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Telecardiology E-Consultation in a Single Payer System: Efficient and Safe but Consultant Satisfaction is Equivocal

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Abstract

Background:

Cardiovascular electronic consultation (e-consult) is a new service line in consultative medicine and enables cardiovascular care without an office-based visit. We aimed to evaluate accessibility and time saved as measures of efficiency, determine the safety of e-consults in a medically-complex and socioeconomically vulnerable patient population, and assess satisfaction by responding cardiologists.

Methods:

Using a mixed-methods approach and a modified time-driven, activity-based, costing framework, we retrospectively analyzed cardiology e-consults within a single-payer system. A random subset of 500 e-consults referred between 2013-2017 were reviewed. Accessibility was determined based upon increased number of patients served without the need for an in-person clinic visit. Medical records were reviewed for emergency room visits or hospital admission at 6-months from the initial e-consult date for assessment of safety. Responding cardiologist satisfaction was assessed by voluntary completion of an online survey.

Results:

The majority of e-consults were related to medication advice, clearance for surgery, evaluation of images, or guidance after abnormal testing. Recommendations included echo (10.8%), stress testing (5.0%), other imaging (4.0%), and other subspecialist referrals (3.8%). E-consults were completed within 0.7 ± 0.5 days of the request, with a time to completion of 5-30 minutes. Over a 6-month follow-up, 13.9% of patients had an in-person visit and 2.2% of patients were admitted, but none were directly related to the e-consult question. Satisfaction by responding cardiologists was modest.

Conclusion:

In conclusion, within a single-payer system, e-consults represent an effective, convenient, and safe alternative for providing consultative cardiovascular care, but

further optimization is necessary to minimize e-consult fatigue experienced by cardiologists.

Keywords: Electronic consultation, cardiology, specialty care, veterans

Word count: 249

Introduction

The Veteran's Health Administration (VHA) is one of the largest integrated, single-payer healthcare systems in the United States with >9 million constituents.¹ Since the 1960s,^{2,3} the VHA has been a leader in piloting telehealth technology and developing programs to improve patient care and access,⁴ particularly in rural areas.⁵ Much of the VHA's telehealth efforts has focused on mental health and primary care. However, with an aging veteran population and shortage of specialized physicians, the need for subspecialty consultations has increased. Ultimately, access and rational triage gave birth to subspecialty electronic consultations (e-consults).^{6,7} Although "curbside" consultations have always existed in clinical medicine, e-consults formalized the process and created a new service line in consultative medicine.^{8,9}

The e-consultation program within VHA^{7,10} and other healthcare systems^{9,11,12} is intended to efficiently enable communication between primary care clinicians and specialists using the electronic medical record (EMR), without the necessity of an in-person clinic visits.⁶ All medical data come directly from a chart review. Several single-center observational studies have demonstrated benefits including increased speed of communication, time and resources saved for both patients and the healthcare system, and user satisfaction.^{13,14} Because cardiovascular patients tend to be more complex and e-consult questions may be time-sensitive, safety becomes a frequent concern. Using both quantitative and qualitative data, the aims of this study were to assess the value of tele-cardiology e-consultations in a single-payer system through measures of efficiency, safety, and consultant satisfaction.

Materials and Methods

The project was reviewed by the local Institutional Review Board and was deemed to be exempt. We used a mixed-methods analytic approach,^{15,16} which included a combination of quantitative and supplemental qualitative data to iteratively enhance the understanding of patterns observed. We defined value in the context of efficiency (accessibility and time saved), safety, and consultant satisfaction. We applied a time-driven activity-based costing (TDABC) framework^{17,18} to assess cost savings in the context of efficiency by comparing the care delivery value chain (CDVC) for cardiovascular e-consults vs conventional in-person, office-based cardiovascular consultative clinic visits (Figure 1). Because cardiovascular e-consults streamlined multiple processes (obviated the cost for ancillary personnel at two different steps of the CDVC, and reduced resource costs to time spent by consulting cardiologists), all seven steps of TDABC were not applied.¹⁸

The VA Greater Los Angeles Healthcare System provides both inpatient and outpatient care services and is composed of the VA West Los Angeles Medical Center (WLAMC; a tertiary referral center), two free standing ambulatory care centers, and eight surrounding community clinics. VA WLAMC is also an academic center with multiple affiliations and hosts medical trainees from local affiliated healthcare institutions. The Division of Cardiology consists of 10 full-time cardiologists, 3 part-time cardiologists, and 2 part-time nurse practitioners. All attending cardiologists rotated on the inpatient cardiology consultation service and sub-specialization included general cardiology, interventional cardiology, cardiovascular imaging, and clinical cardiac electrophysiology. Between 2013 and 2017, a total of 4,833 e-consults were sent to the Cardiology Division at VA WLAMC. Figure 1 outlines the workflow for cardiology e-

consults compared to conventional in-person consultations. Any person with ordering privileges may submit an e-consult to cardiology.

Quantitative data relating to cardiology e-consults were extracted from the EMR and reviewed. Of the 4,833 E-consults received over the 4-year study period, a total of 500 e-consults were randomly chosen for detailed review. From the 500 e-consults, we collected the following data: common consult questions, diagnoses by ICD-9 coding, recommended tests and other consultations, time spent, follow-up visits and/or hospitalizations within 6 months of the e-consult request. Workload credit used for resource allocation was based on self-reported time spent (as a reflection of patient complexity, time, and risk) and were divided into <15 minutes, 15-30 minutes, 30-45 minutes, and >45 minutes. The time duration corresponded to an outpatient complexity typically used for documentation of work-relative value units (wRVUs): Level 2 (1.34 wRVU), 3 (1.88 wRVU), 4 (3.02 wRVU), and 5 (3.77 wRVU) visits. Accessibility was based upon increased number of patients served in lieu of an in-person clinic visit. Measures of efficiency included time-saved and costing analysis based on updated wRVU equivalents for potential in-person specialty clinic visit. Date and time stamps from the signature of the requesting service and the responding consultant were used to determine time to completion. Time-saved was determined by comparing the average elapsed time duration for completion of an e-consult with the conventional wait time for an in-person appointment. To assess short-term safety, medical records were reviewed for in-person clinic visits and/or inpatient hospitalizations occurring within the six-month window of the e-consult. Any subsequent in-person clinic visits or hospitalizations directly related to the e-consult question were reviewed and documented.

To qualitatively assess the overall impression of the e-consult program and consultant satisfaction, an electronic survey (SurveyMonkey®, San Mateo, CA) consisting of six questions was sent to attending cardiologists (n=13). Survey questions were: 1) I am satisfied with the cardiology e-consult program, 2) e-consult is a time burden that is not reflected in the workload and/or detracts from other duties and obligations, 3) the types of clinical questions asked with an e-consult are generally appropriate, 4) the e-consult program minimized inappropriate traditional “in-person” consult referrals, 5) the e-consult program improved access to cardiovascular consultative care. Survey participants were asked to respond to each question as definitely true, mostly true, mostly false, or definitely false. Participants were able to provide free text comments at the end of the survey, which were also reviewed. Participation in the survey was voluntary.

Results

A total of 4833 e-consults were received from 2013-2017 (Figure 2A). The patients were predominantly male (95.8%, 479/500) and between the age of 24-96 years (64 ± 12 years). By 2017, the number of cardiology e-consults received was 5x the number of e-consults from 2013. The background of persons requesting cardiology e-consults and the volume of e-consults are illustrated in Figure 2B. Allopathic medical residents or fellow physicians with an MD degree (141/500; 28.2%) requested the majority of e-consults. Other users of cardiology e-consults included internal medicine attending physicians (MDs), other specialty attending physicians, nurse practitioners (NP), and physician’s assistants (PA). Surprisingly, cardiology e-consults were also

used by both by non-clinicians who had ordering privileges and by clinicians for administrative questions (e.g. we cannot find the Holter report).

Table 1 summarizes the most common diagnoses for cardiology e-consults. Based on ICD-9 codes, the three most frequent diagnoses were essential hypertension, dyslipidemia, and atrial fibrillation. Consult questions ranged from diagnostic to therapeutic including medication recommendations (initiation, change, continuation, and/or discontinuation), clearance for dental work and/or other surgical procedures, evaluation of imaging findings, and guidance on how to proceed with abnormal test results. Less than 5% of e-consults pertained to administrative requests (e.g. where is the echo report?). Of the e-consults analyzed, 78.8% (394/500) did not result in additional testing. In 21.2% (106/500) of consults, one or more subsequent tests or referrals were ordered: 54 echocardiograms (10.8%), 25 stress tests (5%), 20 other imaging tests (4%), and 19 referrals to other subspecialists (3.8%).

The majority of e-consults were completed within 24 hours of request (0.7 ± 0.5 days). The amount of time spent completing an e-consult ranged from 15 to 55 minutes (34.5 ± 7.5 minutes). Over the same study period, the wait time for a traditional in-person clinic visit was: 5.2 ± 2.7 days (2014), 9.2 ± 4.7 days (2015), 15.2 ± 7.5 days (2016), 13 ± 7.5 days (2017). Billing for conventional clinic visits typically account for complexity of the consult question, number of problems addressed, time, and risk. Within the sampled population, there were 50 (10%) Level 5 in-person equivalent consultations, 375 (75%) Level 4 consultations, and 75 (15%) Level 3 consultations. Based on the 2017 outpatient wRVUs from the National Physician Fee Schedule for, the potential reimbursement equivalent for outpatient consultation visits (500 of total 4833 E-consults

received) was \$9,241 (Level 5 consults), \$55,987.50 (Level 4 consults), and \$6971.25 (Level 3 consults). If cardiology consultations were billable (reimbursable), the amount of revenue generated by the cardiology e-consults was approximately \$73,000 for the 500 e-consults (~10.3% of total e-consults). By extrapolation, this could equate to ~\$800,000 of revenue for the 4-year study period or ~\$200,000 per year of additional revenue.

Within 6 months after completion of the e-consult, 70 patients (13.9%) required an in-person cardiology clinic visit indirectly related to the problem addressed in the e-consult. Moreover, 11 patients (2.2%) required inpatient hospitalization due to progression of their disease. Of the patients that required hospitalization, the underlying problem was congestive heart failure (n=6), coronary artery disease (n=3), atrial fibrillation (n=1), and hypertension (n=1).

Of the faculty members surveyed (n=13), a total of 6 voluntarily completed the questionnaire; 2 originally requested faculty members were excluded due to conflict of interest. Three cardiologists provided free-text comments. Figure 3 illustrates the distribution of the survey data. Preliminary survey data results suggested ambivalence about the overall impression of the e-consult program; at the same time, satisfaction by consultants were equivocal (50% were mostly satisfied; 50% were not satisfied). The majority felt that e-consults increased veterans' access to cardiovascular consultative care (33.3% definitely true, 50.0% mostly true, and 16.6% mostly false). The sentiments were more negative when it came to minimization of unnecessary in-person visits (33.3% mostly true, 50.0% mostly false, and 16.6% definitely false). Most felt e-consult questions were appropriate (50.0% mostly true, 16.6% mostly false, and 33.3%

definitely false). However, e-consults were viewed as a time burden because the cardiologists completed e-consults on top of their normally designated clinical work. Consultant cardiologists felt the time spent detracted from other duties while on the inpatient consult service (66.6% definitely true and 33.3% mostly false). When correlated with the billing service level of the e-consult, the additional time burden coincided with an average increase of at least 69 additional hours per cardiologist per year for 2017 (1574 e-consults in 2017 x assume minimum average 34 minutes per e-consult = 53516 minutes / 60 minutes = 892 hours / 13 cardiologists = 69 hours per cardiologist). The free text section provided additional insights including concerns about the types of questions asked (e.g. “how to order a follow up visit” and “how to complete a medication renewal”). Consultants felt documentation using the current EMR system was complex and inefficient contributing to the time burden.

Discussion

Our results demonstrate that e-consultations improved the efficiency of cardiovascular consultative medicine at VA WLAMC and whose value was substantiated by rapid growth between 2013-2017. Within a 6-month follow-up period, 13.9% (70/500) of patients needed in-person cardiology clinic visits and 2.2% (11/500) of patients were hospitalized. Two most frequent reasons for hospitalization were congestive heart failure and coronary artery disease. Unlike observations from multi-payer healthcare systems, our study found that cardiologists were also concerned about the additional time burden and inadequate resource allocation. On average, each cardiologist spent at least 69 additional hours per year answering e-consults in 2017.

Although our patient population was older with likely different socioeconomic challenges than other systems, we found that practice pattern as well as short-term

safety outcomes were similar to those within multi-payer systems.¹¹ Of the reviewed e-consults, 78.80% were resolved without further need for additional diagnostic testing or referrals. Wasfy et al showed a similar frequency of additional testing ordered subsequent to an e-consult.¹¹ In our study, only 13.9% of patients required an in-person visit. At 6-month follow-up, Wasfy et al found that 24.4% patients had an in-person cardiology visit.¹⁹ Although a small percentage (2.2%) of our patients was hospitalized within 6 months for reasons directly related to the e-consult question, the need for hospitalization was unrelated to a delay in care but rather due to natural progression of the condition. While the results of our study substantiated the findings by Wasfy et al, our work provides additional assessment of value from the perspective of the consultants.

The average time spent completing e-consults was 34.5 ± 7.5 minutes; the majority were completed within 1 day (0.7 ± 0.5 days). This response time contributed to time-saved and improved the overall efficiency of cardiology consultation.²³ Patients also benefited by not having to wait for an in-person appointment, which can be as little as 1 month to as long as 6 months on average nationally;^{20,21} whereas, our local wait time ranged from 5 to 15 days. Reduced in-person visits also diminished the need for transportation, which can be a particular problem for elderly veterans²² and those living far from the medical center.

Recent interest in e-consult programs relate to cost-savings; the other facet is potential revenue generation and reallocation of resources as a consequence of cardiology e-consult implementation. Our study was limited by the use of e-consult equivalent levels of service reimbursement in the context of time-driven activity-based costing. We calculated a potential revenue of \$73,000 over the 4-year study period for

the 500 e-consults reviewed, which accounted for only 10.3% (500/4833) of the total number of e-consults. Our estimated costs (or potential revenue) was consistent with those found by colleagues in Eastern Ontario, Canada.²⁴ Liddy et al. determined the overall amount saved during their implementation of e-consults was \$38,729 for the 3,487 completed consults during the 1-year study period.²⁴ In a resource-limited single-payer system such as the VHA, revenue generation may be less significant than the indirect consequences of implementing a cardiology e-consultation service. One notable effect is enabling the in-person clinic visit to be saved for more complex patients or patients who truly require an in-person assessment. For both patients (in terms of time spent) and systems (with all the associated costs an in-person visit), an in-person clinic visit is a scarce and costly resource. While future studies may consider using time-driven activity-based costing to compare the value of e-consult programs in a wide range of healthcare settings, within the larger value equation however, intangible benefits may be gleaned from the types of questions asked through e-consult use, which merits further investigation.

The qualitative findings of our study mirrored those described by Gupte et al.¹⁰ In addition to evaluating quantitative measures of e-consult utilization across the VA Boston Healthcare System, they also reported the unintended consequences relating to the implementation of e-consults. Most notable was the unintended use of e-consults for administrative questions that filled an unmet gap of administrative support within VHA. While others have proposed that e-consults may facilitate avoidance of appropriate vs inappropriate subspecialty referrals,⁹ we did not systematically assess the appropriateness of the e-consult question. Although the workload is accounted based on the time duration spent, resource re-allocation was not made to account for the

additional workload generated by the e-consults and hence, lessened the enthusiasm among consulting cardiologists. Cardiology e-consults were viewed as additional tasks on an already full plate and may potentially contribute to increased dissatisfaction among consulting physicians. Although we expected clinic wait time to improve, the average clinic wait time increased between 2014 to 2017.

Our study has several limitations. First, this study was a single center analysis within the VA healthcare system, which limits the generalizability to other systems. Because the sampling timeframe was limited to the first 3 years, discontent among consultants may relate to growing pains during the early years of implementation. The growing volume of cardiology e-consults may also be specific to VA Los Angeles as an academic teaching hospital where trainees and non-specialists may use e-consults more frequently because it is convenient, readily accessible, and without cost to the user other than the time spent entering the e-consult request. Both our findings and those of Gupte et al¹⁰ suggest that administrative use e-consults for purposes other than to address a clinical issue (e.g. assistance in scheduling a follow up visit in clinic). Second, the VHA is an integrated, single-payer system. All medical centers and clinics use the same EMR, which may be difficult to implement in community practices that do not share a common EMR. The VA healthcare system also functions as a single-payer within the larger landscape of a complicated U.S. healthcare system. The significance is there are no incentives or compensation linked to answering the additional e-consults, which limits widespread adoption of the program. Third, our study did not specifically assess satisfaction of the requesting service. However, many publications have established a high level of satisfaction by patients and requesting clinicians.^{11,22,25} Fourth, while the safety outcomes indicate acceptably low rates of in-person clinic

follow-up and/or hospitalization, the results may reflect a bias towards an overall lower risk profile of patients within the spectrum of complex veteran patients considered for e-consultation, which is highly appropriate. Finally, it is challenging to generate an accurate cost-savings analysis when RVU-based equivalents are used to compare e-consults with in-person visits, but we provided estimates for context. In our analysis, we used the consulting physician's time as a form of costing by leveraging a modified time-driven activity-based approach to account for cost in both methods of care delivery. Indeed, physician time is perhaps the most limited of all resources in the cardiovascular care delivery value chain. If cost-savings are viewed only from the standpoint of physician time, then e-consultation shifted physician time from "in-person" to "remote or virtual" care delivery, but did not necessarily reflect a cost-saving to the healthcare system overall.

Despite a modest sample size, our study demonstrated a variety of important concerns voiced by responding cardiologists in the preliminary survey findings. The trepidation regarding appropriateness of the e-consult question highlighted that a variety of issues could be resolved by improved education of primary care clinicians, such as has been demonstrated in the SCAN-ECHO approach.²⁶ One example relates to questions about prophylactic antibiotics prior to dental procedures, which have a clear set of guidelines provided by the American Dental Association, but in these cases, e-consults were used to mitigate potential legal implications. The VHA has been exploring alternatives to increase the number of frontline clinicians with varying ability and skillset. It remains unknown how implementation of alternative models for providing primary care will ultimately affect the overall work satisfaction of specialists, particularly in the case of e-consults, if resources are not reallocated. Dissatisfaction among cardiologists and

feelings of increased time burden without commensurate incentives are important topics warranting further study in order to minimize the risk of specialist “burnout”. Further studies are also needed to determine the most effective way to encourage widespread adoption and to minimize the negative view of e-consults as a burdensome additional workload.¹⁰

Conclusions

Cardiology e-consultation is currently undervalued by consultants because its implementation has not been fully optimized. But this study along with others show promising results in regards to safety and efficiency. Faster and more convenient cardiovascular care can be provided for patients without substantial negative impact. Additional strategies are needed to improve the implementation of cardiology e-consultations.

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Figure Legends:

Figure 1. Comparison of workflow between telecardiology e-consultation (left) and conventional in-person clinic referral (right). In some cases, conventional in-person cardiology consultations are converted to e-consults and vice-versa. E-consultation mitigates third-party ancillary processes (*), which streamlines the communication between users (primary care team) and cardiology consultants.

Figure 2. Number of cardiology E-consultations between 2013-2017 and users of cardiology E-consults. Bar graphs display (A) the total number of cardiology e-consultations between 2013 and 2017 and (B) user frequency of cardiology e-consultations. Non-clinical staff consisted of clinical specialists, social workers, clinic/center clerks, and other personnel from preventive medicine.

Figure 3. Survey responses from cardiology consultants.