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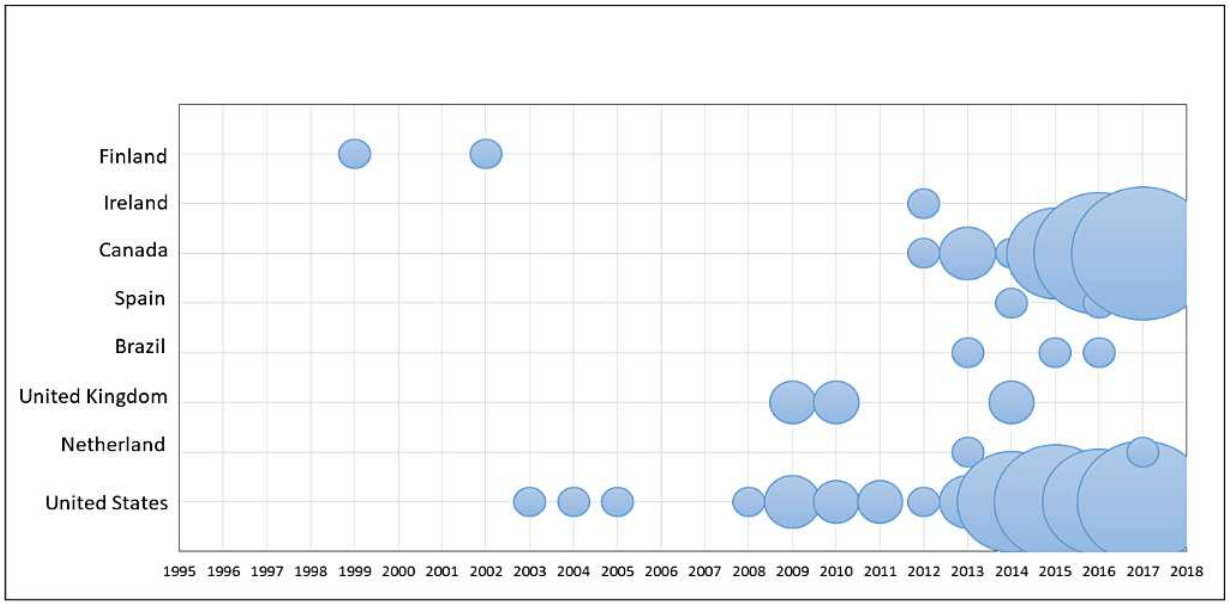
eFigure 1: Bubble plot of the evolution of the eConsult literature



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eFigure 2: Word cloud of terms used to describe electronic consultation

Terms used to describe electronic consultation	Count (%)
e-Consult*	9 (30%)
eConsult*	7 (23%)
Teleconsultation	5 (17%)
Asynchronous	4 (13%)
Electronic referral	3 (10%)

*includes both full (e-Consultations) and truncated (e-Consult) words

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Supplementary Panel 1: PCP perspectives on barriers and facilitators

1. Barriers
Increased workload and workflow disruptions (n = 10)
• one of the strongest themes; Length of time required for PCPs to complete the e-referral due to lack of integration with current EMR
✕ "My only barrier would be if I have two separate systems that I have to go log on and in and on and in to see what's going on…But I don't want to have two systems that now I have to check this, now I have to check this. (Provider)"[1] (Page 4)
✕ "Well I think that's the biggest barrier for primary care docs that we see for e-Consult is exactly that, it's very labour intensive. When we made great efforts to populate our own EMR with relevant information and now we have to reinvent the wheel again to put it into the e-Consult system so I think that if that could be fixed it would be awesome. (Provider)"[1] (Page 5)
✕ "As GPs, we've worked hard to get this EMR system going for us but now you've got to reinvent the wheel, I've got to pull all the data, re-enter it…there's no access; I have to go out and handwrite it and type it in. That's very time consuming, yeah. (Provider)"[1] (Page 6)
• Given that many physicians including pediatricians have had increased workload and are now adapting to their new clinic workflows with the electronic medical record[2] (Page 18)
• potentially adding an unnecessary step when a sick pediatric patient clearly needs to be transferred[2] (Page 18)
• implementation of recommendations with an eConsult model depends on timely receipt and review of the eConsult response by busy PCPs. Particularly for more time-sensitive consultative questions[3] (Page 520)
• From the perspective of PCPs, however, eReferral also had negative effects on work processes in that it shifted workload to them.
✕ "It was a lot easier and quicker for me to write a consultation on…paper…Now I'm having to go through a longer process with a few more hurdles in it. Just mechanically if we have any problems with the computer. If General has any problems with the computer. If there's a problem with a patient's ID number. If the eReferral process suddenly disconnects, which happened quite a bit initially, and that has cleared up for the most part. …this was transferring work that was done by other people to the physician, and I wasn't very happy about it". (PCP)[4] (Page 1341)
✕ "…if somebody missed an appointment I could just go back and tell the scheduler reschedule it. Now…[the doctor] has to go back into his system and ask for it to be rescheduled." (PCP admin staff)
• Resistance to change, particularly to changes in PCP work flow, emerged prominently during our interviews. Without exception, with every eCR, PCP workload in-creased, as they were expected to navigate new technology to enter a referral question and pertinent patient data. Additionally, PCPs acquired extra work in man-aging conditions that they used to refer.[5] (Page 6)
• PCP concerns included increased workload[6] (Page 327)
• time pressure, disruptions in clinical workflows[7] (Page 304)
• Electronic notifications provided to the PCPs via the VA's EHR system have been shown to increase PCP workload and put a strain on the system if not managed effectively[8] (Page 752)
• increased workload for PCP implementing the specialist recommendations[9] (Page S298)
• that the majority of e-consultations contained recommendations for further evaluation and/or treatment resulting in a qualitative and quantitative change in workflow for PCPs[10] (Page 4)
Technical challenges to use eConsult (n = 6)
• A small number of NPs described technical challenges with the service, including low resolution of attached pictures and trouble with e-mail notifications.[11] (Page 148)
• a small number of PCPs experienced technical issues when submitting eConsults or uploading rel- evant photographs or documents. These challenges often involved technical problems or misunderstandings of what file types were supported by the system.[12] (Page 400)
✕ "When I added a follow up question it never seems to go through and the consult disappeared. I had to request a new consult with my follow up question." (ID 115, MD, male).[12] (Page 401)
✕ "Unfortunately [the] specialist was not able to open attachments; would be helpful to have clear guidelines as to which file types are ac-ceptable. Thanks!" (ID 225, MD, female).[12] (Page 401)
• lack of familiarity with the system or technology more generally[13] (Page 4)
• PCP concerns included ……. and dissatisfaction with the technology[6] (Page 327)
• With respect to e-consult technologies, clinicians might be reluctant to adopt technologies that have not been part of their traditional repertoire of tools and techniques[7] (Page 304)
• Some PCPs described a reluctance to initiate an eConsult because of difficulty with technical aspects of the program[14] (Page S3)
Loss of specialist contact (n = 2)
• PCPs are providing less care in hospital settings where they used to interact frequently with consultants
✕ "We used to have a doctor's dining room . . . and we'd go up and do consults at lunchtime while the specialists were there and everybody did get to take lunch. We'd bring charts up during lunchtime and get the answers to our questions. Now the specialists and primary care [clinicians] never get to see each other."[15] (Page 3)
✕ A few PCPs felt their questions were more applicable to a specialty or subspecialty not available in our list of options and requested that these groups be added to the service
• PCP concerns included ……unable to select the specific consultant[6] (Page 327)
Unfamiliarity with using eConsult service (n = 3)
• the need for familiarity and education of telehealth system operations are also concerns for providers[2] (Page 18)
• interviewed two providers who infrequently used e-consults who stated their reason for low use was because they were unfamiliar with the process itself

- The issue with potentially incomplete documentation may be based on the PCP's lack of knowledge concerning what information the specialist requires, forgetfulness to order tests, or failure to obtain relevant documentation[16] (Page 46)

✗ " The preparation…depending on the specialty, what kinds of tests have to be done"[17] (Page 9)

Insufficient remuneration to use eConsult (n = 2)

- lack of reimbursement for PCP to submit the consultation request electronically (this has since been remedied in Ontario)[13] (Page 4)
- High costs of start-up and maintenance[7] (Page 304)

Challenges related to patient follow up (n = 3)

✗ "One of our big issues is getting a hold of any of the patients. Their phone numbers have been changed or disconnected or they screen their calls and won't answer because it comes up unknown name/unknown number."[17] (Page 11)

- The shortcomings of referral systems with exchanges between PCPs and consultants include …… and loss of patients to follow up.[18] (Page 174)
- concern about how and when to communicate with patients regarding a consultant's recommendations.[14] (Page S3)

Receiving timely responses from specialists (n = 3)

- specialists providing unclear or incomplete responses
- Response time is generally satisfactory but widely variable[19] (Page S478)
- frustration with slower-than-promised responses from consultants[14] (Page S3)
- PCPs were not satisfied with the depth of the answer that was provided. Some providers were looking for more detail, whereas others felt their questions were not adequately addressed

✗ "An example of what anti- convulsant to start her on would have [made] this consult more useful." (ID 204, MD, female)[12] (Page 398)

2. Facilitators

PCPs receiving timely response from specialist (n = 12)

- The usefulness of e-consults was related to both the rapidity of the specialist response and the provision of a mechanism for asking simple clinical questions

✓ "I would define an e-consult as a higher-level question for a specialist that could be safely answered by a chart review."[20] (Page 5)

- participants reported that eConsults were preferable to the use of informal, or "curbside", consultations because they offer timely and standardized access to specialist advice without requiring PCPs to call on social networks or ask for favors[14] (Page S3)
- All interviewees identified … improving care timeliness[9] (Page S299)
- Timely communication with specialists can facilitate the management of [Spinal Cord Injury] SCI health issues at a primary care level.[21] (Page 594)
- PCPs reported that they appreciated receiving timely responses to their clinical questions[15] (Page 5)
- E-consultation was regarded as a convenient service that provided timely and helpful advice[22] (Page 3)
- One PCP described eConsult as

✓ "a very helpful service, giving timely help and input to the front-line generalist,"[23] (Page 354)

- In addition to noting the ease with which users can access specialist advice, many providers noted how appreciative they were for the timely response. The average specialist response time during the study period was 18 hours, and many PCPs expressed how helpful it was to receive a quick answer.[12] (Page 398)

✓ "Fantastic to be able to get great advice within hours of sending the consult. This is so helpful for me in my rural practice. Great service!!" (ID 322, MD, male) (Page 398)

✓ "I have had several excellent quick responses from radiology through eConsult, that have saved me a lot of time trying to reach [a radiologist,] which usually takes a lot of time." (ID 27, MD, female) (Page 398)

- During the process, the PCPs submitted many positive comments in the optional open text field

✓ "The timeliness of the consult is the most valuable asset. This patient may have waited for 6 months to 1 year to see a dermatologist otherwise" (Page 839)

✓ "Excellent response. It is great to be able to get back to my patient so quickly and reassure her about the possible diagnosis. This will be very reassuring for her." (Page 840)

✓ "Incredibly timely advice and very practical. Dermatology is often challenging when the patient is acutely unwell and as a family physician including myself needs some clarification in terms of diagnosis and treatment. Very appreciated!"[24] (Page 840)

- All respondents were satisfied or highly satisfied with the quality and timeliness of the e-consultation responses[25] (Page 138)
- most common reason for overall satisfaction was timeliness of care

✓ "It was prompt, and the patient got the attention they needed in a very reasonable timeline."

- The vast majority of primary care providers rated the overall value of the eConsult service very highly

✓ "My patient was surprised about the technology and how quickly a response was obtained,"[26] (Page 1036)

- Many interview participants reported multiple positive effects of eReferral on communication

✓ "It is a potentially very helpful and efficient system for referrals. …you can send information to the referral service and then get feedback in a timely manner that helps to triage the patient to them …" (PCP)

- Specifically, NPs remarked on the speed, helpfulness, and quality of specialist responses[11] (Page 148)

Building capacity and knowledge (n =24)

- PCPs and specialists participating in eConsult services recognize and appreciate their educational value, which is often cited as a motivator for continuing to participate[27] (Page 46)
- The CORE model supports the development and continual adjustment of this provider interface, and can serve as a real-time continuous educational source for the best practices of medicine.[28] (Page 388)
- An additional factor includes the point-of-care educational value in which PCPs were able to gain new or additional knowledge when a new or additional course of action was suggested. This was echoed by comments from many PCPs who noted that the eConsult service served as a valuable educational tool[29] (Page 425)
- Another commonly reported benefit of eConsult services was their ability to act as educational tools for providers. In some instances, the advice PCPs received not only helped them treat the initial patient, but also provided an educational benefit supporting their ability to care for patients with similar concerns in the future.[30] (Page 282)

- Specifically, NPs remarked on ……., and noted the service's ability to reassure patients and serve as an educational tool[11] (Page 148)
- Many PCPs viewed the eConsult service as a learning opportunity. By engaging in iterative conversations with specialists in which problems are presented and diagnosed
- ✓ "Thank you very much for your detailed and very helpful response. It is great learning for me and I have shared it with a couple of my colleagues as well! I am glad that I will now be able to recommend against testing and treating the children with more evidence behind me and I will feel much more confident standing up for my now-more-educated opinion." (ID 402, MD, female)
- some PCPs noted that the knowledge they gained while using eConsult for specific cases could be applied to their practice more generally by guiding their management of all subsequent patients presenting similar conditions.[12] (Page 400)
- ✓ "Thank you to Dr. X for the excellent advice. This will also help me manage patients with similar profiles in the future." (ID 329, MD, male)
- Providing education and knowledge translation "It provides vehicles for some feedback to family docs/education to let them know how we deal with things so that maybe they can feel more confident dealing with things themselves." (ID 212)[31] (Page e6)
- helpful tool for PCP questions, but it also identifies a potential area for education surrounding the topic[32] (Page 5)
- PCPs frequently cited ……. and educational opportunities as its chief benefits[33] (Page 87)
- This dialogue functions as an educational tool, allowing primary clinicians to obtain an electronic "curbside consultation" and often enabling them to manage the patient's problem themselves, with guidance via eReferral from the specialist reviewer—thus reinforcing the centrality of the medical home[34] (Page 971)
- The eConsult service was recognized as a valuable educational tool by PCPs as they were more engaged in patient care through participating in the process of case review.[24] (Page 840)
- An additional benefit of the eConsult system is that it can also be used as a case-based educational tool to disseminate knowledge of effective chronic pain management strategies to PCPs[13] (Page 5)
- The eConsult service was recognized as a valuable educational tool by primary care providers because they were more engaged in patient care through participating in the thought process involved in each consult[26] (Page 1037)
- an eConsult service has added educational value for PCPs. Primary care providers identified education opportunities as a benefit of the eConsult service.[35] (Page 108)
- A related effect reported by many PCPs and specialists was the educational benefit of eReferral, chiefly for PCPs.
- ✓ "I think most of the…eReferral people spend a fair bit of time explaining why we're asking for tests or doing things, and through that I think it helps providers learn how to deal with some of these problems better on their own." (specialty reviewer)[4] (Page 1341)
- ✓ "…and they can say, 'Well, have you thought about this, have you thought about that? … And that is great for me because that expands my repertoire and my understanding of how to work up this kind of condition in the future." (PCP)[4] (Page 1341)
- This type of case-based education may indirectly teach PCPs important diagnostic and therapeutic content to include in consultation requests[36] (Page 5)
- Identifying the most common questions and content being asked via the eConsult service will allow for more informed continuing medical education programs for PCPs[37] (Page 1)
- GPs recognised that e-consultation presented an educational opportunity that increased their confidence in managing chronic kidney disease in the community[22] (Page 3)
- telenephrology-facilitated consultation would empower GPs to provide care for more complex patients with CKD[38] (Page 434)
- PCPs also find the majority of electronic specialist communication for non-scheduled patients helpful and educational[39] (Page 207)
- Another potential benefit ofeConsult is that it facilitates the education of primary care providers through eConsult discussions[40] (Page 498)
- the potential of telehealth to provide support and promote continued education for primary care practitioners in remote locations[41] (Page 987)
- I have found e-consultations to be extremely useful in my clinical practice, as I am able to discuss more challenging or complex cases with my colleagues through the Internet[42] (PCP) (Page 135)

- Taken directly from the reference main text as a barrier or facilitator to eConsult (second order constructs)

✕ Taken from quoted text within the reference as a **barrier** to eConsult (first order constructs)

✓ Taken from quoted text within the reference as **facilitator** to eConsult (first order constructs)

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Supplementary Panel 2: Specialists perspectives on barriers and facilitators

1. Barriers
Increased workload (n = 11)
• Specialists also experienced greater workload in the form of pre-consultative exchange and virtual management, which also served as a barrier to implementation[5] (Page 6)
• worry about the workload that the [Virtual Consultations] VC may generate downstream[43] (Page 17)
• Increase in referrals might overwhelm the nephrologists and lead to delayed response or unsustainable system
✕ "F3: But is there a plan for physician sustainability? Because even though it's faster to answer a question on email or over electronic, you could be having 75 of those as opposed to seeing four patients. (Provider)"[1] (Page 5)
• pediatric subspecialists may fear … or workload from consults for patients who would have been referred for office consultations[44] (Page 393)
• One perceived barrier to adoption of nontraditional consultation models is that such models may induce demand, with PCPs submitting high volumes of low complexity eConsults that would not otherwise have been referred to a specialist[3]
• they complained about the lack of a pre-implementation evaluation of e-consults' impact on the work of the section specialty and the individual providers. E-consults originating outside of VABHS were particularly challenging and time-consuming to complete[20] (Page 6)
• While they understood that some providers may want documentation due to a lack of clinical confidence, the e-consults for this purpose created excess and unwelcome work for some consultants[20] (Page 6)
• The e-consults specific to GI and Neurosurgery took significantly longer to complete overall and at each stage, than Diabetes
• were somewhat less satisfied with time saved with e-consult[17] (Page 9)
✕ "We didn't have any set consult time you know at my end to do this…Now there's an extended figure and it's intended to go even bigger…I'm planning to increase my hours."
• However, the high number of eConsults where an in-person referral "was not originally contemplated and is still not needed" may counterbalance this 'saved' time[35] (Page 107)
✕ "was not originally contemplated and is still not needed" may counterbalance this 'saved' time
• It is worth noting that e-consults have the potential to cause a transfer of noncritical workload to the specialty care teams by providing PCPs the means to quickly refer patients to specialty care teams. Initial observations of the diabetes e-consult system indicated a similar case.[8] (Page 754)
✕ "I'm very enthusiastic about staff messages and e-consults, but I think we have to recognize what the time commitment is. Yesterday, I did 17 e-consults, which took two hours. So, each consult averages about seven minutes, although it was anywhere from two to 12 minutes. We have to recognize that this takes time—it took two hours out of my day."[15] (Page 8)
Concerns with liability (n = 5)
• A minority of them prefer not to use [Virtual Consultations] VCs because of medicolegal concerns[43] (Page 17)
• potential for security and confidentiality breaches[45] (Page 10)
• Another challenge unique to electronic consultation and integrated [electronic consultation] eCR systems but not referral systems was specialist concern about liability[5] (Page 6)
• Providing non-visit consultative communication requires nontraditional specialist expertise, which has implications for both medical liability and training[39] (Page 207)
• medicolegal liability due to the risks of providing advice on a patient who was never evaluated in person[6] (Page 327)
Loss of patient contact (n = 3)
• A minority of them prefer not to use [Virtual Consultations] VCs because of ... discomfort with an impersonal process[43] (Page 17)
• On the other hand, the major limitation and disadvantage, is that rheumatologist are fundamentally clinical physicians and in this case we are not examining the patient[46] (Page 329)
• providing advice on a patient who was never evaluated in person[6] (Page 327)
Challenges with the quality/content of eConsult (n = 5)
• Referrals that lack a clear consultative question and relevant clinical data often render a specialist unable to make a clear diagnosis or a fully developed management plan[3] (Page 519)
• One specialist reported that e-consults could contribute to breaks in continuity of care, as the respondent to an e-consult may be different from the specialist who previously saw a given patient in person.[20] (Page 6)
• The perceived inconsistency in both clarity and content of eReferral processes to patients results in frequent mismatches between patient and subspecialist expectations[45] (Page 12)
• We also found that discrepancies in opinions exist between PCPs and specialists when determining cases that would still benefit from face-to-face referrals after an e-consult process[47] (Page 220)
• Concerns included persistence of unclear clinical questions[6] (Page 327)
• We found that referral outcomes for Champlain BASE e-consults may depend on the type of question being asked, the quality of the question based on the presence of PICO components, and the specialty being addressed[47] (Page 220)
Challenges with the use of technology (n = 2)
• until a more slim-line IT system is developed reducing the number of steps involved in completing an [electronic consultation] eC, … it appears to be beneficial for all parties except [secondary care] SC.[48] (Page A239)
• Suggestions for changing the current service included improving the technical aspects of the site[49] (Page 42)
Insufficient remuneration to use eConsult (n = 4)
• until a more … the cost per [electronic consultation] eC increased, it appears to be beneficial for all parties except [secondary care] SC.[48] (Page A239)
• Concerns included … and the need for adequate protected time and credit[6] (Page 327)

- Some felt the pay should be increased in order to ensure competitiveness of the service, while others argued that they should receive a premium given the rapidity and timeliness of their responses

✗ "I appreciate that eConsult is not as onerous a process as an in person consultation and we are not the [most responsible physician] but there does seem to be a substantive discrepancy. That being said I agree that the manner in which payments are tracked and dispersed is good."[49] (Page 42)

- One particular request made during the interviews was about clarity on how credit for work completed is assigned for consultants, as only the lowest level of workload credit was allowed when e-consults were initially launched.[20] (Page 7)

2. Facilitators

Improved communication with PCPs (n = 17)

- Improved efficiency if the system allowed for communication of additional patient information

✓ "We can always work around that where you have the certain doc that you're used to referring to. You still want to keep that relationship going in certain cases that are not too clear-cut. Sometimes maybe you're not going to be able to write but you can just pick your phone up and talk to the doc."(Provider)[1] (Page 6)

- Safety-net clinicians also emphasized the importance of clear clinical questions to optimize e-consult communication[50] (Page 78)
- exposure to eConsults significantly improved perceptions of how easy it is to obtain a mental health consultation[51] (Page 4)

✓ "A lot of the [e-consult] questions are so-called minor questions and the patient probably does not need to be seen as a formal consult. However, the family doctor wants to know how to answer a minor question, or sometimes they just want general guidance about a workup. So, we can help the family care doctor accomplish that result, without a formal consultation."[15] (Page 5)

- The majority of specialists stated that their motivation to sign up for the service was … and improved their communication with PCPs[49] (Page 41)
- Iterative interaction through eConsult programs may challenge assumptions and transform perspectives for both PCPs and specialists[27] (Page 47)
- specialists validated their feelings and assured them that they had handled the case properly, noting that

✓ "difficult cases like this also require the practitioner to practice self-compassion."[52] (Page 770)

- Accessing primary care provider's advance work on a case before the consultation

✓ "So for me it was nice to be involved in the situation where I've got a lot more from the fam-ily doctor. I had a good sense of what they've tried, what they didn't try, what investigations they've done, everything was attached because to see it right there, you don't have to call them up and ask them for more." (ID 202)[31] (Page e6)

- Improving interaction with primary care providers

✓ "I think it helps in the interaction with the health care provider. They tell you what information they have, you evaluate it and then if you need further information, you tell them 'This is what you need" (ID 216)[31] (Page e6)

✓ "It offers us a chance to talk to the referring physician...and then be certain we have the information that's required to make the decision."[17] (Page 9)

✓ "…so you can reassure the primary care physician, do this, this and that and if that's all negative, [the patient] doesn't need a referral." (specialty reviewer)[4] (Page 1340)

✓ "One of the big issues that used to come up–and it sounds absurd but–it would be very difficult to figure out what the primary provider wanted to have answered… So that's not an issue anymore." (specialty reviewer)[4] (Page 1340)

✓ "That's another advantage for some of these patients who just won't come to our clinic; at least there's a mechanism where you can provide some support for the primary care provider who's stuck dealing with the problem." (specialty reviewer)[4] (Page 1340)

✓ "Yes because we really didn't have an interaction in the past. So this ability to interact, to send a note back to the referring physician who then sends you back a note, you know, there's like a paper trail of what's going backwards and forwards or computer trail let's call it of what's going backwards and forwards. So it makes much better interaction." (specialty reviewer).[4] (Page 1341)

- In various studies, specialists reported improved clarity of clinical questions[6] (Page 327)
- Among specialists, 65 % "strongly agreed" that the eConsult question was clear, and 61 % "strongly agreed" that the question was of "optimal complexity"[53] (Page S446)
- Specialists have likewise expressed high levels of satisfaction and improved communication between themselves and PCPs[54] (Page 2)
- Specific suspected improvements include enhanced communication between PCP and specialists[55] (Page A119)
- concerns exist regarding the positioning and input of specialist care in patient management. E-consultation is a platform to deliver this whilst allowing integration as well as governance[56] (Page 4)
- eConsult services may offer an alternative for chronic pain patients by facilitating communication between PCPs and specialists[57] (Page 56)
- The number of advice requests suggests a desire within primary-care for secondarycare opinion where referral might not normally be sought[58] (Page 28)

This provides a unique system of physician-to-physician feedback, which is lost in the traditional referral-based system[59] (Page 273)

Educational opportunities (n = 8)

- They noted that success of this strategy depended on the engagement of the referring provider in the learning process and that some clinicians made nearly identical referrals repeatedly[20] (Page 6)

✓ "[E-consultation] also provides education. If you take the time to write out the thinking, then they don't have to ask you the question again because you just taught them. So it helps them be a better physician and it also will cut down on the questions."[15] (Page 5)

- and was a good mechanism for providing education to PCP
- Incorporating participation in the eConsult process into training programs for both primary care and specialty trainees is a novel and feasible strategy to ensure acquisition of this competency[27] (Page 49)
- gastroenterologists changed their colonoscopy reports; they included several new paragraphs of instructions explaining tailored follow-up according to the number of polyps and pathology[60] (Page 157)
- E-consultations that convert to a face-to-face visit can still educate the referring provider and should not arbitrarily be viewed as a failure[60] (Page 158)

✓ "Primary care physicians would know [how] to identify the patients in a timely fashion and then for them to [consult us]."

- These findings will be of interest to cardiology educators and potentially to cardio-vascular guideline writing group[61] (Page S280)

- They have also noted the educational opportunities afforded by the eConsults, such as case based teaching and using common eConsult questions as a needs assessment for formal teaching sessions[54] (Page 2)
- This may reflect a role for eConsults as both management and educational tools[62] (Page 7)

Improved referral efficiency (n = 29)

- The program is facilitating more effective referrals as both the primary care physicians and specialists learn and clarify what information needs are present and which situations benefit from referral[28] (Page 387)
- The flexibility of the e-consult mechanism was often considered an advantage by specialists, as each specialty could develop its own triage and response mechanism[20] (Page 5)
- Specialists perceived more available appointment times for scheduling patients who did require face-to-face visits
  - ✓ "It saves patients a lot of time, it makes us more efficient because we can take care of the patients who really need our services and are really sick, and, ultimately, you can probably reduce manpower too."[20] (Page 6)
- Providers had better guidance of the workup, which may have improved effectiveness of the consultation[63] (Page 618)
- reducing wait times to see a specialist
  - ✓ "[I]n our clinic sometimes we struggle to get in the urgent consults within a timely manner just because the wait times are getting longer, not just for the non-urgent but also for the urgent clinic appointments reducing wait times can be associated with less stress to [us] and so forth." (ID 211)
- In the majority of cases, nephrologists and PCPs (99% and 96%, respectively) thought that the e-consult was efficient[64] (Page 821)
- We found that e-consultation referrals are effective at increasing access to specialty care for underserved populations[25] (Page 139)
  - ✓ "We know that many patients were reluctant to come to Pittsburgh to the specialty clinic because they live two to four hours away…We're able to provide care to these patients without burdening them with the trip…to Pittsburgh." "It frees up time for other patients to be seen."[17] (Page 10)
- consultants are able to spend more time with those patients who benefit the most from an in-person visit[65] (Page 14)
- For the nephrologist, e-consultation permitted a detailed and efficient review of a patient's primary care electronic health record, facilitating prompt and informed decision-making[22] (Page 3)
  - ✓ "It avoids patients that are completely inappropriately referred …which saves the patient and us time." (specialty reviewer)[4] (Page 1340)
- Although these cases did not help avoid a face-to-face referral, the use of eConsult can lead to more efficient endocrinologis office visits[66] (Page 1149)
- fewer inappropriate clinic visits, increased efficiency when initial diagnostic testing or treatment had been completed prior to a clinic visit, perceived shorter wait times for face-to-face patients[6] (Page 327)
- The new virtual consultation model drastically reduces delay in specialist attention and this reduction is maintained over time[67] (Page S55)
- Surveys of specialists conducted before and after the rollout of eReferral suggested that the new system helped clarify the reasons for referrals[34] (Page 970)
- This fee-for-service eConsult program … appears to reduce office-based referral rates[53] (Page S446)
- suggesting there is potential for a small geriatrics staff to help many PCPs with clinical geriatrics questions[68] (Page S524)
- Most importantly, in 52% of cases a referral was originally contemplated but now avoided due to the endocrinologists' advice[69] (Page S8)
- Unnecessary referrals are avoided, thus reducing wait times for more urgent referrals[70] (Page 28)
- We found that an eConsult service provides timely access to neurologists and can divert half of intended face-to-face consultations[71] (Page 1)
- Questions involving symptomatic patients may warrant face-to-face consult, although e-consult may expedite initial work-up[72] (Page 1264)
- e-consultations can potentially reduce unnecessary clinic visits, while identifying patients who may benefit from early urological consultation[73] (Page S65)
- Clinical questions can be addressed electronically resulting in a shorter wait time and more efficient referrals to the rheumatology clinic[74] (Page 158)
- This highlights the importance of pre-visit communication in improving the efficiency of specialist services[75] (Page 3)
- It resulted in avoidance of a large number of face-to-face consultations[76] (Page S27)
- We also found decreases in the proportion of referrals deemed to be inappropriate in surgical clinics[77] (Page 1127)
- Geriatrics consult clinic can provide effective support to PCPs in the safety net setting without seeing every patient[78] (Page S481)
- These changes occurred without an increase in face-to-face visits, implying a decreased backlog of patients waiting for appointments, with no evidence of 'pent up' demand leading to increased utilization[79] (Page S384)
- At the same time, my service to non-surgical patients has not only been maintained, but the efficiency and timeliness with which I can manage them has greatly improved[42] (Page 136)
- GI providers may also benefi t from e-consults reducing unnecessary visits for patients who can be managed by their primary provider, thereby increasing access for other patients[80] (Page S407)

Reduced time commitments required for eConsult (n = 10)

- [Virtual Consultations] VCs were an efficient use of their time and … less disruptive than contacts by telephone or pager[43] (Page 16)
- Since eConsults provide for greater efficiency, specialists feel like they waste less time on referrals of marginal value[28] (Page 388)
- The workload to the subspecialist providing the eConsult service was not onerous. All but one eConsult were completed within 10 minutes, and only 1 took 10 to 15 minutes to complete[81] (Page e368)
  - ✓ "we are never going to make as much money as face-to-face time. But this is way easier, more useful and kind of fun."[49] (Page 42)
- Our study found that providing responses to eConsults required only a limited time commitment from otolaryngologists[23] (Page 354)
- Some specialists mentioned how useful it was to build their work on what another physician had already done.
  - ✓ Noted one (ID 202), "It's always quicker to read someone's findings rather than to go ahead and do the full exam yourself. I probably would spend anywhere from 30 to 45 minutes with a new patient. What I re-ported as having spent on e-consultation was much less than that. Nothing more than 20 minutes."[31] (Page e5)

- Finally, it is important to note that the eConsult service did not utilize much of the specialist's time as it took less than 15 minutes to finish 82.8% of eConsults in this study[24] (Page 840)
- Reassuringly, the average self-reported time it took specialists to complete an eConsult was 11.2 min, which is shorter than it would take to complete an in-person consult[35] (Page 107)
- a positive relationship between the time specialist reviewers spend on eConsults and the likelihood of resolution without a visit[40] (Page 498)
- The workload to the subspecialist providing the eConsult service was not onerous[81] (Page e368)

Ability to expedite face-to-face consultation if needed (n = 4)

- Specialists particularly valued having the ability to convert face-to-face consultation requests to e-consults when they deemed it appropriate[20] (Page 6)
- Gaining some control in decisions about which patients should be referred
  - ✓ "[When] we get referrals to see you face to face, you book the patient in to see, you don't really decide necessarily that they absolutely need to see you. Whereas if you recommend it with e-consult, you are making the statement, you are saying that they absolutely need to see you because this is something that you can do." (ID 202)[31] (Page e6)
  - ✓ "If we have any reservations or the patient has any reservations, we see them [face-to face]."[17] (Page 10)
- Our specialists are not obliged to make a recommendation if they do not feel they have sufficient information or cannot answer the question without directly assessing the patient[66] (Page 1149)

- Taken directly from the reference main text as a barrier or facilitator to eConsult (second order constructs)

✕ Taken from quoted text within the reference as a **barrier** to eConsult (first order constructs)

✓ Taken from quoted text within the reference as **facilitator** to eConsult (first order constructs)

Supplementary Panel 3: Patient perspectives on barriers and facilitators

1. Barriers

Some patients preference to see specialist in person (n = 2)

- Those who did not think eConsultations would be beneficial stated that they would feel more confident talking to a specialist directly
  - ✗ "It's important to see the specialist to feel more secure."[82] (Page 327)
- Patients without family doctors also expressed that eConsultations wouldn't be ideal for them
  - ✗ "It wouldn't be useful in my situation because I am not seeing the doctor that referred me again and I don't have a family doctor."[82] (Page 328)
- Others reported "pushback" from patients who wanted in-person advice from a specialist[14] (Page S3)

Perceived decreased accessibility to specialist care (n = 2)

- Potential decreased access to care by increasing, wait times at other points in the care pathway
  - ✗ "The only part that I'm concerned with is the overload of your local doctors, which will slow down the information back to your patient … (Patient)"[1] (Page 4)
- concerns that the subspecialist might not be privy to important information about their condition
  - ✗ "And if I feel like my doctor is brushing off that information, is not communicating other symptoms … you know, these are the only four symptoms that matter and so I'm just going to give those to the specialist, at that point I might feel like wow, there's more information that's not getting through" (English focus group 1).[45] (Page 2492-2493)

Concerns for safety/ appropriateness of eConsult (n = 4)

- patient expressed concern that a provider using eReferral might say
  - ✗ "I asked someone and he told me to give you this. If something happens to you, it's not my responsibility because the other doctor prescribed it" (Spanish Focus Group 1)[45] (Page 9)
- Although an eConsult service is useful, clearly not all infectious disease patient problems can be managed this way. Certain acute infections must be managed urgently with face-to-face consultations[32] (Page 5)
- A common concern with eConsults is whether they pose a safety risk for patients by not having an inperson evaluation[83] (Page 223)
- the results do suggest a trend towards utility of preconsult exchange in sorting patients who need a rheumatologist evaluation, but at a cost of delayed face to face consultation[84] (Page 1586)

2. Facilitators

Remote residence location (n = 11)

- patients have the opportunity to avoid long travel distances to see specialists and to obtain specialty advice in a timely manner compared with an in-person visit[85] (Page 652)
- With perceived benefits including reduced travel time, e.g.
  - ✓ "It's difficult for me to travel and I live far so it could have been beneficial"[82] (Page 327)
- Patients who saw eConsultation as a viable alternative to traditional referrals cited reduced travel time and quicker responses as advantages[86] (Page 9)
- Reduction in travel
  - ✓ "Well we'd get information faster so that our doctor could know, would know what to do. That would be a benefit, yeah. Yeah, without us having to travel. Lots of times you could be treated without going anywhere too. (Patient)"[1]
- Patients who did not want to travel to the specialist either because they were elderly and frail or unable to leave work were most likely to opt for the e-consultation option[15] (Page 4)
- Avoiding unnecessary travel
  - ✓ "I had some specific non-urgent questions so I sent a consult to [name of specialist] and he gave me some specific answers that the patient found helpful; the patient lived in [rural area] and was quite happy to hear from the specialist and didn't have to travel to Ottawa to get an endocrine consult, which takes 6 months." (FG2)[31] (Page e6)
- A reduction in face-to-face referrals may benefit patients … have difficulty traveling due to medical co-morbidities[35] (Page 107)
- patients benefit because they are able to circumvent travel-related barriers[8] (Page 752)
- E-consult use allowed patients to avoid travel[87] (Page S746)
- with perceived benefits including reduced travel time, e.g.
  - ✓ "It's difficult for me to travel and I live far so it could have been beneficial"
- ECs provide timely specialty healthcare access and they may overcome the barrier of geographical distance[88] (Page S458)
- veterans were satisfied with time regarding e-consult
  - ✓ "Yeah, I take my pills not only at 7:30 in the morning along with a shot and at 11:30 and then at 3:30 along with a shot there, and then at 11:30, I mean at 10:30. But traveling, it throws you off…and a lot of times you even totally forget it."
- Several patients discussed eConsult's potential to benefit patients living in rural or remote areas, who often face especially long or costly trips to receive specialist care
  - ✓ "I live in a more remote location […] A lot of the specialists probably aren't going to be here, so [eConsult can] save me a trip to Ottawa."[89] (Page 95)

Timely access to specialist care (n = 12)

- faster responses, e.g.
  - ✓ "I could have gotten an answer a lot quicker!"[82] (Page 327)
- Patients who saw eConsultation as a viable alternative to traditional referrals cited reduced travel time and quicker responses as advantages[86] (Page 9)
- eConsult service has now enabled rapid access to specialist advice for over 11,000 patients in our health region[90] (Page 2)
- faster access to diagnostic and treatment interventions[91] (Page A376)
- patients gain quicker access to specialist advice through primary care, often preventing unnecessary referrals to specialty care

- A decrease in unnecessary patient referrals, and thus overall wait times, will have a positive effect on both the patients receiving timely and appropriate care from their PCP supported by specialist advice and those being seen more rapidly in the specialty care clinics[13] (Page 5)
- Results from this analysis indicate that patients in the intervention group were significantly more likely to receive a consultation from a cardiologist than were control patients[25] (Page 136)
- PCPs stated that they would not have sought nephrology advice, raising the possibility that e-consult may lead to increased access to nephrology services for patients who could benefit from nephrology input.[64] (Page 823)
- For patients, the most frequently noted benefits, as perceived by study participants, included improved access to specialist care[31] (Page e5)
- The eConsult service improved access to specialist care for patients with chronic diseases[92] (Page 1055)
- participants reported that access for non-urgent patient issues had improved, supporting our hypothesis that electronic referrals would improve access to care[63] (Page 618)
- When asked what they liked about the eConsult service, nearly all patients mentioned the service's speed. Many patients noted that they received follow-up from their initial appointments far more quickly than expected:
  - ✓ "she took photos of both my hands [and] sent them through the eConsult and within 24 hours I was back in the office."[89] (Page 95)
  - ✓ 'if I wanted to see them [the specialist] face-to-face it would have taken possibly months.'
- Indirect benefits relate to improvements in access to specialist advice
- Appropriate tests would be ordered and communicated with nephrologists
  - ✓ "Well we'd get information faster so that our doctor could know, would know what to do. That would be a benefit, yeah… Patient)"
- Most patients prefer the convenience and ……, as well as the rapid receipt of specialist input via eConsults.[28] (Page 387)

Potential cost savings (n = 8)

- Most patients prefer the convenience and savings of avoiding an extra appointment[28] (Page 387)
- A few patients also mentioned eConsult's ability to improve accessibility from an economic standpoint by reducing costs to themselves and the Canadian populace more broadly, as the service can result in
  - ✓ "lower cost for the taxpayer, [because] the doctors can see more patients."[89] (Page 95)
- cost savings for eConsult from the societal perspective attributable to patient avoided costs, as patients whose PCPs had originally considered a referral but ultimately chose not to refer them avoided the travel costs and lost wages/productivity associated with face-to-face specialist visits[93] (Page 5)
- From a patient perspective, fewer office visits translates to less time taken off work and reduced transportation costs.[66] (Page 1149)
- The service allowed a significant proportion of patients to avoid traditional consultations leading to the potential of cost savings[37] (Page 42)
- Avoided patient travel for these cases amounted to $184,447.20.[94] (Page 5)
- These patients also avoid having to pay for care themselves if they do not have private health insurance[95] (Page e762)
- eConsults that avert a specialty visit represent a considerable savings to patients, particularly when opportunity costs are considered in addition to direct costs[96] (Page S249)

Patients acceptance of eConsult (n = 6)

- Several patients stated that they were unfamiliar with the technology prior to its use in their care and felt it was a good idea
  - ✓ "It was fairly new to me when I went to this new facility and I was really kind of pleased […] what a great way and efficient way to do something versus to continually going back to the office."[89] (Page 96)
- acceptance is vital to the success of any healthcare innovation, and patients' perspectives on new and innovative services must be thoroughly established.[86] (Page 9)
- Anecdotal feedback from patients suggests that there are no differences between virtual or traditional face-to-face consultations in regard to perceived efficiency, quality of consultation, or involvement of the patient in the decision making.[43] (Page 17)
- While the satisfaction results were high in the population surveyed[97] (Page 554)
- patients were satisfied with the teleconsultation and all wanted the same procedure in future[98] (Page 104)
- The high proportion of referral patients who expressed a preference for eConsult for a similar problem in the future also suggests acceptability among patients previously unfamiliar with the service[99] (Page S145)

- Taken directly from the reference main text as a barrier or facilitator to eConsult (second order constructs)

✗ Taken from quoted text within the reference as a **barrier** to eConsult (first order constructs)

✓ Taken from quoted text within the reference as **facilitator** to eConsult (first order constructs)

Supplementary Panel 4: Barriers and facilitators based on health system structures

1. Barriers
eConsult system design challenges (n = 5)
• The form was time consuming and required that all of the fields are completed. … forms based on algorithms designed by the consultant may be preferred by some specialists, but they do not seem to be favored by the providers who are actually caring for the patients[100] (Page 144)
• To find an application able to integrate seamlessly with diverse systems is often challenging[101] (Page 984)
• Other concerns in this area were related to … use of online forms, and technical quality of attachments[31] (Page e6)
• If the e-consultation request is vague … the consultant is more likely to recommend a face-to-face visit rather than provide an electronic response to the PCP[15] (Page 6)
• Many informants in our study described EMR interoperability as a significant impediment[102] (Page 80)
Lack of resources (n = 3)
• Health systems or practices initiating telehealth programs need to provide a base investment in the technology and then provide an ongoing and available infrastructure[2] (Page 18)
• Two hospital leaders discussed the challenges of implementing e-consults, noting
✗ "There was a lot of infrastructure building for e-consults and a lot of education that had to be done."[20] (Page 6)
• The main barrier identified for the eConsult project was the timing of the project. The project was planned and implemented at the same time the agency was building and moving to a new clinic and hospital[103] (Page 47)
Variation in licensure requirements across provinces/states (n = 3)
• In fact, licensure requirements also differ from state to state, and this introduces a significant possible variation in practice[2] (Page 19)
• physicians cannot provide services within another province without first being licensed in that province … However, these exceptions are not universal, and current policies place numerous restrictions on interprovincial consultation, virtual or otherwise[54] (Page 6)
• many states require licensure for physicians who seek compensation for interstate care, restricting access to potential users because of their location[104] (Page 254)
Privacy concerns (n = 4)
• Other concerns in this area were related to privacy and security[31] (Page e6)
• Less positive comments referred to … and some concerns over patient privacy[22] (Page 3)
• Concerns over privacy remain a barrier to the adoption of electronic platforms or innovations among health care providers[54] (Page 3)
• increasing discussions around privacy and legal issues[49] (Page 42)
2. Facilitators
Increase providers knowledge capacity and confidence (n = 9)
• Awarding CME credits for learning current nephrology best practice by working through the decision-making structure of the form. boosting confidence of non-nephrology physicians in kidney care
✓ "I wonder if you want to again attach a carrot, if you can give CME credit. …Because then you might not get paid for…navigating that CKD pathway with the patient but if you can say, "Well no, I went through it and it took me a half an hour and that's my CME credit." (Provider)[1] (Page 5)
• The benefits include … use of standardized care pathways for pediatric patients[2] (Page 20)
• This information could be used to inform the planning of continuing medical education (CME) and professional development events for PCPs[29] (Page 425)
• The different eConsult topics are helpful to identify areas of continuing medical education for PCPs.[81] (Page e369)
• By evaluating the types of eConsult referral questions asked by PCPs, we may be able to better target CME interventions more effectively[35] (Page 108)
• This has the potential to inform the planning of continuing medical education (CME) events for primary care providers and potentially affecting curriculums of medical and nursing schools[59] (Page 273)
• The different eConsult topics are helpful to identify areas of continuing medical education for PCPs[81] (Page e369)
• We plan to use the types of questions asked to inform planning of future CPD events for PCPs[70] (Page 28)
• By evaluating questions generated from every-day patient problems faced by PCPs, our analysis can serve as a needs assessment to guide cardiology CME for PCPs[105] (Page S101)
eConsult platform choice (n = 5)
• integrate the e-Consult system with an existing province-wide and secured EMR … facilitates potential for wider practice adoption and implementation[1] (Page 6)
• the high-volume sites incorporated e-consults in ways that improved efficiency of operations, whereas the low-volume sites did not. Specifically, high-volume sites spent considerable time and effort tailoring the EHR templates to be completed easily and quickly[106] (Page 4-5)
• Innovators may be tempted to develop a service as an extension of a specific EMR program or vendor, since harnessing an existing platform can reduce the upfront time and costs associated with development. However, greater flexibility will support wider adoption, allowing the service to reach a broader segment of the population[86] (Page 7-8)
• access to a shared electronic healthcare record and … Neither of these factors was present in our system[107] (Page 737)
• A shared EMR and single contact e-consultation ordering system is necessary for e-consultations to be successfully integrated into care processes[108] (Page 228)
eConsult ease of use (n = 6)
• eConsult services offer a relative advantage over current practice and were often seen as easy to use and well integrated into everyday workflow[30] (Page 282)
• The workflow of the e-consultation system must fit as seamlessly as possible into the physician's usual workflow to ensure participation. It is important to minimize system usage time[101] (Page 295)

• Most users reported that the system was "easy to use" and "intuitive."[4] (Page 1342) • Chronic Kidney Disease Electronic Advisory Service (CKDEAS) was easy to use, quick and convenient[109] (Page 6) • Successful technologies must be straightforward and easy to learn[86] (Page 8) • Socio-technical interaction, or the ability of technology to integrate into standard workflow, is an essential component to the success of an e-health initiative[102] (Page 80) • thus these physicians already had prior experience with information and computing technology
Improved access to specialist care (n = 8)
• The benefits include improved access to specialty care for those practicing in remote communities[2] (Page 20) • rapid access to specialist care … early detection of cases that should be referred … future reduction in waiting times for face-to-face consultations due to the improved system efficiency[29] (Page 424) • Managing demand has allowed appointment times at the outpatient clinic to be lengthened, so patients are more thoroughly examined and thus need fewer visits in secondary care[110] (Page 191) • One e-consult site leader from a high-volume site thought the process was very efficient: ✓ "I love it; I think it's fantastic. There are many times things come up and I would like opinions on and get notes in [the] chart but I don't think the provider needs to see the patient. I can do it when I have time to organize my time and thoughts…Most of the time this is faster than [a] face-to-face appointment."[106] (Page 4) • Access to specialist services occurred within hours of a request[81] (Page e368) • One clinical service chief noted ✓ "It allows for better triaging of consults and in theory may be improving access to subspecialty clinics."[20] (Page 6) • E-consults can be used to provide clinical decision support to providers, drive processes for consult triage, improve Veteran access to care[111] (Page 1) • The appropriate use of eConsults can improve timely access to rheumatologists[112] (Page 1311)
Use of case manager to triage consultations (n = 3)
• The consult manager, who screened all the consults, took advantage of the breadth of consultants available to the system and solicited the opinions of a range of specialists for the same question[44] (Page 392) • one safety-net system uses referral case managers to improve e-consult referral efficiency[50] (Page 78) • One site hired a pharmacist to handle the additional workload needed to generate and follow-up on e-consults. In contrast, low-volume sites did not take extra steps to facilitate implementation[106] (Page 5)
Security measures (n = 6)
• use of a password-protected Web site with encryption meets the intent of [Health Insurance Portability and Accountability Act] HIPAA, although it is likely that written consent may eventually be needed before sending a consult[44] (Page 393) • We reviewed our e-consult process with risk management lawyers and we were able to reassure providers that this system would not place them at undue legal risk.[97] (Page 554) • Patient privacy is ensured through a secure system which was created on a private network and meets all patient privacy policies in our jurisdiction[29] (Page 422) • Clearer guidelines on how new technologies can fit into existing privacy policies would help innovators develop and implement secure programs.[54] (Page 4) • A proper privacy and threat analysis must be conducted prior to launching any new platform where patient health information is located[86] (Page 8) • [Health Insurance Portability and Accountability Act] HIPAA privacy standards make explicit, for the first time in federal legislation, that "consultations between health care providers and referrals of a patient for health care from one health care provider to another "are expressly permitted[104] (Page 225)
Improved quality of care / "Safety net" effect (n = 5)
• Analysis of downstream emergency department visits and hospitalizations after the introduction of the eConsult program showed low rates of utilization[3] (Page 519) • 4% of cases PCPs were not planning on sending the patient for a traditional face-to-face referral … however, the eConsultant recommended one due to the potential high-acuity nature or complexity of the problem[29] (Page 425) • The system allows patients to be transferred back to primary care earlier … The hospital admission rates after teleconsulting were low[110] (Page 192) • In 5.0% of these prompted referrals, the specialist expressed a sense of urgency in the timeliness of when a referral should be scheduled[113] (Page e385) • We also find that PCPs implement specialists' recommendations in the large majority of cases, and very few patients subsequently require specialty care or ED visits related to the reason for eConsult[114] (Page S77)
Organizational commitment to implementation (n = 9)
• Obtaining buy-in from health system leadership is essential to lay the necessary ground work, align priorities across many of the silos common to academinc health centres[28] (Page 387) • Public policies should be implemented by the government to assure the utilization of these tools by the professionals[115] (Page 697) • Both clinicians and patients agreed that the program responds to a defined need[50] (Page 77) • Leaders promoted e-consults in a manner similar to how they encouraged their constituencies to embrace other information technology initiatives to improve specialty access, such as telehealth[20] (Page 6) • The need should drive the selection of technology, not the other way around. Many technology initiatives are driven by eHealth experts rather than clinical champions[86] (Page 7) • it suggests that an eConsult system may realize its true potential only with engaged specialist reviewers who are willing to engage primary care providers in dialogue[40] (Pgae 498) • The importance of engaging the end users and identifying physician champions[102] (Page 80) • Currently, each medical subspecialty is managed by a "clinical champion" who is responsible for recruiting consultants[116] (Page 213) • From the beginning, the South Central District stood out for having a team managing the use of teleconsultations[117] (Page 412)
Clarifying providers' duty of care/role (n = 2)

• eConsults from a medical legal perspective are considered along the same lines as a ‘‘curbside consult’’ in that the specialist provider does assume a duty of care once the case is reviewed[29] (Page 422)
• in an eConsult, providers undertake a duty of care in the same way as they do when providing advice in a hallway consultation or over the telephone. As such, specialists are required to provide a reasonable opinion with the information provided to them[86] (Page 8)
End user engagement/consultation (n = 6)
• With e-consults, specialists must reach out to PCPs to engage them, so it is important that good networks and communications exist to facilitate this engagement. Most low-volume sites noted that there was little to no communication around implementation of e-consults
✓ “There’s been a lot of consultation between the e-consult team and us, so we are happy with the product we have… I think there’s a better spirit of collegiality from e-consults too.”[106] (Page 5)
• Disseminate the benefits (using actual data) of E-Consults for patients and for workflow to participating providers[118] (Page S437)
• Specialists must reach out to primary care providers to engage them[118] (Page S437)
• Using an electronic system to collect and report aggregate data could allow for summaries to be presented to PCPs and specialist providers, which could improve feedback[35] (Page 108)
• The finding has implications for the implementation ofa care-delivery innovation, supporting the need to maximize familiarity with the project as well as interaction with the project team[119] (Page s192)
• Success of such programs is facilitated by early engagement of the needed multidisciplinary team and timely training of the end users through relevant CME programs[120] (Page 231)
Providing ongoing support/training/evaluation (n = 4)
• In contrast, a high-volume site participant noted that training was crucial
✓ “the key thing to getting this [e-consults] implemented.”[106] (Page 5)
• One specialist noted their point of contact was
✓ “a really good source of information, and constructive in putting me in contact with other diabetes specialists in the country, and supporting the efforts to learn from our colleagues…[I’ve] been able to grow in unique ways because of his guidance.”
• Provide more guidance and details for implementation, including a better infrastructure for program roll-out—e.g., a standardized template for scheduling, tracking, and recording workload and a timetable for implementation[118] (Page S437)
• As part of the implementation process, OSCT [Office of Specialty Care Transformation] also funded an evaluation center, whose goals are to provide data to OSCT to inform any changes needed to current and future implementation sites[121] (Page S448)
Piloting eConsult (n = 5)
• Conduct a trial, with the explicit agreement to revise the approach if it doesn’t work[118] (Page S437)
• Starting with a small group will allow you to identify many of the obstacles before the system is sufficiently large that they prove extremely[101] (Page 984)
• eReferral was implemented as a pilot in one specialty clinic for the first 18 months before it was launched in a second clinic
✓ "I think the reason why they’ve jumped onto the bandwagon is because they probably saw how efficient it was with GI."[4] (Page 1343)
• Moreover, the pilot, as well as a phased rollout, enabled the development team to make continual improvements to the system[4] (Page 1343)
• The DHS eConsult system was rolled out on a staggered basis across primary care practice sites and specialties from 2012 through the end of 2015[40] (Page 493)
• A single practice pilot of e-consultation indicated potential benefits[22] (Page 2)

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- ✗ Taken from quoted text within the reference as a **barrier** to eConsult (first order constructs)
- ✓ Taken from quoted text within the reference as **facilitator** to eConsult (first order constructs)

Supplementary Panel 5: Cost related barriers and facilitators

1. Barriers
Insufficient remuneration for providers (n = 7)
• A key barrier to widespread adoption of preconsultation exchange is the development of reimbursement models[18] (Page 174) • The most oft-cited barrier to widespread implementation of electronic consultation … Specifically, lack of reimbursement mechanisms for specialists[5] (Page 6) • payment models lag behind and may hinder the potential spread of such programs[85] (Page 653) • A lesson learned from early adopters is that health care systems need to provide incentives for clinicians (especially specialists) to participate[15] (Page 7) • However, some issues regarding asynchronous teleconsult reimbursement are unresolved[44] (Page 393) • There is no consistency for reimbursement through commercial payers or state-based Medicaid organizations[2] (Page 19) • To accommodate this change in workflow, referring providers may require incentives (either in time allotted for addressing e-consultation recommendations or additional pay for coordinating care)[10] (Page 6)
Inadequate funding (n = 2)
• inadequate funding for ongoing costs to support the technology platform[5] (Page 6) • financial costs associated with the development and implantation of an eConsult system[23] (Page 354)
Providers' payment structure (salaried physicians Vs. fee-for-service models) (n = 5)
• in order for e-consults to be more widely adopted, changes to the payment systems are needed. The [Veterans Health Administration] VHA's model of salaried physicians and capitated reimbursement provides a more favorable environment for e-consult implementation. In contrast, under the fee-for-service model, specialists must physically see the patient and bill for a separate visit in order to receive payment.[85] (Page 653) • These incentives can be monetary in fee-for-service systems or workload credit in capitated or salaried health care systems[15] (Page 7) • and might only be cost-effective in a non fee-for-service model such as one found in the [Veterans Health Administration] VHA. However, …, this model may become useful even for fee-for-service practices[122] (Page e244) • Integrated health-care delivery systems that do not rely on fee-for-service reimbursement may be fertile ground for attempts to improve the efficiency of subspecialty care[63] (Page 618) • access to … and salaried physicians were critical success factors. Neither of these factors was present in our system[107] (Page 737)
1. Facilitators
Developing payment models and incentives for providers to use eConsult (n = 10)
• Availability of financial remuneration to enable PCPs to be compensated for this work ✓ "But is there a plan or is there going to be some kind of a fee schedule for this service? There will be good buy-in for guys who are working fee-for-service. It's going to take a significant chunk of time. (Provider)"[1] (Page 5) • financial incentive for psychiatrists to participate[51] (Page 2) • Its success at San Francisco General Hospital depended on …… and on financial incentives that were not completely wedded to clinic productivity.[34] (Page 971) • both the primary care physician and the specialist receive a productivity (RVU) credit for their efforts.[28] (Page 387) • Payment for the specialists is CAD$200 per hour on a proportionately rated time basis in self-reported increments[29] (Page 422) • In consultation with our initial specialist users, we established bailing rate of $200/h for their service. This rate was based on the average current remuneration of specialists in Ontario for a face-to-face consultation, which is approximately $150 for all specialties listed[101] (Page 987) • recommend eC [eConsult] as the way forward with a more appropriate tariff[123] (Page A97) • together with an awareness of the reduction in fixed costs associated with loss of face to face consultation, an agreed putative tariff for an econsultation was set at 15% of the current value of a new outpatient tariff[124] (Page 125) • The average pain specialist is reimbursed $59.19 for an eConsult (approximately 20 minutes) compared to $106.80 for a face-to-face consultation in Ontario, Canada[13] (Page 4) • In a different healthcare context where universal healthcare coverage is not offered, other remuneration models beyond the scope of the Champlain BASE eConsult data may be of interest[125] (Page 8)
Potential cost savings for insurance payers to use eConsult (n = 3)
• Referral to specialty departments dramatically affects the annual cost of medical care for a group of insured patients[126] (Page 256) • An ACO [Accountable Care Organizations] with a high proportion of patients with vascular disease in insurance risk contracts might find implementing a program a promising financial proposition[97] (Page 554) • In the US, insurers have generally not paid for internal e-consultations. However, if internal e-consultations can be low-cost substitutes for expensive face-to-face consultations, insurers will want to support their use[60] (Page 157)
Potential cost savings for society (n = 5)
• The elimination of unnecessary visits subsequently reduces travel reimbursement costs[85] (Page 653) • health systems who currently subsidise patient travel for specialist care could see substantial cost savings through the implementation of eConsult[93] (Page 5) • The estimated total societal savings resulting from eConsult in Nunavut were $180,552.73, or $1,100.93 per eConsult.[94] (Page 5) • cost savings for eConsult from the societal perspective attributable to patient avoided costs, as patients whose PCPs had originally considered a referral but ultimately chose not to refer them avoided the travel costs and lost wages/productivity associated with face-to-face specialist visits.[93] (Page 5) • economic evaluation of a store-and-forward teledermatology service in Spain found the service to be cost saving from a societal perspective[93] (Page 6)
Potential Cost savings for the healthcare system (n = 13)
• with an estimated cost savings of $185408.[44] (Page 392) • the annual savings in outpatient costs would be [Finnish markka] FM 1,720,000.[110] (Page 191)

- which led to a saving of $7,092.05 in specialist fees[94] (Page 5)
- eConsult exhibited even greater cost savings in Nunavut than it did in Ontario[94] (Page 6)
- Extrapolating from our findings, we estimate that if the eConsult service were adopted by the entire territory, with a conservative impact of 10% avoided referrals, it would demonstrate savings of over $7 million per year.[94] (Page 6)
- A few PCPs reported the value of the eConsult service for the health care system as a whole
  - ✓ "That is what an eConsult service should be [:] to help reduce health care services load by a simple and sound advice." (ID 397, MD, female) (Page 399)
  - ✓ "Please continue with e-consult services as it will save on health [dollars] in the long run and will assist in improvement of patient care." (ID 293, MD, female)[12] (Page 399)
- The estimated cost savings, even with specialists' fees for e-consultations factored in, could be as much as $400 000/day[31] (Page e7)
- Savings between June 2014 and December 2015 total $1,337,628 when including both tangible and intangible[127] (Page e1700)
- Additionally, we estimate that 97 of the children would have been transported to TAMC by air, with an estimated cost savings of $662,018.[100] (Page 145)
- If this service becomes widely available, there would be huge potential savings for the healthcare system[24] (Page 840)
- The significant impact on ED costs may represent a downstream benefit of improved access to care[128] (Page S86)
- There is every indication that HELP will continue lead to more cost-savings by preventing unnecessary patient transfers[129] (Page 6)
- Each prevented referral meant a saving of €493.; It facilitates shared care for patients with chronic disease conditions, and it might enable effective use of expensive secondary care facilities.[130] (page 155)

- Taken directly from the reference main text as a barrier or facilitator to eConsult (second order constructs)
- ✗ Taken from quoted text within the reference as a **barrier** to eConsult (first order constructs)
- ✓ Taken from quoted text within the reference as **facilitator** to eConsult (first order constructs)

eTable 1: Characteristics of included studies

First Author, Year	Journal Title	Data Extracted	Study Design	Analytical Approach
The Champlain BASE (Building Access to Specialists through eConsultation) eConsult, Ontario, Canada				
Bradi, 2017 [71]	Neurology	Healthcare system	Retrospective review	Quantitative
Canning, 2016 [70]	Can J Gastroenterol Hepatol (Abstract)	PCP, healthcare system	Retrospective review	Quantitative
Chan, 2016 [61]	Can J Cardiol (Abstract)	PCP, specialist, healthcare system	Retrospective review	Qualitative
Fogel, 2017 [29]	J Telemed Telecare	PCP, healthcare system	Cross-sectional survey	Qualitative
Johnston, 2017 [81]	J Pediat Hematol Onc	PCP, specialist, healthcare system	Cross-sectional survey	Qualitative
Johnston, 2017 [76]	Pediatr Blood Cancer (Abstract)	Specialist	Cross-sectional survey	Not specified
Joschko, 2018 [89]	Fam Pract	Patient	Patient interviews	Qualitative
Keely, 2017 [33]	Acad Med	Patient, PCP, specialist	Commentary	Not specified
Keely, 2015 [49]	Stud Health Technol Inform	Specialist	Cross-sectional survey	Quantitative
Keely, 2015 [86]	Electronic Healthc Law Rev	Patient, healthcare system	Commentary	Not specified
Keely, 2015 [82]	Can J Diabetes	Patient	Mixed methods (patient survey, retrospective chart review)	Quantitative and qualitative
Keely, 2013 [107]	Telemed J E Health	Healthcare system, cost	Provider survey	Qualitative
Keely, 2012 [69]	Can J Diabetes (Abstract)	Patient, healthcare system	Retrospective review	Not specified
Khamisha, 2015 [37]	Blood	Patient, PCP, healthcare system	Retrospective review	Quantitative
Kohlert, 2017 [23]	Laryngoscope	Patient, PCP, specialist, healthcare system, cost	Retrospective review	Quantitative
Liddy, 2017 [113]	Can Fam Physician	Patient, PCP	Cross-sectional survey	Quantitative
Liddy, 2017 [33]	Healthc Policy	Patient, PCP, healthcare system	Cross-sectional study	Qualitative
Liddy, 2017 [52]	J Am Board Fam Med	PCP, specialist, healthcare system	Retrospective review	Qualitative
Liddy, 2017 [57]	Scand J Pain	Patient	Cross-sectional survey	Quantitative
Liddy, 2016 [92]	Pain Med	Patient, PCP, specialist	Cross-sectional review	Quantitative
Liddy, 2016 [94]	Int J Circumpolar Health	PCP, healthcare system, costs	Cross-sectional survey and cost review	Cost
Liddy, 2016 [93]	BMJ Open	Patient, healthcare system, cost	Costing evaluation	Cost
Liddy, 2016 [11]	J Am Assoc Nurse Pract	PCP	Cross-sectional and content analysis	Qualitative
Liddy, 2016 [93]	BMJ Open	Cost	Costing evaluation	Cost
Liddy, 2016 [125]	Informatics	Specialist, healthcare system, cost	Economic evaluation	Cost
Liddy, 2015 [54]	Health Reform Observer	Patient, PCP, specialist, healthcare system, cost	Commentary	Not specified
Liddy, 2015 [12]	J Am Board Fam Med	PCP, cost	Mixed methods (provider survey, retrospective review, themes)	Quantitative and qualitative
Liddy, 2013 [101]	Telemed J E Health	Healthcare system, cost	Case report	Not specified
Liddy, 2013 [31]	Open Med	Patient, PCP, specialist, healthcare system, cost	Mixed methods (provider interviews, survey and focus groups, retrospective review)	Qualitative

First Author, Year	Journal Title	Data Extracted	Study Design	Analytical Approach
McKellips, 2017 [95]	Br J Gen Pract	PCP	Cross-sectional study	Not specified
Murthy, 2016 [32]	Open Forum Infect Dis	Patient, PCP	Retrospective review	Quantitative
O'Toole, 2017 [24]	Int J Dermatol	PCP, specialist, healthcare system, cost	Provider survey	Quantitative
Poulin, 2017 [13]	J Healthc Qual	Patient, PCP, specialist	Cross-sectional study	Quantitative
Rostom, 2015 [112]	J Rheumatol (Abstract)	PCP	Retrospective review	Not specified
Shehata, 2016 [26]	Obstet Gynecol	PCP, specialist	Retrospective review	Quantitative
Shoki, 2015 [105]	Can J Cardiol (Abstract)	PCP	Retrospective review	Not specified
Skeith, 2017 [35]	Thromb Res	PCP, specialist, healthcare system	Cross-sectional study	Qualitative
Stanistreet, 2017 [65]	Healthc Q	PCP, specialist, healthcare system, cost	Costing review	Cost
Tran, 2016 [47]	Telemed J E Health	PCP, specialist	Retrospective review	Quantitative
Tran, 2016 [66]	Endocr Pract	PCP, specialist, healthcare system	Retrospective review	Quantitative
Witherspoon, 2017 [59]	Can Urol Assoc J	PCP, specialist, healthcare system	Retrospective review	Quantitative
Witherspoon, 2016 [73]	Can Urol Assoc J (Abstract)	Patient	Retrospective review	Quantitative
Alberta Netcare eReferral, Canada				
Bello, 2017 [1]	BMJ Open	Patient, PCP, specialist, healthcare system, cost	Focus groups	Qualitative
Consult Conduit, Canada				
Abouali, 2017 [42]	Can Fam Physician	PCP, specialist, cost	Commentary	Not specified
Veterans' Health Administration, USA				
Chang, 2017 [74]	Arthritis Rheumatol (Abstract)	Patient	Retrospective review	Quantitative
Cordasco, 2015 [9]	J Gen Intern Med (Abstract)	Patient, PCP	Observational mixed methods (survey, semi-structured interviews)	Quantitative
Gupte, 2016 [20]	JMIR Med Inform	PCP, specialist, healthcare system	Quality improvement	Qualitative
Haverhals, 2016 [106]	Am J Manag Care	Healthcare system	Observational mixed methods (survey, interviews, ratings)	Qualitative
Haverhals, 2013 [118]	J Gen Intern Med (Abstract)	Healthcare system	Provider interviews	Qualitative
Ho, 2013 [121]	J Gen Intern Med (Abstract)	PCP	Commentary	Not specified
Khan, 2014 [91]	Sleep (Abstract)	Patient	Retrospective review	Not specified
Kim 2017 [87]	J Gen Intern Med (Abstract)	Cost	Retrospective review	Cost
Kirsh, 2015 [85]	Am J Manag Care	Patient, PCP, healthcare system, cost	Retrospective review and cost evaluation	Quantitative
Pawar, 2016 [72]	Eur Heart J (Abstract)	Healthcare system	Retrospective review	Not specified
Rodriquez, 2015 [17]	JMIR Med Inform	Patient, PCP, specialist, healthcare system	Quality improvement	Not specified
Shanawani 2017 [111]	Am J Respir Crit Care Med (Abstract)	Patient, PCP, healthcare system, cost	Retrospective review	Quantitative
Uhlman, 2016 [122]	J Urol (Abstract)	Healthcare system, cost	Quality improvement	Quantitative
Vimalananda, 2014 [19]	J Gen Intern Med (Abstract)	PCP	Retrospective review	Quantitative

First Author, Year	Journal Title	Data Extracted	Study Design	Analytical Approach
Weber, 2016 [88]	Am J Gastro (Abstract)	Patient	Retrospective review	Quantitative
Wild, 2012 [120]	Alzheimers Dement (Abstract)	PCP, specialist	Retrospective review	Not specified
Zoll, 2015 [8]	Med Decis Making	Patient, PCP, specialist, healthcare system	Retrospective review and provider interviews	Quantitative
San Francisco's Safety Net Health System eReferral System, USA				
Chen, 2010 [34]	Health Aff	Patient, PCP, specialist, healthcare system, cost	Retrospective review	Not specified
Chodos, 2015 [68]	J Gen Intern Med (Abstract)	Healthcare system	Retrospective review	Quantitative
Chodos, 2014 [78]	J Gen Intern Med (Abstract)	Patient, PCP	Retrospective review	Quantitative
Kim, 2009 [63]	J Gen Intern Med	Patient, PCP, specialist, healthcare system	Provider survey	Quantitative
Kim-Hwang, 2010 [77]	J Gen Intern Med	Specialist	Provider survey	Quantitative
McGeady, 2014 [18]	Urol Pract	Patient, PCP, healthcare system, cost	Retrospective review	Quantitative
Straus, 2011 [4]	AMIA Annu Symp Proc	Patient, PCP, Specialist, Healthcare system	Provider interviews	Qualitative
Tuot, 2015 [5]	BMC Health Serv Res	Patient, PCP	Provider interviews	Qualitative
Tuot, 2015 [39]	Healthc (Amst)	PCP, specialist, healthcare system, cost	Retrospective review	Quantitative
Ulloa, 2017 [36]	BMC Health Serv Res	PCP, healthcare system	Retrospective review	Quantitative
Olayiwola, 2017 [45]	Health Serv Res	Patient, specialist, healthcare system	Observational mixed methods (patient and provider focus groups, provider survey)	Qualitative
Los Angeles Safety Net Program eConsult System, USA				
Chou, 2016 [84]	Arthritis Rheumatol (Abstract)	Healthcare system, cost	Retrospective review	Quantitative
Barnett, 2017 [40]	Health Aff	Specialist, healthcare system, cost	Retrospective review	Quantitative
Barnett, 2017 [79]	J Gen Intern Med (Abstract)	Healthcare system	Retrospective review	Quantitative
Dhamija, 2014 [55]	Am J Kidney Dis (Abstract)	Patient	Prospective trial	Quantitative
Denver Safety Net, USA				
Fort, 2017 [50]	Perm J	Patient, PCP, specialist, healthcare system	Retrospective review and interviews	Qualitative
University of California, San Francisco, USA				
Ackerman, 2017 [99]	J Gen Intern Med (Abstract)	Patient	Patient survey	Quantitative
Ackerman, 2014 [14]	J Gen Intern Med (Abstract)	PCP, healthcare system	Provider interviews	Qualitative
Cruz, 2015 [3]	Endocr Pract	PCP, specialist, healthcare system	Retrospective review	Quantitative
Gleason, 2014 [128]	J Gen Intern Med (Abstract)	Cost	Retrospective cost review	Cost
Gleason, 2013 [53]	J Gen Intern Med (Abstract)	Patient, PCP, specialist, healthcare system, cost	Observational mixed methods (survey, retrospective chart review)	Qualitative
Lowenstein, 2017 [62]	J Gen Intern Med	Patient, PCP	Retrospective review	Quantitative
Prasad, 2015 [119]	J Gen Intern Med (Abstract)	Healthcare system	Retrospective review	Quantitative
Wrenn, 2017 [83]	J Telemed Telecare	Patient, PCP	Retrospective review	Quantitative
Wrenn, 2016 [114]	J Gen Intern Med (Abstract)	Patient, PCP	Retrospective review	Quantitative
Mayo Clinic, Center for Innovation, USA				

First Author, Year	Journal Title	Data Extracted	Study Design	Analytical Approach
Angstman, 2009 [126]	Health Care Manag	Patient, PCP, cost	Retrospective review	Quantitative
Angstman, 2009 [43]	Health Care Manag	Patient, PCP, specialist, cost	Cross-sectional study	Not specified
North, 2015 [60]	J Telemed Telecare	Specialist, healthcare system, cost	Retrospective review	Quantitative
North, 2014 [108]	J Telemed Telecare	Healthcare system	Commentary	Not specified
Pecina, 2016 [10]	SAGE Open Med	PCP, healthcare system, cost	Retrospective review	Quantitative
Coordinating Optimal Referral Experiences (CORE), USA				
Davis, 2015 [28]	J Rheumatol (Abstract)	Patient, PCP, specialist, healthcare system, cost	Commentary	Not specified
Shipman, 2017 [96]	J Gen Intern Med (Abstract)	Patient, specialist, cost	Cost estimates	Cost
Health Experts onLine at Portsmouth (HELP), USA				
Lin, 2017 [127]	Mil Med	Healthcare system, cost	Retrospective review	Cost
Lin, 2016 [129]	SAGE Open Med	PCP, cost	Retrospective review	Cost
Electronic Children's Hospital of the Pacific (ECHO-Pac), USA				
Callahan, 2005 [44]	Arch Pediatr Adolesc Med	Specialist, healthcare system, cost	Prospective trial	Quantitative
Malone, 2004 [100]	Telemed J E Health	Patient, PCP, healthcare system, cost	Cohort study	Quantitative
ENTConsult.org, USA				
Baum, 2003 [104]	Am J Rhinol	Cost	Commentary	Not specified
Army Knowledge Online, USA				
McManus, 2008 [116]	Prehosp Disaster Med	Patient, PCP	Commentary	Not specified
Clinic located in rural Southeastern Minnesota, USA				
Reber, 2014 [103]	ProQuest (Thesis)	PCP, healthcare system	Not specified	Not specified
Community Health Center, Inc. Connecticut, USA				
Olayiwola, 2016 [25]	Ann Fam Med	Patient, PCP, specialist, healthcare system	Cluster RCT	Quantitative
Allina Health, USA				
Golberstein, 2017 [51]	Healthc (Amst)	PCP, specialist, cost	Provider survey from cluster-randomized evaluation	Quantitative
Massachusetts General Hospital and Brigham & Women's Hospital, USA				
Chittle, 2015 [97]	Vasc Med	Patient, PCP, specialist, healthcare system, cost	Retrospective review	Quantitative
Venkatesh, 2016 [80]	Am J Gastro (Abstract)	Healthcare system	Retrospective review and provider survey	Quantitative
Mendu, 2016 [64]	Am J Kidney Dis	Patient, PCP, specialist, healthcare system	Editorial	Not specified
Hospital Universitario de Canarias, Rheumatology Service, Santa Cruz de Tenerife, Spain				
Segura, 2014 [46]	Ann Rheum Dis (Abstract)	Patient, specialist, healthcare system	Retrospective review	Quantitative
University Hospital Nuestra Senora de Candelaria, Cardiology Department, Santa Cruz de Tenerife, Spain				
Facenda Lorenzo, 2016 [67]	Eur J Prev Cardiol (Abstract)	Specialist	Retrospective review	Quantitative
Neurolink (St. Vincent's University Hospital and the National Healthlink project), Ireland				
Williams, 2012 [75]	Irish Med J	Patient, PCP	Retrospective review	Quantitative
Radboud University Nijmegen Medical Centre, Netherlands				
Scherpbier-de Haan, 2013 [130]	Ann Fam Med	PCP, healthcare system, cost	Prospective cohort	Quantitative
van Gelder, 2017 [38]	Fam Pract	PCP	Cluster RCT	Quantitative
Satakunta Central Hospital, Finland				
Jaatinen, 2002 [98]	J Telemed Telecare	Patient, PCP	Case-control study	Quantitative
District General Hospital Peijas, Finland				

First Author, Year	Journal Title	Data Extracted	Study Design	Analytical Approach
Harno, 1999 [110]	J Telemed Telecare	Healthcare system, cost	Retrospective review	Qualitative
Telehealth Center of the Municipal Department of Health, Belo Horizonte, Brazil				
Marcolino, 2015 [41]	Stud Health Technol Inform	Healthcare system	Retrospective review	Quantitative
Ruas, 2013 [117]	Telemed J E Health	Healthcare system	Retrospective review	Quantitative
The Telehealth Center (NUTES), Brazil				
Diniz, 2016 [115]	Telemed J E Health	Healthcare system	Retrospective review	Quantitative
Bradford Teaching Hospitals NHS Foundation Trust, UK				
Moreea, 2014 [48]	Gut (Abstract)	Specialist, healthcare system, cost	Retrospective review	Quantitative
Moreea, 2014 [123]	Gut (Abstract)	Cost	Retrospective review	Cost
Stoves, 2010 [22]	Qual Saf Health Care	Patient, PCP, specialist, healthcare system	Observational mixed methods (provider interviews and survey, retrospective review	Quantitative
Stoves, 2009 [109]	Qual Saf Health Care (Abstract)	PCP, healthcare system	Quality improvement	Quantitative
Dewsbury District Hospital NHS Trust, UK				
Mohammad, 2014 [56]	Diabetic Med (Abstract)	PCP	Retrospective review	Quantitative
Royal Shrewsbury Hospital NHS Trust, UK				
Koo, 2010 [58]	BJU International (Abstract)	Healthcare system	Prospectively cohort	Quantitative
Non specific systematic/narrative reviews				
Liddy, 2016 [30]	Fam Pract	PCP, healthcare system, cost	Systematic review	Qualitative
Vimalananda, 2015 [6]	J Telemed Telecare	Patient, PCP, specialist	Systematic review	Not specified
Liddy, 2015 [102]	Global Telehealth 2015	Healthcare system	Systematic review, provider interviews	Qualitative
Brophy, 2017 [2]	Adv Chronic Kidney Dis	PCP, healthcare system, cost	Commentary	Not specified

PCP: primary care provider; RCT: randomized controlled trial; NHS: National Health Service; UK: United Kingdom.

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