Evaluation of PARC eConsults Pilot

Summative Report

December 11, 2023

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Executive Summary

The Peterson Center on Healthcare (Center), in collaboration with Arkansas Blue Cross Blue Shield, initiated the Project Arkansas eConsultations (PARC). eConsultations (eConsults) represent an innovative shift in the healthcare landscape, offering a solution to timely and efficient patient care. An eConsult is an asynchronous consultation system that enables Primary Care Physicians (PCPs) to seek input from specialists on specific clinical questions using an electronic platform for exchanging patients' clinical information. eConsults can alleviate the need for physical face-to-face consultations with specialists, which can in turn expedite care, reduce cost, and enhance accessibility, particularly in remote or underserved areas. The study focused on the implementation and outcomes of eConsults in Arkansas, a state which has a mix of urban and rural geographic areas with limited access to specialty care and shortages of specialists.

The purpose of this report, which is the final report of the project, is to summarize the participation patterns and outcomes of patients whose PCPs received eConsults on their behalf (referred to as "eConsult recipients"). An earlier report on the project, conducted by Felt-Lisk et al. (2022), focused on the initial implementation of eConsults in Arkansas, outlining the strategies, challenges, and opportunities for integrating this innovative healthcare solution into the existing system. Building on the foundation laid by the initial report, this final report first uses private commercial data to examine the characteristics of practices and patients who received eConsults, providing insights into the differences between e-Consult recipients and other patients. Next, it presents the outcomes of eConsult recipients by comparing them to patients with similar characteristics at non-implementation practices in Arkansas (i.e., practices who did not make eConsults referrals). These comparisons offer an estimation of the impact of eConsults on key outcomes related to expenditures and utilization, furthering our understanding of how this system can contribute to cost-saving measures within the healthcare landscape. Consistent with the logic model for the project, we prioritize presenting key outcomes for total expenditures for key services and place the greatest emphasis on these findings when summarizing the results.

What were the characteristics and service usage patterns of patients who received eConsults?

The eConsult recipient participation patterns indicated that referrals were made for select groups of patients who could benefit from these services. Of the 11,732 patients who received specialty care that we could observe in the ARBCBS claims data at implementation practices between February 2021 and July 2022,199 patients (2 percent) did so through eConsults. The share of eConsult recipients is even smaller when compared to the over 200,000 patients at implementation practices. Compared to patients with face-to-face specialist visits, eConsult recipients had similar risk scores but were more likely to have chronic conditions such as diabetes. eConsults were more common for patients who had conditions, and that had evidence-based treatment guidelines. eConsults were more highly concentrated in specialties such as dermatology, endocrinology, and neurology. Finally, women are disproportionately representative of recipients of specialty care, representing 60 percent of those receiving eConsults and 69 percent of those receiving face to face visits.

There was a heavy concentration of eConsults in a small number of practices, which is consistent with the implementation findings from Felt-Lisk et al. (2022). Two practices accounted for more than half of the total eConsults utilized across all 14 implementation practices in the study. As noted in Felt-Lisk et al. (2022), eConsult adoption was lower than expected, despite reports of it being easy to use and

practitioners expressing generally high satisfaction with the referrals. The Felt-Lisk et al. (2022) report provides information on barriers and facilitators for eConsult uptake across practices.

What were the expenditure and utilization outcomes of patients who received eConsults?

We present the trajectory of eConsults on our primary outcomes in the month of eConsult and two-month follow-up (Exhibit ES.1). It is important to note that we anticipated stronger effects immediately following eConsults, with these effects expected to diminish over time as patient care transitions.

In the initial month of the eConsult, we observed an average reduction in expenditures for key services of $195 per person during the month of eConsult. This reduction is primarily driven by the decrease in specialty care expenditures resulting from the reimbursement structure for eConsult. The magnitude of this impact, aligned with our projected expectations from the logic model. The finding suggests that eConsults in PARC was a cost-efficient alternative to traditional face-to-face specialty visits. There were no impacts on hospitalizations or emergency department visits following eConsult, suggesting that eConsults did not impact patient access to needed services. This also indicates that deploying eConsults in clinical settings did not increase adverse events. While we found a modest increase in patients receiving lab and imaging services during the two months following the eConsult, this impact was a secondary outcome and was not accompanied by any increase in expenditures for these services.

How Do We Estimate Outcomes Using a Matching Approach?

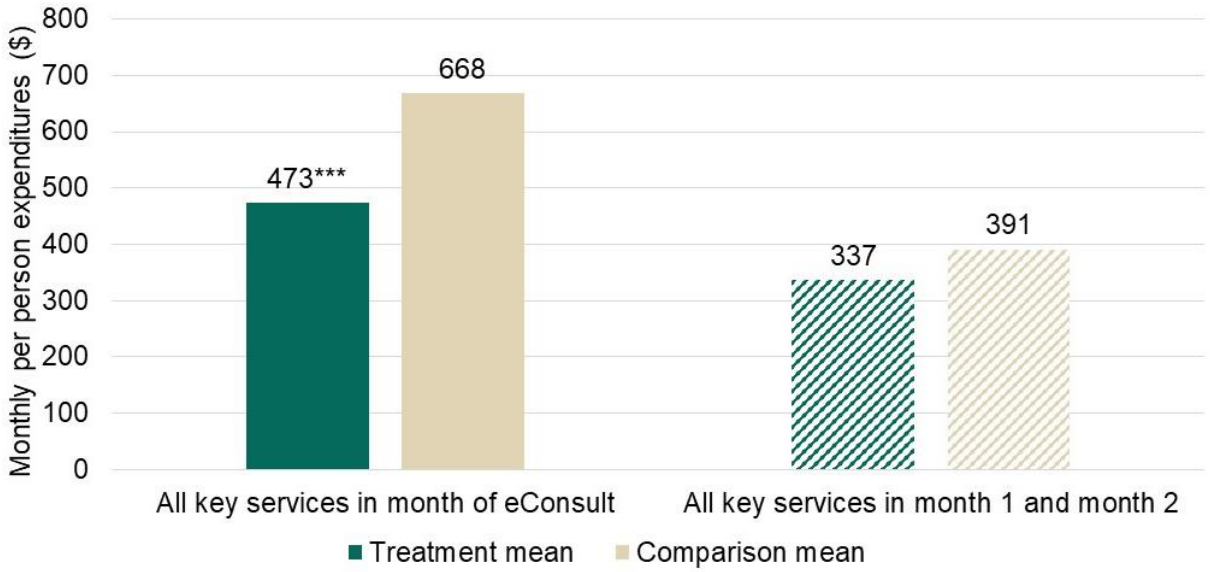
- **Primary and Secondary Outcomes:** We identified ***total expenditures for all key services*** as the primary outcome, which is measured as the sum of per member per month expenditures for specialist visits (including $50 for the eConsult), emergency department visits, hospitalizations, and lab and imaging services. Utilization measures were also constructed for key service categories.
- **Rigorous Matching Approach Employed with Strong Results:** We paired eConsult recipients with a comparison group based on a wide variety of patient characteristics, leading to a strong match. The success of this process reinforces the reliability of our methodology, ensuring high comparability between groups**.**
- **Impact estimation:** We isolated the impact of eConsults by comparing the outcomes with a comparable group of patients without eConsults and adjusted findings using a regression framework.
- **Robustness checks and caveats.** Our non-experimental framework offers a robust approach to generate impact estimates but acknowledges potential unobservable biases and constraints due to the limited sample size.

As we extend our analysis to the two-month follow-up period, the effects of eConsults on healthcare expenditure diminished as we find no statistically significant impacts during this phase. Although the average monthly expenditures for all key services remain lower for eConsult recipients, this difference was not statistically significant. Furthermore, there were no impacts on any specific expenditure components (specialty care, emergency department visits, and lab and imaging services).

Our results align closely with the expectations outlined in the logic model of how impacts might emerge. Across sensitivity tests, our results consistently highlight savings, especially in specialty care, advocating for wider eConsult use in Arkansas healthcare. To maximize potential benefits, future research and implementation should explore ways to increase the utilization of eConsults. A caveat is that we should

approach generalizations with caution because of the non-experimental design, study's limited sample size, and the concentrated use of eConsults among a select group of providers. Hence, there is likely a need for continued monitoring and for more gradual implementation to track whether future eConsult implementation is consistent with the findings set in this study.

Exhibit ES.1. Expenditures for all key services during month of eConsult and the two months following eConsults



Source: ConferMED data, health system data, and Arkansas Blue Cross Blue Shield data.

Note: Estimates are adjusted based on a regression that controlled for patient demographic characteristics, baseline service use and expenditures, baseline risk scores, practice size, whether the practice was in a health system, and characteristics of the practice's county. Expenditures were winsorized, meaning that outliers (above the 98th percentile) were replaced with the value of the 98th percentile. "Key services" include hospitalizations, emergency department visits, specialty services and lab and imaging. Outcomes are measured in the month of eConsult and 1 to 2 months following eConsult.

*/**/*** Impact estimate statistically different from 0 at the .10/.05/.01 level.

I. Introduction

A. Motivation for eConsultations (eConsults) pilot

The increasing demand for specialty care services in the U.S. healthcare system and the associated cost pressures have emphasized the need to improve access to specialist consultations in a more efficient and timely manner (Keely et al. 2013). Primary care providers (PCPs) face challenges in directly connecting with specialists due to a lack of interoperable electronic tools that facilitate seamless information exchange (Bodenheimer and Mason, 2016). Delays in obtaining direct connections to specialty care services negatively impact patient outcomes, contribute to the overburdening of emergency departments, and result in increased health care costs (Song et al. 2014).

One potential solution for accessing specialty care services more cost-effectively is the use of eConsult referrals, an asynchronous consultation system that enables PCPs to seek input from specialists on specific clinical questions using an electronic platform for exchanging patients' clinical information (Keely et al. 2013). Studies have demonstrated that eConsults can improve patient outcomes and reduce costs (Barnett et al. 2017; Anderson et al. 2018).

This approach has the potential to decrease the need for costly patient face-to-face consultations with specialists and reduce inefficient care coordination by addressing the challenges faced by PCPs in connecting with specialists. However, limited empirical evidence exists regarding the effects of eConsults on expenditures and utilization in different implementation environments (Vimalananda et al. 2020). The literature suggests the necessity for more comprehensive assessments, particularly in understanding how eConsults operate in different contexts.

The Peterson Center on Healthcare (hereafter the Center), in collaboration with Arkansas Blue Cross Blue Shield (Arkansas Blue Cross Blue Shield), funded the Project Arkansas eConsultations (PARC), a study that examined the outcomes of implementing eConsults in Arkansas. Arkansas was chosen because the state faces challenges with specialty access constraints, has higher than average population-level morbidity rates, and presented an opportunity to strengthen the state’s telemedicine infrastructure (Felt-Lisk et al. 2022).

The Center is dedicated to transforming U.S. health care through innovative solutions with the goal of improving quality and lowering costs. This research aligns with their broader strategy of exploring innovative solutions like eConsults to reduce healthcare costs while ensuring quality and access to needed care. The Center initiated a study to examine the utility, uptake, and impact of eConsults in a private insurance market that faced limitations in specialist service availability.

B. Purpose

The project’s initial report summarized the early utility and uptake of eConsults in implementation sites in Arkansas (Felt-Lisk et al. 2022). The study placed emphasis on examining operational aspects, motivating factors, and barriers associated with the implementation of eConsults. The findings revealed that practices integrating eConsults seamlessly incorporated them into their workflows with minimal disruption. PCPs reported that they found eConsults relatively easy to use and received timely responses from specialists. Specialists also reported a positive experience with eConsults and found they facilitated responses to clinical questions and improved the appropriateness of care. However, a challenge observed was the overall lower-than-expected utilization of eConsults, possibly influenced by factors such as the COVID-19 pandemic.

This final report of the project summarizes the participation patterns and outcomes of patients whose PCPs received eConsults on their behalf (referred to as "eConsult recipients"). First, we use private commercial data to examine the characteristics of practices and patients who received eConsults, providing insights into the differences between eConsult recipients and other patients. Next, we present the outcomes of eConsult recipients by comparing them to patients with similar characteristics who did not receive eConsults. These comparisons offer an estimation of the impact of eConsults on key outcomes related to expenditures and utilization, which will be described in more detail below.

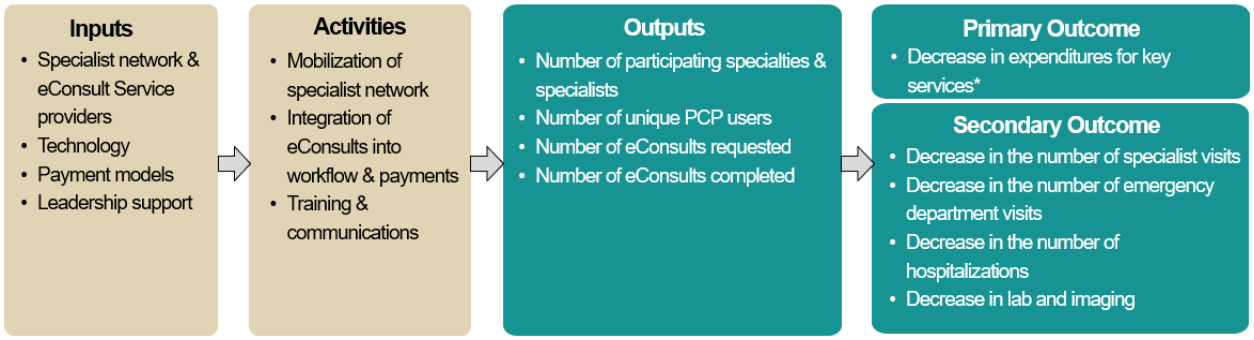
C. Logic model for eConsults

The Center embarked on the PARC project to assess whether eConsult referrals could help lower costs, without affecting quality of care, by enhancing the relationship between primary and specialty care. The project included an eConsult pilot program in one health system and eight independent practices. Both health system and independent practices aimed to improve the efficiency of eConsult referrals and ensure improved access to specialty care.

The Center developed a logic model to provide a common path to outcomes for eConsult services (Exhibit I.1). This model integrates essential inputs, activities, and outcomes for eConsults that drive positive changes in health care. Inputs include vital components such as a specialist network, eConsult providers, technology infrastructure, payment models, and leadership support. Activities involve mobilizing the specialist network, integrating eConsults into workflows, making reimbursements for eConsults and implementing training and communication strategies. These activities lead to outputs such as engaged participating specialists, unique PCP users, and successful completion of eConsults.

The ultimate goal is to achieve impactful outcomes, including decreased health care expenditures, reduced specialty visits, lowered emergency department use, decreased hospitalizations, and a reduction in unnecessary lab tests and imaging. By demonstrating changes in these outcomes, the effectiveness of eConsults in improving health care efficiency, cost-effectiveness, and patient outcomes can be shown.

Exhibit I.1. eConsults logic model depicting common activities, outputs, and outcomes for independent practices and health systems



*Total expenditures for key services measured as per member per month expenditures for specialist visits, emergency department visits, hospitalizations, lab and imaging services.

D. Research questions for this report

Below we present the research questions for this report:

1. **What were the characteristics of the patients and practices that participated in PARC?** Section II analyzes the demographic characteristics and chronic conditions of patients who received eConsults. It also explores the variation in the characteristics of the participating practices. By comprehending the characteristics of both the patients and practices involved in the eConsult pilot, we can gain a clearer understanding of utilization and identify any patterns or trends that may impact the program's outcomes.
2. **What were the cost and utilization outcomes of patients who received eConsults?** Section III investigates the impact of eConsults on patients' health care expenditures and patterns of service utilization. By analyzing patient claims data, we can evaluate the financial implications and health care resource utilization associated with the implementation of eConsults.

E. Overview of approach and data

In the following section, we summarize our study approach, detailing our primary data sources, sample collection, patient matching methods, approach to estimating impacts, and presentation of content in the text and appendices. The main data includes patient claim records provided by Arkansas Blue Cross Blue Shield which includes patients who received electronic consultations from either independent practices or health systems. Matching methods enabled us to identify a suitable comparison group from a vast pool of potential candidates.

The presentation of impacts includes measures of expenditures and utilization to identify the outcomes of eConsults, as shown in the logic model above. We present this information in visual charts in the main text in Sections II and IV. Readers with interest in more detailed source tables can find them in the appendices. Appendices B, C, and D include detailed tables to support the analyses in Sections II, III and IV.

1. Data description

The primary data source consists of patient claim records supplied by Arkansas Blue Cross Blue Shield. These records center on patients attributed to primary care practices that offer electronic consultations and those attributed to potential comparison practices. By using this data, we can delve into the characteristics of patients and monitor their outcomes across various periods. To fortify our analyses and provide broader context, we integrate county-level data from Area Resource Files. This information enables us to create additional measures to track trends at the county level. Furthermore, we employ implementation metrics from ConferMED, the independent practice eConsult vendor, and a participating health system, which aid us in tracing the rate of adoption for electronic consultations.

2. Sample overview

Our study primarily focuses on analyzing the outcomes of 199 patients who received eConsults. Among these patients, 187 (or 93 percent of the sample) are from independent practices, while 12 (or 7 percent of the sample) come from health systems. The sample includes more than 190 unique patients as well as a small number of patients who had multiple eConsults. Due to the small representation of cases within health systems, data were pooled for the purpose of this report. Each patient in the sample contributes a minimum of one month of follow-up data, and a notable 87 percent provide at least two months of data after the initial month of the eConsult.

3. Procedure for patient matching

We identified comparison groups from a pool of over 60,000 patients from independent practices and 19,000 patients from health system practices, none of whom had received eConsults. The initial matching of patients who received eConsults was based on the type of specialist visit and practice type. We further refined matches using a propensity score model. This model matched patients on several key characteristics including risk scores, chronic conditions at baseline, health care utilization in the two years before the electronic consultation, patient demographic characteristics, practice size, and county characteristics. From this large pool, we matched 985 members to form the comparison group. This process not only increased statistical precision but also allowed for flexibility to accommodate potential unmatched variables.

4. Methodology for measuring outcomes and estimating impacts

We worked with the Center to develop measures of the key outcomes presented in the logic model. The primary measure was total expenditures for key services. These expenditures were measured monthly for each individual and included specialist visits, emergency department visits, hospitalizations, lab, and imaging services. In addition, we created utilization measures for each key service category and examined how the costs for each of these services were distributed. All outcome measures capture activities during the initial eConsult month and the two months following the initial eConsult.

We estimate the impact by calculating regression-adjusted differences between the eConsult (treatment) and comparison groups. Specifically, we employ a multivariate model that pools eConsult and comparison group members. The impact is measured by the indicator of treatment status. Intuitively, this represents the differences in the means between the eConsult and comparison groups after controlling for their difference prior to the intervention. Control variables in the model include baseline measures of expenditure outcomes, patient risk score, health care utilization in the two years before the eConsult, patient demographic characteristics, patient chronic conditions, practice characteristics, and county characteristics of the patient's practice. These control variables account for any chance differences between the eConsult and comparison groups and enhance the precision of the estimates. When presenting results, we note when the impact estimate is statistically significant at the 10 percent level. In addition, we describe the impact estimate relative to the comparison group mean to provide the reader with a sense of the magnitude of the impact estimate.

We also run two types of sensitivity tests. First, we test a model that assesses the effects of outliers by trimming (rather than truncating) observations with any extreme values. Second, we examine the effects on key outcomes using a sample that excludes cases that did not have a full two months of follow-up data after the initial month of the eConsult.

Consistent with our logic model, we prioritize presenting outcomes for total expenditures for key services and place the greatest emphasis on these findings when summarizing the results. We also provide a summary of impacts on other outcomes, which we consider as secondary.

5. Presentation of findings

We use charts to visually present our findings on participation and outcomes in the text. The appendices to these sections include detailed tables that represent the source information for our estimates in each section.

II. What Were the Characteristics and Service Usage Patterns of Patients Who Received eConsults?

In this section, we present a summary of the characteristics and specialty usage patterns of patients who received eConsults. Our analysis involves three groups of comparisons.

1. **eConsult recipients vs. other implementation patients**: This comparison highlights how eConsult recipients differ from other patients within implementation practices. We expect some substantial differences across these groups given that eConsult recipients represent patients who requested specialty support.
2. **eConsult recipients vs. other implementation face-to-face specialty patients.** This comparison is more targeted, as it is limited to patients in need of specialty care. Hence, we expect fewer differences than the first set of comparisons above.
3. **eConsult implementation practices vs non-implementation practices.** This comparison provides information on contextual differences between implementation practices and non-implementation practices in Arkansas. This latter comparison is notable, as we use non-implementation practice patients as a basis to create a comparison group (described in Section III) to generate estimates of impacts on outcomes (Section IV).

We also examine the patterns in the types of eConsult by specialty to gain insights into how physicians make decisions regarding eConsults. Specifically, we summarize how many eConsults were used in each type of specialty. We conclude by discussing our findings and their implications for the subsequent sections.

A. How do the characteristics of eConsult recipients compare to other patients within implementation practices?

As a starting point, we examine how the characteristics of eConsult recipients compare to other patients within implementation practices. These comparisons help identify the specific traits that contribute to their referral for an eConsult. Below, we compare eConsult recipients to other patients, based on their demographic data, medical conditions, and expenditure characteristics. To provide a consistent sample throughout the report, we include only eConsult recipients and other patients who had at least one physician visit between February 2021 and July 2022 and whom we could observe in Arkansas Blue Cross Blue Shield claims data.

1. eConsult recipients represented a small segment of patients within implementation practices

Of the 11,732 patients who received specialty care, 199 patients (2 percent) did so through eConsults. The share of eConsult recipients is even smaller when compared to the over 200,000 patients attributed to implementation practices. These findings indicate that physicians used eConsults rather sparingly as most patients received more traditional face-to-face visits. As described below, eConsult utilization was heavily concentrated within a few practices.

The low rate of uptake of eConsults among the general population is consistent with the literature. For example, Liddy et al. (2016) showed in a review of 36 eConsult studies that a small fraction of primary care visits tended to refer via eConsults. However, the specific rates varied based on numerous factors, including implementation specialty, the setting (independent vs. health system), and the patient population.

2. eConsult recipients were older and less healthy than other patients within implementation practices

eConsult recipients tended to be older than other patients (Exhibit II.1). For example, eConsult recipients were less likely than other patients to be younger than age 30 (19 vs. 27 percent). Likewise, there were more eConsult patients in each of the older age brackets relative to other patients at implementation practices.

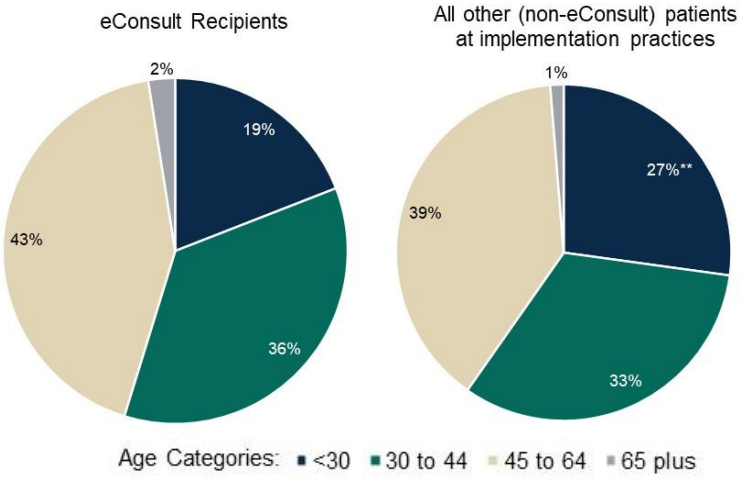
eConsult recipients had a higher average risk score relative to other patients at implementation practices (2.6 vs. 1.8 average risk score).[1] In general, patients with higher risk scores tended to be in poorer health than those with lower risk scores. The elevated risk scores among eConsult recipients likely reflects the fact that individuals in need of specialty care were in poorer health relative to other patients.

eConsult recipients differed from other patients in some demographic characteristics and chronic conditions. Specifically, women made up approximately 60 percent of the eConsult cohort, a distribution consistent with the general patient population at the implementation practices (see Appendix B Exhibit B.1). This concentration of women likely reflects the broader demographic makeup of these medical settings. Furthermore, eConsult recipients were more likely than other patients to have several chronic conditions, including chronic kidney disease, congestive heart failure, chronic obstructive pulmonary disease, and diabetes. For example, 18 percent of eConsult recipients had diabetes, compared to just 9 percent in the general patient population at the implementation practices. This elevated incidence of diabetes is in line with the higher average risk scores of 2.6 among eConsult recipients, suggesting that those opting for specialty consultations are generally in poorer health compared to other patients. We take a deeper dive into these issues below in our comparisons to patients who receive specialty visits.

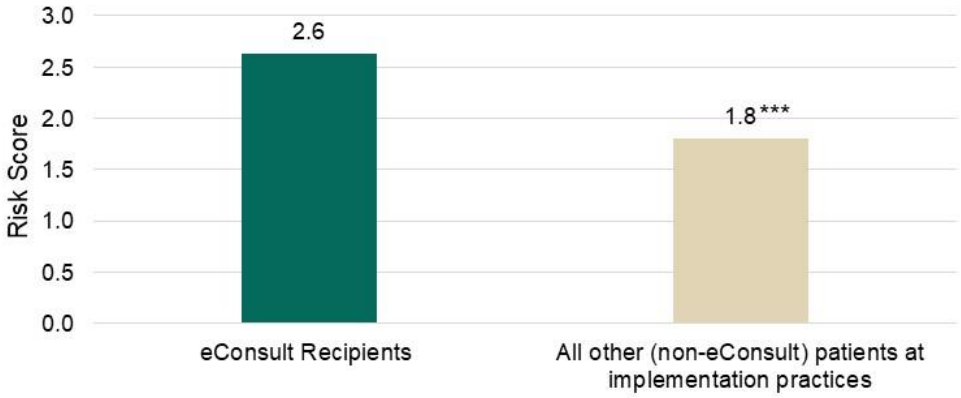
[1] The risk scores reported here were based on patients' diagnoses and procedures received during the baseline period.

Exhibit II.1. Comparison of characteristics of eConsult recipients with all other (non-eConsult) patients at implementation practices

Panel A. Comparison by age



Panel B: Comparison by risk score



Source: Health system data, ConferMED data, and Arkansas Blue Cross Blue Shield claims data.

Note: For eConsult recipients, the baseline visit represents the receipt of an eConsult. In Panel A, patients were grouped into categories based on their age prior to their baseline visit (<30, 30 to 44, 45 to 64 and 65 plus). In Panel B, risk scores were based on diagnoses and procedures received during the baseline period. Patients with higher risk scores are expected to have higher future expenditures. The risk scores reported here are drawn from Appendix B Exhibit B.1.

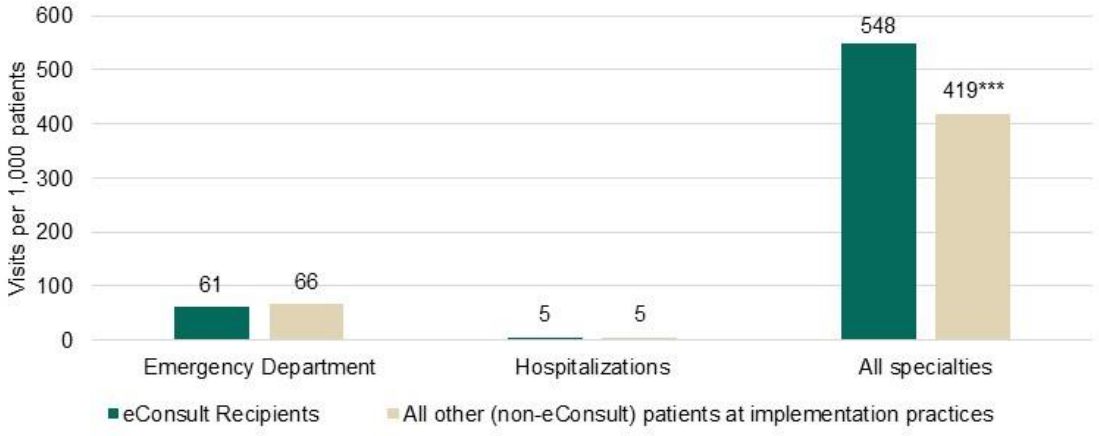
*/**/*** Statistically significant difference between eConsult recipients and other patients at implementation practices at the .10/.05/.01 level.

3. eConsult recipients had higher expenditures and utilization than other patients

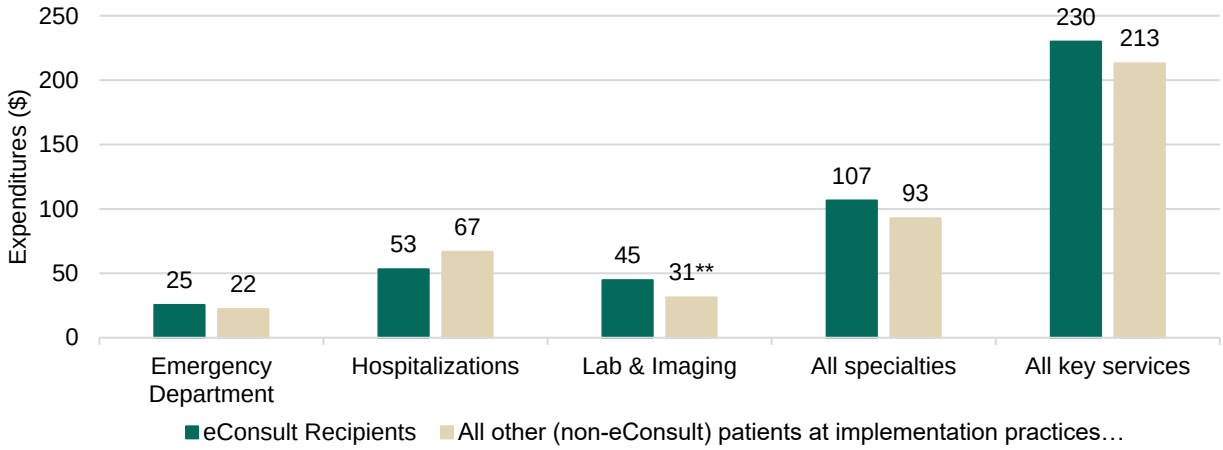
eConsult recipients had greater service use and costs than other patients in the baseline period (Exhibit II.2). For example, eConsult recipients had more specialty visits per 1,000 patients relative to other patient groups (548 vs. 419 patient visits per 1,000). eConsult recipients also had higher lab and imaging expenditures relative to other patients ($45 vs. $31 per person per month). The average expenditures for other services among eConsult recipients was higher than, but not significantly different from, expenditures for other patients.

Exhibit II.2. Comparison of service use of eConsult recipients with all other (non-eConsult) patients at implementation practices

Panel A. Comparison of number of visits (per 1,000 patients per month) during baseline period



Panel B. Comparison of average monthly baseline expenditures



Source: ConferMED data, health system data, and Arkansas Blue Cross Blue Shield claims data.

Note: In Panel A, patient visits per 1,000 per month were calculated by averaging patient visits per month over the two-year baseline period and multiplying by 1,000. In Panel B, all key services includes emergency department, hospitalizations, lab & imaging, and specialties over the two-year baseline period. Expenditures on other services (such as primary care, durable medical equipment, and prescription medications) were excluded. The numbers reported here are drawn from Appendix B Exhibit B.1.

*/**/*** Statistically significant difference between eConsult recipients and other patients at implementation practices at the .10/.05/.01 level.

B. How do the characteristics of eConsult recipients compare to those who received specialty visits at implementation practices?

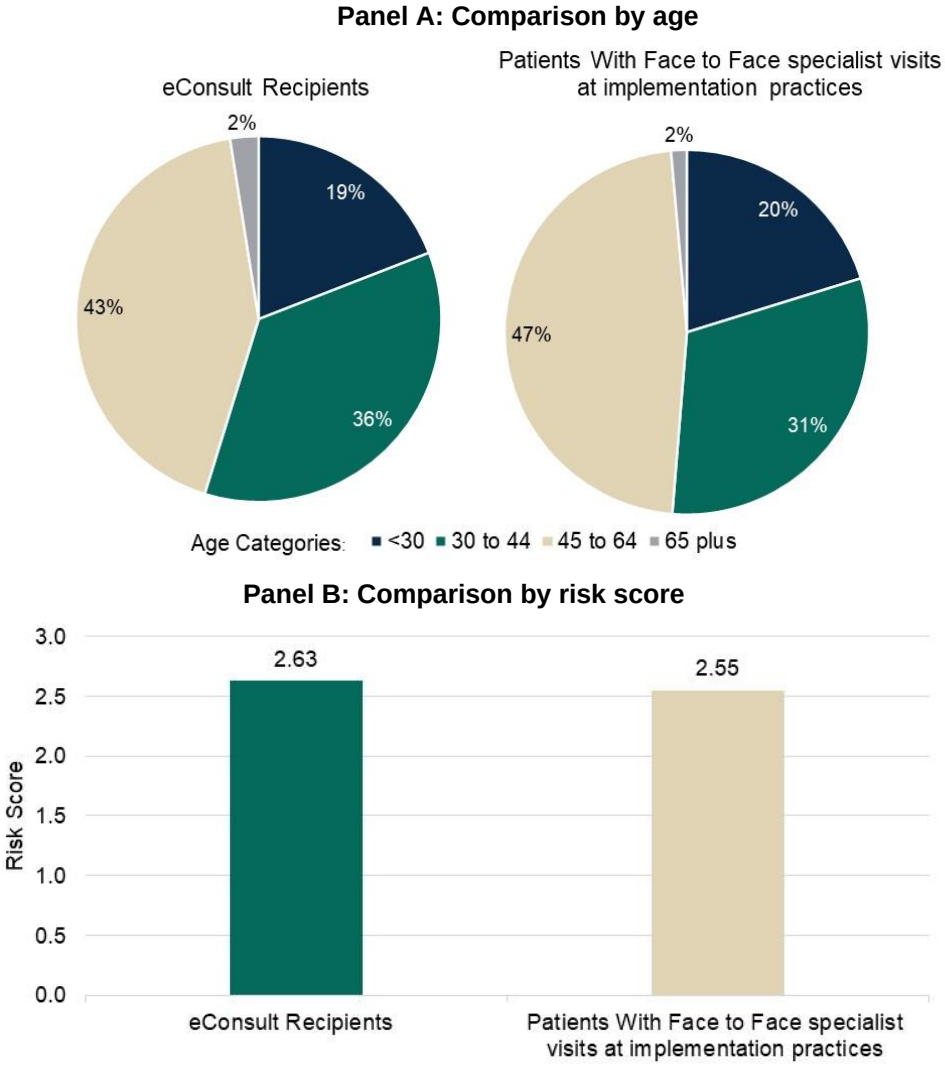
Patients receiving specialty visits within implementation practices serve as a potentially more comparable group to eConsult recipients, given that, like eConsult recipients, they too have been referred to specialists. In this section, we compare the demographic, health, and expenditure patterns of eConsult recipients to those who received face-to-face specialty visits. We use these comparisons to assess whether the differences we find above continue to persist within the narrower population of those who had a face-to-face specialty visit. As we describe below, we continue to find some unique characteristics of eConsult recipients, highlighting the different use of eConsults for specific types of patients.[2]

[2] We find similar patterns regardless of whether we compare eConsult recipients to patients with face-to-face specialty visits at implementation practices or to those with face-to-face specialist visits at non-implementation practices. See Appendix B Exhibits B.2, B.3, and B.5 for comparisons to non-implementation practices.

1. eConsult recipients had similar age and risk score profiles as those who received specialty visits

There were more similarities in the age and risk score profiles when comparing eConsult recipients to patients receiving specialty visits (Exhibit II.3). More than 75 percent of eConsult recipients and patients with face-to-face visits were ages 45 and older. We also find that both groups had risk scores of approximately 2.6. The smaller differences here, relative to those above for the general patient population, align with our expectation that eConsults were targeted toward patients with similar health conditions as those receiving specialty care.

Exhibit II.3. Comparison of characteristics of eConsult recipients with patients receiving face-to-face specialist visits at implementation practices



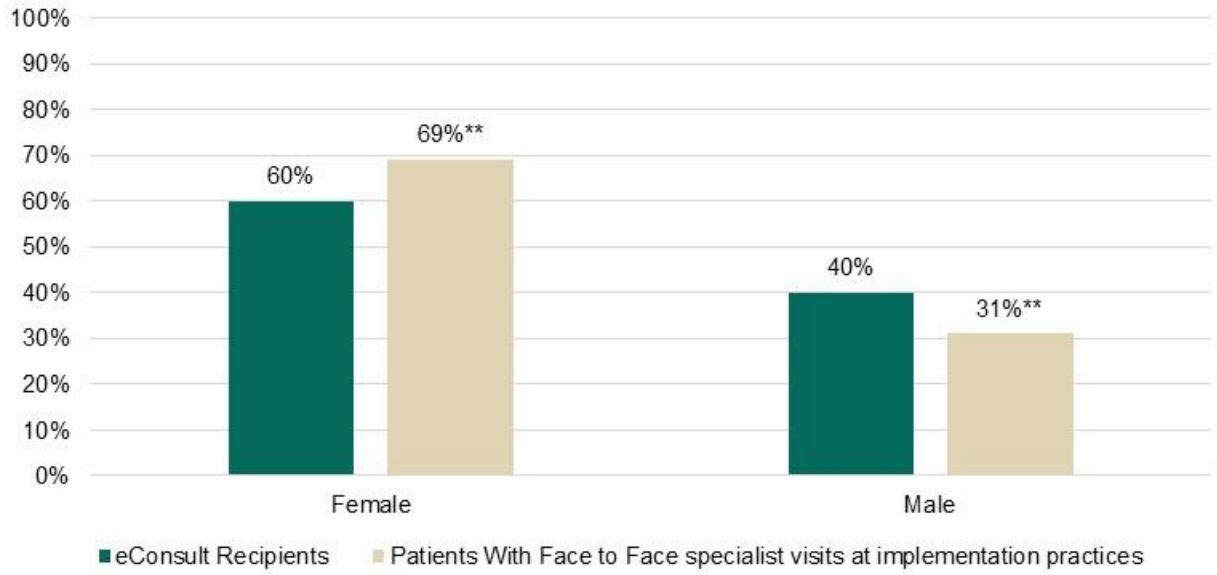
Source: Health system data, ConferMED data, and Arkansas Blue Cross Blue Shield claims data. Data for exhibit drawn from Appendix B Exhibit B.1.

Note: For eConsult recipients, the baseline visit represents the eConsult. For other patients who did not receive an eConsult, the baseline visit is the face-to-face visit to a specialist. In Panel A, patients were grouped into categories based on their age prior to their baseline visit (<30, 30 to 44, 45 to 64, and 65 plus). In Panel B, risk scores were based on diagnoses and procedures received during the baseline period. Patients with higher risk scores are expected to have higher future expenditures. The risk scores for this exhibit were drawn from Appendix B Exhibit B.1.

2. eConsult recipients were less likely to be female and had different medical condition profiles than patients with face-to-face specialist visits.

Building on our earlier findings for implementation patient comparisons, we observe a pronounced divergence in gender trends between eConsult and face-to-face specialty visit recipients (Exhibit II.4), while the pattern for diabetes remains consistent (Appendix B Exhibits B.1). Specifically, women were less prevalent among eConsult recipients, constituting 60 percent, as opposed to 69 percent in face-to-face specialty visits. On the other hand, diabetes continued to be more common among eConsult recipients, with an 18 percent prevalence compared to 12 percent for those receiving face-to-face specialty care. The consistency in elevated diabetes rates even when we limit the comparison to those with face-to-face specialist visits suggests that physicians are particularly inclined to refer these patients for eConsults.

Exhibit II.4. Comparison of eConsult recipients to all patients with face-to-face specialist visits at implementation practices, by gender



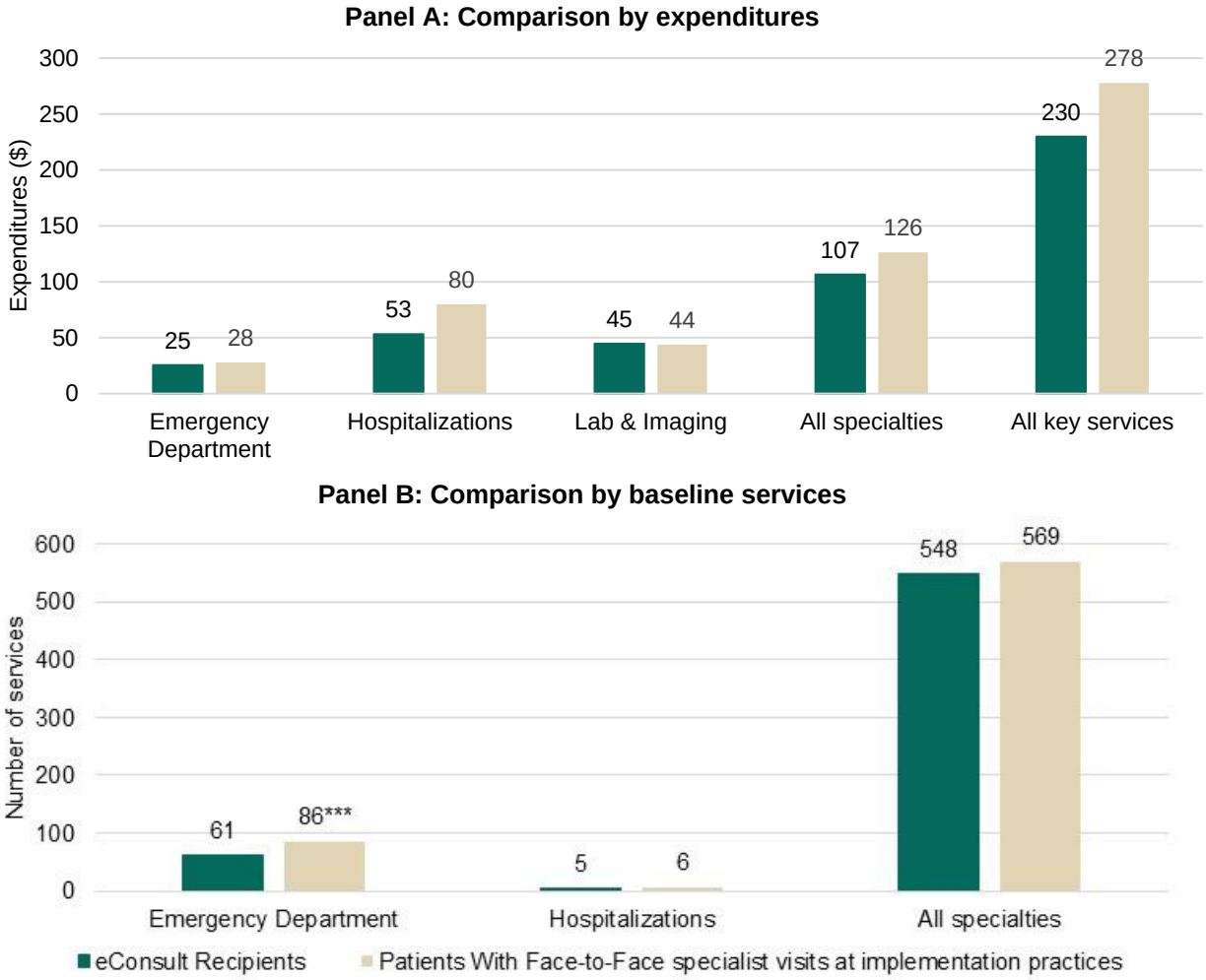
Source: Health system data, ConferMED data, and Arkansas Blue Cross Blue Shield claims data.
Note: The numbers for this exhibit were drawn from Appendix B Exhibit B.1.
*/**/*** Indicates a statistically significant difference between patients between eConsult recipients and those with face-to-face specialist visits at implementation practices at the .10/.05/.01 level.

3. eConsult recipients had similar expenditures, but less service use, than patients with face-to-face specialist visits.

While their expenditures during the baseline period were similar, eConsult recipients had somewhat lower service use (Exhibit II.5). Specifically, the average monthly expenditures per person at baseline across all key services for eConsult recipients was not significantly different from those with face-to-face specialty visits. However, there were some statistically significant differences in utilization. Per 1,000 patients per month, eConsult users had fewer visits to the emergency department than the comparison group (61 vs. 86 visits).

Because eConsult recipients had similar risk scores to patients receiving face-to-face specialty visits, we expected the two groups to have similar expenditure and service use patterns. While expenditure patterns were similar, the service use pattern was unexpectedly different. It could be that physicians were purposeful in selecting patients for eConsults based on their recent service use needs, as discussed in our examination of the specialty types for the eConsults that patients received (Section II.D.1).

Exhibit II.5. Comparison of eConsult recipients to patients with face-to-face specialist visits at implementation practices



Source: Health system data, ConferMED data, and Arkansas Blue Cross Blue Shield claims data.

Exhibit II.5 (*continued*)

Note: For eConsult recipients, the baseline visit represents the receipt of the eConsult. For other patients who did not receive an eConsult, the baseline visit represents a face-to-face visit to a specialist. In Panel A, the "sum of expenditure categories" captures the average monthly expenditures for all key services includes emergency department, hospitalizations, lab & imaging, and specialist visits over the two-year baseline period. Expenditures on other services (such as primary care, durable medical equipment, and prescription medications) were excluded. In Panel B, patient visits per 1,000 per month were calculated by averaging patient visits per month over the two-year baseline period and multiplying by 1,000. The numbers on this exhibit were drawn from Appendix B Exhibit B.1.

*/**/*** Statistically significant difference between eConsult recipients and patients with face-to-face those specialist visits at implementation practices at the .10/.05/.01 level.

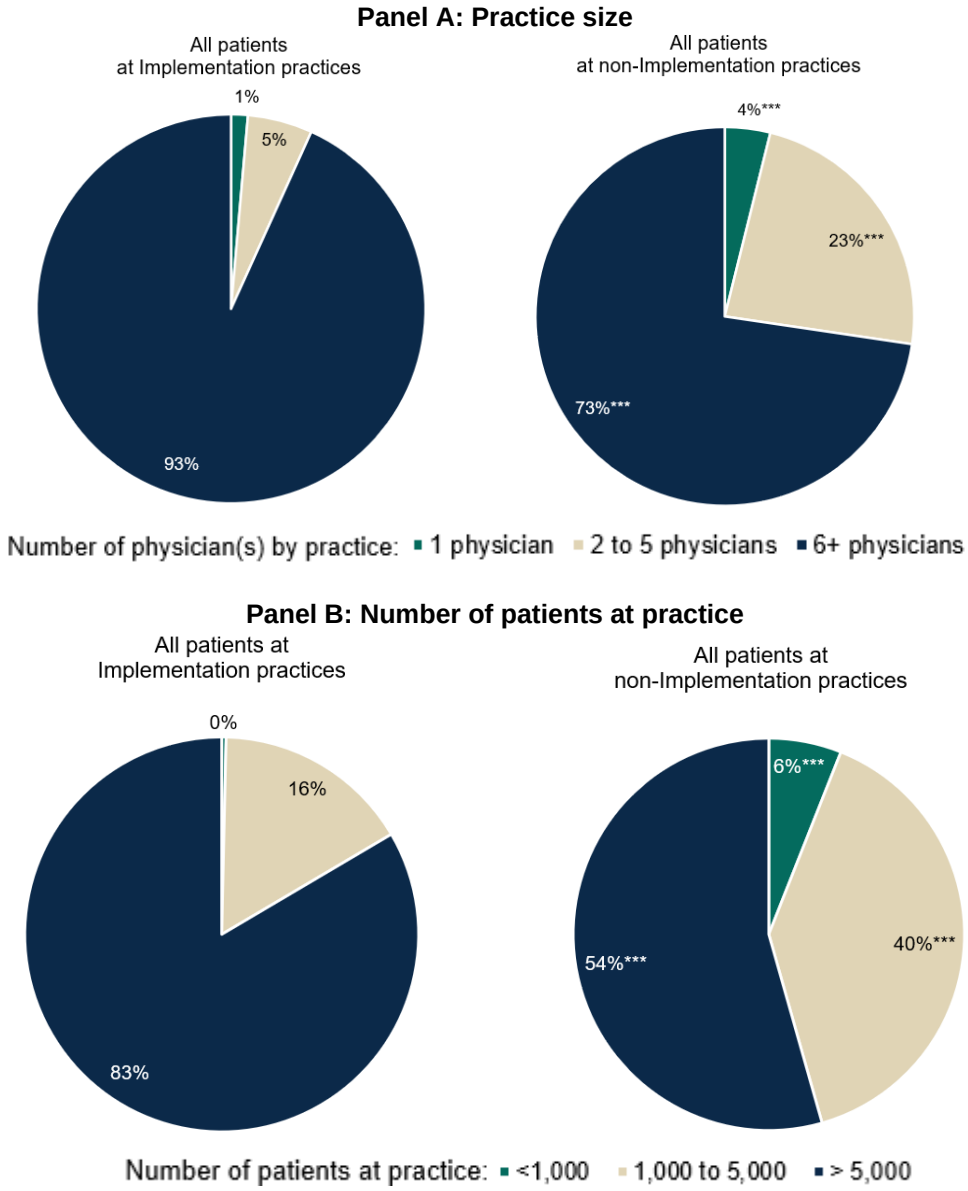
C. How do the characteristics of implementation practices compare to those of non-implementation practices?

To provide context on the matching approach and illuminate similarities and differences between the groups of practices in our analysis, we compare implementation practices to the non-implementation practices that form the pool for our potential comparison group. We found that implementation and non-implementation practices were similar in most respects. The exceptions were that implementation practices were generally larger and more likely to be in rural areas than their non-implementation counterparts, both factors we can match on and control for in our analysis (see Section III).

1. Implementation practices tended to be larger and more likely to be in rural areas

Implementation practices were generally larger both in terms of the number physicians and patients (Exhibit II.6) and were less likely to be in metropolitan areas. Nearly all implementation practices (93 percent) had six or more physicians. In contrast, 73 percent of non-implementation practices had a comparable number of physicians. Similarly, more implementation practices than non-implementation practices had more than 5,000 attributed patients (83 vs. 54 percent). In terms of geographic distribution, fewer implementation practices than non-implementation practices were in metropolitan areas (58 vs. 68 percent).

Exhibit II.6. Comparison of the characteristics of implementation practices and non-implementation practices' characteristics



Source: Health system data, ConferMED data, and Arkansas Blue Cross Blue Shield claims data.

Exhibit II.6 (*continued*)

Note: Implementation practices include those that delivered eConsults. Non-implementation practices include those that that did not deliver eConsults. In the top panel, practice size captured the number of physicians at the practice that each patient was attributed to. The bottom panel captures the percentage of patients attributed to practices in each practice size category (<1,000 patients in practice, 1,000 to 5,000 patients in practice, >5,000 patients in practice). The numbers from this exhibit were drawn from Appendix B Exhibit B.4. Percentages may not add up to 100 due to rounding.

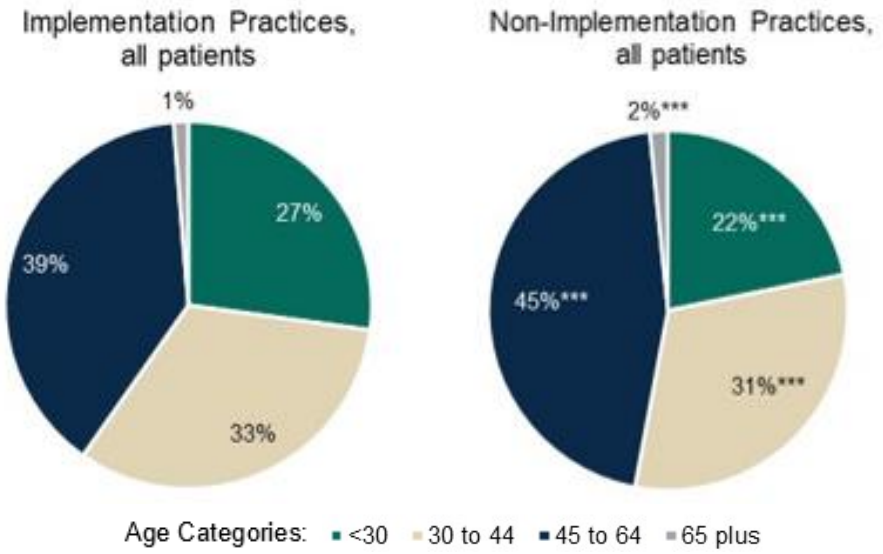
*/**/*** Statistically significant difference between implementation practices and non-implementation practices .10/.05/.01 level.

2. Relatively modest differences existed in the characteristics of patients at implementation and non-implementation practices

Patients in implementation practices were generally younger than those at non-implementation practices, though the differences were not substantial across the full age distribution (Exhibit II.7). For example, implementation practices had more patients under the age of 30 than non-implementation practices (27 vs. 22 percent). Implementation practices were also less likely to have patients in the older age categories.

In summary, the findings across practices indicate some difference between implementation and non-implementation practices across regions, which likely influence some of the demographic differences noted above. Methodologically, in our matching approach described in Section III, we describe how we control for these differences to select a comparison group that is representative of eConsult recipients in implementation areas.

Exhibit II.7. Characteristics of patients attributed to implementation and non-implementation practices, by age



Source: Health system data, ConferMED data, and Arkansas Blue Cross Blue Shield claims data.

Note: Implementation practices include those that delivered eConsults. Non-implementation practices include other practices that did not deliver eConsults. Patients were grouped into categories based on their age at baseline (<30, 30 to 44, 45 to 64 and 65 plus). The numbers for this exhibit were drawn from Appendix B Exhibit B.5.

*/**/*** Statistically significant difference between patients in the sample attributed to implementation practices and those attributed to non-implementation practices at the .10/.05/.01 level.

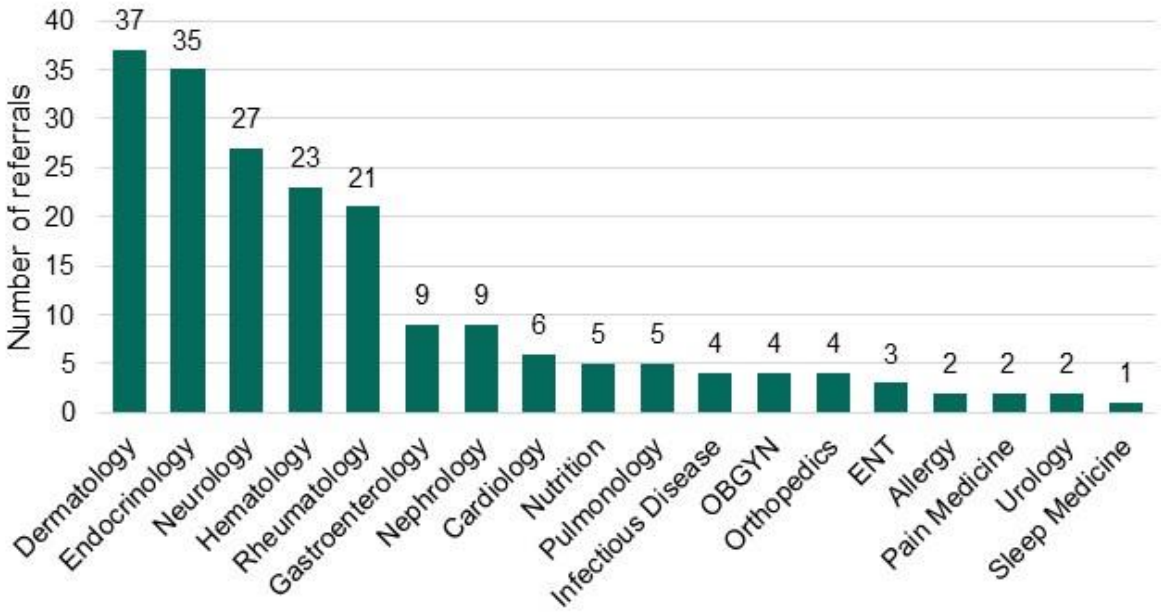
D. What were the patterns in eConsult utilization?

We now shift from our comparisons to delve into the patterns of eConsult utilization, which provide additional insights into the types of eConsults patients received. This examination enables us to discern patterns in eConsult utilization and offers insights into physicians' predilections for the types of specialties for which they use eConsults. Specifically, we note a higher propensity for eConsults within dermatology, endocrinology, and neurology.

1. eConsult utilization was concentrated in dermatology, endocrinology, and neurology

Some specialties were much more commonly referred for eConsults than others (Exhibit II.8). Among the various specialties, dermatology (37 eConsults), endocrinology (35 eConsults), and neurology (27 eConsults) emerged as the most frequent types of eConsults.[3] It is not surprising that endocrinology was high on this list, given the high number of eConsult recipients with diabetes. More generally, the high prevalence of eConsults for dermatology, endocrinology, and neurology is consistent with a study of eConsult implementation in a Canadian intervention (Keely et al. 2013). The prevalence of these specialties (dermatology, endocrinology and neurology) was higher for eConsults than for face-to-face visits.

Exhibit II.8. Patterns of eConsult types



Source: Health system data and ConferMED data.

Note: This figure shows the type of referral for eConsult recipients within the impact evaluation sample. The bars show the number of eConsult referrals in each specialty. The numbers from this exhibit were drawn from Appendix B Exhibit B.6.

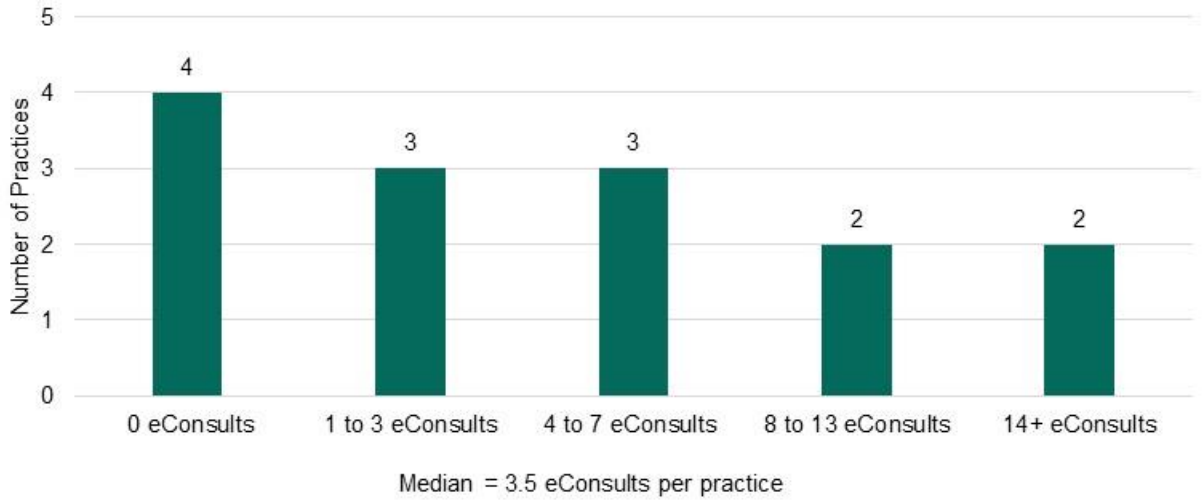
[3] It is notable that there were no eConsults recorded for psychiatry or ophthalmology, which are common specialty types for face-to-face visits (see Appendix Table B.5 to compare the specialties for eConsult use to the specialties of face-to-face visits). It could be that patients already had ongoing relationships with these types of specialists, or that primary care physicians thought that in-person visits were particularly important for patients needing psychiatric care or eye and vision care.

2. Two practices accounted for more than half of eConsults, with a median practice usage of 3.5 eConsults

The distribution of eConsults was not evenly spread among all practices (Exhibit II.9). We tracked the number of eConsults from each practice. In total, there were 14 implementation practices. The median practice usage of eConsults was 3.5, indicating that, on average, practices opted for a relatively small number of eConsults.[4] Of these practices, four practices had zero eConsults. At the other extreme, two practices had more than 14 eConsults. These two practices accounted for more than half of the total eConsults utilized across all practices (not shown), indicating an imbalance in how often practices used eConsults.

This heavy concentration of eConsults within two practices has important implications for interpreting findings from the intervention. As noted in the formative report, eConsult adoption was lower than expected, despite reports of it being easy to use and practitioners expressing generally high satisfaction with the intervention (Felt-Lisk et al. 2022). One factor that differentiated higher uptake of eConsults was strong leadership engagement and a commitment to embedding eConsults as a regular part of practice processes and workflows. This finding is notable and will provide an important caveat to our Section IV finding.

Exhibit II.9. Number of eConsult referrals per implementation practice



Source: ConferMED data and health system data.
Note: The number of eConsult referrals at each practice was calculated for the sample of 14 practices used in the impact evaluation. See Appendix B Exhibit B.7 for details.

E. Summary

The analysis of eConsult recipients' participation patterns indicated that a small portion of select patients received an eConsult, which has important implications for the methods used for the outcome analysis (see Section III). Relative to those with face-to-face specialist visits, eConsult recipients had similar risk scores, but were more likely to have diabetes, suggesting that eConsults were used by patients with specific medical conditions. This highlights that PCPs are more likely to recommend eConsults for conditions that have well-known markers and evidence-based guidelines (for example, diabetes). In

[4] As a point of comparison, patients at implementation practices received 11,732 face-to-face visits with a specialist.

addition, there was a higher concentration of eConsults in certain specialties like dermatology, endocrinology, and neurology, which is consistent with other research (Keely et al. 2013). Women represented the majority of eConsult recipients, even though they comprised a smaller share of eConsult recipients than of face-to-face visit recipients. Finally, we find that the referral of eConsult services was concentrated in a small number of practices, with two practices accounting for the majority of eConsults referrals. This latter finding is consistent with the early implementation findings that eConsults were more heavily concentrated in a smaller number of practices (Felt-Lisk et al. 2022) and has implications in generalizing the findings from the study, which we later discuss in this report.

III. How Do We Estimate Outcomes Using a Matching Approach?

In this section, we summarize our sample and methodological approach to generate estimates of impacts presented in Section IV. Our sample includes the 199 eConsult recipients with available claims data (presented in the prior section) and a pool of patients from non-implementation practices. We generate a comparison group by selecting patients in the non-implementation practices that are similar to eConsult recipients using a matching process. We then present data on the quality of the matches by comparing our treatment group of eConsult recipients to our matched comparison group. Our findings show that the characteristics of the eConsult and comparison groups align, passing an important test of the matching process. We then delve into our methodological framework for estimating impacts. This approach includes making comparisons of outcomes between the eConsult and comparison groups that we adjust using regressions, which is a standard approach to estimating impacts (Kleinbaum et al. 2013).

A. What was the sample of data available for the outcome analysis?

To identify a comparison pool, we selected patients from our non-implementation practices to mirror our sample of eConsult recipients. The pool of comparison patients included those (1) attributed to independent practices in Arkansas that are not participating in the pilot but have at least one clinician that was participating in an advanced primary care initiative (including Comprehensive Primary Care Plus, Primary Care First, or Primary Care Medical Homes)[5] or (2) attributed to a practice within certain health systems in Arkansas. The pool of comparison patients was also limited to those with a face-to-face specialist visit in the same specialty and three-month period as the eConsult recipients.[6]

1. Comparison pool includes over 80,000 patients

An important feature of the comparison pool is the large sample to create matches. Specifically, our starting data included over 60,000 potential comparison patients from independent practices and over 19,000 from system practices that did not implement eConsults.

2. Large starting comparison pool is beneficial for identifying patients with similar characteristics to eConsult recipients

This pool of over 80,000 patients provided flexibility for our matching procedure to identify patients who shared similar characteristics to eConsult recipients. As noted in Section II and shown in Appendix C

[5] This restriction helped narrow the pool of providers to those that were similar to eConsult participants, which were likely to be more advanced and ready to participate in alternative payment models than the average practice.
[6] As noted in Section I, our sample of 199 eConsult recipients includes 187 eConsult recipients from 14 independent practices and 12 from health systems. The timeframe covers those who received an eConsult from an implementing independent practice between February 2021 and July 2022 or from an implementing health system practice between August 2021 and July 2022.

Exhibit C.1, the sample of eConsult recipients has age, risk score, condition, and other characteristics that differentiated them from other patients. Hence, it is important to have a large sample to find similar patients in non-implementation practices who share these characteristics to facilitate the match.

B. What procedure did we use for patient matching?

We used a two-step process to conduct patient matching from the pool of approximately 80,000 patients, none of whom had received an eConsult. The initial step involved exact matching on criteria such as practice type (that is, the health system and eight independent practices described in Section I), specialist visit type, and timing of the baseline visit.[7] The second step used a propensity score model to further refine these matches based on an array of key characteristics. This methodical approach used the maximum amount of information on patient characteristics available to our team to create a match.

Exact matching variables

- **Practice:** Independent or health systems
- **Specialist visit:** Type of specialty of the eConsult/specialty visit (for example, cardiology, dermatology, etc.)
- **Time period of eConsult:** eConsult visit is in same three-month window as specialist visit

Additional propensity score variables

- **Risk scores:** Predictive measure of individual health risk from the commercial data.
- **Selected medical conditions at baseline:** Alzheimer's, cancer, congestive heart failure, chronic kidney disease, chronic obstructive pulmonary disease, diabetes, and all other.
- **Health care utilization:** Emergency room visits and hospitalizations in the two years before the baseline visit
- **Patient demographics:** Age and gender
- **Practice size:** Number of patients and number of physicians
- **County characteristics:** Number of COVID cases per population in county, whether in a metropolitan area, and social vulnerability index

1. Step 1: Exact matching on specialist and practice type

As a first step, we created pools of exact matches of eConsult recipients to patients in the non-implementation practices based on their practice type, type of specialist, and time period of the baseline visit. Specifically, patients in health systems had to exactly match to patients in the comparison group who also went to health systems and had a baseline specialist visit within the same specialty as the eConsult, and within the same three-month period of the eConsult. For example, a patient that had a dermatology eConsult within a health system on March 15, 2022, could match to another patient with a specialty visit in dermatology within a health system between February 1, 2022, and April 30, 2022. Also, to be included in the comparison pool, the comparison group member could not have a visit in the same specialty as the eConsult visit in the six months prior to the baseline specialist visit. This restriction made the pool of potential comparisons similar to the eConsult group, as no treatment group members had a visit to a specialist in the same specialty as their eConsult in the six months prior to the eConsult.

[7] For eConsult recipients, the baseline visit represents the receipt of the eConsult. For the comparison group, this represents the face-to-face visit to the specialist that was in the same specialty and three-month time period as the eConsult visit.

2. Step 2: Propensity score matching on remaining characteristics to generate final comparison group of 985 patients

As a second step, we then used a propensity score model to further match patients based on key characteristics (see text box). This model matched patients on several key characteristics including risk scores, chronic conditions at baseline, health care utilization in the two years before the baseline visit, patient demographic characteristics, practice size, and county characteristics.

In total, we matched 985 patients from non-implementation practices to form the comparison group. These patients represent comparable patients to eConsult recipients. The only difference is that they did not receive an eConsult. Hence, a comparison of the outcomes of this group to eConsult recipients should yield an initial estimate of eConsult impacts under the assumption of a strong matching process that aligns the characteristics of the two groups, which we assess next.

C. How well did the match work?

Our assessment of the match's effectiveness revolves around comparing the 985 patients in the comparison group with our sample of 199 eConsult recipients. We used statistical tests to identify any differences between the two groups. A successful match is expected to yield groups that exhibit similarity across these characteristics, indicating a reliable and accurate comparison. In the following section, we provide a concise summary of the statistical tests and outcomes from the comparisons, which offers insights into the degree of alignment achieved through our patient-matching process.

1. Statistical tests to assess the quality of the match

We present statistical tests (*p*-values) that assess differences in treatment comparison means. *p*-values of less than 0.10 generally indicate that the difference in means between the eConsult and comparison groups is statistically significant. Because we aim to have a comparison group where the two groups are similar, a good comparison group would generally have *p*-values that are not less than 0.10.

2. Comparison group patient characteristics strongly aligned with eConsult recipients

Our matching process produced a comparison group that was comparable to the characteristics of our eConsult recipients' sample based on these statistical tests (Exhibit III.1). There were no differences (that is, a p-value of 1.0) in the variables for the exact matching process (practice and type of specialty). This lack of difference is expected given operation of the exact matching variables. For the remaining variables from the propensity score matching process, we find strong alignment, meaning that the average values for key measures for eConsult recipients were similar to the average values for comparison group members. In total, out of the 18 variables we used in the propensity score model, only one (age at the time of the baseline visit) indicated that the mean for eConsult recipients was significantly different than the mean for the comparison group. Even though statistically different, the relative magnitude of the difference was small.[8] With a large number of statistical tests, this one relatively small difference is not surprising. As we describe below, we adjust for any small differences in characteristics by adjusting our impact estimates using a regression model.

[8] In particular, the average age of eConsult recipients was 43.5, relative to 45.7 for comparison group members.

Exhibit III.1. Means of matching variables for eConsult recipients and comparison group

Matching variable	eConsult recipients (n=199)	Comparison group (n=985)	p-value for treatment-comparison difference
Patient characteristics used in propensity score model			
Patient risk score	2.6	2.4	0.45
Had emergency department visit during baseline period	28.1%	31.3%	0.52
Had hospitalization during baseline period	8.5%	8.3%	0.94
Percent female	60.3%	62.1	0.72
Age	43.5	45.9	0.08*
Has Alzheimer's	0.0%	0.1%	0.64
Has cancer	3.5%	3.5%	1.00
Has congestive heart failure	3.5%	2.1%	0.37
Has chronic obstructive pulmonary disease	4.0%	3.1%	0.63
Has diabetes	18.1%	17.8%	0.94
Has chronic kidney disease	2.5%	1.5%	0.48
Has other chronic condition	85.4%	89.4%	0.23
Specialty of eConsult/specialty visit (used in exact matching)			
Allergy	1.0%	1.0%	1.00
Cardiology	3.0%	3.0%	1.00
Dermatology	18.6%	18.6%	1.00
Endocrinology	17.6%	17.6%	1.00
Ears, nose and throat	1.5%	1.5%	1.00
Gastroenterology	4.5%	4.5%	1.00
Hematology	11.6%	11.6%	1.00
Infectious disease	2.0%	2.0%	1.00
Nephrology	4.5%	4.5%	1.00
Neurology	13.6%	13.6%	1.00
Nutrition	2.5%	2.5%	1.00
Obstetrics and gynecology	2.0%	2.0%	1.00
Orthopedics	2.0%	2.0%	1.00
Pain medicine	1.0%	1.0%	1.00
Pulmonology	2.5%	2.5%	1.00
Rheumatology	10.6%	10.6%	1.00
Sleep medicine	0.5%	0.5%	1.00
Urology	1.0%	1.0%	1.00
Practice characteristics used in propensity score model			
Patients at practice baseline	6,326	5,837	0.55
Number of primary care physicians at practice at baseline	14	14	0.85
Practice was in a health system	6.03	6.03	1.00
County characteristics used in propensity score model			
COVID cases	9,893	9,961	0.77
County is in metropolitan area	37%	42%	0.30
Social Vulnerability Index (2018)	0.32	0.34	0.27

Source: Health system data, ConferMED data, and Arkansas Blue Cross Blue Shield data.

Note: The eConsults (treatment) group consists of those who received an eConsult from an implementing independent practice between February 2021 and July 2022 or from an implementing health system practice between August 2021 and July 2022. Comparison patients included those (1) attributed to independent practices in Arkansas that were not participating in the pilot but have at least one provider in a primary care initiative (Comprehensive Primary Care Plus, Primary Care First, or Primary Care Medical Homes) or (2) attributed to health system practices in Arkansas. The pool of comparison patients was also limited to those with a specialist visit in the same specialty and in the same 3-month time period as the eConsult of the treatment patient. The matched comparison group consists of those patients in the potential comparison pool that were most similar to eConsult recipients in terms of their demographic characteristics, baseline health care expenditures and service use, risk scores, and characteristics of the practice and the practice's county.

*/**/*** Indicates a statistically significant difference between the treatment and comparison group at the .10/.05/.01 level.

D. What are the methods to generate estimates of impacts on outcomes?

To generate estimates of impacts on outcomes, we used a methodological approach to identify outcomes and present estimates from the literature cited above. In collaboration with the Center, we developed measures for the key outcomes described in the logic model presented in Section I. An important component of our approach was identifying primary outcomes (expenditures for all services) and secondary outcomes (utilization and other spending) from this model, which we use to organize our findings in Section IV. We estimated impacts on outcomes using a multivariate regression model that controls for baseline differences in outcome measures, along with other possible confounding variables. In addition, we conducted sensitivity tests to assess the robustness of our findings. Below, we provide a concise summary of this methodology, serving as a preview of the structure of the finding presented in Section IV.

1. Defined primary and secondary outcomes to address multiple comparisons problem

When assessing the impact of eConsults on primary outcomes (total expenditures for all key services) and secondary outcomes (utilization and other spending), we take account of whether the effect stems from a true program effect or random chance in reviewing p-values. The misinterpretation of p-values has contributed to the replication crisis seen in many fields, where statistically significant findings often fail to replicate in subsequent studies, indicating potential chance effects rather than true impacts (Wasserstein and Lazar 2016; Greenland et al. 2016). This misinterpretation arises from the problem of multiple hypothesis testing, where the false discovery rate, (that is, the proportion of statistically significant impacts due to random chance rather than program effects) can be higher than the level of significance used for testing (typically 5 percent).

To mitigate multiple comparison issues, we use the logic model to specify a small number of primary and secondary outcomes. By focusing on a limited number of outcomes, we reduce the likelihood of finding impacts by chance alone without significantly undermining the statistical power of the evaluation to detect true impacts. We operationalize this approach in the presentation of findings by placing greater emphasis on the interpretation of our primary

Primary outcomes

- **Expenditures for all key services:** Sum of per member per month expenditures for specialist visits, emergency department visits, hospitalizations, lab and imaging services

Secondary Outcomes

Utilization

- **Emergency department visit**: Variable equal to one for any emergency department visit in a month
- **Number of specialty visits:** Number of specialty visits in a month
- **Lab and imaging:** Variable equal to one for any lab and imaging order in a month
- **Hospitalization.** A variable equal to one for any hospitalization in a month.

Service expenditure components

- **Emergency department expenditures:** Total emergency department expenditures in a month
- **Specialty visit expenditures:** Total specialty expenditures in a month (including $50 per eConsult)
- **Lab and imaging expenditures:** Total lab and imagining expenditures in a month

Time frame

We measure all outcomes for eConsult recipients in the month of eConsult, as well as the two months following the eConsult. We measure all outcomes for the comparison group in the month of the specialty visit, as well as the two months following the specialty visit.

outcome than of our secondary outcomes. The approach balances the need for addressing the potential multiple comparisons and has been used in other studies (see Pocock et al. 2021; Schochet 2008; Wittenburg et al. 2022; Patnaik et al. 2022).

As specified in our logic model, the primary outcome is includes expenditures all key services, defined as those services expected to be affected by the intervention. Specifically, the primary measure is the sum of service expenditures for specialist visits, emergency department visits, hospitalizations, and lab and imaging services. Our secondary outcomes include utilization and other components of expenditures. In addition, we created utilization measures for each key service category and examined how the costs for each of these services were distributed. All outcome measures capture activities two to three months after the initial eConsult. In our presentation of impacts in Section IV, we lead with the presentation of the primary outcome and then use the other measures to support the interpretation of that outcome, as well as explore other outcomes from the evaluation. We also estimated impacts during the month of the eConsult, but do not consider that month to be the timeframe for our follow-up period because the month of the eConsult includes the period both before and after the eConsult occurred.

Like many health care analyses, in our primary analysis, we use methods to ensure that our results are not unduly affected by extreme values (Weichle et al. 2013). Specifically, to reduce the chance of spurious outliers, we winsorized our expenditure outcomes, meaning that we replaced extreme values. Our specific approach to winsorization involved replacing any expenditure values above the 98th percentile with the value at the 98th percentile for the sample. This step is particularly crucial due to the extreme variation in expenditures for adverse events, such as hospitalizations. While rare, these occurrences have the potential to significantly impact the interpretation of the estimated impacts. This approach helps mitigate the influence of these outliers and ensures a more accurate representation of the overall expenditure distribution. Note that because less than 2 percent of our sample had a hospitalization, expenditures for hospitalizations become zero when we winsorize. Therefore, we do not report expenditures for hospitalizations alone, though they are a component of the "sum of key expenditures" measure, and we also examine the binary measure for whether a person had a hospitalization (as measured by whether they had any expenditures for inpatient services).

2. Implemented regression model to adjust comparisons of outcomes between treatment and comparison group

We estimate the impact of the eConsult pilot by calculating regression-adjusted differences between the treatment group (eConsult recipients) and the comparison group:

$$y_i = \alpha + \beta T_i + \delta X_i + \varepsilon_i$$

The regression model estimated the effect of assignment to the treatment group (T_i) on outcome of interest (y_i) while controlling for any chance differences in characteristics (X_i) among the treatment and comparison groups. The coefficient of interest is β, which measures the adjusted difference in means between the treatment and comparison groups. Because of the matched comparison group design, β provides an estimate of the impact of an eConsult . The model controls for several individual and practice characteristics in X_i, including baseline measures of expenditure outcomes, patient risk score, health care utilization in the two years before the eConsult, patient demographic characteristics, patient chronic conditions, practice characteristics, and county characteristics of the patient's practice. These control variables account for any chance differences between the treatment and comparison groups and enhance the precision of the estimates. As with our matching process, we note statistical differences at the 10

percent level. In addition, we describe the impact estimate relative to the comparison group mean, to provide the reader with a sense of the magnitude of the impact estimate.

3. Tested the sensitivity of findings in two ways

We also run two sensitivity tests. First, we test a model that removes outliers instead of winsorizing them. This test represents an alternative to winsorizing and provides insights into how much potential outliers could drive a result. Second, we examine the effects on key outcomes using a sample that excludes patients with less than three months of follow-up data. This test enables us to see if effects might have been diluted because of the inclusion of some sample members that only had a short follow-up period.

Consistent with our logic model, we prioritize presenting outcomes for the sum of expenditures for all key services and place the greatest emphasis on these findings when summarizing the results. We also provide a summary of impacts on other outcomes, which we consider as secondary.

E. Caveats to findings

Our findings on impacts should be interpreted with some caveats for three reasons. First, because we use a quasi-experimental design, it is possible that unobservable characteristics might influence outcomes from our matches. Specifically, even after matching on patient and practice characteristics, it is possible that there were unobserved differences between the two groups. This issue is especially notable given the select sample of patients (noted in Section II) that received eConsults. For example, physicians could have been more likely to refer patients for eConsults who seemed healthy and unlikely to experience an adverse event; they also might have disproportionately provided eConsults for patients who seemed hesitant to seek face-to-face specialty care. It is possible that patient preferences played a role in determining the receipt of an eConsult. If physicians referred patients for eConsults due to factors that we could not control for, and if those factors were correlated with patients' subsequent expenditures and service use, our results would be biased. We make every attempt to minimize these potential biases, including using winsorization to address potential adverse events, though these biases cannot be completely controlled for in a non-experimental design.

A second caveat is that our limited sample size of eConsult recipients (n = 199) limits our power to detect smaller impacts. We address this issue by showing confidence intervals in our appendices for impact estimates so readers can assess the bands on our impact estimates. In the text in Section IV, we also add caveats to our findings when we report statistically insignificant findings.

A final caveat, which relates to the second limitation is that our ability to generalize to other practices is limited. Specifically, as noted in Section II, the majority of the eConsults were provided by only two practices and eConsult delivery was concentrated among larger providers. Hence, our results may not be generalizable to all providers.

F. Summary

Our analysis resulted in a strong match between eConsult recipients and the comparison group, reinforcing the reliability of our methodological approach. The two-step process began with exact matching on criteria such as practice type, specialist visit type, and timing of the baseline visit, forming pools of exact matches. Then, propensity score matching further refined these matches based on an array of key characteristics, yielding very comparable samples. In total, we identified 985 patients from non-implementation practices to form a comparison group. Statistical tests affirmed the quality of the match, with strong alignment in key measures between eConsult recipients and the 985 patients in the

comparison group. To further refine the estimates of eConsult impacts, we employ a multivariate regression model that controls for baseline differences in outcome measures and other potential confounding variables. This model calculates the adjusted differences between the treatment and comparison groups as impacts. We measure impacts by assessing statistical significance through p-values, calculating regression-adjusted differences between the treatment group (eConsult recipients) and the comparison group.

Overall, the methodology employed in this study represents a robust approach for generating impact estimates within a non-experimental framework. By utilizing well-matched comparison groups and integrating precise regression models, we have constructed a compelling evidence base. However, it is essential to acknowledge the inherent caveats associated with non-experimental designs, such as potential unobservable biases, and the constraints posed by the limited sample size in this study, which may influence the generalizability of the findings. Despite these limitations, the strong match and rigorous analytical approach underscore the promise of our methodology in estimating impacts.

IV. What Were the Expenditure and Utilization Outcomes of Patients Who Received eConsults?

In this section, we summarize impacts on expenditure and utilization outcomes over two distinct time frames: the month of the eConsult and the next two months. This split allows for a summary of immediate impacts and any lingering effects of eConsults in future months. We hypothesized that the eConsult would have a pronounced impact during the initial period, especially on specialty visits, with diminishing effects over time.

As described in Section III, to identify impacts, we compare the outcomes of our treatment group (eConsult recipients) to the matched comparison group. We employ regression models to adjust for any incidental discrepancies in characteristics between the two groups. We present findings for the primary outcome (total expenditures for all key services) and treat all other outcomes (utilization and other expenditure measures) as secondary. We use statistical tests to identify impacts that are significantly different from zero. In the text, an impact indicates that the outcomes are statistically different at the 10 percent level (we also label whether the impact is significant at the 5 and 1 percent levels in the tables).[9] Conversely, no impact indicates the difference between the eConsult and comparison group was not statistically significant. To provide a useful frame of reference for understanding the *size* of these impacts, we report them relative to the mean of the comparison group. This additional reporting provides context for how big the impact is relative to the comparison group outcomes. Our findings are visually represented through charts. We also validate the robustness of our findings through sensitivity tests.

Appendix D includes a full, tabulated summary of our impact findings. Appendix D Exhibits D.1 to D.4 show the estimated impacts on each outcome measure along with confidence intervals and significance tests for the impact estimate. We note the use of confidence intervals given the limitations noted in Section III that our samples are relatively limited (199 eConsult recipients). Hence, the confidence intervals provide readers with some additional bands for understanding the impacts here, though we focus on statistically significant findings in the text below. Appendix D Exhibits D.5 and D.6 show the detailed regression output for the primary expenditure measure during the month of the eConsult and the two months following the eConsult. These exhibits show both the coefficients on treatment status (which is

[9] The statistical interpretation of these results implies that they have a p-value less than 0.10, which indicates that there is less than a 10 percent probability that the observed differences occurred by chance alone.

the impact estimate) and the coefficients on regression control variables. We do not focus on the coefficients for regression control variables in this section because most are not statistically significant because our comparison group was well-matched to the eConsult group.

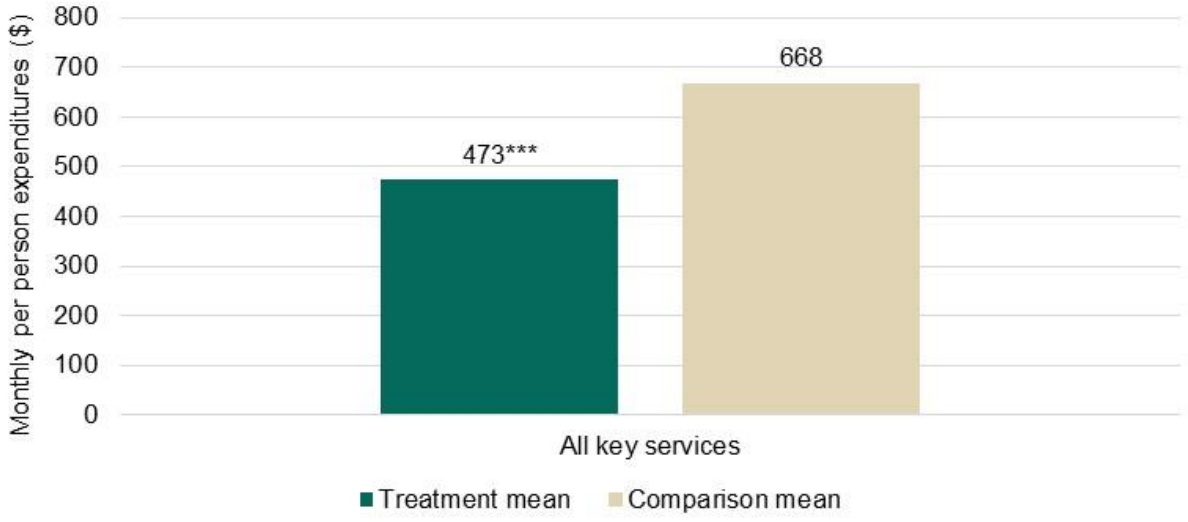
A. What were expenditure and service use patterns during the month of the eConsult?

As a starting point, we examine impacts on our primary outcome measure (total expenditures for all key services) in the month of the eConsult (or in the case of the comparison group, the face-to-face specialty visit). We then examine how the different components of these expenditures (specialty, emergency department, hospitalizations, and lab and imaging) potentially drive these impacts. We expected to find large impacts on expenditures for specialty visits given that eConsults (which are relatively inexpensive) were intended to replace face-to-face visits. Below, we summarize our findings.

1. Total expenditures for key services were lower for eConsult recipients

The eConsult pilot generated positive impacts on savings. eConsult recipients' average monthly expenditures were $195 lower on all key services (hospitalizations, emergency department, specialty, and lab and imaging) relative to comparison group members' monthly expenditures ($473 vs. $668, or a 29 percent reduction). This $195 reduction is in line with the potential savings that might occur mechanically from employing eConsults (which cost $50 per eConsult) in lieu of a face-to-face specialist visit. For example, according to a brief from the Agency for Healthcare Research and Quality, the overall mean expense for an office-based specialist visit in 2016 was $265, though costs ranged from $159 to $419 across specialty types (Manchlin and Mitchell 2018). We now turn to examine the source of these expenditure reductions below (Exhibit IV.1).

Exhibit IV.1. Expenditures for all key services during month of eConsult



Source: ConferMED data, health system data, and Arkansas Blue Cross Blue Shield data.

Note: Estimates are adjusted based on a regression that controlled for patient demographic characteristics, baseline service use and expenditures, baseline risk scores, practice size, whether the practice was in a health system, and characteristics of the practice's county. Expenditures were winsorized, meaning that outliers (above the 98th percentile) were replaced with the value of the 98th percentile. "Key services" include hospitalizations, emergency department visits, specialty services and lab and imaging. Details are shown in Appendix D.1 Exhibit D.1.

*/**/*** Impact estimate statistically different from 0 at the .10/.05/.01 level.

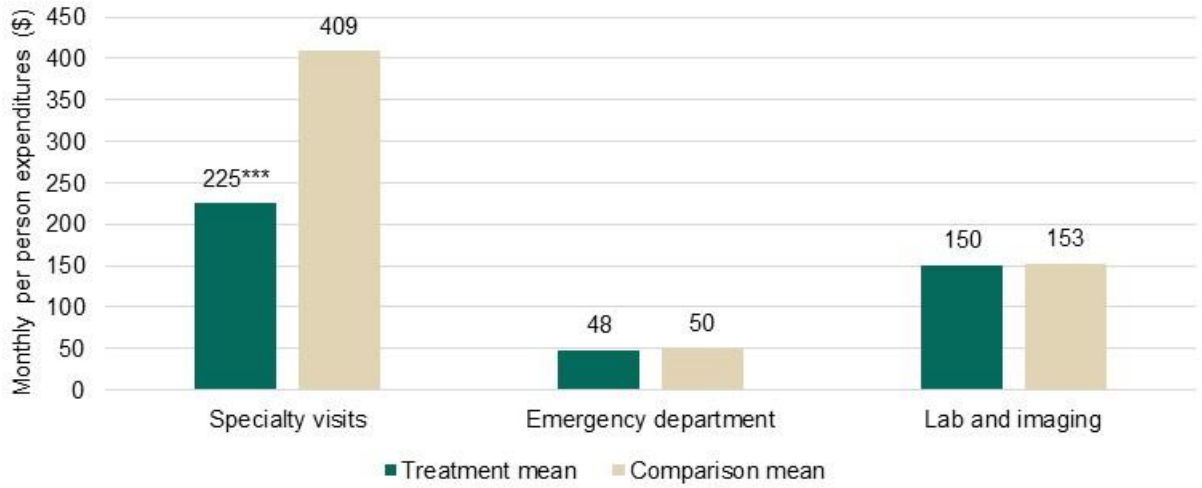
2. Declines in specialty visit costs drove the declines in total expenditures for key services

The primary driver behind the savings in total expenditures for key services was a reduction in expenditures for specialty visits (Exhibit IV.2). In particular, eConsult recipients had lower average monthly expenditures ($225 vs. $409) than the comparison group—a decrease of $184 or 45 percent.

When we drilled down further (see Appendix D, Exhibit D.1), we confirmed that the reduction in specialty visits primarily occurred within implementation specialties (that is, the specialties where eConsults were offered). In particular, eConsult recipients' expenditures for visits to implementation specialties were $144 lower than those for the comparison group ($98 vs. $242). This confirms that the overall reduction in specialty visit expenditures was driven by the use of an eConsult rather than a face-to-face specialty visit, consistent with the theoretical expectations for the pilot.

As expected, we do not observe impacts on expenditures for emergency department visits or for lab and imaging services. The average monthly expenditures for lab and imaging (approximately $150) and emergency department visits (approximately $50) were virtually identical across the two groups. We do not include expenditures for hospitalizations in the exhibit here because so few people had hospitalizations.[10]

Exhibit IV.2. Average expenditures for selected services during month of eConsult



Source: ConferMED data, health system data, and Arkansas Blue Cross Blue Shield data.

Note: Estimates are regression adjusted based on a regression that controlled for patient demographic characteristics, baseline risk scores, practice size, whether the practice was in a health system, and characteristics of the practice's county. Expenditures were Winsorized, meaning that outliers (above the 98th percentile) were replaced with the value of the 98th percentile. Expenditures for hospitalizations are zero when Winsorized (so are not shown in the figure). However, expenditures for hospitalizations are included in the total for all key services, so the sum of the selected services shown in Exhibit IV.2 is less than "all key services" reported in Exhibit IV.1. Details are shown in Appendix D Exhibit D.1.

*/**/*** Impact estimate statistically different from 0 at the .10/.05/.01 level.

[10] We note this exclusion here because the sum of the individual expenditure components in Exhibit IV.2 will not sum to the total in Exhibit IV.1.

3. The pilot increased the likelihood of receiving an additional specialty visit during the eConsult month

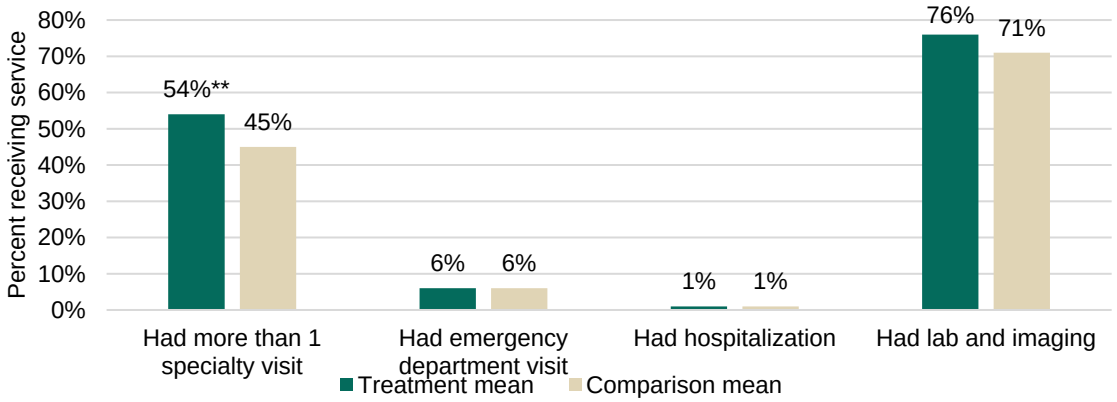
The eConsult pilot did have a small but positive impact on the percentage of people who received an additional specialist visit during the month of the eConsult (Exhibit IV.3). We measured additional specialty visits because, by design, all members of both the eConsult and comparison groups had one specialty visit. The additional specialty visit could have been a face-to-face to the same specialist or to a new specialist. One interesting aspect of our findings is that a sizeable share of both eConsult and comparison group patients had more than one visit (53 percent and 45 percent, respectively).

At first, it might seem counterintuitive that patients using eConsults have more specialist visits but lower overall costs. However, the data provides clarity. As noted in Exhibit IV.2 above, eConsults significantly cut the cost of initial specialist visits. Despite a slight rise in follow-up visits shown in Exhibit IV.3, it was not enough to substantially increase overall expenditures for specialty visits because the cost per visit was so much lower for eConsult recipients. Therefore, even with the 9-percentage point increase in eConsult recipients needing additional specialty care, the costs of these additional visits did not offset the initial savings from using eConsults.

4. There were no changes in other visits or services (emergency department, in-patient, or lab and imaging)

The eConsult pilot did not have an impact on emergency department, in-patient, or lab and imaging service utilization (Exhibit IV.3). A relatively small minority of eConsult recipients and comparison group members had an emergency department visit (6 percent) or hospitalization (1 percent).There was a higher incidence of lab and imaging use among both groups, with slightly higher (but statistically insignificant) lab and imaging use among eConsult recipients (76 percent vs. 71 percent). While statistically insignificant, we note this small change because it will become relevant to our follow-up findings two months after eConsult, as shown below.

Exhibit IV.3. Percentage receiving emergency department, hospitalization, and lab and imaging services during month of eConsult



Source: ConferMED data, health system data, and Arkansas Blue Cross Blue Shield data.

Note: Services are measured during the month of the eConsult (for the treatment group) and during the month of the baseline specialist visit for the comparison group. Estimates are regression adjusted based on a regression that controlled for patient demographic characteristics, baseline risk scores, practice size, whether the practice was in a health system, and characteristics of the practice's county. Details are shown in Appendix D Exhibit D.1.

*/**/*** Impact estimate statistically different from 0 at the .10/.05/.01 level.

B. How were eConsult expenditures and service use affected in the two months following the eConsult?

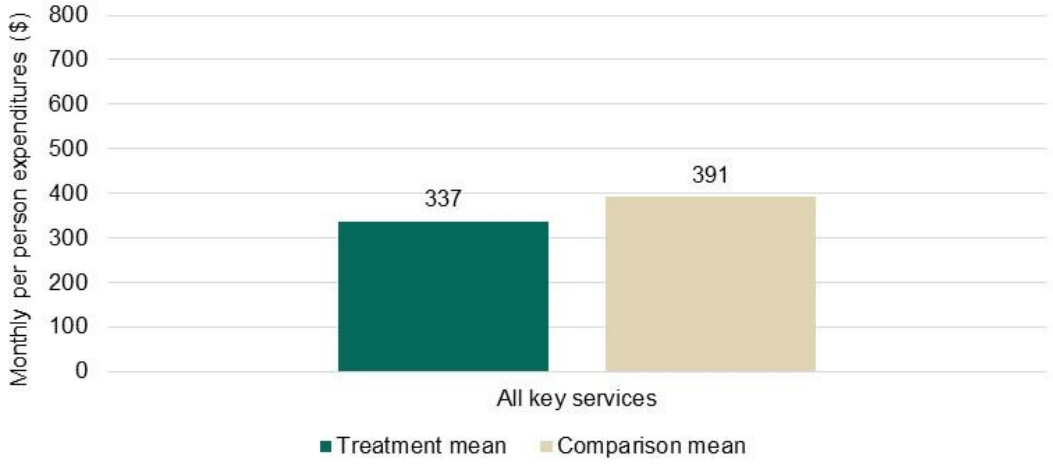
We now examine the impacts on each of the outcomes above in the two months following the eConsult (or in the case of the comparison group, the face-to-face specialty visit). We present findings in the same way as above, starting with our primary outcome measure (expenditures for all key services) and then our secondary expenditure and utilization measures. As expected, the impacts diminish in later months for all outcomes.

1. There were no impacts on expenditures

The eConsult pilot did not generate impacts on monthly expenditures for all key services in the two-month follow-up period (Exhibit IV.4). Average monthly expenditures for all key services were lower for eConsult recipients (similar to above), but this finding was not statistically significant.

We do not find any impacts on the expenditure components for specific services (specialty, emergency department, and lab and imaging) (Exhibit IV.5). Specialty service expenditures represented the bulk of the spending for both groups and were slightly higher but not statistically significant for the comparison group than for eConsult recipients ($193 vs. $226 average per person per month spending). This finding is consistent with expectations of the pilot that the impact of eConsults would diminish over time, as this reduction was only $33 here, but was $195 in the initial month. Emergency department and lab and imaging expenditures represented substantially smaller shares of spending, and there were no notable differences between eConsult recipients and the comparison group.

Exhibit IV.4. Expenditures for all key services during the two months following eConsults

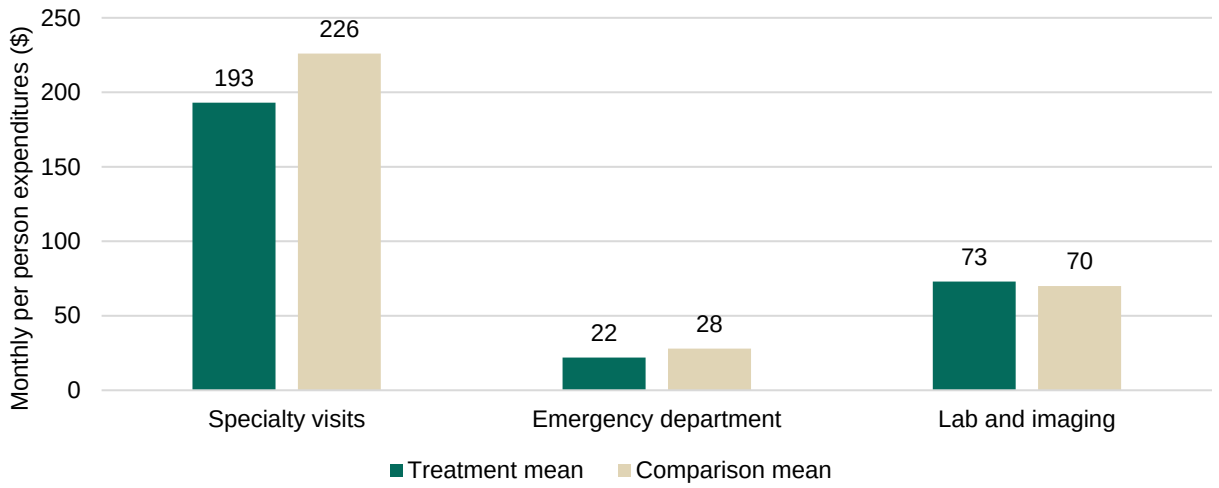


Source: ConferMED data, health system data, and Arkansas Blue Cross Blue Shield data.

Note: Estimates are adjusted based on a regression that controlled for patient demographic characteristics, service use and expenditures during the baseline period, baseline risk scores, practice size, whether the practice was in a health system, and characteristics of the practice's county. Expenditures were winsorized, meaning that outliers (above the 98th percentile) were replaced with the value of the 98th percentile. Details are shown in Appendix D Exhibit D.2.

*/**/*** Impact estimate statistically different from 0 at the .10/.05/.01 level.

Exhibit IV.5. Expenditures for selected services during the two months following eConsults



Source: ConferMED data, health system data, and Arkansas Blue Cross Blue Shield data.

Note: Estimates are adjusted based on a regression that controlled for patient demographic characteristics, service use and expenditures during the baseline period, baseline risk scores, practice size, whether the practice was in a health system, and characteristics of the practice's county. Expenditures were winsorized, meaning that outliers (above the 98th percentile) were replaced with the value of the 98th percentile. Expenditures for hospitalizations are not shown because the average was zero after winsorization. However, expenditures for hospitalizations are included in "all key services", so the sum of the selected services shown in Exhibit IV.5 is less than "all key services" reported in Exhibit IV.4. Details are shown in Appendix D Exhibit D.2.

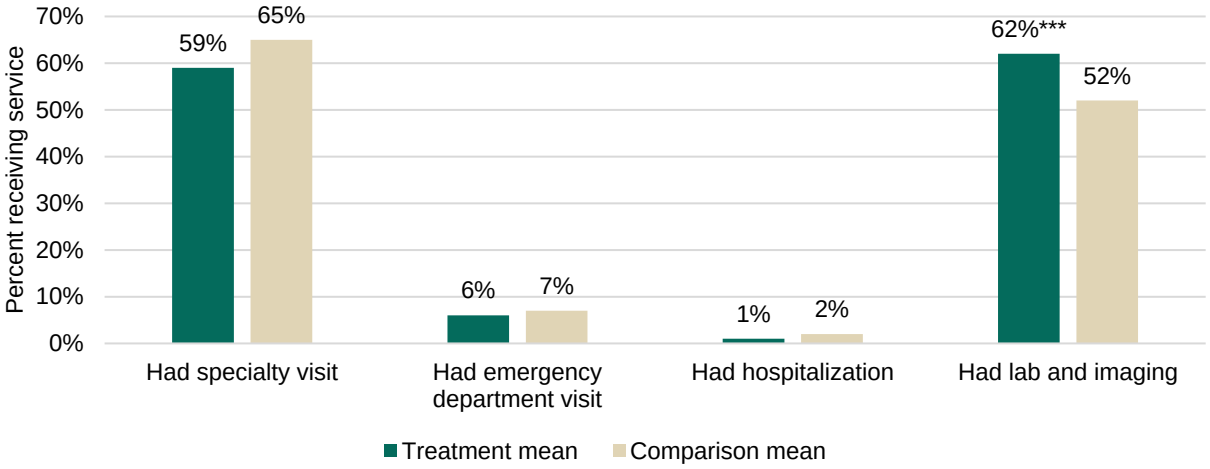
*/**/*** Impact estimate statistically different from 0 at the .10/.05/.01 level.

2. Impacts exist for lab and imaging use but no other services

The eConsult pilot increased lab and imaging service use (Exhibit IV.6). eConsult recipients were more likely than the comparison group to use lab and imaging services (62 vs. 52 percent, a 19 percent difference). The pattern of increased lab and imaging is consistent with what we observed above, though the result here is statistically significant. We are careful not to put too much weight on the finding given that this is a secondary outcome and there is not a corresponding statistically significant difference in lab and imaging expenditures.

We do not find impacts on emergency department or on hospitalizations. As above, both types of service usage represented a small minority of services during the two-month follow-up period.

Exhibit IV.6. Percentage using services during the two-month follow-up period



Source: ConferMED data, health system data, and Arkansas Blue Cross Blue Shield data.

Note: Services are measured during the two months following the month of the eConsult (for the treatment group) and the two months following the month of the baseline specialist visit for the comparison group. Estimates are regression adjusted based on a regression that controlled for patient demographic characteristics, baseline risk scores, practice size, whether the practice was in a health system, and characteristics of the practice's county. Details are shown in Appendix D Exhibit D.2.

*/**/*** Impact estimate statistically different from 0 at the .10/.05/.01 level.

C. How sensitive were the results to alternative specifications?

Our findings are similar across alternative specifications (see Appendix D Exhibit IV.3 and IV.4). We tested three different specifications that did the following:

1. Removed outliers rather than truncating them at the 98th percentile
2. Limited the sample to those who had data for the full follow-up period

Regardless of the specification, we continue to find the same pattern of results noted above. Specifically, all of our findings show savings across key services (ranging from $181 to $196 per person) during the month of the eConsult. In addition, we find that the savings in key services were driven by savings in specialty visits due to the inexpensive cost of eConsult. Finally, we continue to find no impacts on other expenditure measures during either the month of the eConsult or the two-month follow-up period.

D. Summary

The eConsult pilot exhibited anticipated impacts on expenditures during the month of the eConsult across all specifications. We estimated that there was a $195 reduction in expenditures for key services, almost entirely driven by the reduction in specialty care expenditures in the month of the eConsult visit. The magnitude of this impact and the corresponding reduction in expenditures for eConsult visits in the implementation specialties align with our expectations from the logic model. In essence, eConsults were less expensive than face-to-face specialty visits. There were no impacts on hospitalizations or emergency department visits following eConsult, suggesting that eConsults did not impact patient access to needed services and is safe to deploy in clinical settings and did not drastically compromise patient safety in the short term. While we found a modest increase in patients receiving lab and imaging services during the two months following the eConsult, this impact was a secondary outcome and was not accompanied by an increase in expenditures for these services. Hence, we do not emphasize this finding, particularly in light of the impacts on our primary service expenditure noted above.

The impacts of the eConsult on expenditures and on other outcomes began to diminish in the two-month follow-up period. We do not find any statistically significant impacts on expenditures during this time, and the effects on other outcomes were very limited. Specifically, average monthly expenditures for key services were lower for eConsult recipients, but this finding was not statistically significant. We do not find any impacts on the expenditure components for specific services (specialty, emergency department, and lab and imaging). We do find a statistically significant increase in lab and imaging use that was modest, though we are careful not to over interpret the results given it is a secondary outcome.

As noted in Section III, limitations to our model include the non-experimental design, limited sample sizes, and generalizability. Despite these limitations, the consistency in the pattern of findings with the logic model and the relative size of the impact estimates, given the higher costs of face-to-face specialty care, are credible. This consistency with theoretical predictions, in particular, should foster confidence in the robustness of the results.

V. Discussion

The analysis of eConsult recipients uncovers logical patterns in their usage. Characteristics reveal that patients with specific conditions (such as diabetes) and in certain specialties (like dermatology, endocrinology, and neurology), are more likely to receive eConsults. eConsult utilization was also notably concentrated within two high-utilizer practices, a finding consistent with earlier observations. This concentration has implications for the generalizability of the results and emphasizes that PCPs are more likely to recommend eConsults for conditions with well-known markers.

In terms of impact, the eConsult pilot exhibited anticipated financial savings, with an average reduction of $195 in expenditures for key services during the month of the eConsult, predominantly due to a decrease in specialty care costs. This reaffirms that eConsults are a less expensive alternative and the lack of adverse events suggests they are likely safe to deploy in clinical settings.

These impacts began to diminish in the two-month follow-up period, reflecting a trajectory that was expected the further we moved out from the month of the eConsult. Specifically, the analysis revealed no significant changes in expenditures for key services such as specialty care, emergency department visits, and lab and imaging during this period. While a modest, statistically significant increase in lab and imaging use was observed, these effects were considered secondary outcomes and therefore were not

emphasized. The lack of continued financial impact in the subsequent months underscores the immediate but not sustained nature of the cost savings associated with eConsults.

Despite certain limitations in our analysis, such as a non-experimental design and limited sample size, our results align closely with the expectations outlined in the logic model of how impacts might emerge. The consistency in findings across multiple sensitivity tests lends further credibility to the results and fosters confidence in their robustness. The pilot provides a compelling case for the wider adoption and potential scalability of eConsults across different health care settings in Arkansas. The consistent demonstration of significant savings, particularly in relation to specialty care visits, highlights the model's potential utility in a broader context. Nevertheless, it is crucial to exercise caution when making generalizations due to the original study's limited sample size and heavily concentrated use of eConsults among a smaller number of providers.

Further expansion of eConsults will need to consider the implementation lessons from the formative report (Felt-Lisk et al. 2022). The report underscored key operational factors such as strong leadership engagement and clear goal setting for successful integration. Providers' resistance to change emerged as a notable barrier, suggesting the necessity for comprehensive organizational change management strategies. Furthermore, the report stressed the importance of instructional support for posing eConsult questions and incorporating reminders to boost utilization. While specialists generally reported positive experiences, the need for more focused questions from PCPs during the eConsult and a reassessment of possibly counting eConsults toward productivity metrics was expressed. The lower-than-expected eConsult utilization presents an area for improvement, with the findings providing a roadmap for refining the implementation and utilization of eConsults to maximize potential benefits.

An expanded implementation that considers these lessons and further research could help validate the efficacy and cost-effectiveness of eConsults in varying contexts, thereby strengthening the validity of the study's findings. This expansion would also provide a more robust understanding of the program's replicability in other settings and its potential impacts on the broader health care landscape.

A potential avenue for enhancing future research lies in examining the benefits to patients, with an emphasis on patient access, satisfaction, and outcomes. The formative report (Felt-Lisk et al. 2022) underscored that PCPs were motivated to provide eConsult referrals largely due to perceived patient benefits. However, our study lacked concrete data on these components, pinpointing a crucial area for future investigation. As eConsults potentially expand within Arkansas, incorporating measures of patient access, satisfaction, and outcomes with the eConsults process could provide invaluable insights.

Appendix A: Summary of Findings from Summative Report

The Project Arkansas eConsultations had several intervention components to support the implementation of eConsults to facilitate the utility, uptake, and impact of eConsults in a private insurance market with limited specialist availability. The components included the following:

- **Outreach to health system and independent practices.** Electronic Consults (eConsults) were introduced as an innovative approach to reduce reliance on costly specialist services. eConsults allowed primary care providers (PCPs) to seek input from specialists on specific clinical questions through an electronic platform, avoiding the need for expensive face-to-face consultations. This intervention aimed to improve access to specialty care, reduce waiting times for appointments, and minimize the use of emergency department services.
- **Integration with health records.** The program included the integration of eConsults into the electronic health records of participating health systems and into the workflows for independent practices. This integration streamlined the process of submitting and receiving eConsults, ensuring seamless communication between PCPs and specialists.
- **Financial incentives.** Financial incentives were provided to encourage participation, such as seed funding to institutions and compensation for both PCPs and specialists involved in eConsults. These interventions aimed to provide incentives for and facilitate the adoption of eConsults by health care providers.

Our summative report describes the primary findings from implementation, which are summarized in Appendix A Exhibit A.1. During implementation, we found that both health care settings successfully integrated eConsults into their respective technology and workflows in a manner that was minimally disruptive and, for those who used eConsults, required little-to-no additional effort than the regular referral process.

Within the independent practices, the highest utilizer also had the strongest leadership engagement, which included a routine of goal setting, monitoring, and provider feedback. The per-provider eConsult use in this practice was higher than that of other independent practices. For the health system, eConsult use seemed to rise with the introduction of each new wave of specialists, but overall use was low, with the average health system PCP using eConsults only two times over the pilot project's measured duration.

Financial incentives were not an influencing factor in eConsult use; there was little awareness of incentives except among the physicians we interviewed who were also practice leaders.

Exhibit A.1. PARC structure and implementation approach within health system and independent practice settings

Aspect of structure/ implementation	Health system	Independent practices
Implementation dates/timelines	Initiated in August 2021; concluded July 2022	Initiated in February 2021; concluded in July 2022
eConsult model		
eConsult implementation model/solution	Project CORE	ConferMED
Location of specialists	Within the health system	National panel of specialists, including those in Arkansas
Clinical questions that can be addressed through eConsults	In consultation with specialists, eConsult templates are developed that include clinical guidance for a subset of common questions or conditions. Some specialties prefer to leave their templates more open, and questions can be "unspecified"	No template, no restriction
Which specialties can be used	Specialties added over time, in four waves beginning August 2021; total of 13 by end of Wave 4; see footnote 1 below.	Specialists in 23 adult specialties, immediately available starting in February 2021; the list of specialties is in footnote 2 below
eConsult payment and seed funding		
Seed funding to participating institutions from PCH	$70,000	$10,000 per participating practice, to 8 practices
Payment for participating providers	0.5 RVU for both specialists and PCPs, applies up to the minimum productivity standard (not PCH-funded)	$50 per eConsult (PCH-funded) to the requesting eConsult practice; specialists are compensated through ConferMED (PCH-funded)
eConsult model workflows		
EHR integration	Health system information technology team integrated eConsults into the EHR as order templates	Some practices were able to integrate eConsults into their EHRs, while others transferred the documents to Box or faxed to ConferMED
Who is involved in submitting eConsults	PCPs only	PCPs and practice staff such as referral coordinators
Who processes and responds to the eConsult	Designated specialist eConsultants receive the message and response goes directly back to the requesting PCP; the question and response are automatically documented in the patient's chart	ConferMED routes the eConsults to an appropriate specialist and sends response back to practice staff; practice staff ensure the PCP receives the response and places it in the patient chart, typically as a PDF

EHR = electronic health record; IT = information technology; PARC = Project Arkansas eConsultations; PCH = Peterson Center on Healthcare; PCP = primary care provider; RVU = relative value unit.

[1] Wave 1 introduced endocrinology, hematology, and nephrology. Wave 2 introduced infectious diseases, cardiology, geriatrics, and vaccine questions. Wave 3 introduced rheumatology, neurology, orthopedics, and pain management. Wave 4 introduced bone density and genetics.

[2] ConferMED's specialties are addiction medicine, allergy, cardiology, dermatology, endocrinology, ENT/otorhinolaryngology, gastroenterology, geriatric medicine, hematology, infectious disease, nephrology, neurology, nutrition, women's health, ophthalmology, orthopedics, pain medicine, palliative care, psychiatry, pulmonology, rheumatology, sleep medicine, and urology.

Appendix B: Comparison of eConsult Recipients and Non-recipients Characteristics

Exhibit B.1. Characteristics of eConsult recipients and non-recipients with face-to-face specialist visits at implementation practices

Characteristics	eConsult recipients (1)	All other (non-eConsult) patients at implementation practices (2)	Patients with face-to-face specialist visits at implementation practices (3)
Number of patient-visit-months	199	193,950	11,732
Gender (%)			
Female	60.3	58.33	68.53**
Male	39.7	41.67	31.47**
Age (%)			
<30	19.1	27.17**	20.22
30 to 44	35.7	32.58	31.06
45 to 64	42.7	38.97	47.32
65 plus	2.5	1.29	1.40
Medical conditions (%)			
Alzheimer's	0.0	0.09	0.20
Cancer	3.5	3.41	5.67
Congestive heart failure	3.5	1.01***	1.45**
Chronic kidney disease	2.5	0.18***	0.26***
Chronic obstructive pulmonary disease	4.0	2.06*	2.86
Diabetes	18.1	9.50***	11.90**
All Other	85.4	79.39**	86.06
Health status (#)			
Risk score	2.6	1.79***	2.55
Average expenditures per person per month during baseline period years ($)			
Emergency department	25.4	22.18	27.88
Hospitalizations	53.2	66.71	79.90
Lab & imaging	44.6	31.35**	43.78
All specialties	106.6	92.80	126.24
Implementation specialties	34.5	29.30	41.45
Expenditures for all key services (expected to be affected by eConsults)	229.9	213.05	277.81
Average visits per 1,000 persons per month during baseline period			
Emergency department	61.1	65.92	85.68**
Hospitalizations	4.8	5.22	6.45
All specialties	547.9	419.00**	569.08
Implementation specialties	152.4	133.09	189.92**

Exhibit B.1 (*continued*)

Characteristics	eConsult recipients (1)	All other (non-eConsult) patients at implementation practices (2)	Patients with face-to-face specialist visits at implementation practices (3)
Utilization in past two years (%)			
Emergency department	28.1	27.81	33.11
Hospitalized	8.5	8.44	9.88
Emergency department or hospitalized	30.2	30.04	35.15

Source: Health system data, ConferMED data, and Arkansas Blue Cross Blue Shield claims data.

Note: Column 1 includes patients receiving eConsults received between February 2021 and July 2022. The baseline period is the two years prior to the "baseline visit." The baseline visit is the eConsult (column 1), primary care visit (column 2), or face to face specialist visit (column 3).

*/**/*** Indicates a statistically significant difference between this column and eConsult recipients in column 1 at the .10/.05/.01 level.

Exhibit B.2. Practice characteristics for eConsult recipients and other patients

	eConsult recipients (1)	All other (non-eConsult) recipients at Implementation practices (2)	All patients at non-Implementation practices (3)	All patients at Implementation practices with face-to-face specialist visits (4)	All patients at non-Implementation practices with face-to-face specialist visits (5)
Practice characteristics					
Number of patient-visit-months	199	193,950	1,453,009	11,732	88,149
Practice is in a health system (%)	6	21.79***	22.46***	24.47***	23.65***
Practice size (%)					
1 physician	58	1.34***	3.88***	0.83***	3.68***
2 to 5 physicians	2	5.39*	23.46***	6.30**	22.36***
6+	40	93.28***	72.66***	92.87***	73.96***
Number of patients at practice (%)					
<1,000	51	0.31***	6.17***	0.14***	6.10***
1,000 to 5,000	13	16.17	39.53***	17.07	38.11***
> 5,000	36	83.52***	54.30***	82.78***	55.79***
Characteristics of practices' county at baseline					
Social vulnerability index	0.32	0.25***	0.34***	0.25***	0.33
COVID cases per capita per 1,000	9,893	9,080.93***	10,005.99**	9,100.02***	9,913.17
COVID deaths per capita per 1,000	245	186.66***	167.64***	183.71***	166.67***
Number of specialists per 1,000	1.2	1.56***	1.21	1.58***	1.27
Number of hospital beds per 1,000	6.5	6.75	5.18***	6.77	5.34***

Exhibit B.2 (*continued*)

	eConsult recipients (1)	All other (non-eConsult) recipients at Implementation practices (2)	All patients at non-Implementation practices (3)	All patients at Implementation practices with face-to-face specialist visits (4)	All patients at non-Implementation practices with face-to-face specialist visits (5)
Metropolitan (%)	36.7	58.31***	68.09***	61.16***	70.55***

Source: Health system data, ConferMED data, and Area Resource file.

Note: Column 1 includes eConsults received between February 2021 and July 2022. Columns 2 through 5 include patients who received primary care or specialist visits during this same time period.

*/**/*** Indicates a statistically significant difference between this column and eConsult recipients in column 1 at the .10/.05/.01 level.

Exhibit B.3. Characteristics of patients in sample attributed to implementation and non-implementation practices

Characteristics	Implementation practices, all patients (1)	Non-Implementation practices, all patients (2)	Implementation practices, face-to-face specialty patients (3)	Non-Implementation practices, face-to-face specialty patients (4)
Number of patient-visit-months	194,149	1,453,009	11,732	88,149
Gender (%)				
Female	58.3	55.53***	68.5	65.81***
Male	41.7	44.47***	31.5	34.19***
Age (%)				
<30	27.2	21.80***	20.2	16.52***
30 to 44	32.6	31.16***	31.1	28.39***
45 to 64	39.0	45.43***	47.3	53.22***
65 plus	1.3	1.61***	1.4	1.87***
Medical conditions (%)				
Alzheimer's	0.1	0.10	0.2	0.16
Cancer	3.4	3.48	5.7	6.02
Congestive heart failure	1.0	1.11***	1.4	1.70*
Chronic kidney disease	0.2	0.40***	0.3	0.56***
Chronic obstructive pulmonary disease	2.1	3.19***	2.9	4.46***
Diabetes	9.5	10.77***	11.9	13.14***
All Other	79.4	81.30***	86.1	86.77**
Health status (#)				
Risk score	1.8	1.92***	2.5	2.70***
Average expenditures per person per month during baseline period years ($)				
Emergency department	22.2	25.37***	27.9	32.00***
Hospitalizations	66.7	64.28*	79.9	83.30
Lab & imaging	31.4	33.42***	43.8	46.81***

Exhibit B.3 (*continued*)

Characteristics	Implementation practices, all patients (1)	Non-Implementation practices, all patients (2)	Implementation practices, face-to-face specialty patients (3)	Non-Implementation practices, face-to-face specialty patients (4)
All specialties	92.8	96.18***	126.2	133.51**
Implementation specialties	29.3	31.48***	41.4	44.22**
Expenditures for all key services (expected to be affected by eConsults)	213.1	219.25***	277.8	295.63**
Average visits per 1,000 persons per month during baseline period				
Emergency department	65.9	69.16***	85.7	88.04
Hospitalizations	5.2	5.05***	6.5	5.98*
All specialties	419.1	443.80***	569.1	607.53***
Implementation specialties	133.1	132.82	189.9	189.47
Utilization in past two years (%)				
Emergency department	27.8	29.33***	33.1	33.52
Hospitalized	8.4	8.37	9.9	9.77
Emergency department or hospitalized	30.0	31.31***	35.2	35.54

Source: Health system data, ConferMED data, and Arkansas Blue Cross Blue Shield claims data.

Note: For implementation practices, sample includes all patients that received either an eConsult or primary care visit (column 1) or specialist visit (column 3) between February 2021 and July 2022. For non-implementation practices, sample includes all patients that received a primary care or specialty visit (column 2) or face-to-face specialist visit (column 4) between February 2021 and July 2022.

*/**/*** Indicates a statistically significant difference between patients in sample attributed to implementation practices and those attributed to non-implementation practices at the .10/.05/.01 level.

Exhibit B.4. Practice characteristics of implementation and non-implementation practices

	All patients at Implementation practices	All patients at non-Implementation practices
Practice characteristics		
Number of patient-visit-months	194,149	1,453,009
Practice is in a health system (%)	22	22**
Practice size (%)		
1 physician	1	4***
2 to 5 physicians	5	23***
6+	93	73***
Number of patients at practice (%)		
<1,000	0	6***
1,000 to 5,000	16	40***
> 5,000	83	54***

Exhibit B.4 (*continued*)

	All patients at Implementation practices	All patients at non-Implementation practices
Characteristics of practices' county at baseline		
Social vulnerability index	0.25	0.34***
COVID cases per capita per 1,000	9,082	10,006***
COVID deaths per capita per 1,000	187	168***
Number of specialists per 1,000	1.6	1.2***
Number of hospital beds per 1,000	6.8	5.2***
Metropolitan area (%)	58	68***

Source: Health system data, ConferMED data, and Arkansas Blue Cross Blue Shield claims data.

Note: For implementation practices, sample includes all patients that received an eConsult, primary care, or specialist visit between February 2021 and July 2022. For non-implementation practices, the sample includes all patients that received a primary care or specialist visit between February 2021 and July 2022.

*/**/*** Indicates a statistically significant difference between patients at implementation and non-implementation practices at the .10/.05/.01 level.

Exhibit B.5. Type of specialty visit for eConsults and for potential comparison group

Specialty	eConsult recipients (1)	Face-to-face specialist visits at non-implementation practices (2)
Dermatology	37	8,163
Endocrinology	35	1,620
Neurology	27	4,714
Hematology	23	1,556
Rheumatology	21	1,389
Gastroenterology	9	7,420
Nephrology	9	483
Cardiology	6	11,151
Nutrition	5	268
Pulmonology	5	2,251
Infectious disease	4	5,608
Obstetrics and gynecology	4	16,825
Orthopedics	4	9,241
Ear, nose, and throat	3	3,871
Allergy	2	1,206
Pain medicine	2	1,351
Urology	2	3,472
Sleep medicine	1	113
Addiction medicine	0	2
Geriatric	0	48
Ophthalmology	0	3,927
Palliative care	0	50

Exhibit B.5 (*continued*)

Specialty	eConsult recipients (1)	Face-to-face specialist visits at non-implementation practices (2)
Psychiatry	0	3,420
Total	199	88,149

Source: Health system data, ConferMED data, and Arkansas Blue Cross Blue Shield claims data.

Note: Column 1 includes eConsults received between February 2021 and July 2022. Column 2 represents the potential comparison group and includes all face-to-face specialist visits between February 2021 and July 2022.

Exhibit B.6. eConsults per implementation practice

Number of implementation practices	14
Number of eConsults	199
Number of eConsults per practice (mean)	14.2
Number of eConsults per practice (median)	3.5
Number of practices with:	
0 eConsults	4
1 to 3 eConsults	3
4 to 7 eConsults	3
8 to 13 eConsults	2
14+ eConsults	2
Patients with 0 eConsults out of patients with an eConsult or face-to-face specialist visit (%)	97.7
Patients with 1 eConsult out of patients with an eConsult or face-to-face specialist visit (%)	2.2
Patients with more than 1 eConsult out of patients with an eConsult or face-to-face specialist visit (%)	0.1

Source: ConferMED and Health system data.

Note: Includes all practices that had a patient who received an eConsult between February 2021 and July 2022.

Appendix C: Comparison of eConsult Recipients and Pool of Potential Comparison Patients

Exhibit C.1. Characteristics of eConsult recipients and pool of potential comparison patients

Characteristics	eConsult recipients	Patients with face-to-face specialist visits at non-implementation practices
Number of patient-visit-months	199	88,149
Gender (%)		
Female	60.3	65.81
Male	39.7	34.19
Age (%)		
<30	19.1	16.52
30 to 44	35.7	28.39**
45 to 64	42.7	53.22***
65 plus	2.5	1.87
Medical Conditions (%)		
Alzheimer's	0.0	0.16
Cancer	3.5	6.02
Congestive heart failure	3.5	1.70*
Chronic kidney disease	2.5	0.56***
Chronic obstructive pulmonary disease	4.0	4.46
Diabetes	18.1	13.14**
All Other	85.4	86.77
Health status (#)		
Risk score	2.6	2.70
Average expenditures per person per month during baseline period years ($)		
Emergency department	25.4	32.00
Hospitalizations	53.2	83.30*
Lab & Imaging	44.6	46.81
All specialties	106.6	133.51**
Implementation specialties	34.5	44.22**
Expenditures of measures expected to be affected by eConsults	229.9	295.63**
Average visits per 1,000 persons per month during baseline period		
Emergency department	61.1	88.04**
Hospitalizations	4.8	5.98
All specialties	547.9	607.53
Implementation specialties	152.4	189.47**
Utilization in past two years (%)		
Emergency department	28.1	33.52
Hospitalized	8.5	9.77
Emergency department or hospitalized	30.2	35.54

Source: ConferMED data, Health System data, and Arkansas Blue Cross Blue Shield data.

Exhibit C.1 (*continued*)

Note: Column 1 includes all patients that received an eConsult visit between February 2021 and July 2022. Column 2 represents the potential comparison group and includes all patients that received a specialist visit at a non-implementation practice between February 2021 and July 2022.

*/**/*** Indicates a statistically significant difference between eConsult recipients and patients with face-to-face visits in non-implementation practices at the .10/.05/.01 level.

Appendix D: Impact Estimate, Statistical Significance, and Confidence Intervals for Outcome Measures

Exhibits D.1 to D.4 provide the impact estimate, statistical significance, and confidence intervals for each outcome measure. Exhibits D.5 and D.6 provide the full regression output for our primary outcome measure (expenditures in the month of the eConsult and in the two months following the eConsult). The impact estimates were drawn from the coefficient on treatment status in the regression output. For example, the -$195 coefficient in the first row of Exhibit D.5 is the impact estimate shown in the first row of Exhibit D.1. Most of the other coefficients shown on Exhibits D.5 and D.6 are not statistically significant. We do not focus on interpreting these coefficients in the text as the eConsults (treatment) group and comparison group already had similar mean values for these variables due to matching.

Exhibit D.1. Effect of eConsult receipt on key outcomes during the month of the eConsult

Measure	eConsult (N=199)		Comparison group (N=985)		Impact estimate (p-value)
	Mean	95 percent confidence interval	Mean	95 percent confidence interval	
Primary outcome (expenditures per person per month)					
All key services (specialist visits, emergency department visits, hospital services, and lab and imaging)	473	[365, 581]	668	[613, 724]	-195*** (0.002)
Secondary outcomes (expenditures per person per month)					
Specialist visits ($)	225	[186, 264]	409	[613,724]	-184***(0.000)
Specialist visits, implementation only ($)	98	[80,117]	242	[229,255]	-144*** (0.000)
Emergency department visits ($)	48	[18, 77]	50	[35, 64]	-2 (0.910)
Lab and Imaging ($)	150	[122, 179]	153	[139, 166]	-2 (0.884)
Secondary outcomes (utilization)					
Number of specialist visits (all specialties)	2.12	[1.91, 2.32]	1.87	[1.78, 1.96]	0.24** (0.038)
Number of specialist visits (implementation specialties only)	1.27	[1.19, 1.35]	1.21	[1.17, 1.26]	0.06 (0.219)
Had any specialist visit other than the “baseline” visit (%)	53.5	[46.7, 60.2]	45.2	[42.1, 48.4]	8.2** (0.031)
Had an emergency department visit (%)	5.9	[2.7, 9.1]	5.7	[4.2, 7.2]	0.2 (0.909)
Had any hospitalizations (%)	1.1	[-0.4, 2.7]	0.6	[0.1, 1.2]	0.5 (0.569)
Had any lab and imaging (%)	75.7	[69.9, 81.6]	71.2	[68.3, 74.0]	4.5 (0.174)

Source: ConferMED data, health system data, and Arkansas Blue Cross Blue Shield data.

Note: Means are regression-adjusted; impact estimate captures the regression-adjusted difference between eConsult users and the comparison group, where the regressions controls for a patient’s baseline expenditures and utilization, demographic characteristics, risk scores, chronic conditions, and

Exhibit D.1 (*continued*)

characteristics of their practice and their practice's county. A patient was considered an eConsult recipient if they received an eConsult from an implementing independent practice between February 2021 and May 2022 or from an implementing health system practice between August 2021 and May 2022. Expenditures were winsorized, meaning that outliers (above the 98th percentile) were replaced with the value of the 98th percentile. Implementation specialties include specialty types for which eConsults were available.

*/**/*** Impact estimate statistically significant at the .10/.05/.01 level.

Exhibit D.2. Effect of eConsult receipt on key outcomes during the two months after the eConsult

Measure	eConsult (N=199)		Comparison group (N=985)		Impact estimate (p-value)
	Mean	95 percent confidence interval	Mean	95 percent confidence interval	
Primary outcome (expenditures per person per month)					
All key services (specialist visits, emergency department visits, hospitalizations, and lab and imaging)	337	[247, 428]	391	[342, 439]	-53 (0.317)
Secondary outcomes (expenditures per person per month)					
Specialist visits ($)	193	[144, 242]	226	[199, 252]	-33 (0.252)
Specialist visits, implementation only ($)	74	[51, 97]	84	[72, 96]	-10 (0.463)
Emergency department visits ($)	22	[9, 35]	28	[21, 35]	-6 (0.448)
Lab and Imaging ($)	73	[56, 91]	70	[62, 78]	3 (0.723)
Secondary outcomes (utilization)					
Number of specialist visits (all specialties)	0.92	[0.74, 1.10]	1.07	[0.96, 1.19]	-0.15 (0.173)
Number of specialist visits (implementation specialties only)	0.33	[0.25, 0.41]	0.46	[0.37, 0.56]	-0.13** (0.048)
Had any specialist visit (%)	58.9	[52.5, 65.3]	64.7	[61.7, 67.7]	-5.8 (0.113)
Had an emergency department visit (%)	6.1	[2.9, 9.3]	6.8	[5.2, 8.4]	-0.7 (0.723)
Had any hospitalization (%)	1.1	[-0.4, 2.6]	1.7	[0.8, 2.5]	-0.6 (0.545)
Had any lab and imaging (%)	62.1	[55.4, 68.8]	52.2	[49.0, 55.4]	9.9*** (0.009)

Source: ConferMED data, health system data, and Arkansas Blue Cross Blue Shield data.

Note: Means are regression-adjusted; impact estimates capture the regression-adjusted difference between eConsult users and the comparison group, where the regressions controls for a patient's baseline expenditures and utilization, demographic characteristics, risk scores, chronic conditions, and characteristics of their practice and their practice's county. A patient was considered an eConsult recipient if they received an eConsult from an implementing independent practice between February 2021 and May 2022 or from an implementing health system practice between August 2021 and May 2022. The month the eConsult was received is counted as Month 1; the post-intervention period includes Months 2 and 3. Expenditures were winsorized, meaning that outliers (above the 98th percentile) were replaced with the value of the 98th percentile. Implementation specialties are the specialty types for which eConsults were available.

*/**/*** Impact estimate statistically significant from 0 at the .10/.05/.01 level.

Exhibit D.3. Sensitivity tests for effect of eConsults receipt on key outcomes during eConsult month

Measure	eConsult (N=199)			Comparison group (N=985)			Impact estimate (p-value)
	N	Mean	95 percent confidence interval	N	Mean	95 percent confidence interval	
Sensitivity to treatment of outliers							
Per person per month expenditures on key services, trimmed ($):	195	396	[319, 474]	966	578	[536, 619]	-181*** (0.000)
Limiting sample to those with 3 months of follow-up data ($)							
Per person per month expenditures on key services ($):	189	482	[370, 595]	935	679	[622, 736]	-196*** (0.003)
Specialist visits (all specialties) ($)	189	227	[186, 267]	935	415	[386, 443]	-188*** (0.000)
Specialist visits (implementation only) ($)	189	98	[79, 117]	935	242	[229, 256]	-144*** (0.000)
Emergency department visits ($)	189	50	[19, 81]	935	50	[35, 66]	0 (0.991)
Lab and Imaging ($)	189	152	[123, 182]	935	153	[139, 167]	-1 (0.970)

Source: ConferMED data, health system data, and Arkansas Blue Cross Blue Shield data.

Note: Means are regression-adjusted; impact estimates capture the regression-adjusted difference between eConsult users and the comparison group, where the regressions controls for a patient's baseline expenditures and utilization, demographic characteristics, risk scores, chronic conditions, and characteristics of their practice and their practice's county. A patient was considered an eConsult recipient if they received an eConsult from an implementing independent practice between February 2021 and May 2022 or from an implementing health system practice between August 2021 and May 2022. The month the eConsult was received is counted as Month 1. Expenditures were winsorized, meaning that outliers (above the 98th percentile) were replaced with the value of the 98th percentile. Implementation specialties are the specialty types for which eConsults were available.

*/**/*** Impact estimate statistically significant at the .10/.05/.01 level.

Exhibit D.4. Sensitivity tests for effect of eConsults receipt on key outcomes during Months 2 and 3

Measure	eConsult (N=199)			Comparison group (N=985)			Impact Estimate (p-value)
	N	Mean	95 percent confidence interval	N	Mean	95 percent confidence interval	
Sensitivity to treatment of outliers							
Per person per month expenditures on key services, trimmed ($):	197	294	[222, 367]	964	319	[282, 357]	-25 (0.545)
Limiting sample to those with 3 months of follow-up data ($)							
Per person per month expenditures on key services ($):	189	348	[253, 443]	935	399	[349, 450]	-51 (0.354)
Specialist visits (all specialties) ($)	189	199	[148, 251]	935	233	[206, 261]	-34 (0.255)
Specialist visits (implementation only) ($)	189	76	[52, 100]	935	86	[73, 98]	-9 (0.487)
Emergency department visits ($)	189	23	[10, 37]	935	28	[20, 35]	-4 (0.580)
Lab and Imaging ($)	189	73	[56, 91]	935	70	[61, 78]	4 (0.707)

Source: ConferMED data, health system data, and Arkansas Blue Cross Blue Shield data.

Note: Means are regression-adjusted; impact estimates capture the regression-adjusted difference between eConsult users and the comparison group, where the regressions controls for a patient's baseline expenditures and utilization, demographic characteristics, risk scores, chronic conditions, and characteristics of their practice and their practice's county. A patient was considered an eConsult recipient if they received an eConsult from an implementing independent practice between February 2021 and May 2022 or from an implementing health system practice between August 2021 and May 2022. The month the eConsult was received is counted as Month 1; the post-intervention period includes Months 2 and 3. Unless noted otherwise, expenditures were winsorized, meaning that outliers (above the 98th percentile) were replaced with the value of the 98th percentile. Implementation specialties are the specialty types for which eConsults were available.

*/**/*** Impact estimate statistically significant at the .10/.05/.01 level.

Exhibit D.5. Regression output for model predicting expenditures for all key services during month of initial eConsult

Variable	Coefficient	Standard error	*p*-value	95% confidence interval	
Treatment indicator	-195.30	62.95	0.002***	-318.81	-71.79
Baseline expenditures for key services	0.20	0.17	0.243	-0.14	0.54
Patient has data for full follow-up period	75.02	69.34	0.279	-61.02	211.07
Number of specialty visits during baseline	-253.13	305.07	0.407	-851.66	345.41
Number of emergency department visits during baseline	-103.58	272.48	0.704	-638.19	431.03
Age at baseline visit	-1.51	2.69	0.574	-6.78	3.76
Average risk score at baseline	38.20	21.74	0.079*	-4.45	80.86
Had hospitalization during baseline period	-59.39	208.77	0.776	-469.00	350.22
COVID cases in practice's county	0.00	0.01	0.706	-0.01	0.02
Social vulnerability index in practice's county	118.85	121.80	0.329	-120.12	357.81
Practice county in a metropolitan statistical area	184.63	62.59	0.003***	61.84	307.43
Patient has diabetes at baseline	80.81	93.22	0.386	-102.08	263.69
Patient has cancer at baseline	238.63	179.55	0.184	-113.64	590.90
Patient has congestive heart failure at baseline	-149.78	184.18	0.416	-511.14	211.58
Patient has other chronic condition at baseline	149.00	79.43	0.061*	-6.85	304.85
Patient has chronic obstructive pulmonary disease at baseline	69.73	162.69	0.668	-249.47	388.92
Patient has chronic kidney disease at baseline	725.12	281.13	0.010**	173.54	1276.70
Patient has Alzheimer's/dementia at baseline	-338.75	85.91	0.000***	-507.30	-170.20
Patient is female	109.80	56.19	0.051	-0.44	220.04
Number of patients at practice	0.01	0.00	0.006***	0.00	0.02
Number of physicians at practice	-3.17	1.15	0.006***	-5.42	-0.91
Practice is independent	-223.66	136.69	0.102**	-491.84	44.52

Source: ConferMED data, health system data, and Arkansas Blue Cross Blue Shield data.

Note: The coefficient on treatment status represents the impact estimate. Expenditures were winsorized, meaning that outliers (above the 98th percentile) were replaced with the value of the 98th percentile. "Key services" include hospitalizations, emergency department visits, specialty services and lab and imaging. Control variables are measured over the "baseline period," defined as the two years prior to the "baseline visit." The baseline visit is the eConsult (for the treatment group) or face-to-face specialist visit (for the comparison group).

*/**/*** Impact estimate statistically significant at the .10/.05/.01 level.

Exhibit D.6. Regression output for model predicting expenditures for all key services during two months after eConsult

Variable	Coefficient	Standard error	*p*-value	95% confidence interval	
Treatment indicator	-53.23	53.13	0.317	-157.48	51.03
Baseline expenditures for key services	0.06	0.10	0.535	-0.13	0.26
Patient has data for full follow-up period	135.96	60.74	0.025**	16.78	255.13
Number of specialty visits during baseline	192.37	223.00	0.388	-245.15	629.90
Number of emergency department visits during baseline	368.14	209.66	0.079	-43.21	779.50
Age at baseline visit	0.16	2.14	0.939	-4.04	4.36
Average risk score at baseline	20.84	12.43	0.094*	-3.54	45.23
Had hospitalization during baseline period	-293.84	119.29	0.014**	-527.89	-59.78
COVID cases in practice's county	-0.01	0.01	0.43	-0.02	0.01
Social vulnerability index in practice's county	176.92	126.82	0.163	-71.90	425.75
Practice county in a metropolitan statistical area	75.19	54.84	0.171	-32.41	182.78
Patient has diabetes at baseline	80.56	80.33	0.316	-77.05	238.17
Patient has cancer at baseline	-59.98	105.17	0.569	-266.32	146.37
Patient has congestive heart failure at baseline	-119.01	170.83	0.486	-454.17	216.15
Patient has other chronic condition at baseline	-58.92	81.20	0.468	-218.23	100.38
Patient has chronic obstructive pulmonary disease at baseline	-23.28	129.62	0.857	-277.58	231.02
Patient has chronic kidney disease at baseline	-184.73	131.31	0.16	-442.36	72.90
Patient has Alzheimer's/dementia at baseline	-194.24	77.73	0.013**	-346.73	-41.74
Patient is female	27.75	49.83	0.578	-70.01	125.51
Number of patients at practice	0.01	0.00	0.029	0.00	0.01
Number of physicians at practice	-2.70	0.94	0.004	-4.54	-0.86
Practice is independent	-62.56	127.07	0.623	-311.87	186.74

Note: The coefficient on treatment status represents the impact estimate. Expenditures were winsorized, meaning that outliers (above the 98th percentile) were replaced with the value of the 98th percentile. "Key services" include hospitalizations, emergency department visits, specialty services and lab and imaging. Control variables are measured over the "baseline period," defined as the two years prior to the "baseline visit." The baseline visit is the eConsult (for the treatment group) or face-to-face specialist visit (for the comparison group).

*/**/*** Impact estimate statistically significant at the .10/.05/.01 level.

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