

Electronic Consults for Infectious Diseases in a United States Multisite Academic Health System

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We launched Infectious Disease electronic consultations (eConsults) in 2018. During the first 15.5 months, primary care practitioners submitted 328 eConsults; the most frequent reasons were a positive culture or polymerase chain reaction (PCR) result, syphilis, and latent tuberculosis. Practitioners commonly requested advice on antimicrobial choice, clinical evaluation, and indications for treatment. Internal phone consultations decreased after eConsult implementation.

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Geographic isolation, overwhelmed referral systems, and other barriers limit access to specialist consultation in many parts of the United States [1]. Obtaining specialist advice often relies on “curbside” consults, which raise medicolegal risks. Electronic consultations (eConsults) through the electronic medical record (EMR) can reduce referral wait times, expand care capacity, and decrease costs of care [2–6]. Primary care practitioners (PCPs) report that eConsults strengthen relationships with specialists and enhance clinical knowledge [7–9].

A review from Canada showed that eConsults for Infectious Diseases (ID) impacted clinical decision making by PCPs, and a study from the Veterans Affairs Health System in Massachusetts found that eConsults replaced face-to-face encounters for certain ID conditions and shortened time to ID input [10, 11]. We summarize the first 15.5 months of eConsults at a US multisite academic health system. We also review all completed ID

eConsults and assess whether wait times for in-person referrals or volume of formal phone consultations changed.

METHODS

Electronic Consultation Design and Implementation

The design of our eConsult program has been described [7]. As one of the Association of Academic Medical Centers (AAMC) Coordinating Optimal Referral Experiences (CORE) sites, we modeled our program after one developed at University of California, San Francisco (UCSF) [12]. We launched eConsults for ID at the University of Washington (UW), Seattle, WA, in April 2018 as an opt-in option for UW network clinic PCPs.

Before offering ID eConsults, a group of UW ID specialists and Epic (Epic Systems Corporation, Verona, WI) program staff created eConsult templates for 10 different clinical conditions (chosen based on predicted frequency of topics) plus an “Unspecified” option. Primary care practitioners submitting an eConsult select and complete one of these templates, which include directed clinical questions and automatically populated laboratory results. A specialist receives the completed template, reviews the chart, then sends a response that includes a summary of the clinical question, recommendations, and reasoning behind the recommendations. If the consultant decides the patient needs in-person consultation, they convert the eConsult to a standard in-person referral. The specialist can decline an eConsult if it is not appropriate. Consultants are expected to respond within 3 business days.

At our institution, ID specialists volunteer to field eConsults. During the timeframe of this review, specialists did not receive compensation for performing eConsults; the institution supported the division by attributing relative value units (RVUs) for the work. Our institution now bills insurers for eConsults.

Electronic Consultation Review and Analysis

We reviewed all ID eConsults completed between April 2018 and August 2019. Three authors (J.A.B., S.J., and B.R.W.) reviewed deidentified text from each eConsult for the following: type of template used, diagnoses, and question type. We developed categories for question type based on the publication from Ottawa [10], and we also independently reviewed a subset of the UW ID eConsults to confirm the question type categories. In addition, we reviewed automated Epic reports, which include outcomes of eConsults (completed, converted, or declined), time from submission to response (based on date submitted by the PCP and date completed by the specialist) and time spent by the consultant (at completion of the eConsult, the specialist selects 1 of 5 options to designate amount of time spent).

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We assessed the change in frequency of calls from UW providers to ID specialists via a phone consultation line for the 12 months before the launch of ID eConsults and 12 months after (paired Student *t* test). To assess for changes to in-person referral volume and access, we compared mean total number of referrals from UW network PCPs, mean percentage of referred patients seen within 14 days, and mean percentage seen within 30 days, all for the 12 months before launch versus 12 months postlaunch (paired Student *t* test). Statistical analyses were performed with Stata IC, version 6.0 (StataCorp LLC, College Station, TX). Data reviewed were deidentified and deemed exempt from UW Institutional Review Board review.

Table 1. Summary of all ID eConsults Ordered From April 2018 to August 2019

ID eConsults at University of Washington Medical System		
Usage Metrics	Number	Percent
Total eConsults submitted	328	
Completed (recommendations delivered electronically)	278	84.8%
Declined	5	1.5%
Converted to in-person referral*	41	12.5%
Unknown	4	1.2%
Specialist time spent (n = 278 completed)		
<5 minutes	3	1.1%
5–10 minutes	41	14.7%
11–20 minutes	172	61.9%
21–30 minutes	52	18.7%
>30 minutes	10	3.6%
Diagnoses (n = 385**)		
Positive culture, PCR, or serology for specific organism (not included in other diagnostic categories)	38	9.9%
Syphilis	37	9.6%
Latent tuberculosis	36	9.4%
UTI	25	6.5%
Skin/soft tissue infection	25	6.5%
Other	224	58.2%
Question type (n = 450***)		
Antimicrobial choice (duration, dose, selection)	117	26.0%
Clinical evaluation (laboratory testing, other work-up)	111	24.7%
Is treatment indicated?	80	17.8%
Interpretation of a diagnostic test	57	12.7%
Prevention of infection with medications	24	5.3%
Vaccination or immunity	23	5.1%
Transmission risk	9	2.0%
Treatment monitoring	8	1.8%
Other	8	1.8%
Is referral indicated?	6	1.3%
Unknown	4	0.9%
Infection control or return to work	3	0.7%

Abbreviations: eConsults, electronic consultations; ID, Infectious Diseases; PCR, polymerase chain reaction; UTI, urinary tract infection.

*, Most common diagnoses for which specialists recommended in-person consultation were fever (n = 8), bone or joint infections (n = 7), recurrent skin infections (n = 6), and parasitic infections (N = 5).

**, Some eConsults included more than 1 diagnosis. Those diagnoses that occurred in more than 5% are listed here. See [Supplementary Appendix](#) for examples of "Other" diagnoses.

***, Some eConsults included more than 1 question type.

RESULTS

A total 328 ID eConsults were ordered from April 17, 2018 to August 3, 2019 (mean, 21.2 per month) by 154 unique providers (median number of eConsults ordered by providers who used the system, 1; range, 1 to 10). Of 324 eConsults with available data, 321 (99.1%) received a response within 3 business days (mean, 0.7 days; range, 0 to 5 days) ([Supplementary Appendix](#)). Of the 328 total eConsults, 278 (84.8%) received specialist recommendations electronically, 41 (12.5%) were converted to an in-person appointment, 5 (1.5%) were declined, and data were missing for 4 (1.2%) ([Table 1](#)). Our full-text review revealed that 42 (15.1%) eConsults that provided recommendations electronically also included a suggestion to refer the patient to ID clinic.

The most common reason for an eConsult was interpretation of a positive culture, serology, or polymerase chain reaction (PCR) result for a specific organism (9.9%); this excluded syphilis and latent tuberculosis infection (LTBI), which were separate categories ([Table 1](#)). The next most frequent reasons were syphilis (9.6%) and LTBI (9.4%). Ordering providers used the "Unspecified" template most frequently (49.4%), followed by the templates for syphilis, LTBI, recurrent skin or soft tissue infection, and recurrent UTI ([Supplementary Appendix](#)). In 18 instances, the PCP did not use a template. The most common question types asked via eConsult were as follows: (1) antimicrobial choice, (2) recommended clinical evaluation, and (3) whether treatment was indicated ([Table 1](#)).

In the 12 months before the launch of ID eConsults, mean number of internal calls per month to the telephone line for ID consultation was 5.8, compared with 2.9 per month in the 12 months postlaunch ($P = .022$). Mean total number of in-person ID referrals from UW network PCPs in the 12 months before ID eConsult launch and 12 months postlaunch were 208.75 and 215.83, respectively ($P = .41$). Mean percentage of in-person referrals from UW network PCPs seen within 30 days pre- versus postlaunch were 73.48% and 72.78%, respectively ($P = .7$); mean percentage seen within 14 days prelaunch compared with postlaunch were 49.57% and 53.25%, respectively ($P = .11$).

DISCUSSION

Novel systems are needed to expedite specialist consultation and reduce wait times for overburdened specialty clinics. Our review of eConsults as a method for asynchronous ID consultation demonstrates that it offers PCPs an efficient means for obtaining specialist advice. We found that PCPs used this system frequently and that ID consultants were able to provide recommendations rapidly and electronically for the majority of eConsults.

Most frequently, eConsult questions addressed a positive culture, PCR, or serology result that identified a specific organism. These were often organisms that a PCP would not encounter

frequently or that commonly demonstrate antimicrobial resistance. A substantial proportion of eConsults were triggered by syphilis serologies or LTBI, which is similar to prior reviews [10, 11]. Such conditions may require specialized ID knowledge but not a physical examination or extensive chart review, which is the optimal scenario for an eConsult. We found that PCPs chose the “Unspecified” template approximately half the time and the topics of these consult questions varied widely, reflecting the broad diversity of clinical issues addressed by ID specialists.

We found a reduction in the frequency of calls from UW network providers to a UW phone consultation system, suggesting that providers used the eConsult system in place of telephone consults. This is important because the telephone consults do not always include medical chart review, do not generate RVUs, and cannot be billed. In the report from Ottawa, PCPs frequently reported that eConsults changed their plans for traditional referral and helped to avoid in-person consults [10]. We did not find a reduction in the total number of in-person ID referrals or an improvement in the percentage of in-person referrals seen within 30 days; there was a trend towards increase in the percentage seen within 14 days. Although a goal of the eConsult program is to reduce in-person referrals and shorten wait times, many factors affect these parameters, and our follow-up period may be too short to identify a difference. The study from Massachusetts found an increase to overall consult volume after implementation of eConsults, but also a change to the nature of face-to-face referrals, with eConsults frequently replacing face-to-face referrals for certain issues [11]. It is possible that eConsults allow relatively straightforward questions to be addressed electronically and free up space for in-person visits for more complex conditions. Another analysis found that in-person referral rates from providers actively using eConsults were significantly lower than those from providers not using eConsults, suggesting that in-person referrals from early or frequent adopters of eConsults decrease; variable use of the eConsult system by our providers may have limited overall impact on referral rates [3].

Our analysis has limitations. We did not review individual patient charts to determine whether specialist recommendations were implemented, and we did not seek qualitative data pertaining to PCP or specialist satisfaction or patient feedback. We cannot confirm that implementation of eConsults was the cause of changes to calls to the formal telephone consultation service, and we were unable to assess rates or changes to informal curbside consultations. All of this may be the subject of further analyses.

CONCLUSIONS

Our results generated internal quality improvement, including revision of template types and content for internal and external (planned in the near future) eConsults. We also developed conferences in which a specialist provides education to PCPs based on frequent eConsult questions. Our results may inform

other medical centers by demonstrating the essential templates, topics, and types of questions for ID eConsults. As eConsult systems are adopted by other medical centers, future research should examine changes to referral wait times and cost of care.

Supplementary Data

Supplementary materials are available at *Open Forum Infectious Diseases* online. Consisting of data provided by the authors to benefit the reader, the posted materials are not copyedited and are the sole responsibility of the authors, so questions or comments should be addressed to the corresponding author.

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Author contributions. B. R. W., J. A. B., and S. J. reviewed the eConsults, summarized the data, performed the statistical analysis, and contributed to the interpretation of the data. J. D. S., L. D. C., Y. P., R. D. H., S. D., G. S. G., P. S. P., and L. R. helped to develop the ID eConsult topics and templates, plan and implement the ID eConsult system, and review and interpret the ID eConsult data.

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