pressure, oxygen saturation, weight, and blood glucose) provides further discriminatory information concerning an individual patient's risk of deterioration. These data are often transmitted from the biometric devices that are integrated into the home telehealth technology and sent directly to VHA

where they are accessible on the care coordinator's desktop computer for follow-up. Analysis of risk prioritized home telehealth data (vital sign and disease management) allows care coordinators to intervene immediately instead of patients' either having to wait for the next routine clinic visit, or go to the emergency department if they further deteriorate. VA's CCHT programs do not monitor patients with the aim of detecting and managing acute events. If a patient, family caregiver, or care coordinator perceives a serious or life-threatening concern, patients access emergency services through the usual channels. Eligible patients are offered the choice to receive CCHT-based care or other NIC care services and thereafter are free to withdraw from CCHT and chose other NIC services if they wish.

For reasons of patient safety, efficiency, and ease of implementation, VHA has national policies for the clinical, educational, technical, and business elements of routine care delivered within its CCHT program. The national support for CCHT implementation and subsequent routine operations includes clinical risk management, ongoing program development, equipment contracting, utilization data, outcomes analysis, a national home telehealth HIT infrastructure, integration with other VA enterprise HIT systems, and an internal VHA CCHT certification process called "conditions of participation" (COPs). Based upon these national policies and procedures, a CCHT-specific operations manual standardizes all programs locally to national policies. This operations manual forms the basis for a national training curriculum for staff involved in CCHT.

To provide staff with the requisite skills and competencies to support CCHT expansion of CCHT and meet VHA's expectation of caring for 50,000 NIC patients within 8 years, VHA created a national CCHT training center in Lake City, Florida. CCHT training uses the Internet and facility-based competency methodologies. The training curriculum consists of 12 hours of continuing education online and 2–4 weeks of hands-on training at the local site that a care coordinator must complete in conjunction with other assigned duties. Since its inception in 2004, VA's CCHT training center has trained 1,500 unique employees at onsite training meetings and 5,000 unique employees have completed the online performance support program for CCHT.

Data exchange between patient's homes and servers within the VHA firewall relies on the COTS technologies purchased under national contracts linking with VHA enterprise HIT systems. The CCHT IT infrastructure is fully secure and protective of patient information. VHA standardized specific data and technical requirements in its technology contracts (e.g., Health Level 7 [HL-7][18]) for the routine exchange of vital signs. VHA's financial decision support system (DSS) captures CCHT workload and provides cost data. A 97% accurate, electronically mediated patient census links CCHT data from vendor systems with other routine HIT data systems in VHA and provides routine clinical outcomes reports for program management and internal benchmarking purposes. Information on patient satisfaction with CCHT-based care is collected from patients every 3 months. All data and analyses in this paper are routinely used for program management of CCHT in VHA.

Results

ROUTINE DEMOGRAPHIC, DISEASE, AND TECHNOLOGY DATA

Table 1 shows the growth in census (point prevalence) for numbers of patients receiving care via CCHT in VHA at the end of each fiscal year.

Since VHA implemented CCHT, a total of 43,430 patients have been enrolled in the program. Of these patients, 41,741 (96.11%) were

Table 1. Care Coordination Patient Census (Point Prevalence) by Year with Percentage Change over Preceding Year FY03–7

YEAR	CENSUS	CHANGE FROM PREVIOUS YEAR
FY03	2,000	N/A
FY04	4,430	121%
FY05	8,922	101%
FY06	21,572	142%
FY07	31,570	46%

N/A, not available.

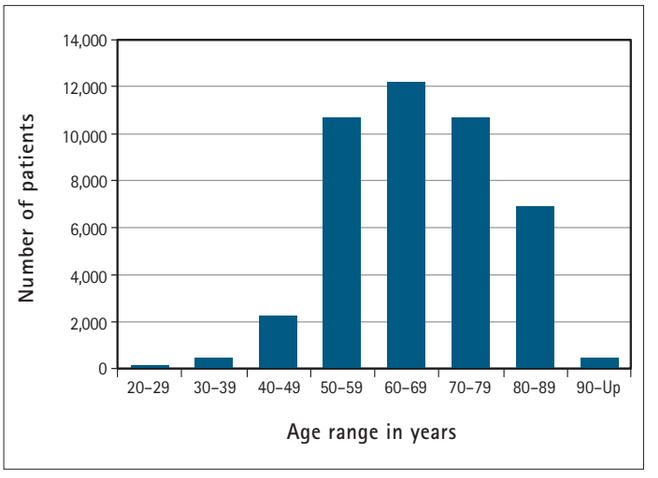

Fig. 3. Age distribution of Care Coordination/Home Telehealth (CCHT) patients (all patients).

male and 1,689 (3.89%) female. Their age range was 20–101 years (mean, 66.5 years), with 16.5% of patients aged 85 years or older. The age distribution of patients is shown in *Figure 3*. At the end of FY07, 11,635 (36%) of patients received their CCHT care for NIC. Enrollment of the remainder was for chronic care management.

Fifty-seven percent (24,530) of patients lived in urban areas, 37% (16,076) in rural areas, and 2% (829) in highly rural areas (data was not recorded for the remaining 1,997). Forty-eight percent of patients were managed for DM, 40% for HTN, 25% for CHF, 12% for COPD, 2% for depression, and 1% for PTSD (totals are greater than 100% because of multiple patient comorbidities). Almost 67% of patients were monitored for one condition and 33% for multiple conditions. *Table 2* gives the associated reasons for care by disease management protocol (DMP). The majority (85%) of technology utilized for CCHT in VHA was messaging/monitoring devices, 11% were videotelemonitors, and 4% videophones.

CLINICAL OUTCOMES DATA

Satisfaction surveys were administered every 3 months to CCHT patients via the home telehealth devices. There was an 86% mean satisfaction score from 42,460 surveys submitted during 2006 and 2007 (60% response rate in the CCHT population).

For reasons of both data system development and data validation, routine outcomes information is reported for a cohort of 17,025 patients who were enrolled in CCHT between FY2006 and 2007. The mean age of this cohort at enrollment was 65 years (range, 20–98 years) with 15.1% aged 80 years or older, and 96% male. Their age distribution is given in *Figure 4*.

Fifty-eight percent (58%) of these patients lived in urban areas, 40% in rural areas, and 2% in highly rural or frontier-type areas. Fifty-two percent (52%) of patients were managed for DM, 44% for HTN, 24% for CHF, 11% for COPD, 2% for depression, and 1% for PTSD (totals are greater than 100% because of multiple patient comorbidities). Sixty-four percent (64%) of these patients were monitored for one condition and 36% for multiple conditions.

Routine outcomes analysis for performance measurement of healthcare resource utilization by CCHT patients involved comparing hospital admission data for patients during the year prior to enrollment into CCHT with the data from 6 months postenrollment. This

Table 2. Reasons for CCHT Care by Disease Management Protocol (DMP)

CONDITION (DMP)	NUMBER OF PATIENTS	PERCENTAGE OF TOTAL PATIENTS
Diabetes	21,047	48.4%
HTN	17,528	40.3%
CHF	10,800	24.8%
COPD	5,069	11.6%
Depression	1,039	2.3%
PTSD	498	1.1%
Other mental health (not PTSD or depression)	545	1.2%
Single condition	28,948	66.6%
Multiple conditions	14,484	33.3%
No condition	0	0%

CCHT, Care Coordination/Home Telehealth; HTN, hypertension; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; PTSD, posttraumatic stress disorder.

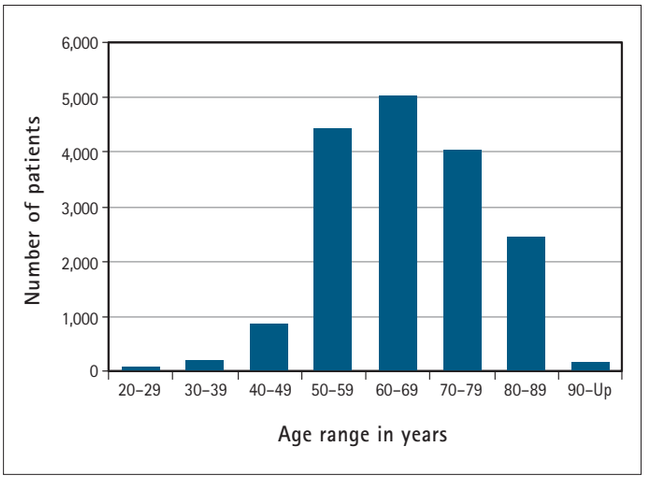

Fig. 4. Age distribution of Care Coordination/Home Telehealth (CCHT) patients (outcomes analysis cohort).

Table 3. Reduction in Utilization by Age

AGE RANGE	NUMBER OF PATIENTS	% DECREASE IN UTILIZATION
20–29	31	12
30–39	162	9.7
40–49	832	30
50–59	4,402	26.2
60–69	5,008	22

cohort of patients had a 19.74% reduction in hospital admissions and 25.31% reduction in bed days of care (BDOC) following enrollment into the CCHT program. During the same time period, there was a decline of 4.6% in BDOC for all patients enrolled within VHA that needs to be taken into account when interpreting this change. *Table 3* gives the reduction in utilization by age; *Table 4* by whether patients were located in urban, rural, or highly rural areas; and *Table 5* by the condition monitored and for patients monitored for single or multiple diagnoses.

Discussion

VHA's national CCHT program successfully supports the care of veteran patients with NIC and chronic care management needs in their own homes. The potential benefits of home telehealth in this population are well recognized[19] but translating this into routine care on an enterprise level has been problematic[20] to date. VHA's implementation of home telehealth into routine care across the organization is therefore a groundbreaking achievement.[21] At this time, there is no program elsewhere in the United States of the size and complexity of VHA's national program to enable detailed comparison. Even though the technologies utilized are in use on a much smaller scale elsewhere, other programs lack the comprehensive and systematic approach to the clinical, educational, technology, and business processes that constitute VHA's CCHT model of care.

Table 4. Reduction in Utilization by Patient Location (Urban, Rural, or Highly Rural Area)

LOCATION	NUMBER OF PATIENTS	% DECREASE IN UTILIZATION
Urban	9,880	29.2
Rural	6,782	17
Highly rural	294	50.1
Unknown	60	101

Table 5. Reduction in Utilization by Condition Monitored (Single and Multiple Diagnoses)

CONDITION	NUMBER OF PATIENTS	% DECREASE IN UTILIZATION
Diabetes	8,954	20.4
Hypertension	7,447	30.3
Chronic heart failure	4,089	25.9
Chronic obstructive pulmonary disease	1,963	20.7
Posttraumatic stress disorder	129	45.1
Depression	337	56.4
Other mental health condition	653	40.9
Single condition	10,885	24.8
Multiple conditions	6,140	26.0

CCHT met VHA's main objective in implementing the program, which was to meet an escalating demand for NIC and caring for those with chronic conditions. The patient census for CCHT increased from 2,000 to 31,570 over 4 years for patients whose category of care (NIC or chronic care management) was formally assessed. The associated 19.74% reduction in hospital admissions and 25.31% reduction in BDOC replicate VHA's experience in the antecedent pilot programs on which CCHT was based. Patient acceptance of CCHT was high (only 10% of patients decline the service) and their satisfaction with services (86%) is very high. Experience elsewhere shows that once enrolled many patients are reluctant to cease this care[22] and the favorable acceptance of CCHT by practitioners in VHA was consistent with other programs experience.[23]

The cost of CCHT was $1,600[24] per patient per annum. This compares very favorably to the direct cost of VHA's home-based primary care services of $13,121[25] per annum and market nursing home care rates that average $77,745[26] per patient per annum. CCHT is therefore a flexible and cost-effective adjunct to VHA's existing NIC services.

The basis for the reduced utilization of healthcare resources for the patient population receiving CCHT is likely due to its underpinnings in patient self-management, disease management, and use of virtual visits.[27] CCHT targeted high-utilization patients[28] who were amenable to this modality of care. However, this case report is of routine outcomes data collected for program management purposes and the reduced utilization finding could be accountable for, in part or in total by "regression to the mean."[29] Formal research studies are needed to elucidate this further. The lower cost of providing NIC via CCHT to appropriate patients provides a clear economic justification for including CCHT as part of the standard range of NIC services. CCHT's function within this patient population was akin to an "air traffic control system" that monitored patients with chronic care needs. CCHT enabled interventions to occur in this group of patients just in time[30]—before they deteriorate; consequently, CCHT prevented hospital admissions and reduced hospital length of stay. CCHT replicates the potential for cost-savings and cost-avoidance at an enterprise level that previous pilots have shown elsewhere[19] and a reduction in staff travel to visit patients in their homes[31] is a likely component of this.

VHA's CCCS program, a precursor to CCHT, showed reductions in utilization and cost avoidance. Therefore centralized funding for new care coordinator positions was not provided by the national office for VHA's CCHT implementation. Programs made the business case for staff resources in support of their implementation locally. National training support for CCHT ensured that staff recruited at a local level rapidly acquired the necessary skills and competencies to meet the ambitious growth targets for the program. VHA's national CCHT training program focused on rapidly training existing clinicians and providing them with the necessary care coordination skills. New healthcare developments often fail when attempts are made to implement them at an enterprise level because they neglect the associated "people" and training issues. The training center also provided mentoring, consultation, and performance support that included helping with organizational change.

VHA attributes the rapidity and robustness of its CCHT implementation to the "systems approach" taken to integrate the elements of the program. Wherever possible, CCHT incorporated existing business processes to reduce the program's overhead costs and increase efficiency. Key to the success of this systems approach was VA's standardization of the clinical, educational, technical, business, and organizational elements of CCHT based upon experience gained from piloting it prior to its widespread implementation.

The uniformity and consistency of the component elements of CCHT within local CCHT programs in VHA is confirmed operationally by an internal certification process, conditions of participation (COP) that all programs must satisfactorily complete every 2 years. In designing its CCHT model, VHA ensured it integrated into existing hospital and community-based services to support care across the continuum. This integration into existing services and the COP process meant there was no instance of CCHT creating an issue with Joint Commission[32] accreditation of VHA facilities. Although there is no formal Joint Commission assessment of home telehealth, the CCHT programs are all subject to possible inspection under the Joint Commission's tracer methodology.[33]

The wider conceptual framework for CCHT is the Chronic Care Model.[34] Adopting this model as its foundation helped to meld CCHT into operational services and orient them toward making the patient's home into the preferred place of care where possible and appropriate. This focus on the home and emphasis on patient self-management[35,36] meant CCHT addressed the complex biopsychosocial care needs of its target patient population. These needs are ones that current healthcare delivery systems are usually maladapted to cope with.[37] Given the parallel challenges faced by other societies in meeting these healthcare needs, CCHT offers a potential model that other integrated healthcare systems in the United States, Canada, Australia, New Zealand, and the United Kingdom[38] could adapt to address issues with marrying health and social elements of care.[39]

The clinical practice implications of incorporating CCHT into policy are equally profound. The patient-self management elements of CCHT represent a sharing of responsibility for the care provided with patient and caregiver. This makes patient education and caregiver support essential elements of CCHT, ones that VHA has incorporated into its model. The intent of the CCHT model is that a care coordinator operates collaboratively with other disciplines, thereby facilitating a true team approach to care. In this process, the role of CPRS is crucial to assist in the coordination of care between the professionals associated with a patient's care across the continuum. While the majority of care coordinators in VHA are nurses or social workers, some are dieticians, occupational therapists, physicians, and pharmacists. The HIT elements to the CCHT program that exist, or are planned for CPRS, in VHA mean that in the future care coordination may be conducted by whichever clinician a patient sees and referrals made (subject to appropriate delegation and scope of practice) without the patient having to be automatically seen by a primary care physician. The fact that a care coordinator can be trained over a 3- to 5-week period makes this a flexible means of providing care that does not have the inelasticity and rigidity associated with many traditional programs that are provider- rather than patient-centric.

Based upon its experience with CCHT between 2003 and 2007, VHA plans to expand and extend the program. By 2011, VHA anticipates that NIC care for 50,000 patients (50% of its NIC requirements) will be met by CCHT. Also, upwards of 25,000 additional patients will receive support from CCHT. In addition to those with chronic care management needs, CCHT will support those with acute care management and health promotion and disease prevention needs. The policy implications that result from the implementation of CCHT are profound. If 50% of patients requiring NIC can ultimately be managed in a way that means they get improved access to care at lower cost and higher quality, then this represents an important advance. It means that a low cost and flexible solution will be available to deal with the large numbers of patients with chronic care conditions that healthcare systems know they need to serve.

Conclusions

VHA's implementation of CCHT replicates the findings of previous smaller-scale pilots of home telehealth to provide care to patients with chronic diseases on a far larger scale and shows it is a practical and cost-effective means of caring for populations of patients with chronic disease that is acceptable to both patients and clinicians.

Implementation of CCHT into routine practice on a large-scale enterprise level has substantial benefits to patients in redefining the location of care as the home and to a healthcare organization in reduced costs and cost avoidance.

Clinical process reengineering is necessary to create the clinical, quality, educational, business, logistic, and organizational systems necessary to support implementation of CCHT on an enterprise scale. The processes that support CCHT in VHA are not unique to the organization and it should be possible to implement CCHT or a variant of CCHT in other healthcare systems. The computerized patient record is a fundamental prerequisite to establishing a viable CCHT program at an enterprise level.

CCHT does not replace the need for nursing home care or for traditional noninstitutional care programs. It does, however, enhance the ability for self-management of chronic disease as well as delaying institutionalization. For selected patients with chronic care needs who have the necessary caregiver support, CCHT offers a way to remain living independently at home.

CCHT provides one solution to the complex equation of how to provide care for the rapidly rising numbers of patients with chronic care needs in the population that is applicable to both urban and rural settings. It offers a potential model for other healthcare systems facing comparable challenges.

Disclosure Statement

No competing financial interests exist.

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