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Review

eConsult in infectious diseases: A narrative review

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ABSTRACT

Objectives: Asynchronous electronic consultation, eConsult, is increasingly applied in infectious diseases (ID) management to improve access to specialty care and reduce unnecessary referrals. We aimed to integrate published studies to provide a comparative perspective and propose future directions for ID eConsult.

Methods: To synthesize relevant findings and present a comprehensive overview of ID eConsult, we searched in MEDLINE database and identified 11 studies between 2017 and 2025 on ID eConsult programs. Structured data were extracted on study characteristics, mode of consultation, and outcomes.

Results: Nine studies on outpatient ID eConsult demonstrated faster turnaround times, high rates of avoidance of in-person referrals (24–87%), improved antimicrobial optimization, and high provider satisfaction. Two studies on inpatient ID eConsult reported reductions in mortality, readmission rates, and broad-spectrum antibiotic use.

Conclusions: Given its affordability and scalability, the ID eConsult model is particularly advantageous in resource-limited environments. Collectively, ID eConsult may replace traditional telephone or face-to-face consultations, reducing the need for informal curbside discussions.

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Introduction

Telehealth is defined as “the use of electronic information and telecommunications technologies to support long-distance clinical healthcare, patient and professional health-related education” [1]. A specific form of telehealth, known as electronic consultation (eConsult), refers to an asynchronous, provider-to-provider interaction—typically between physicians—conducted either through integration within the electronic health record or via a secure web-based platform. This system enables rapid turnaround without direct patient consultation, mainly allowing primary care providers to seek expert input or recommendations from disease-specific specialists regarding a patient’s clinical concern.

To a considerable extent, the development of eConsult has been driven by the growing reliance on informal ‘curbside’ consultations. Such a consultation model represents a longstanding element of medical culture, which can support patient care when access to formal consultations is limited by availability or time constraints [2]. Nevertheless, they are undocumented in electronic

medical records, legally precarious, uncompensated, and often fail to acknowledge the clinician’s contributions [3]. In addition, compared with formal consultations, curbside consultations are more prone to incomplete or inaccurate information, thereby raising concerns regarding care quality, patient safety, and medicolegal risk [4,5].

As far as we know, the eConsult model was first developed within primary care systems, such as Canada’s BASE program and the United States Veterans Affairs (VA) system, followed by major academic medical centers. The clinical utility and accessibility of the eConsult system have been increasingly acknowledged, prompting its wider implementation across diverse healthcare settings worldwide to facilitate timely and convenient access to specialty care [6–12]. Thus, eConsult may replace the need for a face-to-face referral or allow necessary investigations to be completed prior to a specialist visit, thereby improving communication between providers, lowering healthcare delivery costs, and achieving high satisfactions by both patients and providers [13,14]. Primary care practitioners (PCPs) report that the eConsult strengthens their relationships with specialists and enhances clinical knowledge as well [15,16].

The clinical validity and utility of Infectious Diseases (ID) eConsult have also been explored. Due to its unpopularity among young physicians, many do not choose ID as their specialty. In the United

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States, for instance, on-site ID specialists are absent from at least one-quarter of hospitals and from nearly all nursing homes [17,18]. Furthermore, nearly 80% of counties lack an ID physician, with rural populations disproportionately affected [19]. This shortage is expected to worsen, as interest in ID fellowship training continues to decline: in the most recent match cycle, approximately 44% of programs remained unfilled, and about 49% had at least one unfilled position [20]. In recent years, ID-specific eConsult programs have proliferated across a variety of settings [21–31]. These programs have demonstrated improvements in timeliness and clinical decision-making, shorter times to expert input, reductions in unnecessary referrals, increased confidence among primary care providers in managing infections, enhanced antimicrobial stewardship, fewer curbside consultations, and greater patient access to specialty care. At the same time, they have raised diverse concerns, especially regarding sustainability, legal liability, and health equity.

In such a situation, the Infectious Diseases Society of America (IDSA) has encouraged the use of telehealth services to expand access to ID care, including antimicrobial stewardship programs (ASPs) [1]. ID eConsult may reduce costs and patient burden by replacing some face-to-face referrals. However, in the absence of a comprehensive review, the current role of ID eConsult remains insufficiently defined. By integrating published evidence, this review provides a comparative perspective and proposes future directions for ID eConsult.

Methods

This is a descriptive study aimed at narratively presenting a comprehensive overview of ID eConsult. The authors collected relevant evidence published before August 2025 from the MEDLINE database. We searched for relevant articles in the research engine using terms such as “electronic consultation (eConsult)”, “telehealth”, and “remote consultation” without adhering to an established systematic review methodology such as PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses). The characteristics of identified studies (period, design, country/region, setting, and sample size), mode of eConsult (consultee, target patient population, consulting topics, and reimbursement or funding system), and reported outcomes (turnaround time, proportion of avoided referrals, need for face-to-face consultation, completion time, and patient and provider satisfaction) were summarized and narratively synthesized.

Results

Between 2017 and 2025, 11 peer-reviewed studies assessing the clinical utility of ID eConsult were identified as eligible for inclusion in this narrative review. All relevant information is presented in Tables 1–3, with detailed descriptions provided in **Supplementary material** [21–31].

Initially, the advantages of outpatient ID eConsult are summarized [21–23,26–31]. First, the most important benefit is rapid and timely access to ID physicians. In outpatient settings, the average or median turnaround times via eConsult were reported as 0.6 days [21,28], 8 hours 38 minutes [22], 0.7 days [23], and 20 hours [29]. Within 24 hours, 63% [22], 60.6% [29], and 72.5% [30] of eConsult were completed. Second, a significant reduction in in-person referrals has been observed. Although avoidance rates varied across studies, ranging from 24% to 87% [22,26,28,30,31], many of the inconveniences associated with hospital visits could be avoided. The main consultees were primary care providers (84% [22], 63% [26], 55% [29], 72.1% [30], and 83.2% [31]), indicating that the ID eConsult system appears particularly beneficial in primary care contexts. Nevertheless, 16% [21], 25% [22], 12.5% [23], 22% [26], 5% [28], 12.8% [30], 21.6% [31] of cases ultimately

required in-person consultation, indicating that complex cases are appropriately transferred for specialty care by ID physicians. Third, the burden on ID physicians appears to be relatively limited, based on the reported completion times for eConsults. Murthy *et al.* [22] found that consultations took less than 10 minutes in 52% of cases, 10–15 minutes in 30%, and 15–20 minutes in 13%. Similarly, Wood *et al.* [23] reported durations of <5 minutes in 1.1%, 5–10 minutes in 14.7%, 11–20 minutes in 61.9%, and 21–30 minutes in 18.7%. Medford *et al.* [26] observed <10 minutes in 27%, 10–15 minutes in 47%, and 15–20 minutes in 23% of cases. Other studies reported a mean of 16 minutes [28] or mostly 10–15 minutes [29]. Collectively, the majority of ID eConsult were completed in under 20 minutes. Finally, the consulting topics addressed through ID eConsult varied according to clinical need, most commonly including antimicrobial use, LTB1, syphilis (sexually transmitted infections), and immunizations, followed by Lyme disease, *C. difficile* infection, perioperative advice, interpretation of testing, and COVID-19 [21–23,26,28–31]. These conditions generally require specialized ID expertise but not a physical examination, making them well suited to eConsult. In contrast, complex cases such as fever workup, musculoskeletal and skin infections, non-tuberculous mycobacterial infections, and parasitic infections typically required face-to-face evaluations [23,26].

Focusing on inpatients, although only two studies have been published to date [24,25], inpatient eConsult programs appear to demonstrate more tangible patient-level benefits. Previously, remote ID physician consultation has been associated with fewer hospital transfers and shorter lengths of stay [32]. According to a study by Tande *et al.* [24], which demonstrated reductions in 30-day mortality (aOR 0.3) and readmission rates (aOR 0.4) among community hospital patients, the asynchronous eConsult model also holds substantial potential for improving inpatient outcomes. In addition, telehealth-based communication has shown promise as an antimicrobial stewardship tool in hospitalized populations, contributing to reduced antibiotic use, fewer antibiotic-related adverse events, and lower costs [33–35]. The studies also corroborated that the eConsult model accelerated antibiotic de-escalation in one study [24] and significantly reduced the administration of carbapenem, vancomycin, and fluoroquinolone in another [25].

Discussion

Across studies published between 2017 and 2025, asynchronous ID eConsult has consistently been shown to provide a rapid and high-value consultation platform that improves access to ID expertise in both outpatient and inpatient settings. Typical turnaround times were within 24–72 hours—often less than 1 day—substantially faster than traditional referral pathways, with most cases resolved without the need for in-person visits. These programs can address a broad range of clinical questions and offer tangible benefits for both frontline clinicians and patients, including enhanced clinical decision-making, expedited specialist input, and a reduction in informal or curbside consultations that may carry medicolegal risks. Additional advantages include fewer unnecessary referrals, decreased use of broad-spectrum antibiotics, high provider satisfaction, and educational value for referring clinicians. From a patient perspective, eConsult reduces the inconvenience of hospital visits, low-yield referrals for simple inquiries, missed appointments, and overall healthcare costs.

Importantly, inpatient and integrated telehealth models also suggest potential improvements in clinical outcomes and antimicrobial stewardship, further highlighting the system-level value of this approach. While protection of personal information remains essential in telehealth practice, no major safety concerns have been reported. Nevertheless, patients with complex or invasive infections still require face-to-face evaluation, underscoring that eConsult should complement rather than fully replace traditional

Table 1
Characteristics of the eligible studies.

No.	Study ID [Reference]	Study Period	Study Design	Country (Region)	Setting (System or Platform)	Sample Size (Additional information)
1	Strymish et al. [21]	2014 (Compared to data in 2011)	Observational	USA (Boston)	Outpatient (Veterans Affairs Boston Healthcare System [VABHS])	285 eConsult (Comparative cohort: 195 FTF consult in 2014 and 193 FTF consult in 2011)
2	Murthy et al. [22]	2013-2015	Observational	Canada (Ontario)	Outpatient (Champlain BASE)	224 eConsult
3	Wood et al. [23]	2018-2019	Observational	USA (Washington Univ., Seattle)	Outpatient (Washington Univ. network clinic)	328 eConsult (from 154 unique providers)
4	Tande et al. [24]	2018	Observational (Propensity-matched, case-control)	USA (Mayo Clinic)	Inpatient (Mayo Clinic Health System: Two community hospitals)	100 eConsult versus 300 matched cases
5	Vento et al. [25]	2016-2018	Observational	USA (Utah and Idaho)	Inpatient (Intermountain Healthcare system: 16 small community hospitals)	761 eConsult (30%) (2487 in total: 35% telephone advice, 35% synchronous, audio-visualized telemedicine)
6	Medford et al. [26]	2018-2021	Observational	USA (Dallas, Texas)	Outpatient (Parkland Health, Safety Net Healthcare System)	725 eConsult
7	Nishiguchi et al. [27]	2017-2019	Observational	USA (San Francisco)	HCV patients (San Francisco Health Network, Safety Net Healthcare System)	242 eConsult versus 214 control
8	Singh et al. [28]	2020	Observational	Canada (Ontario)	COVID-19 patients (Champlain BASE and Ontario eConsult Service)	289 eConsult (from 208 primary care providers)
9	Hofmann et al. [29]	2020-2022	Observational	USA (Ohio)	Outpatient (Ohio State University Wexner Medical Center)	488 eConsult (from 270 [55%] primary care providers)
10	Butt et al. [30]	2022-2024	Observational	USA (Indiana)	Outpatient (A county hospital)	280 eConsult
11	Madhavan et al. [31]	2018-2023	Observational	USA (Boston)	Inpatient and outpatient (Mass General for Children and Mass General Hospital)	727 eConsult

USA, United States of America; BASE, Building Access to Specialist Advice through eConsultation.

consultation models. In addition, several studies have identified unresolved challenges, including reimbursement frameworks, sustainable business models, infrastructure requirements, and appropriate patient selection. Taken together, the current literature portrays ID eConsult as a feasible, scalable, and impactful model that can expand the scope and capacity of ID services while maintaining quality of care.

Generally, an eConsult is an asynchronous, provider-to-provider communication conducted through a secure electronic platform, in which a primary care provider seeks expert advice from a specialist. Over more than a decade, medical services delivered through eConsult have become increasingly widespread. A recent study based on 73 semi-structured interviews with primary care providers, specialists, and clinical leaders examined how eConsult affects communication and relationships among clinicians [36]. The eConsult was valued for its contributions to formal documentation, improved transparency, and more timely responses from specialists, three major concerns were identified: (i) legal liability and reduced confidentiality of personal information, (ii) diminished opportunities for ongoing dialogue and shared decision-making in complex cases, and (iii) fewer opportunities for relationship-building among clinicians. Although eConsult may positively reshape communication between clinicians, it also risks limiting confidential and iterative discussions, underscoring the need for healthcare systems to balance clinical applicability with legal, ethical, and collegial considerations.

Based on prior literature, Livorsi *et al.* [37] published a review article presenting a step-by-step, structured, flexible roadmap for establishing ID eConsult services in underserved settings. They emphasized three major phases for program success: (i) *Pre-implementation phase*—secure leadership and stakeholder buy-in,

identify local champions, assess capacity and barriers (e.g., online infrastructure, staffing, finances), design a tailored standard operating procedure (SOP), and establish baseline evaluation metrics; (ii) *Implementation phase*—launch telehealth services after training staff, deploying technology, and finalizing SOPs, while continuously monitoring outcomes and adjusting based on stakeholder feedback; and (iii) *Sustainment phase*—incorporate telehealth services into routine workflows, ensure long-term funding mechanisms, and maintain ongoing evaluation to adapt the program to local needs. To support sustainability, they highlighted the importance of practical considerations such as licensing, credentialing, reimbursement, and local staff training, as well as relationship-building, iterative adaptation, and quality monitoring.

To enable the widespread implementation of the eConsult model, multi-perspective concerns need to be addressed. First, the lack of prespecified search terms and explicit inclusion and exclusion criteria in the single-database (MEDLINE) search may have compromised the comprehensiveness of the literature review. In addition, the absence of a critical appraisal process and formal evaluation of study quality is another major limitation of this review. Second, of the 11 studies, 10 were observational in design, while one was a propensity-matched case-control study [24]. To further determine the clinical utility of eConsult in various clinical situations, additional clinical data are warranted. Third, notably, all studies were conducted in and reported from North America: nine in the United States and two in Canada. This is not merely a geographical bias of evidence, prompting us to recognize that the clinical applicability, feasibility, concerns, and generalizability of ID eConsult reported in the literature should be carefully validated by future studies conducted in countries with different healthcare and reimbursement systems. Forth, data is biased in outpatient

Table 2
Mode of ID eConsult.

No.	Study ID [Reference]	Mode of eConsult	Main consultee	Target Patient Population	Frequent topics	Reimbursement or Funding
1	Strymish et al. [21]	Asynchronous	Outpatient clinics Subacute or long-term care facility	Adults	Antimicrobial use (33%) LTBI (14%) Lyme disease CDI Perioperative advice Immunizations	Not reported
2	Murthy et al. [22]	Asynchronous	Primary care physicians (84%) Nurse practitioners (16%)	Not specified	LTBI (14.3%) Lyme disease (14.3%) Parasite infection (12.9%) Vaccination (10.3%)	Not reported (Paid \$200 per hour)
3	Wood et al. [23]	Asynchronous	Primary care practitioners	Not specified	Interpretation of testing (9.9%) Syphilis (9.6%) LTBI (9.4%)	Volunteer by ID specialists
4	Tande et al. [24]	Asynchronous	Hospitalists at community hospitals	Not specified	Not specified	Not reported
5	Vento et al. [25]	Integrated	Providers and pharmacists at small community hospitals	Not specified	Bacteremia (31%)	Each facility paid an annual subscription fee for access to all telehealth services as part of Intermountain's integrated clinical support system. Not reported
6	Medford et al. [26]	Asynchronous	Primary care providers (63%)	50 years (mean)	LTBI (16%) Syphilis (16%) Gastrointestinal infections (10%) HCV treatment (direct acting agents therapy)	Not reported
7	Nishiguchi et al. [27]	Asynchronous	Primary care providers	Adults	COVID-19	Ministry of Health and Long-Term Care of Ontario Not reported
8	Singh et al. [28]	Asynchronous	Primary care providers	Not specified	LTBI (18%), COVID-19 (10%), UTI (9%), syphilis (7%), CDI (5%), Hepatitis C (4%), cellulitis (3%), HIV (3%), Lyme disease (3%)	Not reported
9	Hofmann et al. [29]	Asynchronous	Primary care providers (55%)	Not specified	STI (28%) Mycobacterial (18%) Bacteriuria (16%)	wRVU billing
10	Butt et al. [30]	Asynchronous	Primary care providers (72.1%)	Not specified	Diagnostic guidance (24.5%) Interpretation of culture/diagnostic test (16.6%) Vaccine recommendations (12.0%)	Hospital-funded program: individual PID consultants received a small stipend, being approximately equivalent to 80% of one wRVU for PIDs
11	Madhavan et al. [31]	Asynchronous	Primary care providers (83.2%)	Children		

EMR, electronic medical record; LTBI, latent tuberculosis infection; CDI, *Clostridioides difficile* infection; wRVU, work relative value unit.

settings: nine studies targeted outpatients, while only two studies exclusively targeted inpatients [24,25]. We believe that inpatient ID eConsult has great potential, considering that telehealth for remote ID physician consultation improved patient outcomes when compared to in-person consultation [38]. Fifth, clinical feasibility and sustainability remain critical challenges for the success of the ID eConsult model. It is essential to protect dedicated time and resources from the ID department and each consultant engagement. To solve this, pharmacist support and oversight by the medical director would be key components. Consultants may frequently face challenges integrating eConsult work into daily practice, particularly when electronic medical record systems lack interoperability. To address these issues, programs incorporating structured templates, “dot phrases,” and FAQ dashboards to streamline the process would be recognized for their efficiency and educational value [30]. Reimbursement reform, or securing consultation fee, is also essential for long-term viability. In the United States, CPT (Current Procedural Terminology) code 99451 (0.7 wRVU) undervalues the time commitment of eConsult compared to in-person visits (0.93–3.5 wRVUs), limiting physician engagement and scalability [30]. Thus, revising billing codes to better incorporate the total involvement time and effort by eConsult work into RVU model, and advocating for insurer and governmental recognition of eConsult as equivalent to in-person consults are required [29]. Sixth, the ID eConsult achieved high satisfaction among consulting providers, who emphasized timely responses, clarity of documentation, and educational benefits. Seventh, accountability in asynchronous con-

sultations is always a matter of debate. The possibility of communication errors between consultees and consultants must be acknowledged, as incomplete information may lead to adverse outcomes. Because there is no direct interaction between the consulting patient and ID specialist, critical details—such as the patient's condition, clinical course, and laboratory data—are provided and interpreted by the referring providers [39]. This reliance can introduce information bias, potentially resulting in misdiagnosis or inappropriate treatment. Indeed, qualitative interviews have raised concerns regarding the weakening of clinician relationships and issues of medico-legal accountability [36]. Potential solutions would include the development of clear institutional policies, documentation of shared decision-making, and malpractice coverage explicitly encompassing eConsult activities. Eighth, the digital divide, a gap between those who have access to digital technology and those who do not, was not considered in any of the preceding studies. Patients under the care of older physicians who lack internet literacy may be at risk of losing access to the potential benefits of eConsult. Ninth, evaluation metrics and research gaps in ID eConsult studies should be discussed. Heterogeneous outcome definitions across studies hindered comprehensive comparison. Thus, consensus quality parameters, such as responding time, completion time for each consultative case, referral avoidance rate, and contributions to antimicrobial stewardship, should be established, especially before diving into future studies in other regions and health-care systems to explore the broader applicability of ID eConsult model in different situations. Additionally, only a single study on

Table 3
Outcomes of ID eConsult.

No.	Study ID [Reference]	Turnaround time (Comparison)	Avoided referrals (%)	Requiring FTF consults	Completion time	Patient satisfaction	Provider satisfaction
1	Strymish et al. [21]	Average 0.6 days (16.5 days for FTF consults)	Not reported	16% (Not decreased)	Not reported	Not reported	Not reported
2	Murthy et al. [22]	Average 8 h 38 min 63% responded within 24h	32% avoided	25% (New referral 8%)	<10 min in 52% 10-15 min in 30% 15-20 min in 13% over 20 min in 5%	Not reported	Nearly 90% rated the service as highly valuable
3	Wood et al. [23]	Average 0.7 days (99% within 3 days)	Not reduced	12.5%	<5 min in 1.1% 5-10 min in 14.7% 11-20 min in 61.9% 21-30 min in 18.7% over 30 min in 3.6%	Not reported	Not reported
4	Tande et al. [24]	≤24 h	N/A	10.0% (hospital transfer)	29 min for initial consult (range, 8-66 min) 9 min for a follow-up (range, 2-15 min).	Not reported	95% satisfied
5	Vento et al. [25]	Not specified	N/A	32%	5 min for phone calls 20 min for eConsult 50 min for telemedicine	All patients satisfied (improved care and necessary)	care improved (97%) necessary (90%) easy to access (90%) easy to use (95%)
6	Medford et al. [26]	Not specified	78% avoided	22%	<10 min in 27% 10-15 min in 47% 15-20 min in 23% over 20 min in 3%	Not reported	Not reported
7	Nishiguchi et al. [27]	Not specified	Not reported	Not reported	Not reported	Not reported	Not reported
8	Singh et al. [28]	Median 0.6 days (range, 3 min to 15 days)	24% avoided	5%	Mean 16 min (range, 5-59 min)	Not reported	Not reported
9	Hofmann et al. [29]	Median 20 h (24.7% ≤3 h, 60.6% ≤24 h, 83.8% ≤48 h, and 100% ≤72 h)	Not reported	Not reported	Mostly 10-15 min	Not reported	73.4% satisfied
10	Butt et al. [30]	72.5% completed within 24 h, 7.5% ≤48 h, 7.5% ≤72 h, 12.5% > 72 h	87% avoided	12.8%	Not reported	Not reported	Not reported
11	Madhavan et al. [31]	Mean 3 days	Not reported	21.6% (0.6% emergent referrals)	Not reported	Not reported	98.3% were either satisfied or very satisfied

FTF, face-to-face; STI, sexually transmitted infections.

PID eConsult exists, and the feasibility of this model among pediatricians requires further investigation.

Conclusion

In conclusion, current evidence indicates that the ID eConsult service is a promising platform for delivering consistent benefits in high-quality ID management, even in the absence of on-site specialists, by providing timely access to subspecialty care. Although various resources, including artificial intelligence and clinical guidelines, are available to support diagnostic and therapeutic decision-making in difficult cases, individualized consultation with ID specialists may provide more practical and insightful guidance. Although this approach requires additional infrastructure, such as an integrated electronic health record, appropriate workflow design, and a reimbursement system, once established, it can substantially contribute to improving the quality of care in rural hospitals. The ID eConsult model also offers expanded opportunities for clinical education across all stages of physicians' careers. Over time, it has evolved from pilot initiatives into mature programs with demonstrated benefits in antimicrobial stewardship. However, given the diversity of study designs, patient populations, clinical settings, and funding systems, the clinical utility and validity of ID eConsult systems require further investigation and evaluation. Moving forward, addressing challenges related to reimbursement and long-term sustainability will be essential to securing its role in the future of ID care worldwide.

Transparency statement

The lead author affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as originally planned (and, if relevant, registered) have been explained.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Ethical approval

Not applicable.

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Author contributions

HH conceived the study, collected relevant studies, and drafted the manuscript. SF, HA, KN, and KO critiqued and revised the manuscript. All authors gave final approval to the submitted manuscript. HH is responsible for the overall content as guarantor.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.ijid.2026.108524.

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