

TRANSFORMING HEALTHCARE

Contribution of Infectious Disease Consultation Toward the Care of Inpatients Being Considered for Community-Based Parenteral Anti-Infective Therapy

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BACKGROUND: In the acute care setting in a multidisciplinary healthcare environment, the contribution of infectious disease (ID) specialists to overall patient care is difficult to measure. This study attempts to quantify the contribution of ID specialists when consulted for an activity specific to ID practice, community-based parenteral anti-infective therapy (CoPAT).

METHODS: In February 2010, an electronic form for requesting ID consultations was introduced in the computerized provider order entry (CPOE) system at the Cleveland Clinic. This allowed for easy identification of ID consultations for CoPAT. Hospital records for all patients with CoPAT consultation requests between February 11, 2010 and May 15, 2010 were reviewed for specific defined contributions in the domains of optimization of antimicrobial therapy, significant change in patient assessment, and additional medical care contribution.

RESULTS: Over a 3-month period, there were 263 CoPAT consultation requests via CPOE, of which 172 were initial consultations and 91 reconsultations. Antimicrobial treatment was optimized in 84%, a significant change in patient assessment made in 52%, and additional medical care contribution provided in 71% of consultations. In 33% of consultations, there was contribution in all 3 domains. CoPAT was deemed not to be necessary in 27%. For patients requiring CoPAT, effective care transition from the inpatient to outpatient setting was assured at least 86% of the time.

CONCLUSION: Infectious disease consultation before discharge on parenteral antibiotics adds value by contributing substantially to inpatient care, and providing antimicrobial stewardship and continuity of care at a critical patient care transition point. *Journal of Hospital Medicine* 2012;7:365–369 © 2012 Society of Hospital Medicine

With dramatically increasing costs of healthcare, it has become increasingly necessary for healthcare providers to demonstrate value in the delivery of care. Porter and Teisberg have strongly advocated that healthcare reform efforts should focus on improving value rather than limiting cost, with value being defined as quality per unit cost.¹ However, it has been pointed out that value means different things to different people.² The biggest challenge in defining value stems mainly from the difficulty in defining quality, because it, too, means vastly different things to different people. Modern medicine is increasingly characterized by multidisciplinary care. With limited or shrinking resources, it will become necessary for individual specialists to describe and articulate, in quantitative terms, their specific contributions to the overall outcome of individual patients.

Previous publications have provided broad descriptions of the value provided by infectious disease (ID) specialists in the domains of sepsis, infection control, outpatient antibiotic therapy, antimicrobial stewardship, and directive care and teaching.^{3,4} Studies have also shown the value of ID physicians in specific disease conditions. ID consultation is associated with lower mortality^{5,6} and lower relapse rates⁷ in hospitalized patients with *Staphylococcus aureus* bacteremia. In another study evaluating the impact of ID consultants, patients seen by ID consultants had longer lengths of hospital stay, longer intensive care unit lengths of stay, and higher antibiotic costs than matched controls not seen by ID consultants.⁸ It can be argued that a major limitation of the study was that controls were not matched for the ID diagnosis, nor for the causative microorganisms, but it is clear that ID physicians are challenged to demonstrate their contribution to the care of patients.

A unique activity of ID physicians is the management of community-based parenteral anti-infective therapy (CoPAT). At Baystate Medical Center, a policy of mandatory ID consultation was instituted for patients leaving hospital on parenteral antibiotics. A study was conducted on the impact of predischarge ID consultation for 44 patients who were not already being followed by the ID service. The study documented change from intravenous (IV) to oral

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Additional Supporting Information may be found in the online version of this article.

Received: August 4, 2011; Revised: October 31, 2011; Accepted: November 15, 2011

2012 Society of Hospital Medicine DOI 10.1002/jhm.1902

Published online in Wiley Online Library (Wileyonlinelibrary.com).

formulation, change of antibiotic choice, and change of dose/duration of treatment in a substantial proportion of patients.⁹ These are significant changes, but ID consultation contributes more than the themes explored in the study.

The purpose of this study was to evaluate the contribution of ID consultation when consulted for CoPAT, an activity specific to ID practice, in a different institution, and using an expanded definition of medical contribution.

METHODS

The Cleveland Clinic's Department of Infectious Disease has 24 staff physicians and 11 inpatient ID consultative services. These include: 2 solid organ transplant services; a bone marrow transplant and oncologic service; 2 infective endocarditis/cardiac device infection services; an intensive care unit (ICU) service; a bone and joint infection service; a neuroinfection service; and 3 general ID consult services. Consultative services are provided 7 days a week. At the Cleveland Clinic, ID consultation is required prior to discharge on parenteral antibiotic therapy.^{10,11} ID consultation for CoPAT usually occurs when the primary service deems the patient is close to being discharged from hospital. This circumstance allows for assessing the specific contribution of ID physicians beyond that of the primary service and other consulting services.

Case Ascertainment

The study was approved by the institutional review board. In February 2010, an electronic form for requesting ID consultations had been introduced into the computerized provider order entry (CPOE) system at the Cleveland Clinic. One of the required questions on the form was whether the consultation was regarding CoPAT, with options of "Yes," "No," or "Not sure." These electronic ID consultation requests were screened to identify consultation requests for this study.

Inclusion and Exclusion Criteria

All adult ID consultations between February 11, 2010 and May 15, 2010 for which the "CoPAT consult?" field was marked "Yes" were included in the study. All other consultations, including "not sure" for CoPAT, were excluded.

Definitions

The first ID consultation during a hospitalization was considered an initial consultation. ID consultations for patients whom an ID service had previously seen during the same hospitalization were deemed reconsultations. Value provided was defined as contribution of the ID consultation team in the following domains: 1) optimization of antimicrobial therapy, 2) significant change in patient assessment, 3) additional medical

TABLE 1. Definitions of ID Contributions in the Identified Domains

Domain 1: Optimization of antibiotic therapy
• Alteration of an antibiotic (change of antibiotic or route of administration)
• Defining duration of therapy
• Identification of psychosocial factors (eg, injection drug use) that influence treatment
Domain 2: Significant change in patient assessment
• Diagnosis of an infectious process
• Better appreciation of extent of disease
• Refutation of a false infectious disease diagnosis
• Recognition of a noninfectious process needing urgent attention
• Identification of a positive culture as contaminant/colonization
• Recognition of a need for additional testing (testing needed to arrive at a diagnosis or clarify a treatment plan <i>before</i> a patient could be safely discharged from hospital)
• Recognition of need for surgery/invasive intervention
• Refutation of antibiotic allergy by history or allergy testing
Domain 3: Additional medical care contribution
• Administration of vaccines
• Identification of an unrecognized medical problem that needed to be addressed after discharge from hospital
• Provision of effective transition of care (ensuring that the same ID physician who saw the patient in hospital followed the patient after discharge from hospital)

Abbreviation: ID, infectious disease.

care contribution. Specific contributions included in each domain are outlined in Table 1.

Data Collected

For each ID consultation episode, clinicians' notes were reviewed from the day of the ID consultation to the day the patient was discharged from hospital or the day the ID service signed off, whichever happened sooner. Results of recommended tests were followed up to determine if results led to a change in patient assessment. Data elements collected for each consultation episode included patient age, gender, race, date of hospitalization, date of discharge, date of ID consultation or reconsultation, primary service, and documentation of ID service contributions. Data were collected and entered in a Microsoft Access relational database. To minimize bias, the data collection was performed by physicians who had not participated in the care of the patient.

Analysis

The proportion of ID consultations in which the ID team contributed in the defined domains were enumerated, and described for the group overall and also separately for initial consultations and reconsultations.

RESULTS

In the time period studied, there were 1326 CPOE requests for ID consultation. The response to the question, "CoPAT consult?" was "Yes" for 304, "No" for 507, and "Not sure" for 515 requests. Of the 304 consultation requests marked "Yes," 41 were excluded. Reasons for exclusion were: no ID consultation note (21), wrong service consulted (8), consultation request placed while the ID service was already

following the patient (7), and duplicate consultation request (5). The remaining 263 consultation requests corresponded to 1 or more CoPAT consultation requests for 249 patients (across different hospitalizations). Of the 263 consultation requests, 172 were initial consultations, while the remaining 91 were reconsultations (patients not actively being followed

by the ID service, but previously seen during the same hospitalization).

Consultation characteristics are outlined in Table 2. The most common group of infections for which CoPAT was sought was bone and joint infections, accounting for over 20% of the consultation requests. CoPAT consultations were requested a median of 4 days after hospitalization. Patients were discharged from hospital a median of 3 days after they were seen by the ID service. ID consultation did not delay discharge. The ID service usually saw the patient the same day, and followed the patient in hospital for a median of 1 day. There was no difference in hospital days after consult for patients who did not need antibiotics versus those who did.

ID consultation provided value in at least 1 domain in 260 of the 263 consultations. This included optimization of antimicrobial treatment in 84%, significant alteration of patient assessment in 52%, and additional medical care contribution in 71% of consultations. Substantial contributions were made in all domains in both initial consultations and in reconsultations. Specific ID contributions within each of the domains are shown in Figure 1. There was wide overlap of contributions across the 3 domains for individual consultations (Figure 2), with contributions in all domains occurring in 34% of consultations. CoPAT was deemed not to be necessary in 27% of consultations. Among patients who did not require CoPAT, 60% received oral antibiotics and 40% were deemed not to need any antibiotics at hospital discharge. Among the patients discharged on CoPAT, a follow-

TABLE 2. Consultation Characteristics

Characteristic	Initial Consultation [172] n (%)*	Reconsultation [91] n (%)*	Overall [263] n (%)*
Patient age in years, mean (SD)	58 (14)	62 (13)	59 (14)
Male gender	98 (60)	91 (56)	149 (57)
Caucasian race	126 (73)	74 (81)	200 (76)
Services requesting consults (5 most common overall)			
Medicine	41 (17)	14 (15)	55 (21)
Orthopedics	34 (14)	0 (0)	34 (13)
Hematology/Oncology	16 (7)	10 (11)	26 (10)
Cardiology	9 (4)	15 (16)	24 (9)
Gastroenterology	14 (6)	5 (5)	19 (7)
Consult diagnosis (5 most common overall)			
Bone and joint infection	45 (26)	9 (10)	54 (21)
Skin or soft tissue infection or rash	21 (12)	8 (9)	29 (11)
Endocarditis or cardiac device infection	7 (4)	15 (16)	22 (8)
IV catheter or other endovascular infection	9 (5)	8 (9)	17 (6)
Urinary tract infection	12 (7)	5 (5)	17 (6)
Days from admission to ID consult, median (IQR)	4 (1-11)	7 (2-19)	4 (1-14)
Days to respond to consult request, median (IQR)	0 (0-1)	0 (0-0)	0 (0-0)
Days from ID consult to discharge, median (IQR)	3 (2-7)	2 (1-4.5)	3 (1-6)

Abbreviations: ID, infectious disease; IQR, interquartile range; IV, intravenous; SD, standard deviation. * Unless otherwise specified.

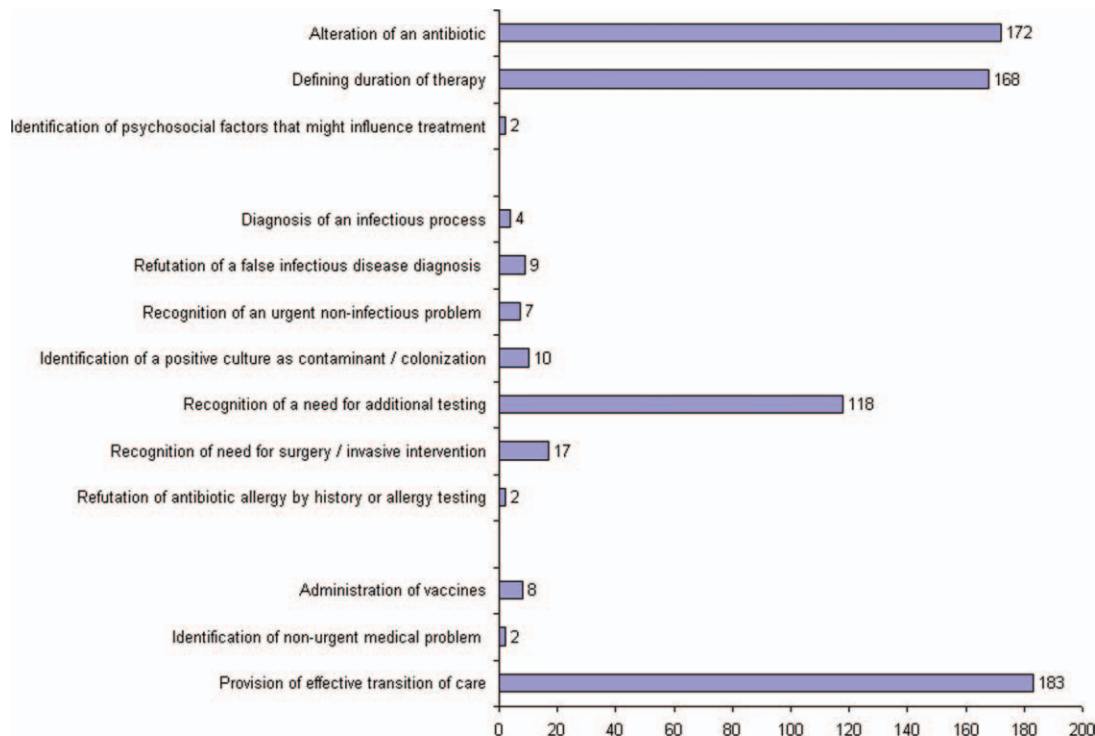


FIG. 1. Specific infectious disease (ID) contributions with numbers of consultations in which they were made (total of 263 consultations).

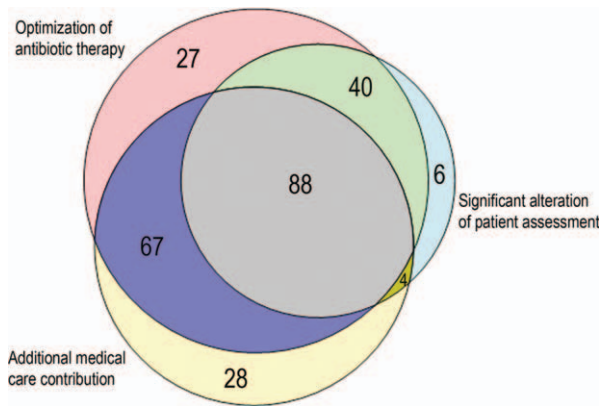


FIG. 2. Venn diagram showing overlap of contributions in the different domains for individual consultations.

up appointment with a Cleveland Clinic ID physician familiar with the patient was set up 86% of the time; the rest either followed up with another physician or it was deemed that a scheduled follow-up ID visit was not necessary.

DISCUSSION

Physicians practicing in the specialty of infectious diseases face challenges and opportunities, as they adapt to changing demands within hospital practice in regard to reimbursement in an Accountable Care environment. Other challenges include emerging infections, antimicrobial resistance, need for antimicrobial stewardship, and increasing numbers of immunocompromised patients.¹² From a health systems perspective, the overall value of care provided by the entire organization, and overall outcomes, are ultimately what matter. However, healthcare administrators need an appreciation of contributions of individual providers and specialties to fairly allocate resources and compensation for care provided. Articulating unique contributions is particularly challenging for individuals or services that provide purely cognitive input. Shrinking healthcare resources makes it critically important for cognitive specialists to be able to define their unique role in the care of patients with complex problems.

Our study found that a major contribution of ID consultation for CoPAT is that the process identifies a large number of patients who do not need CoPAT, thus effecting a powerful antimicrobial stewardship function. In our study, CoPAT was deemed unnecessary 27% of the time. The Infectious Diseases Society of America practice guidelines on outpatient parenteral antimicrobial therapy emphasize the importance of careful evaluation of patients considered for parenteral antibiotics outside the hospital setting.¹³ The focus on careful selection of appropriate patients for CoPAT has been a cornerstone of the Cleveland Clinic model of care. Nearly 30 years ago, we found that outpatient parenteral antibiotic therapy was unnecessary or not feasible in 40% of the patients referred for evaluation.¹⁰ If we adjust the numbers with the

assumption that reimbursement issues present at that time are now less of an issue, the proportion of patients who were referred for CoPAT but not discharged on it was 29%, a figure remarkably similar to that found in the current study.

Another major contribution of ID consultation is the provision of effective transition of care from the inpatient to the outpatient setting. Frequent occurrence of postdischarge adverse events has been recognized as a problem in clinical practice.¹⁴ Primary care physicians are rarely involved in discussions about hospital discharge.¹⁵ A consensus conference including the American College of Physicians, Society of Hospital Medicine, and Society of General Internal Medicine, convened in July 2007 to address quality gaps in transitions of care between inpatient and outpatient settings. It identified 5 principles for effective care transitions: accountability, communication, timeliness, patient and family involvement, and respect for the hub of coordination of care.¹⁶ Recognizing gaps in care transition, hospitalists in a hospital-based infusion program developed a model of care that successfully bridged the hospital-to-home care transition for patients who could return to hospital for daily antimicrobial infusions.¹⁷ In our system, ID physicians take ownership for directing parenteral antibiotic therapy for the episode of illness, specifying the physician, date, and time of follow-up before the patient is discharged from hospital, thereby essentially satisfying the principles of effective care transitions identified. The purpose of the ID follow-up is not to replace other follow-up care for patients but to ensure safe transition of care while treating an episode of infection.

Attribution of identified contributions to the ID consultation could be done because our study was limited to CoPAT consultations. Such consultations typically occur when patients are deemed close to hospital discharge by the primary service. There should be little controversy about attribution of cognitive input in such consultations, because from the primary service's perspective, the patient is ready or almost ready to be discharged from hospital. It would be fair to state that most of the identified contributions in the study would not have occurred had it not been for the ID consultation.

We acknowledge that the study suffers from many limitations. The biggest limitation is that the contribution elements are defined by ID physicians and sought in the medical record by physicians from the same specialty. This arrangement certainly has potential for significant bias. To limit this bias, data collection was performed by physicians who had not participated in the care of the patient. In addition, we only could assess what was documented in the electronic health record. Our study found that alteration of antibiotic therapy was a substantial contribution, however, documentation of recommendation to change antibiotics in the medical record rarely specified exactly why the change

was recommended. Reasons for antibiotic change recommendations included bug-drug mismatch, minimum inhibitory concentration (MIC) considerations, pharmacokinetic considerations, adverse effects, convenience of dosing, drug interactions, and insurance coverage. However, it is not possible to quantify the specific contribution of each of these reasons, in a retrospective study, without making assumptions about why specific ID physicians made specific antibiotic change recommendations. There may have been more contributions that might not have been apparent on a retrospective chart review. The lack of a control group also lessens the impact of our findings. We could not have a control group, because no patient is discharged from the Cleveland Clinic on CoPAT without having been seen by an ID physician. Mandatory ID consultation for CoPAT has previously been shown to reduce costs,⁹ however, our study was not designed to evaluate cost.

The perceived value of ID consultation in our institution can be appreciated when one considers the longstanding institutional policy of requiring ID consultation for CoPAT.^{10,11} The perpetuation of this tradition in the hospital is testament to the presumption that mandatory ID consultation is seen to be of value by the institution.

In summary, ID consultation in our institution contributes to the care of inpatients being considered for CoPAT by substantially reducing unnecessary parenteral antibiotic use, optimizing antibiotic therapy, recognizing need for additional testing before discharge from hospital, and by providing effective transition of care from the inpatient to the outpatient setting.

Disclosure: All authors are practicing infectious disease physicians. No honorarium, grant, or other form of payment was given to anyone to produce this manuscript. All authors had access to the data and were significantly involved in the preparation of this manuscript.

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