Implementation of Inpatient Electronic Consultations During the COVID-19 Crisis and its Sustainability Beyond the Pandemic

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Abstract

Background: Limiting in-person contact was a key strategy for controlling the spread of the highly infectious novel coronavirus (COVID-19). To protect patients and staff from the risk of infection while providing continued access to necessary healthcare services, we implemented a new electronic consultations (eConsults) service that allowed referring providers to receive subspecialty consultations for hospitalized patients who don't require in-person evaluation by the specialist.

Objective: We aimed to assess the impact of implementing eConsults in the inpatient setting to reduce avoidable face-to-face referrals during the COVID-19 pandemic.

Methods: This quality improvement study evaluated all inpatient eConsults ordered from July 2020 to December 2022 at the University of California Irvine medical center. Impact of eConsults was assessed by evaluating usage, (e.g., number of eConsults ordered), eConsult response times, and outcome of the eConsult requests (e.g., resolved electronically or converted to in-person evaluation of patient).

Results: There were 1,543 inpatient eConsults ordered across 11 participating specialties. Approximately 54% (826/1543) of requests were addressed electronically, without the need for a formal, in-person evaluation of the patient. The median time between ordering an eConsult and a specialist documenting recommendations in an eConsult note was 3.7 hours (Interquartile Range, IQR: 1.3-8.2) across all specialties, contrasted with 7.3 hours (IQR: 3.6-22.0) when converted to an in-person consult (P<.001). The monthly volume of eConsult requests increased, coinciding with surges of COVID-19 cases in California. After the peaks of the COVID-19 crisis subsided, usage of inpatient eConsults persisted at a rate well above pre-crisis levels.

Conclusions: An inpatient eConsults service was successfully implemented, resulting in fewer unnecessary face-to-face consultations and significant reductions in the response times for consults requested on hospitalized patients not requiring an in-person evaluation. Thus, eConsults provided timely, efficient delivery of inpatient consultation services for appropriate problems while minimizing the risk of direct transmission of the COVID-19 virus between healthcare providers and patients. The service also demonstrated its value as a tool for effective inpatient care coordination beyond the peaks of the pandemic leading to sustainability of service and value.

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Abstract

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Conclusions: An inpatient eConsults service was successfully implemented, resulting in fewer unnecessary face-to-face consultations and significant reductions in the response times for consults requested on hospitalized patients not requiring an in-person evaluation. Thus, eConsults provided timely, efficient delivery of inpatient consultation services for appropriate problems while minimizing the risk of direct transmission of the COVID-19 virus between healthcare providers and patients. The service also demonstrated its value as a tool for effective inpatient care coordination beyond the peaks of the pandemic leading to sustainability of service and value.

Keywords: COVID-19; electronic consultation; eConsult; inpatient

Introduction

When the novel coronavirus (COVID-19), the disease caused by SARS-CoV-2, began to quickly spread around the world, the high transmissibility of this disease urged healthcare systems to explore alternatives to face-to-face interactions that would reduce the risk of exposure for both the patient and the provider. Electronic consultations (or eConsults) are asynchronous, non-face-to-face, provider-to-provider exchanges that have been shown to improve patient access to specialty care for appropriate referral problems that don't require an in-person evaluation of the patient by the specialist [1-3]. The rapid rise in COVID-19 cases induced a demand for the adoption of eConsult services and triggered an increase in utilization of eConsults.[4] Although its use in the outpatient setting is well established [5, 6], eConsults in the inpatient arena are relatively new.

As the only academic health system in the sixth largest county in the US, University of California Irvine (UCI) Health has been a leader in the advancement of virtual health technologies that expand access to care and improve healthcare efficiency and resource utilization [7]. UCI already has a well-developed eConsults program in the ambulatory setting [8] and to complement this existing service, we expanded eConsults to hospitalized patients to further help reduce in-person contacts between consulting providers and patients, thereby minimizing disease transmission and conserving scarce personal protective equipment (PPE) during the COVID-19 crisis. Other health systems have implemented similar eConsults services for inpatients, but provider adoption was temporary in response to the pandemic [9], inpatient eConsults were offered by only a single specialty consulting service [10, 11], and use cases involved early inpatient eConsult models [12, 13]. In this study, we describe our rapid implementation of inpatient eConsults in multiple specialties and its sustained use beyond the peaks of the pandemic.

Methods

Setting

The inpatient eConsults service was implemented at UCI's medical center, a 478-bed acute care hospital providing tertiary and quaternary care, ambulatory and specialty medical clinics, behavioral health care, and rehabilitation services. Located in Orange, California, it serves a diverse population of close to 4 million persons with broad health care needs. With more than 500 specialty and primary care physicians, UCI offers a full scope of acute and general care services. It is also the primary teaching location for UCI medical and nursing students, medical residents, and fellows, and is home to Orange County's only adult Level I and pediatric Level II trauma centers, National Cancer Institute (NCI)-designated comprehensive cancer center, regional burn center, the County's only hematopoietic stem cell/bone marrow transplant program, and the region's only high-risk perinatal/neonatal program and maternal-fetal transport system. In winter 2020, UCI medical center opened a temporary mobile field hospital that added up to 50 acute care beds in response to a surge of COVID-19 patients.

Implementation

The design and implementation of inpatient eConsults was guided by a steering committee, which included the Chair of the Department of Medicine and Executive Director of Hospital Medicine (who was the lead to design and develop eConsults at UCI), Clinical Informaticist,

specialty physician leads, information technology (IT) build team, representatives from the Compliance & Privacy Office and Physicians Billing Group, and a project manager. Early on, members of this committee engaged UCI leadership to affirm support for the new service and obtain the IT resources needed to build the inpatient eConsults workflow. Regular steering committee meetings were established to discuss the design of the inpatient eConsults workflow and develop a process for provider reimbursement/credit. Prior to the go-live, the inpatient eConsults service was publicized by members of the steering committee through email communications with house staff. Steering committee members also hosted Zoom training and orientation sessions with participating consulting services, and distributed tip sheets summarizing the steps to complete the requesting provider and responding consultant workflows.

Our IT team was able to efficiently implement our inpatient eConsults service by designing workflows similar to those for traditional in-person consults. Thus, the processes for requesting and responding to inpatient eConsults were not unfamiliar to providers (Figure 1). To request an eConsult, the inpatient service or team places a consult order in the electronic health record (EHR), indicating that the request is for an eConsult. The patient is then added to the Physician eConsults system list of the appropriate specialty. A follow-up call or page is also sent to the specialty by the requesting team to alert the inpatient consulting team of the eConsult and, if necessary, provide them with any additional details. To respond to the eConsult request, the inpatient consulting team reviews the relevant clinical information available in the EHR and documents their assessment and recommendations in a consult note. If the case is deemed too complex to be addressed electronically, the consulting team converts the eConsult to a traditional in-person consultation and the patient is examined before documenting guidance in the EHR. The requesting provider and responding consultant are each credited with 0.7 work relative value units (RVU; a measure of the provider's time and effort required to perform the service) for every completed eConsult that doesn't result in an in-person evaluation of the patient by the consulting service, while usual billing/RVU credit applies for in-person consultations.

Measurement/Analysis

We conducted a retrospective evaluation of all inpatient eConsults ordered at UCI medical center from implementation in July 2020 to December 2022 to assess usage, outcomes, and response times. Usage was tracked by examining the volume of eConsults ordered per specialty over the 2½-year period and comparing it with the volume of traditional in-person consults ordered for the specialties offering inpatient eConsults. Outcomes were assessed by categorizing the result of each eConsult order as either "resolved electronically" if the consulting team addressed the request without a face-to-face evaluation of the patient or "converted to in-person" if the consulting team deemed the case too complex and the patient required a physical examination. The response time was defined as the interval between the documented consult order in the EHR and the consulting team filing recommendations in a consult note. We calculated the median response time and the interquartile range (IQR) in hours for each specialty and performed nonparametric Mann-Whitney tests in SPSS (v. 28, IBM Corp) to compare median response times of requests resolved electronically and converted to in-person. All *P* values were 2-tailed, and $P<.05$ was considered statistically significant.

IRB Approval/Ethical Issues

Our implementation and retrospective analysis of the inpatient eConsults service constituted as

quality improvement activities and did not require Institutional Review Board review. This study followed the Standards for Quality Improvement Reporting Excellence (SQUIRE) guidelines.

Results

UCI's eConsults service was launched in 11 total specialties (Allergy & Immunology, Cardiology, Dermatology, Endocrinology, Infectious Diseases, Nephrology, Palliative Care, Pediatric Endocrinology, Pulmonary, Radiation Oncology, and Rheumatology). Over a 2½-year period, 1543 eConsults were requested out of 14,974 total consult orders (eConsult and traditional in-person consults) across the 11 participating specialties (Figure 2). Thus, the average proportion of consult orders requested as eConsults is 10%, though this proportion varied widely among participating specialties. The specialty with the lowest eConsult proportion was Pulmonary, which had 2% (13/850) of total consult orders requested as eConsults, while the specialty with the highest eConsult proportion was Pediatric Endocrinology, which had 48% (12/25) of total consult orders requested as eConsults. Although, Pediatric Endocrinology also had the smallest volume of total consult orders of all participating specialties.

The most requested eConsult specialties were Infectious Diseases (which received 37% [574/1543] of the eConsults requests), Cardiology (17% [261/1543] of the eConsults requests), Endocrinology (15% [229/1543] of the eConsults requests), and Dermatology (15% [226/1543] of the eConsults requests) (Figure 3). Approximately 54% (826/1543) of eConsult requests across all participating specialties were addressed without the need for an in-person evaluation of the patient by the consulting team. The specialty with the fewest eConsult requests resolved electronically was Pulmonary, which completed 0% (0/13) of requests electronically, while the specialty with the most eConsult requests resolved electronically was Pediatric Endocrinology, which completed 100% (12/12) of eConsults requests, without needing to physically examine the patient. However, both specialties had the smallest volumes of eConsult requests of all participating specialties.

We found that the overall median response time of eConsult requests resolved electronically was significantly lower than requests converted to an in-person consultation (Figure 4). The median time between ordering an eConsult and a specialist documenting recommendations in a consult note was 3.7 hours (IQR: 1.3-8.2) across all specialties when resolved electronically, contrasted with 7.3 hours (IQR: 3.6-22.0) when converted to an in-person consult (P<.001). Over half (6/11) of the participating specialties had significantly faster median eConsult response times for requests resolved electronically compared to requests converted to an in-person consultation. The specialties with the fastest eConsult response times were Dermatology and Radiation Oncology, which had median response times of 1.3 hours (IQR: 0.4-3.0) and 0.9 hours (IQR: 0.3-1.5) when resolved electronically, respectively. However, Radiation Oncology had one of the smallest volumes of eConsult requests among participating specialties.

The overall response times of eConsult requests were much faster than the turnaround goal mandated by our institutional guidelines, which require a same day response by 8pm, if the consult is ordered before noon or a response by the following morning, if ordered after noon. For reference, the overall median response time for completion of a traditional in-person

consult by the same 11 specialties during the same 2½-year period is 25.8 hours (IQR: 10.8-65.7) (see Multimedia Appendix 1). Thus, regardless of whether an eConsult request was resolved electronically or converted to an in-person consult, eConsults significantly improved the turnaround times for inpatient consultations.

The average volume of requests was 19 inpatient eConsults per month during the first 5 months that inpatient eConsults were live (Figure 5). Then, California experienced surges of COVID-19 cases throughout the pandemic and we saw corresponding increases in inpatient eConsults utilization. During the winter 2020 surge, the average volume of requests increased to 53 inpatient eConsults per month. Then the Delta variant wave arrived in summer 2021 and the average volume of requests increased to 61 inpatient eConsults per month. When the Omicron variant wave emerged in winter 2021, the average volume of requests peaked at 75 inpatient eConsults per month. During a sustained wave in spring-summer 2022 driven by Omicron subvariants, the average volume of request was 62 inpatient eConsults per month. After these surges subsided and COVID-19 cases declined, usage of inpatient eConsults remained at a high-level baseline with an average of 59 inpatient eConsults per month. Interestingly, similar patterns of increased eConsults utilization were observed in the ambulatory setting.

Discussion

In response to the COVID-19 crisis, we successfully implemented an inpatient eConsults service that offered providers the option of requesting a subspecialty consultation for hospitalized patients who do not require an in-person evaluation by the specialist. Strong engagement by the clinical champions and technology partners in our steering committee, along with support from UCI's leadership which provided us with dedicated IT, compliance, and billing teams, contributed to the successful design and implementation of our inpatient eConsults service. Additionally, we were able to rapidly launch the service by leveraging our experiences with implementing eConsults in the ambulatory setting and capitalizing on existing infrastructure for inpatient consults. Instead of creating unique eConsult orders, configuring our existing inpatient consult order reduced the build components for our IT team, allowing us to quickly and effectively launch the inpatient eConsults service. Because we utilized workflows similar to those for traditional in-person consults, the processes for requesting and responding to inpatient eConsults were not new for providers. This strategy, along with provider familiarity with our well-established eConsults service in the ambulatory setting, likely helped to foster adoption of inpatient eConsults. Although the COVID-19 crisis provided the key stimulus, these factors may have also contributed to the more rapid adoption of inpatient eConsults, in comparison to the initial uptake of our ambulatory eConsults.

We found that the eConsults service helped to significantly reduce the response times for consults requested on hospitalized patients not requiring an in-person evaluation. In fact, the overall median response time of eConsult requests resolved electronically was approximately half of the response time for requests converted to an in-person consultation and nearly 7 times faster than the response time for traditional in-person consults. This time saving was critical during surges of COVID-19 cases when emergency departments and inpatient units were overwhelmed, leading to prolonged wait times for hospitalized patients to receive consultative care. eConsults helped to streamline the inpatient consultation process and enabled the consulting team to promptly and efficiently provide recommendations on patients

not needing a physical examination.

Although some diagnoses require in-person evaluation of the patient, lower complexity problems can be managed effectively using eConsults. Indeed, we found that over half of eConsult requests were addressed electronically without the need for an in-person evaluation of the patient by the consulting team. By reducing unnecessary in-person consultations, eConsults likely helped to limit use of scarce PPE, minimize disease transmission, and free up specialists for other activities, such as examining patients with more complicated conditions and performing procedures. This improved resource utilization may also translate to potential cost savings associated with avoided in-person consultations and increased productivity. Future work should aim to analyze the cost effectiveness of inpatient eConsults.

After the peaks of the COVID-19 crisis subsided in California, we discovered that provider usage of inpatient eConsults persisted at a rate well above pre-crisis levels. This sustained utilization implies positive provider experiences with the service and suggests a preference for eConsults when addressing lower complexity problems. Developing workflows for the inpatient eConsults service that were familiar to providers and significantly improving the turnaround times for inpatient consultations also likely helped to facilitate this sustainability. Thus, while case numbers and death rates associated with the COVID-19 pandemic have declined, eConsults continued to be an important part of our healthcare delivery.

Although relatively new, there have been a few reports of eConsults in the inpatient setting. The earliest examples involved the unexpected use of the ambulatory eConsult platform in the inpatient setting [13] and the design for an inpatient eConsult protocol that provided subspecialty consultations to inpatients at a remote hospital that lacked access to these clinical services [12]. Other reports described the feasibility and use of inpatient eConsults for only one specific specialty consulting service [10, 11]. While one health system reported their implementation of an inpatient eConsult program in several specialties, provider adoption was temporary in response to the COVID-19 crisis [9]. Our experience with inpatient eConsults uniquely contrasts from these other health systems because we not only successfully implemented inpatient eConsults in multiple specialties, but we also demonstrated its sustained use beyond the pandemic.

Limitations

Although anecdotal provider feedback has been positive, limitations to this study include the absence of a formal assessment of user experiences with the inpatient eConsults service. Also, the volumes of eConsult requests and total consult orders were low for some specialties; thus, caution must be applied in the interpretation of results from these low-volume specialties. Nevertheless, we believe our unique development of inpatient eConsults is easily translatable to other institutions interested in implementing it and will lead to positive user experience and greater utilization since we fit the eConsult process into already existing and common workflows of requesting a consultation. Additionally, though the implementation of our inpatient eConsults service was in a single academic health system, we successfully demonstrated that use of eConsults in the inpatient setting is a promising approach to expediting patient care and reporting our experience in designing and implementing inpatient eConsults may provide guidance to other health systems considering similar virtual care models.

Conclusions

Our implementation of electronic consultations in the inpatient setting highlighted an innovative use for eConsults in the era of COVID-19. It allowed for timely, efficient delivery of inpatient consultation services while reducing the unnecessary exposure of health care workers to potential infection. Consequently, inpatient eConsults likely helped to conserve precious personal protective equipment, minimize disease transmission, and enhanced our ability to deal with surges in COVID-19 cases by expediting rapid assessment and management of lower complexity referrals. Although the COVID-19 emergency served as motivation to expand our ambulatory eConsults program to the inpatient setting, the service has become a vital component of our regular practices and will remain an essential part of our healthcare delivery, both in the ambulatory and inpatient settings, beyond the current the pandemic, achieving sustainability and value.

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Conflicts of Interest

ANA has been a principal investigator or co-investigator of clinical trials sponsored by NIH/NIAID, NeuroRx Pharma, Pulmotect, Blade Therapeutics, Novartis, Takeda, Humanigen, Eli Lilly, PTC Therapeutics, OctaPharma, Fulcrum Therapeutics, Alexion, and a speaker and/or consultant for BMS, Pfizer, BI, Portola, Sunovion, Mylan, Salix, Alexion, AstraZeneca, Novartis, Nabriva, Paratek, Bayer, Tetraphase, Achogen LaJolla, Ferring, Seres, Spero, Eli Lilly, Gilead, Millenium, HeartRite, Aseptiscope, and Sprightly; these relationships were unrelated to the current work. ASA, AAD, and AAA have no conflicts of interest to report.

Abbreviations

eConsults: electronic consultations
EHR: electronic health record
PPE: personal protective equipment
UCI: University of California Irvine

Multimedia Appendix 1

Median (IQR) response times by specialty for traditional in-person consults, compared with median (IQR) response times for eConsults converted to in-person and eConsults resolved electronically.

	Traditional in-person consults	eConsults converted to in-person	eConsults resolved electronically
All Specialties	25.8 (10.8-65.7)	7.3 (3.6-22.0)	3.7 (1.3-8.2)
Allergy & Immunology	30.9 (23.1-56.6)	6.1 (3.6-22.5)	3.1 (1.0-5.8)
Cardiology	24.9 (9.7-57.4)	6.9 (3.5-19.9)	3.5 (1.3-6.2)
Dermatology	13.5 (4.8-47.3)	3.8 (1.8-7.3)	1.3 (0.4-3.0)
Endocrinology	29.9 (18.1-66.9)	6.5 (3.7-10.9)	3.7 (1.4-7.5)
Infectious Diseases	42.7 (22.3-100.9)	13.3 (5.7-27.0)	5.3 (2.6-18.9)
Nephrology	21.8 (10.8-39.2)	7.6 (2.3-18.9)	10.2 (5.5-14.9)
Palliative Care	10.9 (6.1-23.6)	5.2 (3.3-18.0)	3.5 (3.5-3.5)
Pediatric Endocrinology	12.4 (9.9-16.3)	N/A	9.3 (6.1-15.1)
Pulmonary/ Critical Care	43.5 (20.3-105.2)	4.8 (2.1-9.5)	N/A
Radiation	23.5 (10.1-51.5)	20.8 (10.5-35.2)	0.9 (0.3-1.5)

Oncology			
Rheumatology	60.5 (27.2-147.7)	4.5 (2.0-10.6)	3.0 (1.3-7.5)

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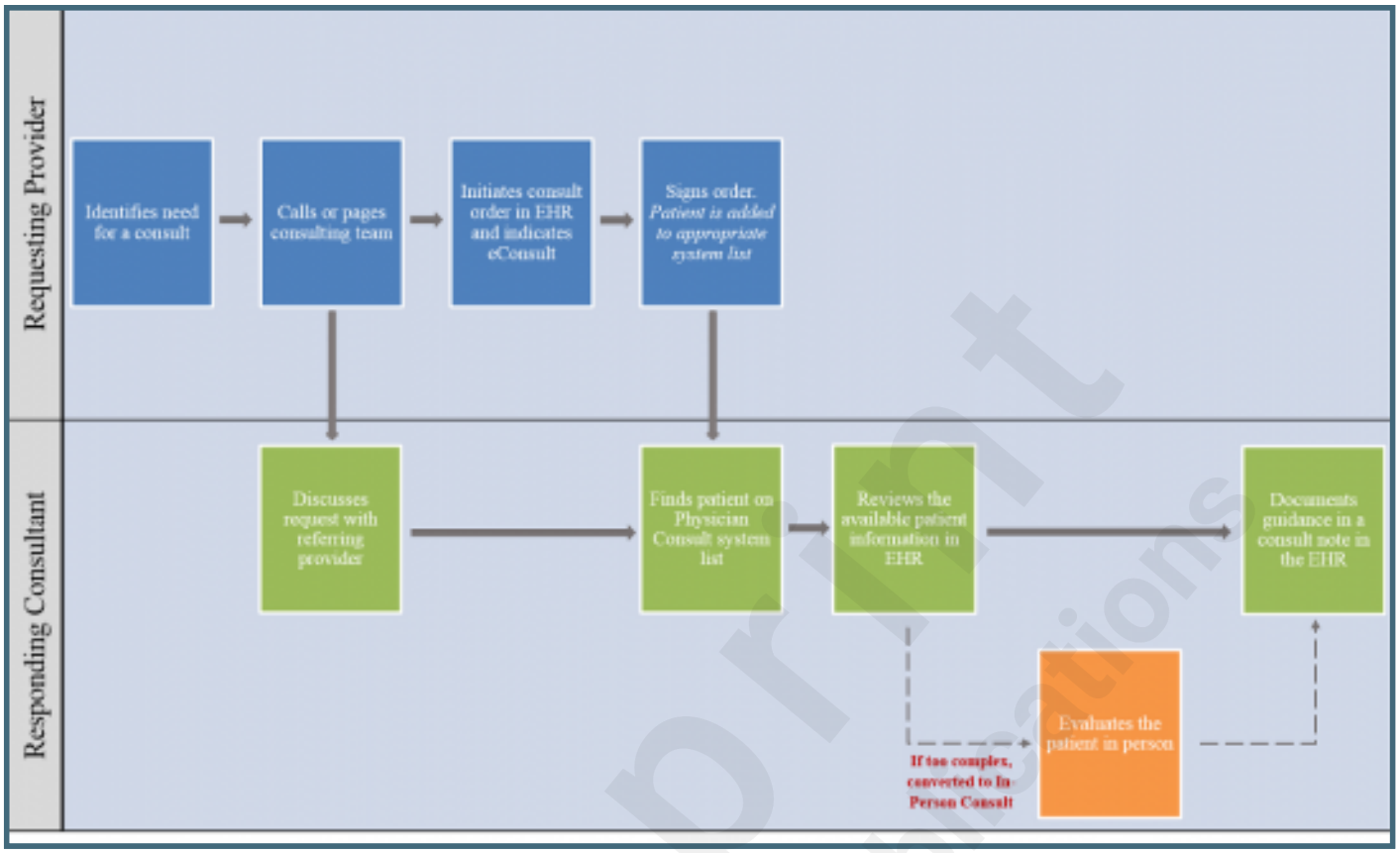
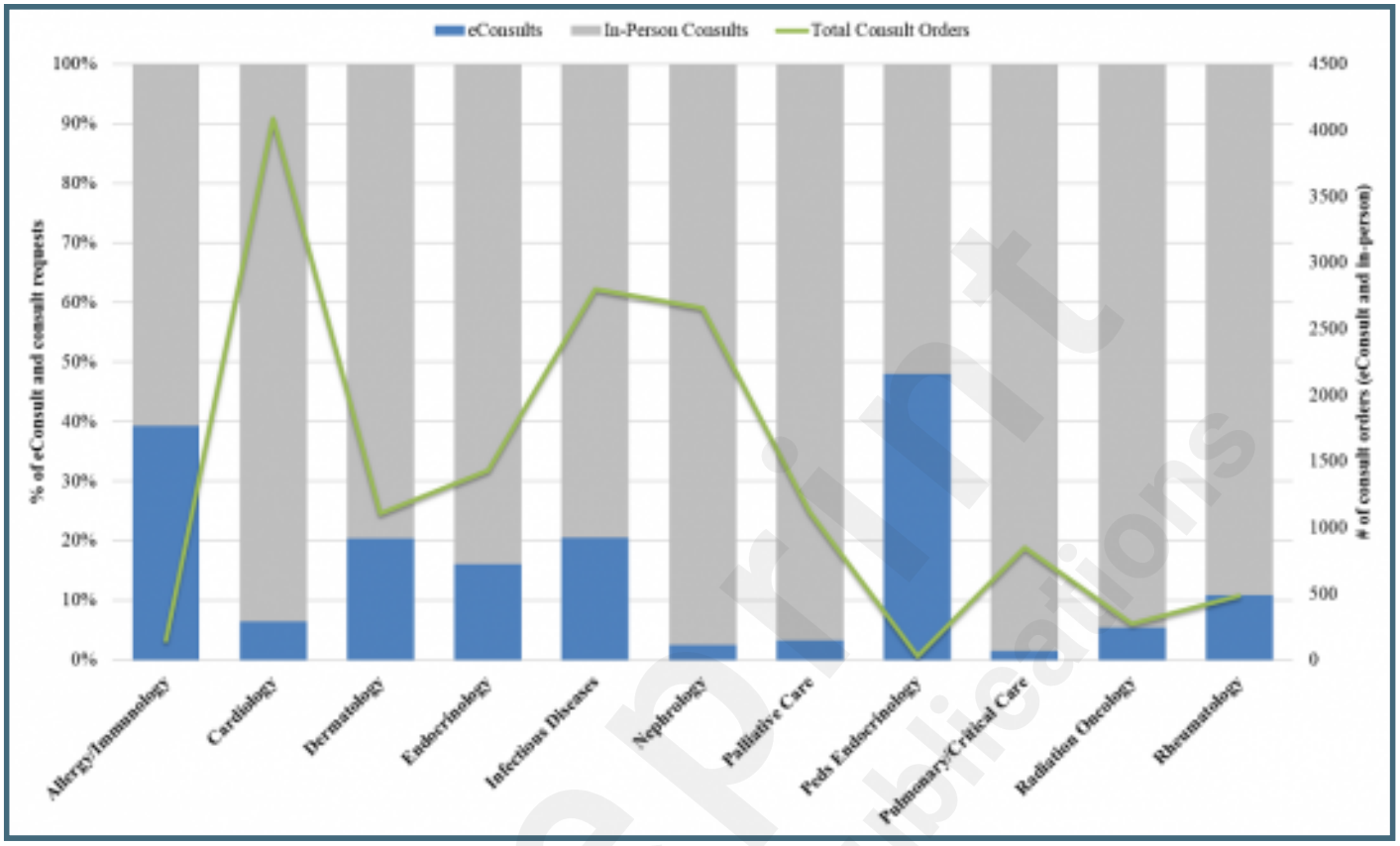
Supplementary Files

Figures

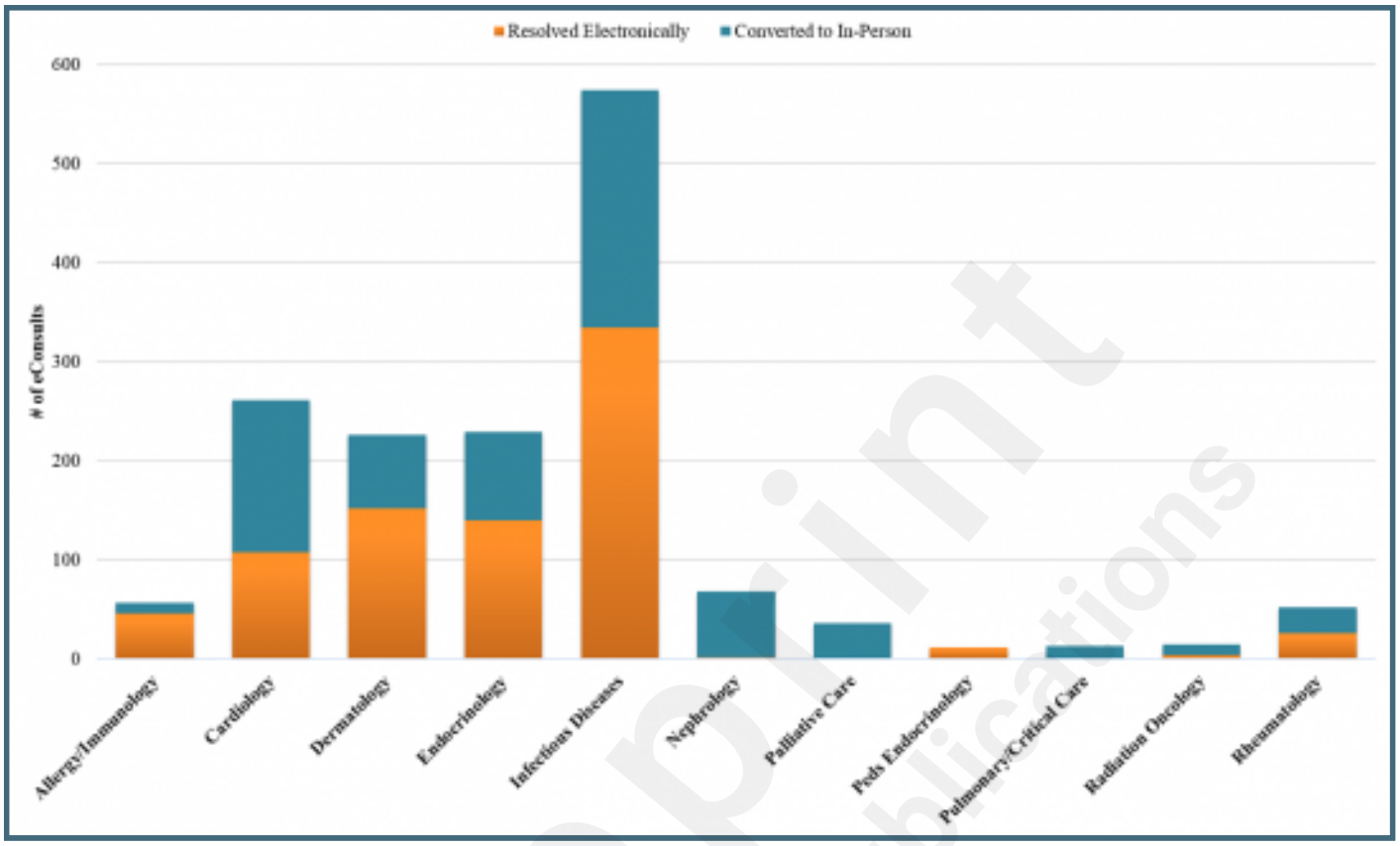
Workflows for requesting and responding to inpatient eConsults.



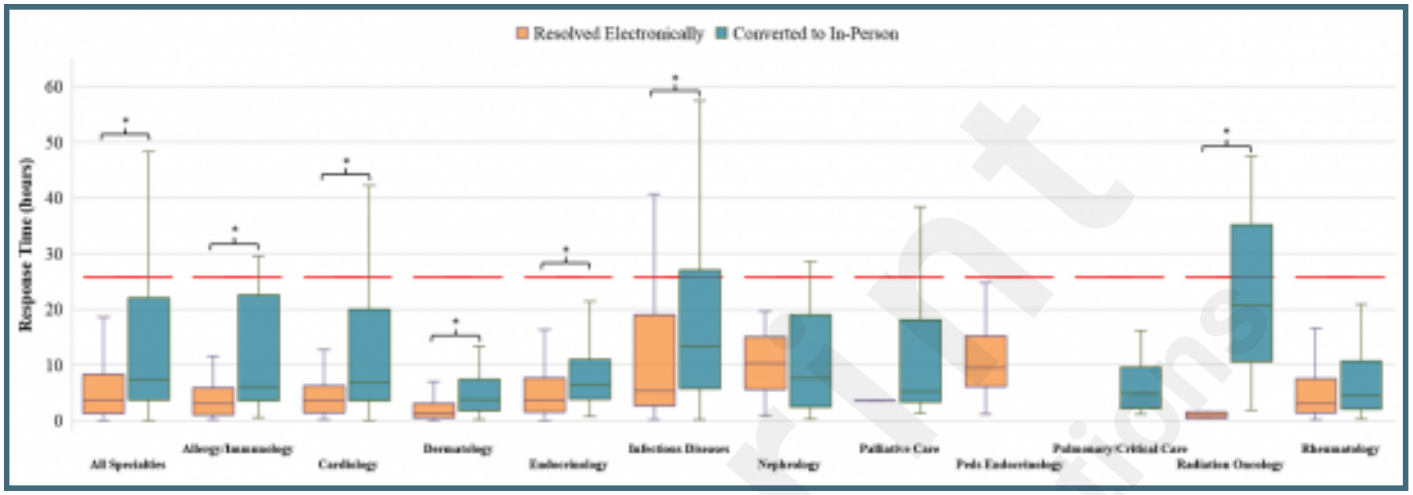
eConsult and traditional in-person consult volume by specialty. Percentages of eConsults (blue) and traditional in-person consults (gray) requested by specialty are shown on the primary axis. Total consult orders (eConsult and traditional in-person consults) by specialty are shown on the secondary axis.



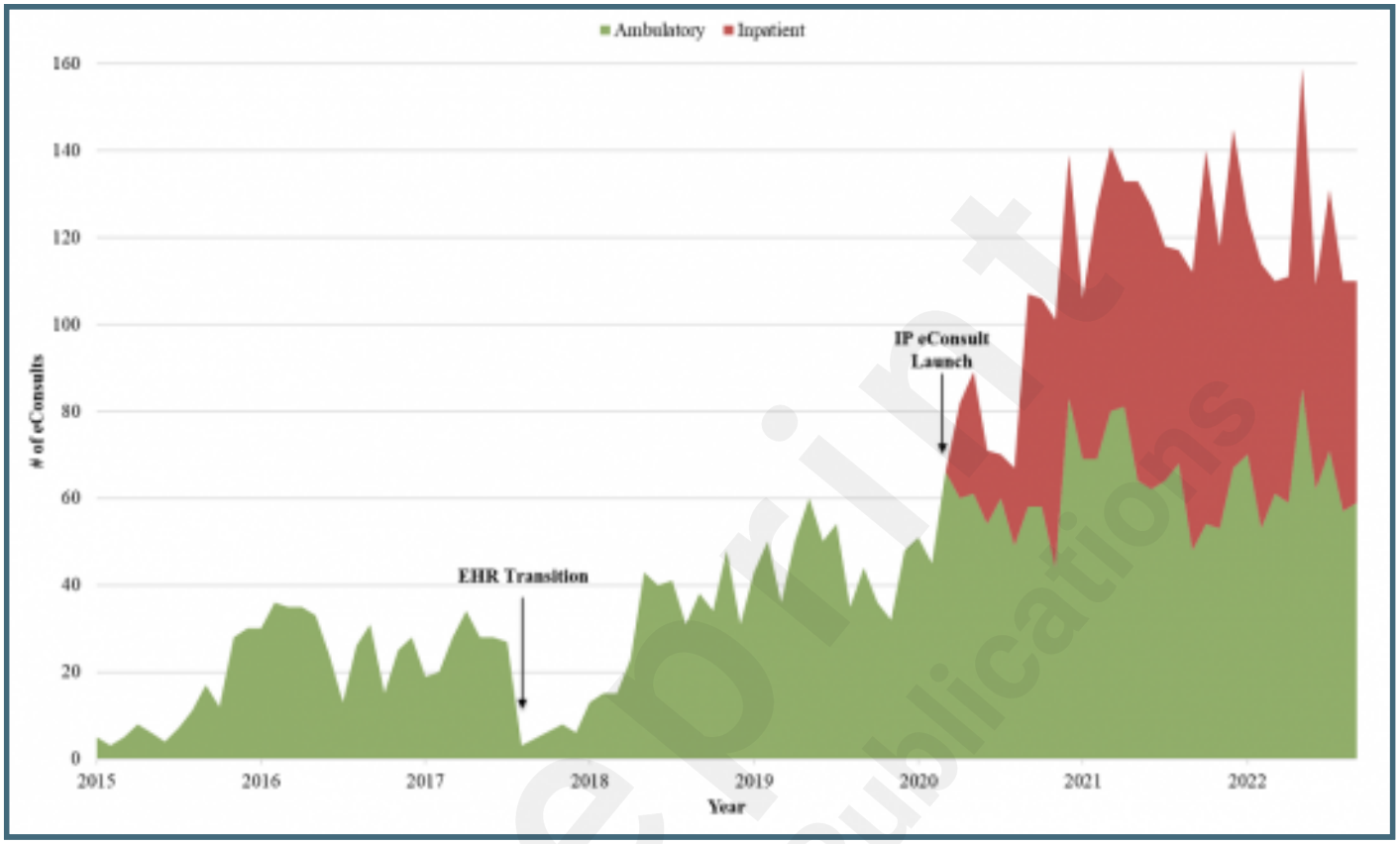
Volume and outcomes of eConsult requests by specialty (resolved electronically shown in orange and converted to in-person in teal).



eConsult response times by specialty. Boxplot of response times by specialty for eConsult requests resolved electronically (orange) and converted to in-person (teal). The box represents the interquartile range (IQR), with the top and bottom of box corresponding to the upper (third) and lower (first) quartiles, respectively. The horizontal line inside the box marks the median and the lines extending out from the box (whiskers) represent values within 1.5 times the IQR. For reference, the median response time for completion of a traditional in-person consult is marked by the dashed red line. *Indicates statistical significance.



eConsult volume over time. Monthly eConsult orders for ambulatory (green) and inpatient (red) settings at the University of California Irvine (UCI), 2015-2022. UCI transitioned from the Allscripts electronic health record (EHR) platform to Epic in Fall 2017. Launch dates for ambulatory and inpatient eConsults were April 2015 and July 2020, respectively.



Multimedia Appendixes

Median (IQR) response times by specialty for traditional in-person consults, compared with median (IQR) response times for eConsults converted to in-person and eConsults resolved electronically.
URL: http://asset.jmir.pub/assets/18d506ad6f3385725c34c0cdcd75df0e.xlsx