

Automatic ID Consultation for Inpatients With COVID-19: Point, Counterpoint, and a Single-Center Experience

Cynthia T. Nguyen,^{1,✉} Gregory Olson,^{2,✉} Mai T. Pho,² Alison K. Lew,¹ David Pitrak,² Jina Saltzman,² Aniruddha Hazra,² Kenneth Pursell,² and Natasha N. Pettit¹; on behalf of the University of Chicago Medicine ID COVID Consult Study Group

¹Department of Pharmacy, University of Chicago Medicine, Chicago, Illinois, USA, and ²Department of Medicine, Section of Infectious Diseases and Global Health, University of Chicago Medicine, Chicago, Illinois, USA

There are many unknowns with regard to COVID-19 clinical management, including the role of Infectious Diseases Consultation (IDC). As hospitalizations for COVID-19 continue, hospitals are assessing how to optimally and efficiently manage COVID-19 inpatients. Typically, primary teams must determine when IDC is appropriate, and ID clinicians provide consultation upon request of the primary team. IDC has been shown to be beneficial for many conditions; however, the impact of IDC for COVID-19 is unknown. Herein, we discuss the potential benefits and pitfalls of automatic IDC for COVID-19 inpatients. Important considerations include the quality of care provided, allocation and optimization of resources, and clinician satisfaction. Finally, we describe how automatic IDC changed throughout the COVID-19 pandemic at a single academic medical center.

Keywords. COVID-19; infectious diseases; referral and consultation.

POINT

As new infections emerge, infectious diseases (ID) experts are needed on the frontlines. Close scrutiny of rapidly available COVID-19 data combined with longstanding experience managing other infections allows ID clinicians to serve as content experts. As such, Infectious Diseases Consultation (IDC) is well positioned to recommend treatment plans, characterize trends in COVID-19 progression and associated complications, and reinforce antimicrobial stewardship program (ASP) interventions. Furthermore, IDC can facilitate continuity of care and reduce the burden faced by primary teams who are focused on optimizing supportive care, managing preexisting comorbidities, handling high patient volumes, adhering to infection prevention precautions, and managing downstream complications of COVID-19.

IDC has demonstrated the ability to optimize short-term and long-term outcomes for a variety of conditions. While much of the data demonstrating the benefits of IDC are for *Staphylococcus aureus* bacteremia [1], multiple studies have

demonstrated the positive impact of IDC for other infections [2–5]. Analyses of claims data among patients admitted for >10 infection types found significant reductions in mortality, hospital length of stay, and readmission rates with IDC compared with no IDC [3, 4]. These benefits have often been attributed to physical examinations performed by ID physicians, leading to the identification of primary and secondary foci of infection, as well as improved adherence to standard of care recommendations. Furthermore, IDC early in the hospitalization has been associated with a lower likelihood of in-hospital mortality relative to either late or no IDC [4, 5]. Consequently, early automatic IDC for COVID-19 may be necessary to maximize the potential benefits of IDC.

ID clinicians are well versed in the latest infection-related literature and therapies. The number of COVID-19-related publications, peer-reviewed and non-peer-reviewed, has been enormous. IDC teams are experienced in evaluating the nuances of literature related to the treatment of infectious diseases and are well suited to develop, maintain, and recommend treatment plans for inpatients with COVID-19. Consequently, IDC can seize this opportunity to take ownership of COVID-19 diagnostics and therapeutics, including stewardship, in order to demonstrate the value of the ID clinician and better align with market forces [6]. This allows primary teams to focus on providing bedside management, which is particularly important given that hospitalists and intensivists will be rotating on and off COVID-19 services in most medical centers and may not be keeping up with newly published literature. Thus, automatic IDC pairs continuity of care with expertise, which is invaluable when data are rapidly emerging and changing.

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Correspondence: Cynthia T. Nguyen, PharmD, Department of Pharmacy, University of Chicago Medicine, 5841 S Maryland Ave MC0010 TE019, Chicago, IL 60637-1470 (cynthnguyen@gmail.com).

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Many IDC teams are multidisciplinary, often including physicians, pharmacists, and advanced practice practitioners (APPs), with each team member enhancing the effectiveness of the consultation. For example, pharmacists can amass knowledge of COVID-19 therapeutics in order to provide information regarding the safe delivery of medications, such as drug–drug interactions and dose optimization, which is particularly important when the efficacy of experimental therapies is unproven [7]. This multidisciplinary team is also able to execute ASP services, such as improving guideline adherence and optimizing antimicrobial therapy for co-infections, which has been linked to improved patient outcomes [8]. However, ASPs cannot substitute for IDC, as the combination of IDC and ASPs has demonstrated significant improvements in antimicrobial prescribing compared with ASP intervention alone [9].

ID is typically consulted for complicated or unusual infections, as most primary teams can manage uncomplicated infections utilizing evidence-based consensus guidelines. For a novel infection such as COVID-19, where the natural history and optimal management are rapidly evolving, information must be rapidly synthesized, and automatic IDC can provide support by performing case-by-case evaluations. This has been described in a study of solid organ transplant recipients, a high-risk population with few high-quality clinical trials to guide infection management, in which IDC was associated with reduced mortality and readmission rates [10]. IDC for all COVID-19 inpatients allows ID clinicians to identify nuances between each COVID-19 case and characterize trends among patients in different hospital units. IDC can also facilitate optimal management of bacterial and fungal co- or superinfections that may further complicate the clinical course for patients with COVID-19. Importantly, as concerns of antibiotic resistance due to antibiotic overprescribing increase [11], automatic IDC can also guide early antimicrobial stewardship to optimize antimicrobial use and diagnostic workup of patients with possible bacterial or fungal co-infection. Among unstable patients or those with a protracted clinical course, IDC can manage superinfections or help prevent “spiraling empiricism” of antibiotic therapy.

Automatic IDC also encourages collaboration and improves communication among medical subspecialties [12], an important practice for a disease that involves multiple organ systems, such as COVID-19. Similar to the model for ASPs, multispecialty working groups led by ID clinicians can gather consensus on institutional treatment guidelines, recommend changes to order sets and/or alerts, establish eligibility criteria for experimental therapies, and facilitate clinical trial enrollment by identifying potential study candidates. This collaboration ensures the stewardship of medications, including investigational agents and antibiotics. Ultimately, patients may receive more efficient care if IDC is able to guide multiple aspects of

COVID-19 management, including the diagnostics, medications, and infection prevention strategies, with the primary team upon admission. While managing patients, IDC can also answer questions from front-line health care workers and provide education regarding infection prevention strategies. This may reduce redundant questions to infection preventionists, increase comfort among staff, and facilitate transmission reduction strategies.

Limiting the consumption of resources by providing IDC via virtual medicine is an important benefit to health organizations. As most facilities struggle with limited personal protective equipment (PPE), virtual consults can mitigate risks to health care workers and preserve PPE, while also maintaining compliance with social distancing recommendations and ensuring provider availability in case of COVID-19 exposure or illness. Telemedicine has been described as a successful strategy for IDC and can be readily adapted to automatic IDC. Available data suggest that telemedicine IDC results in similar outcomes, such as mortality, length of stay, and readmission, compared with either no IDC or other IDC modalities [13]. Telemedicine IDC also expands the capacity for IDC to care for more patients, while reducing the frequency of calls or “curbsides,” which may lead to incomplete care [14, 15]. Importantly, telemedicine may also improve access to IDC for hospitals in underserved areas [16, 17].

Automatic IDC may improve resource utilization by stewarding medications that are on shortage. There are few established treatments for COVID-19, and investigational therapies are limited in supply. ID clinicians familiar with the inclusion and exclusion criteria for clinical trials can identify clinical trial options for patients, educate primary teams and patients regarding available therapies, and serve as a conduit to clinical trial teams by determining which therapies are most likely to benefit patients. Coupling the hands-on knowledge of the daily inpatient census with an understanding of the changing availability in resources is crucial to seeing the “big picture” and effectively allocating resources. These clinical decisions are beyond the scope of the primary teams, and automatic IDC can add value by providing education regarding best practices as they emerge.

Finally, when there are many unknowns and high-quality data are limited, a team approach improves clinician and patient satisfaction [11, 13]. Collaborating with stakeholders on a management plan via shared decision-making provides greater comfort among health care workers and patients. Written and verbal education provided by IDC has been reported to enhance the confidence of the primary care providers and enrich the learning experiences for trainees. Additional benefits of virtual consultation by specialists include the ability to build relationships with a primary team, educate through patient cases, and prompt further learning [11]. These valuable outcomes are long-lasting and may transcend the management of patients with COVID-19.

COUNTERPOINT

While IDC can be invaluable in the care of inpatients with conditions such as *Staphylococcus aureus* bacteremia and candidemia [1, 2], such infections have been studied for years, giving ID clinicians the benefit of a longstanding knowledge base to formulate management plans. With a novel condition such as COVID-19, the information is constantly evolving, and one could argue that there are no true experts. Additionally, many COVID-19 complications are better managed by clinicians in other specialties. These factors may reduce the benefit of IDC in all patients admitted with COVID-19. Furthermore, robust deployment of clinicians to support automatic IDC may not be an appropriate use of resources and could contribute to clinician burnout.

Before COVID-19, respiratory viruses were not routinely managed by ID clinicians. Influenza is the only viral respiratory illness that is routinely treated, and primary care providers are familiar with the antiviral and supportive care therapies used to treat this common disease. During the COVID-19 pandemic, ID clinicians have been broadly essential in developing the public health response, investigating novel therapeutics, and helping hospitals manage infection prevention challenges. However, at the individual patient level, IDC likely offers less benefit due to limited antiviral treatment options. For most patients, management decisions may be best left to primary teams and other experts. Pulmonologists and intensive care specialists are needed to manage noninvasive oxygen delivery and mechanical ventilation. Complications such as cardiomyopathy and arrhythmias are better managed by cardiologists and acute kidney injury by nephrologists. COVID-19-related hypercoagulability also remains a challenge, but this subject falls outside the typical IDC.

With limited data to support therapies for COVID-19, guidelines have suggested that most medications should be used only in the context of clinical trials [18]. The lack of well-established therapies leaves little ambiguity in need for expert navigation by an ID clinician. Clinical trial research teams are most familiar with protocols and are able to educate patients and obtain patient consent. Automatic IDC adds another “cook to the kitchen,” which may have benefits such as interdisciplinary communication, but has risks including diffusion of responsibility and the potential for communication breakdowns between teams [19]. The development of an institutional COVID-19 treatment guideline may provide sufficient guidance for primary teams. This approach has been taken by ASPs and, when paired with active interventions, such as prospective audit with feedback and intervention, has improved outcomes for many infections, independent of IDC [20]. In hospitals with infection prevention practices that limit in-person evaluation by multiple providers, primary teams may have a particular advantage compared with consult services, as they are able to conduct physical exams and evaluate clinical progression in-person. Empowering the

primary team to drive clinical decision-making may provide a cohesive and sustainable approach to managing COVID-19 as a disease state, rather than considering antiviral management and complications of COVID-19 as separate entities.

Additionally, resource allocation must be considered when employing automatic IDC in a pandemic setting. With a widespread disease that often requires hospitalization, automatic IDC will require a significant number of clinicians and pharmacists. Automatic IDC requires removing these practitioners from other clinical, administrative, and research duties. Although ambulatory activities were reduced during the initial COVID-19 surge, outpatient responsibilities have subsequently increased [21]. Diverting ID clinicians’ effort to inpatients with COVID-19 may come at the expense of outpatients with HIV infection, those on long-term antibiotics, or those on outpatient parenteral antibiotic therapy. Data from New York City suggest that many deaths during the COVID-19 pandemic may not be directly attributable to the virus itself [22]. Some of these deaths may be due to delays in seeking medical care or avoiding medical care entirely. If automatic IDC for COVID-19 is desired and providers are not removed from their other responsibilities, this may create an unmanageable workload for those providers providing IDC, and thus reduce quality of care.

Another factor worthy of consideration is how IDC for COVID-19 will be provided (in-person vs virtual). PPE shortages and social distancing measures encourage clinicians to limit face-to-face contact with patients unless necessary. Given these factors, virtual IDC may be favored over in-person consultation for COVID-19 patients, but this has its limitations. Telephone IDC has previously been found to be inferior to bedside IDC in the context of *Staphylococcus aureus* bacteremia [23]. As the benefits of IDC for COVID-19 are unproven, a virtual IDC primarily consisting of chart review may not be worth the resources. Furthermore, not all hospitals in the United States have IDC available on site. Although virtual IDC may be considered in some of these hospitals, this may not be justified until its value is more established for COVID-19. In the meantime, if review of all patients with COVID-19 is desired, most hospitals have ASPs, which can take on this role and triage to IDC when appropriate. This may be more feasible and sustainable than automatic IDC.

Finally, employee satisfaction and burnout must be considered when employing IDC for all COVID-19 inpatients. As the pandemic unfolds in the absence of an effective vaccine, patients with COVID-19 will continue to be admitted for months to come. Automatic IDC requires having a team of clinicians available to perform consults continuously for the duration of the pandemic. Consequently, judicious planning and coordination, including personnel and task shifting, will be needed to ensure both adequate coverage and time off. Deploying a large number of clinicians to perform automatic

IDC may compromise medical education for trainees, such as ID fellows who inevitably will be involved with the consultations and faculty who may be unavailable to give educational sessions. Performing multiple similar consultations on the same disease state for which there are many unknowns and few therapeutic options may be dissatisfying and contribute to burnout or poor morale. Although the ID community clearly has a role in fighting the COVID-19 pandemic, automatic IDC for inpatients with COVID-19 may have downfalls that are not yet clearly outweighed by benefit to the patient.

UNIVERSITY OF CHICAGO MEDICINE EXPERIENCE

We describe how IDC managed COVID-19 inpatients at an 811-bed academic medical center located on the south side of Chicago. The first patient with COVID-19 was admitted on March 12, 2020, and a formal automatic COVID IDC service was established on March 19. The initial COVID IDC service consisted of 2 ID attending physicians and 1 ID pharmacist. Patients were identified using an automated list in the electronic medical record identifying all SARS-CoV2-positive inpatients. COVID IDC held morning rounds and reconvened later in the day after a batched release of new SARS-CoV2 test results. Eligibility for research protocols was discussed with study investigators. Following rounds, ID physicians communicated recommendations including referral to clinical trials with the primary teams via page. Notably, the COVID IDC service referred to the physical exam findings performed by the primary teams rather than examining patients in-person, in accordance with institutional recommendations to limit hospital staff exposure.

Starting March 21, morning COVID IDC rounds continued, and the COVID IDC service also began rounding daily via teleconference with the primary COVID-19 Unit team. The primary COVID-19 Unit team consisted of attending physicians, fellows, residents, and pharmacists. The purpose of IDC-COVID Unit rounds was to efficiently communicate recommendations, most of which were already formulated at morning IDC rounds. During the IDC-COVID Unit rounds, the primary COVID Unit team provided insight on patients' clinical status, as they had the advantage of physically examining patients, and the COVID IDC service addressed all ID-related concerns. Specifically, the COVID IDC provided recommendations regarding clinical trial eligibility, therapies outside of clinical trials, non-COVID infection management, medication dosing, drug-drug interactions, and antimicrobial de-escalation and durations of therapy. During this initial phase of COVID IDC, patients were followed for the entirety of their hospital stay.

COVID IDC efforts had to be scalable to accommodate the rapidly growing number of inpatient COVID-19 admissions. By April 6, there were four geographic COVID IDC services, each receiving 6–8 new consults per day at its peak. Given the increased volume, a separate daily virtual meeting with clinical

trial coordinators and principle investigators (PIs) began to discuss potential study candidates. This allowed the COVID IDC services to effectively communicate study eligibility with primary COVID Unit teams during IDC-COVID team rounds. Each COVID IDC service included an ID attending, an ID pharmacist, and 2–3 additional ID providers (ID attending, APP, and/or fellow). The ID providers were redistributed from other services and responsibilities. As non-COVID research projects were paused in the setting of state and local orders, providers involved in research efforts were temporarily diverted to various COVID roles, including the COVID IDC services. ID pharmacists added the COVID IDC services to their daily activities. The COVID IDC services conducted IDC-COVID team rounds separately, 7 days per week. During this time, COVID IDC also began to sign off on clinically stable cases, those with no therapeutic options, and/or those with a final management plan in place for the patient's infection(s). The 4 COVID IDC services and this rounding structure continued until May 4.

On May 4, based on the reduced COVID IDC service patient volume, increased familiarity with COVID-19 management by the primary COVID Unit teams, and a shift away from off-label use of experimental therapies, the 4 services consolidated to 1 COVID IDC service, and IDC-COVID Unit rounds were eliminated. This change allowed ID providers and trainees to return to some regular research and/or clinical duties. The single COVID IDC service now consists of 3 ID attendings, 1 ID pharmacist, and 1 ID APP. The service provides automatic IDC on all newly admitted COVID-19 patients and discusses clinical trial eligibility with trial coordinators or PIs. If applicable, co-infections and antimicrobial management are also evaluated. Following rounds, recommendations are paged to primary COVID Unit teams. In cases where a patient requires continued follow-up by IDC, they are transferred to a general IDC service.

Feedback was solicited from the primary COVID Unit teams throughout the process and during a virtual meeting with COVID Unit team leaders early in the pandemic. This feedback was used to evaluate the utility of the automatic IDC and also to optimize the method in which IDC provided recommendations, including the structure and timing of IDC-COVID Unit rounds. Early in the pandemic, the dedicated IDC-COVID Unit rounds were reported to provide stability and organization in patient care while providers adapted to changes in admitting service structure and rounding practices. Primary teams found IDC recommendations to be helpful and discussions educational. Providers also reported that the process was efficient and found comfort in knowing that IDC would automatically evaluate patient eligibility for clinical trials and provide recommendations regarding the need for antibiotics and/or other investigational agents upon the diagnosis of COVID-19.

Several additional activities and services have been crucial to the organization of the COVID IDC service(s). First, weekly meetings within the Section of Infectious Diseases afforded

opportunities to provide feedback and enabled rapid adjustment of the service model based on patient volume and experience over time. Second, the COVID IDC service attendings rotate coverage of a 24-hour pager for any questions related to the management of COVID-19 inpatients. The number of pages is minimal because the primary COVID Unit teams understand the IDC's daily workflow and when to expect COVID IDC recommendations. Third, establishing clear communication channels and having daily meetings with clinical trial coordinators has facilitated continuity of care, particularly in the setting of several ongoing clinical trials (eg, remdesivir, tocilizumab, convalescent plasma). Finally, a weekly standing meeting is held to discuss new literature and update institutional COVID treatment guidelines. This meeting is multidisciplinary and multispecialty, comprised of the COVID IDC service, ASP, pharmacy management, ID, critical care, rheumatology, and hematology/oncology. All of these activities are necessary to support the COVID IDC service and may be adapted by other hospitals in which automatic IDC is not feasible.

The COVID IDC services required tremendous commitment and flexibility from clinicians in infectious diseases and pharmacy, as well as buy-in from the primary COVID Unit teams. They also served a critical function in a time of high uncertainty and stress. Many structural changes were required throughout the process, which were based on patient volume and acuity, continually changing institutional COVID-19 treatment guidelines, and feedback from key stakeholders. Given the novelty of the virus, initial COVID IDC oversight was extensive. As patient volume increased, maintaining this oversight required considerable resources. The COVID IDC services extracted a cost in regards to personnel shifting away from routine activities and likely increased the utilization of off-label therapies at the initial phase of the service. Over time, the primary COVID Unit teams and COVID IDC service learned their roles in efficiently caring for COVID-19 inpatients, facilitating clinical trial referral, evaluation of co-infections, and antimicrobial stewardship. As our front-line providers become increasingly comfortable with managing COVID-19 inpatients, we plan to transition away from automatic IDC and offer traditional consultation-based IDC. The ASP and clinical trial coordinators or PIs will absorb some of the services previously provided by automatic IDC. Although providing automatic IDC interfered with regular clinical activities and affected training, it was to the benefit of our patients and colleagues in mitigating the extreme impact of COVID-19 on our community. Importantly, we provided guidance and support during a formidable period and will be prepared to resume automatic IDC, if called upon in the future (eg, if COVID-19 inpatient census increases and providers with less experience are called upon to manage patients, or if newer therapies make decision-making more complicated). As the COVID-19 pandemic continues and data regarding disease progression and therapeutic options become increasingly available, the impact of IDC, including various models of service delivery at different institutional settings, on

clinical outcomes such as morbidity, mortality, length of stay, and antimicrobial use should be further investigated.

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