Impact of a National Specialty E-Consultation Implementation Project on Access

Susan Kirsh, MD, MPH; Evan Carey, MS; David C. Aron, MD, MS; Omar Cardenas, BS; Glenn Graham, MD, PhD; Rajiv Jain, MD; David H. Au, MD; Chin-Lin Tseng, DrPH; Heather Franklin, MPH; and P. Michael Ho, MD, PhD

ABSTRACT

Objective:s To assess the early impact of implementation of the electronic consults (e-consults) initiative by the Veterans Health Administration (VHA), designed to improve specialty care access.

Study Design: Observational cohort study exploiting a natural experiment begun in May 2011 at 12 VHA medical centers and expanded to 122 medical centers by December 2013.

Methods: The following were assessed: 1) growth of e-consults by VHA regional networks, medical centers, and specialty; 2) location of patient's primary care provider (medical center vs community-based outpatient clinic [CBOC]); 3) potential patient miles needed to travel for a specialty care face-to-face consult in place of the observed e-consults using estimated geodesic distance; 4) use of specialty care subsequent to the e-consult.

Results: Of 11,270,638 consults completed in 13 clinics of interest, 217,014 were e-consults (adjusted rate, 1.93 e-consults per 100 consults). The e-consult rate was highest in endocrinology (5.0 per 100), hematology (3.0 per 100), and gastroenterology (3.0 per 100). The percentage of e-consult patients with CBOC-based primary care grew from 28.5% to 44.4% in the first year of implementation and to 45.6% at year 3. Of those e-consult patients from community clinics, the average potential miles needed to travel was 72.1 miles per patient (SD = 72.6; median = 54.6; interquartile range = 17.1-108), translating to a potential savings of 6,875,631 total miles and travel reimbursement costs of $2,853,387.

Conclusions: E-consult volume increased significantly since inception within many medical and surgical specialties. For patients receiving primary care at one of more than 800 CBOCs, e-consults may decrease travel burden and direct travel costs for patients.

Am J Manag Care. 2015;21(12):e648-e654

The Veterans Health Administration (VHA) is the largest integrated healthcare delivery system in the United States. Like an accountable care organization (ACO), the VHA provides care to a defined group of enrollees with the goal of delivering coordinated, high-quality, patient-centered care.[1-3] Approximately 50% of the 8 million veterans cared for in the VHA receive specialty care. Efforts to bring primary care closer to veterans' homes have led to more than 800 community-based outpatient clinics (CBOCs). In contrast, specialty care remains largely concentrated in urban medical centers, although 41% of veterans enrolled in VHA live in rural communities. These and other barriers to access present challenges for the delivery of specialty care.[4,5]

To improve access, efficiency, and coordination between specialty care and primary care, the VHA's Specialty Care Transformation Program Office implemented electronic consults (e-consults) in 2011. Primary care clinicians request clinical guidance with the expectation of an expeditious, albeit asynchronous, response. E-consults and responses are integrated into the VHA's electronic health record (EHR). Through e-consults, primary care clinicians can incorporate specialty care advice into veteran care and better prepare patients for specialty care visits if needed. Although e-consults have been implemented on smaller scales in other settings, the implementation of a national e-consult program has not been previously described.

The study's objective was to describe the spread and impact of the VHA national e-consult program. We assessed the growth of e-consults by VHA regional networks, medical centers, and clinical specialty, and evaluated the use of e-consults based on the location of the patient's primary care provider (PCP) (medical center vs CBOC). Finally, we estimated the number of miles patients may have potentially traveled for an in-person specialty care visit in the absence of an e-consult program. E-consultation implementation across

the VHA system can serve as a model for technology-based interventions to improve access to specialist consultation and provide patient-centered specialty care.

Take-Away Points

This article discusses a broad-scale implementation of outpatient specialty care e-consults within a patient-centered medical home model for a large integrated health system.

- This can be a patient-centered model that saves patients travel time and money.
- E-consults may obviate the need for some specialty care visits.
- Policy to financially support this model may be prudent.
- Increased uptake may occur in specific medical specialties.

METHODS

VHA Network of Care

The VHA has 152 medical centers and over 800 CBOCs within 21 regional networks (Veterans Integrated Service Networks [VISNs]). Each regional VISN has 4 to 8 medical centers and generally covers 1 to 4 states. In addition to medical centers, each VISN has CBOCs located 10 to 300 miles from a medical center, providing primary care to patients closer to their homes. To support veterans living far from medical centers (41% of the veteran population lives in rural areas), patients are frequently eligible for financial reimbursement for miles traveled for care. In general, veterans are assigned to a PCP at a CBOC or medical center closest to them.

E-Consult Process

At the discretion of the PCP, e-consults can be entered into the EHR for any specialty in which an e-consult mechanism has been implemented. E-consults about specific questions are generally entered as free text or into templates with pre-specified questions. Responding specialty clinicians have access to the medical records, including progress notes, laboratory data, radiology tests, and medications. E-consults generally focus on narrow questions that help address questions of diagnosis, testing, or management of a condition. Either specialist or PCP can convert an e-consult into a request for a face-to-face consultation. Follow-up communication with patients about recommendations, if any, is the responsibility of the PCP, unless otherwise identified in the EHR.

Implementation of the E-Consult

In May 2011, the e-consult program for certain specialties began at 12 VHA medical centers in 7 VISNs. Through a competitive process, 12 pilot-site medical centers received limited funding and national guidance for business rules. Oncology, diabetes, endocrinology, dementia, neurosurgery, cardiology, hematology, liver transplant, pain medicine, and rheumatology were the included specialties. Following initial rollout at pilot sites, Specialty Care Transformation worked with VISN leadership to expand the use of e-consults nationally. Further funding was provided until September 30, 2014, to all VISNs; local facilities could implement e-consults in other clinical specialties based on facility needs. Subsequently, e-consults became a national priority and use of e-consults was tracked for each medical center as a component of VHA goals for patient-centered care delivered virtually.

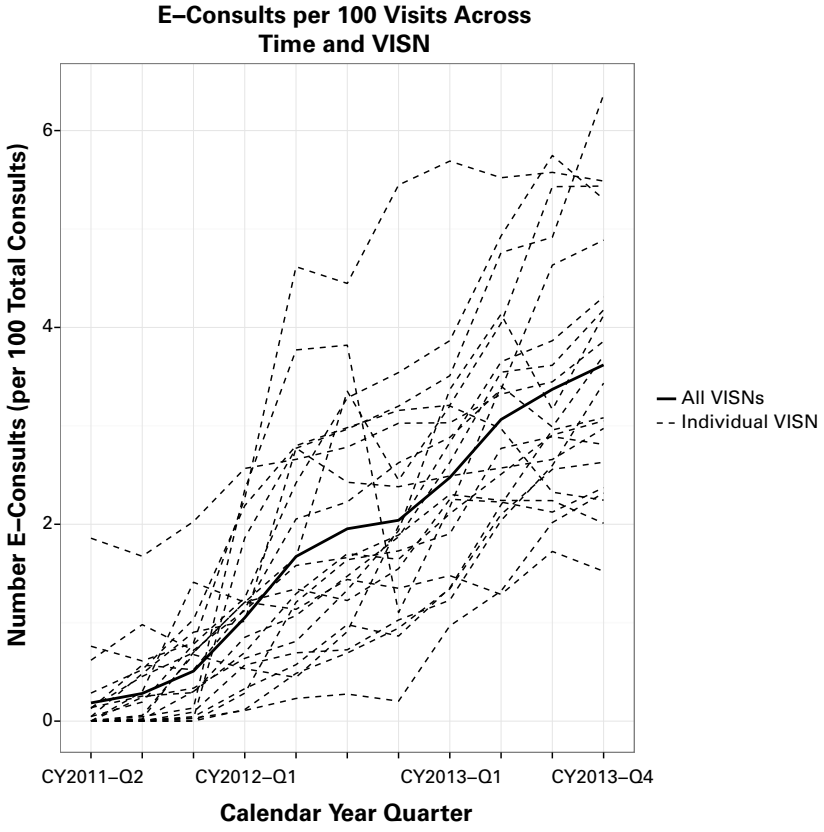
Measures

Specialty clinic of interest. We focused on the following clinics of interest to Specialty Care Transformation: endocrinology, hematology, neurology, pulmonary, nephrology, urology, cardiology, gastroenterology, oncology, pain medicine, geriatric, dementia, and diabetes. Consults were identified in administrative outpatient visit data that included specialty clinic category (ie, clinic stop codes) and a designated Current Procedural Terminology code to distinguish e-consults. We focused on medical centers in the continental United States and patients with assigned PCPs.

E-consult volume adjusted for clinic volume. Many medical centers implemented e-consults in multiple specialties. For every specialty/site combination, we calculated daily rolling rates of e-consult volume adjusted for total clinic volume. For a given 30-day window, we summed the number of e-consults and divided by the number of total consults.

Miles-needed-to-travel calculations. Travel distance was estimated by the geodesic ("as the crow flies") distance from patients' residence to their "home station" (ie, facility where they received primary care). The adjusted distance was considered the difference between the distance from the patient's residence to the specialty care facility and the distance from the patient's residence to their primary care facility. Distances were considered erroneous and set to missing if the patient distance to primary care exceeded 150 miles or the adjusted distance was lower than –25 miles. (Negative values may occur if the patient's primary care location is farther away than the specialty clinic completing the e-consult.) Primary care visits outside the specialty care administrative region didn't contribute to home station identification; patients receiving primary care outside that region were considered to have missing home stations. Patients with home locations outside the contiguous 48 states were excluded from all analyses.

Figure 1. E-Consults per 100 Visits Across Time and Veterans Integrated Service Networks (VISNs)



Analyses

We aggregated the number of completed e-consults by specialty, regional network, and location where patients received primary care, either at a CBOC or medical center. We reported the quarterly frequency of e-consults from May 2011 to December 2013, stratified by VISN and specialty. Quarterly e-consults were adjusted by total consults and expressed as a rate. We calculated the e-consult rate to facilitate comparisons across VISNs, facilities, and clinic specialties.

We calculated the proportion of patient consults receiving primary care at a CBOC for each yearly quarter, stratified by type of consult (e-consult or not). We used χ^2 tests to compare binary outcomes (patient receiving primary care at a CBOC; subsequent face-to-face consult after the first consult; and primary care visit in the 3 months following the first consult) between e-consults and face-to-face consults. Among patients receiving primary care at a CBOC, we used Wilcoxon rank-sum tests to compare the distribution of miles needed to travel between e-consults and face-to-face consults.

Statistical tests were performed using R software, version 3.1.0, (R Foundation for Statistical Computing, Vienna, Austria). Initial data aggregation was performed with SAS version 9.3 (SAS Institute, Cary, North Carolina).

RESULTS

We identified 14,182,136 specialty care visits between May 1, 2011, and December 31, 2013, of which 262,143 were e-consults. We excluded visits outside of the continental United States (n = 275,611), visits occurring outside of VHA medical centers (n = 1,265,169), visits by patients without an assigned primary care clinic (n = 692,726), visits by patients whose assigned primary care clinic was not a CBOC or VHA medical center (eg, residents of long-term care facilities) (n = 986,759), sites that had less than 1 e-consult per 10,000 visits (n = 1,127,251), and sites with less than 1000 total visits across the time period (n = 87,973). These categories had some overlap, and 2,911,498 visits in total were excluded.

There were 217,014 completed e-consults that met the inclusion criteria in the 13 clinics of interest in all 21 VISNs. During the same time period, there were 11,270,638 total consults that met the inclusion criteria, giving an adjusted rate of 1.93 e-consults per 100 consults. At the VISN level, the rate of e-consults per 100 total consults varied (mean = 2.0; SD = 0.8; median = 1.9; interquartile range [IQR] = 1.4-2.4). Although there has been some variability in uptake of e-consults across VISNs, it has generally increased with time (Figure 1). At the individual medical centers, the range of e-consults has varied from 0.02 to 26 per 100 consults.

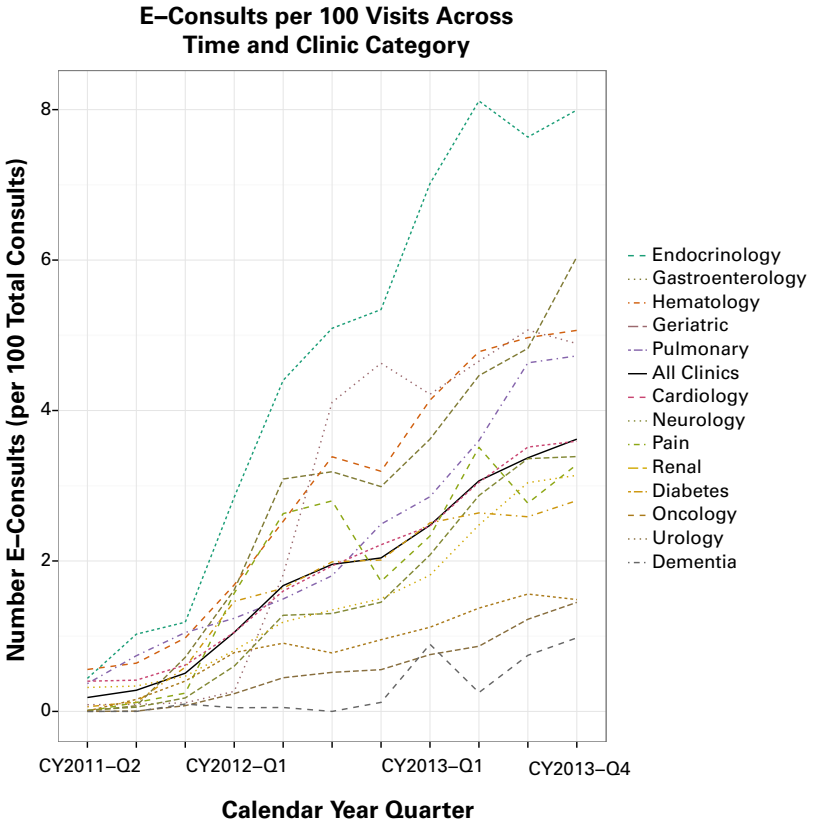
E-consults were completed most frequently in cardiology (n = 44,322), gastroenterology (n = 29,043) and endocrinology (n = 23,972). Adjusting for total consult volume, the rate of e-consults were highest in endocrinology (5.0 per 100 total consults), hematology (3.0 per 100 total consults), and gastroenterology (3.0 per 100 total consults) (Figure 2).

Comparing e-consults to face-to-face consults, there were differences in both: 1) the percent of patients coming from outside the specialty care medical center, and 2) the distance from their primary care center to the specialty care center. During the study period, comparing the patients

participating in e-consults with those participating in face-to-face consults, the e-consult population had a higher percentage of patients who received primary care at CBOCs (45.3% vs 36%; *P* <.0001). In the first year of implementation, the percent of e-consult patients with CBOC-based primary care grew from 28.5% to 44.4%. This increase slowed in the subsequent 2 years, growing from 44.4% to only 45.6%. In the same 3-year period, the percent of face-to-face consult patients with CBOC-based primary care grew slightly, from 34.7% to 37% (see **eAppendix Figure**, available at **www.ajmc.com**). Among the patients receiving primary care at CBOCs outside of a medical center, the distance from their PCP to the medical center was farther for patients receiving e-consults (38 vs 32 miles; *P* <.0001) compared with patients receiving face-to-face consults. These results suggest that compared with face-to-face consults, e-consults are used more frequently for patients with lower spatial access to specialty care.

Geographic distributions of "hub" medical centers and "spoke" community clinics demonstrate wide variation in number of spoke connections for each hub, as well as number of consults between each hub and spoke combination (**Figure 3**). The Figure 3 map highlights the geographic reach of e-consults to patients with potentially less access to specialty care.

Figure 2. E-Consults per 100 Consults Across Time and Clinic Category



Clinic categories are presented in the legend in the order of their final e-consult rate in CY2014 [Au: Figure says CY2013]-Q4 (endocrinology had the highest final e-consult rate, followed by gastroenterology, etc).

In the 3 months following a specialty care consult, patients who had received e-consults were less likely to have subsequent face-to-face visits with the same specialty compared with patients with a face-to-face consult (18.6% vs 43.2%; *P* <.001). In contrast, e-consult patients were more likely to have a subsequent primary care visit compared with patients with a face-to-face consult (78.8% vs 67.4%; *P* <.001), suggesting that patients receiving an e-consult have a higher probability of follow-up with their PCP for subsequent care compared with patients with a face-to-face specialty care visit.

Finally, we calculated the potential miles needed to travel to receive a face-to-face consult in lieu of an e-consult. Among the 217,014 e-consults, 93% (201,735) had acceptable distance calculations. Among those patients, 52.7% (n = 106,310) received primary care from the same facility; thus there were no potential mileage-traveled differences between an in-person consult and an e-consult. For the 47.3% (n = 95,425) of e-consults for patients from CBOCs, the average potential miles needed to travel was 72.1 miles per patient (SD = 72.6; median = 54.6; IQR = 17.1-108) (see **Figure 4**). This distance translates into 6,875,631 total potential miles needed to travel. During the time period, the VHA reimbursed patient mileage at a rate of 41.5 cents per mile; thus, the total potential miles needed to travel would translate into potential direct costs of $2,853,387. These mileage estimates are conservative because they are based on "as the crow flies" rather than true distance necessary to be driven.

DISCUSSION

Our study describes the implementation, spread, and impact of the VHA national e-consult program. Since VHA implementation in 2011, nearly 2% of all consults were e-consults without evidence for a plateau in their

Figure 3. A Spatial Visualization of E-Consult Touches

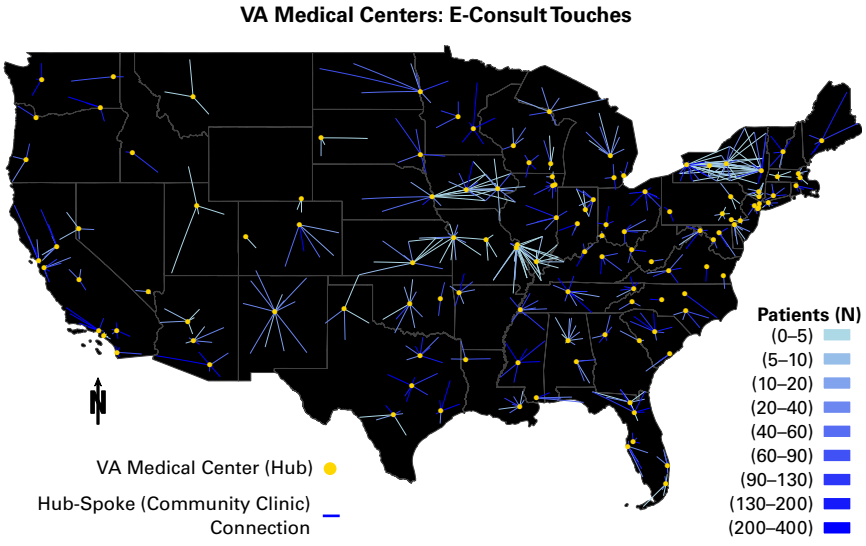
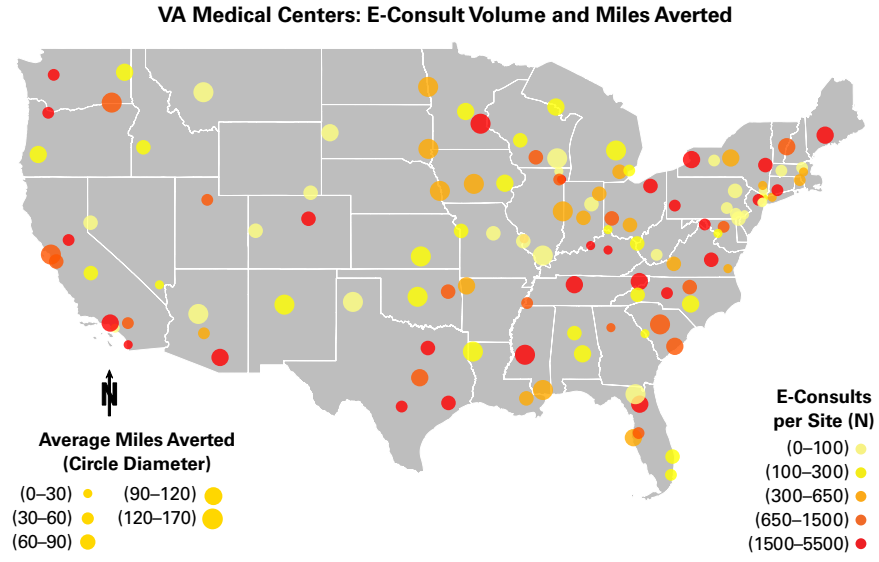


Figure 4. E-Consult Volume and Miles Averted Associated With VA Medical Centers



use. In addition, receipt of e-consults for patients with primary care at CBOCs was associated with reductions in the total potential miles traveled and travel costs. These findings have important implications for the VHA for addressing both spatial and nonspatial barriers to access for specialty care services, especially for veterans who live in rural communities. Furthermore, our results provide potential approaches to specialty care access for ACOs and other integrated healthcare delivery systems.[6] Like other healthcare institutions, VHA has adopted the "triple aim" framework for optimizing healthcare delivery to improve the patient healthcare experience and the health of the patient population while balancing per capita cost.[7] The implementation of e-consults is a potential mechanism by which VHA can strive to achieve these aims.[8-24]

E-consults may improve the overall patient experience of care by reducing inconvenience and waiting times for specialist consultation/input. In addition, patients have the opportunity to avoid long travel distances to see specialists and to obtain specialty advice in a timely manner compared with an in-person visit. For patients who either prefer or require an in-person specialist visit, the initial e-consult may also provide an opportunity to be more prepared for the visit. For example, by arranging for diagnostic or laboratory tests in advance, some visits to the specialist could be avoided and time to needed services potentially decreased. We found that for the majority of consults, an in-person visit did not occur following the e-consult. This finding reinforces the study of Keely et al, who found that specialists were able to answer the e-consult without needing further information 89% of the time.[23]

E-consults have the potential to improve quality of care for both individuals and the general patient population. First, e-consults improve patient access to specialist expertise, especially for the large number of veterans who live in rural communities. We found higher utilization of e-consults for those in CBOCs and more follow-up appointments with primary care after e-consults than for those patients not receiving e-consults. Second, e-consults promote the use of a standardized referral process with iterative communication that can lead to increased effectiveness of care delivered. In fact, preliminary results of interviews with clinicians have found that both PCPs and specialists value the benefits e-consults have for patients. In addition, e-consults provide

an opportunity to improve care coordination for patients as a consequence of better PCP-specialist communication. Third, when combined with the capabilities of an EHR, it is possible to identify populations who would benefit from additional specialty care expertise. "Consultation" may be pre-emptive, thereby avoiding preventable morbidity.[25,26] This population management approach will need to be evaluated prospectively.

E-consults may reduce the per capita cost of healthcare from the healthcare system perspective. Reductions may be accomplished by improved efficiency of use of high-cost specialists. On the other hand, increased access to specialists may result in increased testing and consequent expense; healthcare value may improve, albeit without reducing costs.[27,28] However, we believe that the overall costs will be less with use of e-consults over time due to primary care coordination. VHA cost structure also has some unique aspects. The VHA outsources specialty care—particularly for rural veterans—because of difficulties for these veterans to access specialists. This so-called "fee-basis" care consumes funds that are used for outside care and do not return to the system. In addition, specific populations of veterans are reimbursed for their travel to clinic visits; generally, this reimbursement is provided to veterans with at least a 30% service-connected disability. The elimination of unnecessary visits subsequently reduces travel reimbursement costs. Finally, efficiency may be improved by better coordination of care and less fragmentation of care.[29,30] We are not suggesting that e-consults will obviate the need for face-to-face visits, but this technology-supported platform can optimize efficient use of specialist expertise, which may be limited in differing geographic locations and health systems.

E-consult programs have been established in a variety of healthcare systems. However, in order for e-consults to be more widely adopted, changes to the payment systems are needed. The VHA's model of salaried physicians and capitated reimbursement provides a more favorable environment for e-consult implementation. In contrast, under the fee-for-service model, specialists must physically see the patient and bill for a separate visit in order to receive payment. Thus, although the reach of technology expands and allows the extension of care delivery into areas where few specialists reside, payment models lag behind and may hinder the potential spread of such programs. It will be important to assess how the different models for reimbursement and shared savings in ACOs under the Affordable Care Act evolve; their effects on different types of specialist care delivery and coordination of care remain to be seen.[31-35]

Limitations

Our study has several limitations. First, the rate of increase of e-consults may reflect changes in documentation; formalized coding of e-consults was part of the initiative because of its relevance to tracking patient care and the necessity to capture the work of specialty care providers. Second, the e-consult initiative was conducted within an integrated healthcare delivery system and a single EHR enabling ready access to information for both PCPs and specialists. Nevertheless, trends in use of EHRs and efforts to achieve interoperability may render implementation of e-consults in other settings less difficult in the future. The logistical issues for implementing such a system in the fee-for-service sector are likely to be different. This may include recognition that some healthcare systems may need to contract out for specialist care; contracted specialists may not be interested in supporting large-scale e-consult initiatives. However, as the country moves toward ACOs, the lessons learned in implementing this initiative in the VHA may be applicable to ACOs. Finally, although the number of e-consults has increased, we do not know if these e-consults have resulted in improved patient outcomes. Future studies must be done to address any potential unintended consequences for patients, clinicians, and healthcare systems, as well as other unanswered questions. Last, the patients' perspectives need to be considered and to that end, we will be conducting interviews with patients in the near future to obtain their feedback and experience with e-consults.

CONCLUSIONS

Since the e-consult initiative rolled out in 2011, there has been a steady increase in the use of e-consults across 21 networks and for a diverse group of specialties. Specifically, the number of patients with primary care at CBOCs—which are relatively remote from sites where specialists are located—receiving an e-consult has increased. Use of e-consults has been associated with reductions in potentially unnecessary driving, as evidenced by potential miles saved. These findings have important implications for the VHA in terms of increasing access to specialty care in general and to veterans who live in rural communities in particular, and the findings may apply to other healthcare systems.

Acknowledgments

The authors thank the Evaluation Center Quantitative Analysis Group: Jackie Szarka, PhD; Jeffrey A. Todd-Stenberg, BA; Christian D. Helfrich, PhD, MPH; Anne C. Lambert-Kerzner, PhD, MSPH; Catherine T. Battaglia, PhD, MS; Thomas J. Glorioso, MS; Kent Davis; Katherine M.

Fagan Williams, MPH. All authors and the Evaluation Center Quantitative Group had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Author Affiliations: Office of Specialty Care Services (SK, OC, GG), Patient Care Services (RJ), Veterans Health Administration, Washington, DC; Louis Stokes Cleveland VA Medical Center (SK, DCA), Cleveland, OH; Case Western Reserve University School of Medicine (SK, DCA), Cleveland, OH; Eastern Colorado VA Medical Center (EC, PMH), Denver, CO; Puget Sound Health Services Research & Development Center of Innovation, Department of Veterans Affairs (DHA), Seattle, WA; Department of Medicine, University of Washington (DHA), Seattle, WA; New Jersey Veterans Health Care System, East Orange Campus (C-LT, HF), East Orange, NJ

Source of Funding: This material is based upon work supported by the US Department of Veterans Affairs, the Office of Specialty Care Transformation and the Office of Research and Development Quality Enhancement Research Initiative.

Author Disclosures: The authors are employed by the VA and this work was funded, in part, by the VA Office of Specialty Care Transformation, the office overseeing the e-consult initiative. The views expressed here do not necessarily reflect the position or policy of the Department of Veterans Affairs. The authors report no relationship or financial interest with any entity that would pose a conflict of interest with the subject matter of this article.

Authorship Information: Concept and design (OC, HF, DHA, DCA, GG, RJ, PMH, EC, SK); acquisition of data (DHA, GG, EC, SK); analysis and interpretation of data (OC, HF, DHA, C-LT, DCA, GG, RJ, EC, SK); drafting of the manuscript (DHA, C-LT, DCA, EC, SK); critical revision of the manuscript for important intellectual content (OC, DHA, DCA, GG, RJ, PMH, EC, SK); statistical analysis (HF, C-LT, EC, SK); provision of patients or study materials (GG, SK); obtaining funding (OC, DHA, DCA, SK); administrative, technical, or logistic support (DHA, GG, PMH, SK); and supervision (DHA, GG, RJ, SK).

Address correspondence to: Susan Kirsh, MD, MPH, Case Western Reserve University School of Medicine, 10701 East Blvd, Cleveland, OH 44106. E-mail: susan.kirsh@va.gov.

REFERENCES

1. Jha AK, Perlin JB, Kizer KW, Dudley RA. Effect of the transformation of the Veterans Affairs Health Care System on the quality of care. *N Engl J Med.* 2003;348(22):2218-2227.

2. Kizer KW, Dudley RA. Extreme makeover: transformation of the Veterans Health Care System. *Annu Rev Public Health.* 2009;30:313-339.

3. Kizer KW. Veterans and the Affordable Care Act. *JAMA.* 2012;307(8):789-790.

4. Chen AH, Yee HF Jr. Improving the primary care-specialty care interface: getting from here to there. *Arch Intern Med.* 2009; 169(11):1024-1026.

5. Mehrotra A, Forrest CB, Lin CY. Dropping the baton: specialty referrals in the United States. *Milbank Q.* 2011;89(1):39-68.

6. Fisher ES, Shortell SM. Accountable care organizations: accountable for what, to whom, and how. *JAMA.* 2010;304(15):1715-1716.

7. Berwick DM, Nolan TW, Whittington J. The triple aim: care, health, and cost. *Health Aff (Millwood).* 2008; 27(3):759-769.

8. Angstman KB, Rohrer JE, Adamson SC, Chaudhry R. Impact of e-consults on return visits of primary care patients. *Health Care Manag (Frederick).* 2009;28(3):253-257.

9. Kim-Hwang JE, Chen AH, Bell DS, Guzman D, Yee HF Jr, Kushel MB. Evaluating electronic referrals for specialty care at a public hospital. *J Gen Intern Med.* 2010;25(10):1123-1128.

10. Stoves J, Connolly J, Cheung CK, et al. Electronic consultation as an alternative to hospital referral for patients with chronic kidney disease: a novel application for networked electronic health records to improve the accessibility and efficiency of healthcare. *Qual Saf Health Care.* 2010;19(5):e54.

11. Singh H, Esquivel A, Sittig DF, et al. Follow-up actions on electronic referral communication in a multispecialty outpatient setting. *J Gen Intern Med.* 2011;26(1):64-69.

12. Warren J, White S, Day KJ, Gu Y, Pollock M. Introduction of electronic referral from community associated with more timely review by secondary services. *Appl Clin Inform.* 2011;2(4):546-564.

13. Palen TE, Price D, Shetterly S, Wallace KB. Comparing virtual consults to traditional consults using an electronic health record: an observational case-control study. *BMC Med Inform Decis Mak.* 2012;12:65.

14. Hysong SJ, Esquivel A, Sittig DF, et al. Towards successful coordination of electronic health record based-referrals: a qualitative analysis. *Implement Sci.* 2011;6:84.

15. Singh H, Esquivel A, Sittig DF, et al. Follow-up actions on electronic referral communication in a multispecialty outpatient setting. *J Gen Intern Med.* 2011;26(1):64-69.

16. Chaudhry R, Spurrier BR, Wood D, LaRusso NF. Physician perspectives on electronic consultations for specialty care delivery for patients: implications for person-centered medicine. *Int J Person Centered Med.* 2012;2(3):453-457.

17. Stoves J, Connolly J, Cheung CK, et al. Electronic consultation as an alternative to hospital referral for patients with chronic kidney disease: a novel application for networked electronic health records to improve the accessibility and efficiency of healthcare. *Qual Saf Health Care.* 2010;19(5):e54.

18. Chen AH, Yee HF Jr. Improving primary care-specialty care communication: lessons from San Francisco's safety net: comment on "referral and consultation communication between primary care and specialty care physicians." *Arch Intern Med.* 2011;171(1):65-67.

19. Malagrino GD, Chaudhry R, Gardner M, et al. A study of 6,000 electronic specialty consultations for person-centered care at The Mayo Clinic. *Int J Person Centered Med.* 2012;2(3):458-466.

20. Bergus GR, Emerson M, Reed DA, Attaluri A. Email teleconsultations: well formulated clinical referrals reduce need for clinical consultation. *J Telemed Telecare.* 2006;12(1):33-38.

21. Horner K, Wagner E, Tufano J. Electronic consultations between primary and specialty care clinicians: early insights. *Issue Brief (Commonwealth Fund).* 2011;23:1-14.

22. Kim-Hwang JE, Chen AH, Bell DS, Guzman D, Yee Jr. HF, Kushel MB. Evaluating electronic referrals for specialty care at a public hospital. *J Gen Intern Med.* 2010;25(10):1123-1128.

23. Keely E, Liddy C, Afkham A. Utilization, benefits, and impact of an e-consultation service across diverse specialties and primary care providers. *Telemed J E Health.* 2013;19(10):733-738.

24. Bergus GR, Sinift SD, Randall CS, Rosenthal DM. Use of an e-mail curbside consultation service by family physicians. *J Fam Pract.* 1998;47(5):357-360.

25. Dubose T, Behrens MT, Berns A, Klotman P, Yee HF Jr, Campbell R. The nephrology-primary care interface: providing coordinated care for chronic kidney disease. *Nephrology Self-Assessment Program.* 2010;9(1):1-4.

26. Kirsh SR, Ho PM, Aron DC. Providing specialty consultant expertise to primary care: an expanding spectrum of modalities. *Mayo Clin Proc.* 2014;89(10):1416-1426.

27. Starfield B, Shi L, Macinko J. Contribution of primary care to health systems and health. *Milbank Q.* 2005;83(3):457-502.

28. Starfield B, Shi L, Grover A, Macinko J. The effects of specialist supply on populations' health: assessing the evidence. *Health Aff (Millwood).* 2005;suppl web exclusives:W5-97-W5-107.

29. Nutting PA, Crabtree BF, Miller WL, Stange KC, Steward E, Jaen C. Transforming physician practices to patient-centered medical homes: lessons from the national demonstration project. *Health Aff (Millwood).* 2011;30(3):439-445.

30. Rosland AM, Nelson K, Sun H, et al. The patient-centered medical home in the Veterans Health Administration. *Am J Manag Care.* 2013;19(7):e263-e272.

31. Lipsitz LA. Understanding health care as a complex system: the foundation for unintended consequences. *JAMA.* 2012;308(3):243-244.

32. Fisher ES. Building a medical neighborhood for the medical home. *N Engl J Med.* 2008;359(12):1202-1205.

33. Kirschner N, Barr MS. Specialists/subspecialists and the patient-centered medical home. *Chest.* 2010;137(1):200-204.

34. Starfield B. Primary care, specialist care, and chronic care: can they interlock? *Chest.* 2010;137(1):8-10.

35. O'Malley AS, Reschovsky JD. Referral and consultation communication between primary care and specialist physicians: finding common ground. *Arch Intern Med.* 2011;171(1):56-65. ■

www.ajmc.com Full text and PDF

eAppendix Figure