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Innovative Use Of Electronic Consultations In Preoperative Anesthesiology Evaluation At VA Medical Centers In New England

ABSTRACT Electronic consultations (e-consults) improve access to specialty care without requiring face-to-face patient visits. We conducted a mixed-methods descriptive study to understand the variability in e-consult use across anesthesiology departments in the Veterans Affairs New England Healthcare System (VANEHS). In the period 2012–15, the system experienced a rapid increase in the use of anesthesiology e-consults: 5,023 were sent in 2015, compared with 103 in 2012. Uptake across sites varied from near-universal use of e-consults for preoperative assessment to use for only selected low-risk patients or no use. Interviews with stakeholders revealed considerable differences in the perceived impact of e-consults on workflow and patient-centeredness. Clinicians at sites with high use of e-consults noted that they improved workflow efficiency. In comparison, clinicians at sites with low use preferentially valued face-to-face visits for some or all patients. The adoption of a health information technology innovation can alter the process of care delivery, depending on perceptions of its value by key stakeholders.

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Timely access to specialty care remains a challenge in many US health care systems.^{1–3} To address this problem, an increasing number of systems, including the Department of Veterans Affairs (VA),^{1,4,5} have implemented electronic consultations (e-consults). E-consults are a platform for provider-to-provider consultation using a shared electronic health record (EHR) or web-based portal.⁶ They allow primary care providers to obtain specialists' input on questions that can be addressed through a chart review, thereby avoiding a specialty clinic visit for the patient.^{6–9} Communication by physicians via e-consult can also increase the efficiency of a subsequent face-to-face patient visit.¹⁰ Previous studies have demonstrated that e-consults result in improved timeliness of specialists' input compared to traditional referrals,^{11–15} fewer inappropriate clinic visits,¹⁴ increased schedul-

ing of appropriate follow-up visits,¹⁴ improved communication between primary and specialty care providers,¹⁶ and high levels of patient satisfaction and convenience.^{17–20}

The use of e-consults in the VA is associated with increased access to care, improved patient and provider satisfaction, and cost savings.^{19,21,22} In 2011 VA leaders promoted the use of e-consults nationwide as a way for primary care providers to enhance access to specialists on behalf of their patients. In the VA New England Healthcare System (VANEHS), regional leaders communicated regularly with local medical centers to advocate for expansion of e-consults in all specialties. A prior study found wide variation in the volume of e-consults for preoperative assessment received by anesthesiology departments across the VANEHS, even after accounting for differences in overall facility size and complexity.⁸

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Anesthesiologists conduct preoperative assessments of surgical patients to gauge their risk of complications and implement measures to mitigate this risk. Preoperative assessment is believed to reduce complication rates, length of hospital stay, and postponed or cancelled surgeries, although the supporting data are mixed and mostly retrospective.^{23,24} We therefore undertook this mixed-methods study to examine how the uptake of e-consults relates to the models in use for the provision of anesthesiology preoperative care across the VANEHS, and to understand stakeholder clinicians' perceptions of e-consults.

Study Data And Methods

SETTING The VA serves over six million patients annually. The VANEHS is one of eighteen Veterans Integrated Service Networks within the VA. It cares for approximately 240,000 veterans each year in eight VA medical centers and affiliated clinics in Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.

This study was reviewed by the VA Boston Healthcare System's Institutional Review Board and was determined to constitute a quality improvement project rather than human subjects research.

INTERVENTION The VANEHS began implementing e-consults in 2011, and in 2013 it directed its eight medical centers to establish e-consults for all clinical specialties. The VA EHR, known as the Computerized Patient Record System, features a functionality that allows clinicians to request and respond to e-consults. Specialty services that receive e-consults have flexibility in determining how e-consults are routed, for what purposes they can be used, and when to convert them to face-to-face consults.^{8,22}

STUDY DESIGN We conducted an observational descriptive study using a mixed-methods sequential explanatory design. This approach involved first collecting and analyzing quantitative data, then acquiring qualitative data in consecutive phases.^{25,26}

DATA COLLECTION In the quantitative phase, we used administrative data to gather VA medical center-level information on numbers of anesthesiology e-consults, full-time equivalent anesthesiologists, procedures completed in 2015, and preventable operating room (OR) cancellations in the period 2010–15. This standard quality metric, available in administrative data, could be inspected for changes or trends that developed with the introduction of anesthesiology e-consults.

In the qualitative phase, we gathered informa-

tion on preoperative assessment workflow and stakeholder perceptions through semistructured interviews with clinical staff members at the four highest-use sites (the Providence VA Medical Center, in Rhode Island; the Togus VA Medical Center, in Chelsea, Maine; the VA Boston Healthcare System, in Massachusetts; and the West Haven Campus of the VA Connecticut Healthcare System) that together accounted for the vast majority of anesthesiology e-consults in the VANEHS. Our prior quality improvement study⁸ indicated that the specialties requesting the largest number of anesthesiology e-consults were general surgery, orthopedics, and otolaryngology. We therefore invited providers in each of these specialties at each facility, as well as members of the facilities' anesthesiology departments, to participate in interviews. We developed a semistructured interview guide (online appendix A)²⁷ to understand how e-consults related to, and changed, the preoperative assessment process workflow, tasks, and efficiencies and providers' perceptions of constraints, impacts, and challenges. Two or more study team members conducted each interview by phone or in person.

DATA ANALYSIS We measured the number of e-consults and types of requesting specialties at each site in the VANEHS. We limited subsequent analyses to the four highest-use sites, since the volume of surgical procedures at the other four sites was so low that they did not provide sufficient information to examine the impact of e-consults on preoperative assessment. We collected data on staffing and workload, such as the numbers of full-time-equivalent anesthesiologists and OR and non-OR procedures. We collected the preventable OR cancellation rate at each site by month for 2010–15. This standard quality metric for OR efficiency was an outcome measure that could be inspected for changes or trends that coincided with the introduction of anesthesiology e-consults. The data were analyzed using a nonparametric univariate test for trends (the Mann-Kendall test).

We used qualitative description, as outlined by Margarete Sandelowski,^{28,29} to provide a reproducible description of the different models of the use of preoperative anesthesiology e-consults and how clinicians perceive their value. We conducted twelve interviews. The results are organized into site-specific case studies.

LIMITATIONS AND STRENGTHS This study had several limitations. First, the setting was restricted to the VANEHS, and our results might not be generalizable to other systems. Second, because the VA is a single-payer system with salaried specialists, a change in workflow does not affect income. Financial risks or incentives for e-con-

sults may be different in other health systems and will be a key issue for policy makers to address in supporting their use among specialists. Third, this is an early descriptive study of the innovative use of anesthesiology preoperative e-consults. Thus, we had limited outcomes data. However, the qualitative data from adopting sites with high use and the preventable OR cancellation rates we observed both point toward the benefits of this innovation.

The study also had several strengths. First, the setting represented a spectrum of urban and rural locales, presenting a spectrum of case complexity across sites. Second, the increasing use of e-consults in non-VA settings in many disciplines suggests that these findings may be relevant to other health care delivery settings.^{9,12,30-33}

Study Results

QUANTITATIVE FINDINGS

► **VARIATION IN VOLUME OF E-CONSULTS ACROSS FACILITIES:** Of the eight medical centers in the VA New England Healthcare System, six provided anesthesia services during the study period. At these six sites, 7,988 e-consults were completed by anesthesiology services. In the period 2012–15, the system experienced a rapid increase in the use of anesthesiology e-consults: 5,023 were sent in 2015, compared with 103 in 2012. The four sites listed accounted for 97 percent of the e-consults in 2015: Providence, 36 percent; Togus, 31 percent; Boston, 22 percent; and West Haven, 8 percent. Exhibit 1 shows the volume of e-consults per site by year. That volume was not associated with the volume of surgical procedures or with a site’s full-time-equivalent anesthesiologists (exhibit 2).

► **PREVENTABLE OPERATING ROOM CANCELLATIONS:** We collected preventable OR cancellation rates at each site per month for the period 2010–15, representing several years before anesthesiology e-consults were implemented and continuing through our study period. In analyses of data for individual facilities and in an analysis of data for all facilities combined, we did not identify any measurable effect of e-consult implementation on these rates ($p = 0.47$) (exhibit 3).

QUALITATIVE FINDINGS

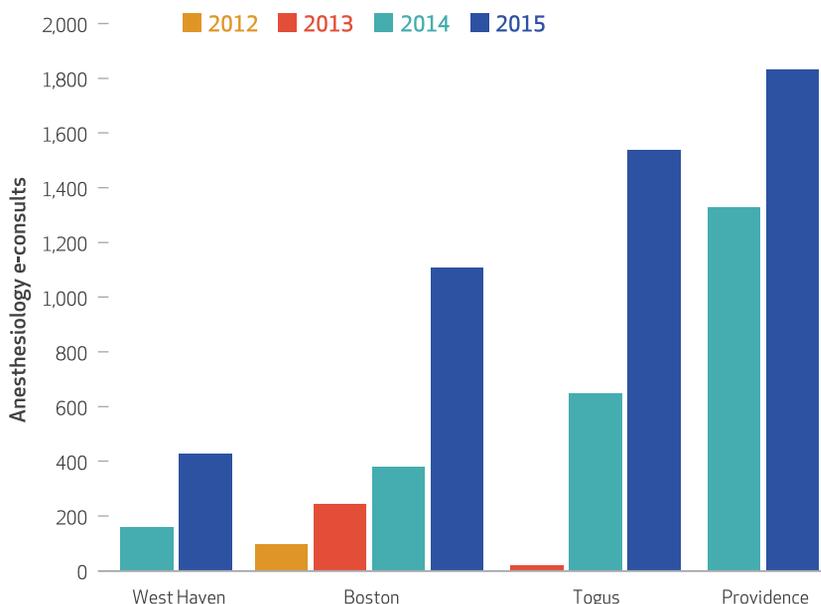
► **CASE 1: PROVIDENCE—HIGHEST USE:** The Providence VA Medical Center is a small urban hospital with intermediate surgical complexity. Before the implementation of e-consults, the usual workflow for preoperative evaluation included referring most elective procedures to anesthesiology for face-to-face consultations. This process required hosting a preoperative anesthesiology face-to-face clinic that often

was overbooked and often conflicted with the staffing needs of the OR. E-consults were seen as an opportunity to risk-stratify patients and develop an anesthetic plan without a face-to-face preoperative visit, since most of the relevant information was available in the VA’s integrated EHR. In late 2013 anesthesiology e-consults were introduced for minor surgical cases in ophthalmology, such as cataract procedures. Based on early perceptions of success, the e-consult approach was rapidly extended to all cases. In 2014 and 2015 there was such a substantial increase in anesthesiology e-consults that the Providence VA Medical Center completed the highest number of anesthesiology e-consults and had the highest ratio of e-consults to OR procedures within the VANEHS.

Since 2015 clinicians (nurse practitioners, physician assistants, or surgeons) in the surgical departments routinely send e-consults to anesthesiology for all elective cases. Patients are seen face-to-face by an anesthesiologist before the day of surgery only when the patient requests or the surgeon recommends it. The anesthesiologist may phone the patient to clarify history or symptoms. If clinical issues needing clarification are identified during the anesthesiologist’s review of the medical record, these questions are noted in the e-consult. Surgical staff members—most

EXHIBIT 1

Anesthesiology e-consults at four Veterans Affairs (VA) New England Healthcare System facilities since the year of implementation of e-consults at each site, 2012–15



SOURCE Authors’ analysis of administrative data from the VA. **NOTES** $N = 7,783$. Selected sites had high use of e-consults. West Haven is the West Haven Campus of the VA Connecticut Healthcare System. Boston is the VA Boston Healthcare System, in Massachusetts. Togus is the Togus VA Medical Center, in Chelsea, Maine. Providence is the Providence VA Medical Center, in Rhode Island.

EXHIBIT 2

Characteristics of four Veterans Affairs (VA) New England Healthcare System facilities and anesthesiology departments, 2015

	Providence	Togus	Boston	West Haven
FACILITY CHARACTERISTICS				
Location	Urban	Rural	Urban	Urban
VA surgical complexity designation ^a	Intermediate	Intermediate	Complex	Complex
Unique patients seen ^b	35,592	41,513	63,132	57,884
ANESTHESIOLOGY DEPARTMENT CHARACTERISTICS				
FTE anesthesiologists	2.2	2.3	12.6	12.4
All procedures	2,161	1,929	7,461	2,694
OR procedures	2,114	1,919	4,974	2,661
Other procedures	47	10	2,487	33
E-consults sent to anesthesiology	1,832	1,539	1,110	427
Ratio of anesthesiology e-consults to OR procedures	0.86	0.80	0.22	0.16

SOURCE Authors' analysis of VA administrative data. **NOTES** Providence, Togus, Boston, and West Haven are explained in the notes to exhibit 1. FTE is full-time equivalent. OR is operating room. ^aEach VA inpatient medical center has a level of operative complexity (standard, intermediate, or complex). The designations are based on facilities, equipment, workload, and staffing load. These measures were implemented on May 7, 2010, per VA Directive 2010-18, "Facility Infrastructure Requirements to Perform Standard, Intermediate, or Complex Surgical Procedures." ^bPatients can be seen at more than one facility and so can be counted more than once.

often nurse practitioners—manage the preoperative process and are expected to obtain the necessary information or guidance from the primary care provider or a specialist.

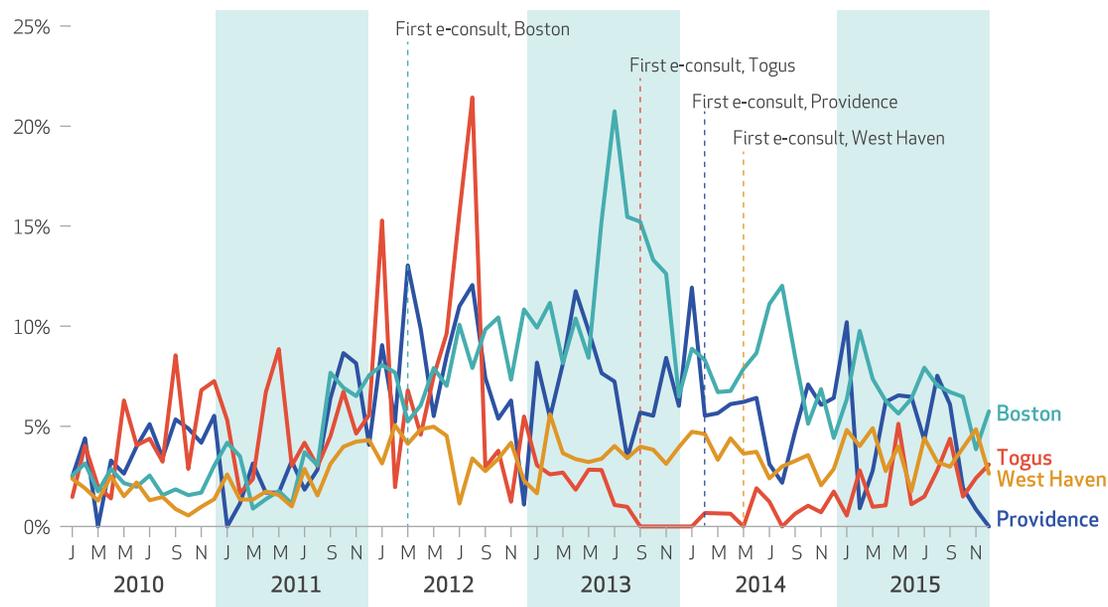
One consequence of the new workflow has been an increase in the number of cardiology e-consults as part of the preoperative process.

One cardiologist estimated that one-third of the section's thirty monthly e-consults relate to questions generated as a result of preoperative reviews.

According to one anesthesiologist at the Providence VA Medical Center, the use of e-consults has expedited care and is regarded favorably by

EXHIBIT 3

Percentages of preventable operating room cancellations at four Veterans Affairs (VA) New England Healthcare System facilities, by month, 2010-15



SOURCE Authors' analysis of administrative data from the VA. **NOTES** Boston, Togus, West Haven, and Providence are explained in the notes to exhibit 1. The data were analyzed using a nonparametric univariate test for trends (the Mann-Kendall test). There was no measurable effect of e-consult implementation on operating room cancellations ($p = 0.47$).

patients: “Any possible issues are identified earlier than they would [have been] if the patient had come in for a preop visit, because the e-consult is done weeks in advance of the surgery rather than a day or two in advance of a procedure. Patients like this process better because they don’t have to come in for a visit, and it reduces their time to surgery since they don’t have to have a separate visit just for scheduling lab tests.”

Another anesthesiologist reported that the preoperative process has been simplified, the rate of cancelled procedures has not increased, he has not observed any adverse events attributable to the e-consult process, and the workflow has greatly improved. He also reported that e-consults are completed when time is available during the day and mitigate the previous challenge of anesthesiologists being needed both in the clinic and in the OR.

► **CASE 2: TOGUS—HIGH USE, HYBRID MODEL:** The Togus VA Medical Center serves a large rural population, and many patients have to travel for hours for a visit at the center. The surgical case-mix is of intermediate complexity. Before the introduction of e-consults, a preoperative clinic was staffed five days a week by an anesthesiologist, and all elective surgical cases required a face-to-face preoperative visit. The center implemented anesthesiology e-consults in mid-2013 after hearing a presentation by anesthesiologists from the Providence VA Medical Center. Anesthesiology leaders at Providence shared their e-consult templates, which were modified at Togus to accommodate the specifications of its anesthesia staff and surgical colleagues.

At Togus, surgical staff members assess patients’ American Society of Anesthesiology surgical risk class²⁴ and send anesthesiology e-consults for all patients who are class 1 or 2 (that is, lower risk) and those undergoing low-risk procedures such as cataract removal, hernia repair, hand surgeries, or lymph node biopsies. Surgical staff members may solicit additional face-to-face consults or e-consults from medical specialties such as cardiology or pulmonology. For more complex surgical cases, such as total joint replacements, all patients are scheduled for a face-to-face anesthesiology visit. Since the implementation of e-consults, anesthesiology clinic days have been reduced to two days a week.

According to key informants within the anesthesiology department at Togus, preoperative assessments have become more efficient since the introduction of e-consults. Stakeholders asserted that anesthesiology preoperative e-consults have improved access to care and organizational efficiency by eliminating unnecessary

visits. Providers see this approach as a “veteran-centric innovation” that reduces the burden on veterans by decreasing their travel time. Anesthesiologists feel that their operational capacity for scheduling surgeries and managing wait time has improved. The facility now has the second-highest number of anesthesiology e-consults within the VANEHS.

► **CASE 3: BOSTON—HYBRID MODEL:** The VA Boston Healthcare System is the major referral center and performs the largest number of operative procedures among facilities in the VANEHS. VA Boston has the broadest range in the complexity of cases and has a large anesthesiology department (exhibit 2).

With the introduction of e-consults, the anesthesiology department negotiated criteria for the use of e-consults with their surgical colleagues. Most e-consults are for low-risk procedures such as cataract surgery and hernia repair. For most intermediate- and high-risk procedures, and for selected patients with low operative risk, anesthesiology staff members prefer to provide face-to-face consultations at the preadmission testing center. Compared to the other VANEHS facilities, VA Boston has moderate usage of anesthesiology e-consults relative to procedural volume (exhibit 2).

Anesthesiology e-consult users at VA Boston assert that the process improves efficiency and patient-centeredness for patients who they believe derive no added value from a face-to-face visit. One general surgery provider praised the use of e-consults: “I like using e-consults because it saves us a lot of time.” An anesthesiologist stated, “For many procedures, a preoperative consultation with an anesthesiologist provides important education to the patient that facilitates postoperative care and may shorten the postoperative hospital stay.”

Ambivalence related to the impersonal nature of an e-consult was expressed by others. One anesthesiologist said: “Maybe one of the more stressful parts of their whole hospital stay is that everybody is afraid of anesthesia, going to sleep. I find it very impersonal when you walk in five minutes before the procedure and say, ‘Hey, I am your anesthesiologist and you are going to go to sleep, and I am going to give you the same drug which Michael Jackson got.’ It doesn’t bode very well.” However, a senior member of the surgical staff claimed that “every adverse outcome on the service is reviewed, and we have not found a single case in which I believe that poor preoperative assessment by e-consult played a role.”

The cardiology unit at VA Boston noted an increase in e-consults from approximately thirty per month to more than seventy per month concurrent with the initiation of anesthesia e-con-

sult usage. One cardiologist attributed this increase to a greater number of preoperative-related queries: An audit of 115 consecutive cardiology e-consults from VA Boston confirmed that 50 (43 percent) were about preprocedure questions, most commonly from surgical nurse practitioners involved in the preoperative processing of patients.

In summary, e-consults at VA Boston have been adopted for specific circumstances—for example, to accommodate anesthesiologists' workflow for minor surgical cases in which the anesthesiologists perceive no added value in a face-to-face visit, and for many low-risk patients to obviate the need for patients living at considerable distance from this tertiary referral center to travel to it. The anesthesiology department still provides anesthesiology preoperative clinic coverage five days per week, but anesthesiologists report that they have more appointment times available for the patients who need it.

► **CASE 4: WEST HAVEN—LIMITED USE:** The West Haven Campus of the VA Connecticut Healthcare System has a low volume of anesthesiology e-consults compared to other VANEHS facilities with busy surgical services. Following a systemwide request for services to use e-consults, the anesthesiology department set a goal of using e-consults to reduce the number of preadmission testing clinic visits by at least 20 percent. The department developed criteria for surgical cases they believed would be appropriate for e-consults, which were limited to patients with deemed low risk on American Society of Anesthesiology scores and who were undergoing low-risk procedures such as hernia repair or simple orthopedic procedures as well as certain ophthalmology procedures such as alternate eye cataract extraction in a patient they previously had evaluated. The preadmission clinic continues to be staffed five days a week. As one anesthesiologist said, "The e-consults allow us to see a larger number of people, and the complaints [have] decreased."

Anesthesiologists at West Haven did raise several concerns. A major concern related to workflow, with one anesthesiologist commenting: "I think e-consultations are helpful, but when they add to the workload and we get ten per week, then we have to assign someone to do them, because [it is] too much work for those at the clinic. ...The amount of time it takes to do them [is not adequately understood]." Some anesthesiologists articulated the fear that without a formal preadmission testing session, patients may lack adequate preoperative preparation. Unlike the other facilities in this study, West Haven had only limited adoption of anesthesiology e-consults (exhibit 2), and the depart-

ment still relies heavily on traditional face-to-face preoperative visits.

Discussion

E-consults, a relatively minor health information technology innovation, have been variably adopted across the VA New England Healthcare System in the preoperative assessment process. One facility effectively replaced face-to-face preoperative consultation with e-consults. In contrast, two other sites have developed criteria for using preoperative e-consults, and one site promulgated a relatively narrow set of criteria so that the workflow still primarily consists of face-to-face visits. Stakeholders' perceptions of the value of e-consults tended to parallel the degree of adoption at each site. Stakeholders at sites with high use of e-consults appreciated the convenience for patients and the improvement in workflow, and they believed that the quality of care was maintained. Many stakeholders at sites with lower use of e-consults believed that a face-to-face visit with an anesthesiologist offered better care to patients, and some interviewees expressed concern that shifting work from face-to-face visits to e-consults did not reduce the workload burden.

Diffusion of innovations theory describes the mechanism by which a change or innovation gains momentum and spreads over time through a system or population.^{34,35} The adoption of e-consults by anesthesiology departments within the VANEHS follows nearly all of the precepts identified in the science of dissemination of innovations in health care. Perception of the innovation is the dominant factor determining adoption, accounting for more than half of the variation of spread. E-consults have all five features that constitute this critical element of the dissemination model: They are perceived to be beneficial; compatible with the beliefs and needs of the adopters; relatively simple, and—by virtue of being embedded into the VA's EHR infrastructure—easily modified to meet the consulting specialty's needs; able to be trialed before full adoption; and have observable and measurable impacts on the workflow. In departments and clinical situations in which providers judged the benefits to outweigh the downsides, e-consults were rapidly adopted and perceived to have a positive impact on workflow. Where anesthesiologists identified fewer benefits, uptake has been lower.

The diffusion of innovations model also cites the importance of the context in which the uptake of an innovation is to occur.³⁴ The VANEHS was well suited to adopt such an innovation. Nationally, the VA has advocated for the en-

hanced use of technological interventions to improve access to specialty care through its Transformation for the 21st Century initiative.³⁶ In the VANEHS, the network director encouraged all specialties to implement e-consults and had regular communication with leaders at each medical center in the region during the implementation year. E-consults were conceptualized as a mechanism for primary care providers to use in gaining access to specialty care, yet in our study we saw specialty-to-specialty use. This latter observation speaks to another characteristic of enhanced dissemination, that of the “evolution” (or modifiability or adaptability) of the innovation.

E-consults can provide a benefit that traditional face-to-face consults cannot, as they have the potential to improve the efficiency and timeliness of services.^{37–39} Prior studies have demonstrated that e-consults can significantly change health care delivery practices, improve care, and reduce costs.^{30,40,41} As policies and market forces move toward bundled payment approaches and population-based models,⁴² health care delivery organizations will be compelled to deliver value-based care and will be held more accountable for the efficient use of resources. With an increasing number of hospitals and health systems now using EHRs as a result of the Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009,⁴³ e-consults have the potential for wide dissemination. Policy makers’ attention to the key features of diffusion of innovations theory may help providers realize the greatest possible impact of e-consults on access and wait times for patients.

Anesthesiology e-consults for preoperative evaluation decrease the number of face-to-face appointments and the travel burden for patients and are often completed in a timelier manner, thus potentially expediting surgical scheduling. However, it is not known whether these improve-

ments in efficiency are accompanied by measurable changes—either positive or negative—in clinical outcomes or facilitywide efficiency. Our data on preventable OR cancellation rates over a period before and after the implementation of e-consults showed stable-to-reduced rates. While we cannot directly attribute the decrease in these cancellations to the e-consult process, we are at least confident that the use of e-consults did not increase their rate, which would be a negative consequence. We speculate that the absence of rigorous outcome data may contribute to clinicians’ widely varying perceptions regarding the acceptability and usefulness of preoperative e-consults.

Conclusion

A novel application of e-consults in the VA New England Healthcare System—their use by anesthesiologists for preoperative assessments—was triggered by both an administrative mandate to have e-consults generally available and an early adopter or champion who perceived benefit. Communication with the early adopters helped facilitate e-consults’ diffusion to various sites.

The increasing adoption of e-consultation in health care systems and e-consults’ promise for improving access while controlling costs under new payment models⁴⁴ make e-consults an attractive intervention. The impact of e-consults on overall efficiency as a result of potential work shifting to other specialties and an assessment of medical outcomes need further examination. The operational efficiencies and improved patient and provider satisfaction attributable to the adoption of preoperative e-consults suggest that this innovation is not solely a tool for primary care providers to access specialty care. Open-minded providers and administrators may find more novel uses and best practices of this sort of innovation to share and adopt. ■

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