

# Experience of Infectious Diseases Consultants with Outpatient Parenteral Antimicrobial Therapy: Results of an Emerging Infections Network Survey

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**Background.** Despite the increasing use of outpatient parenteral antimicrobial therapy (OPAT), little is known about the role of infectious diseases consultants in the process or their perceptions of OPAT.

**Methods.** In May 2004, the Infectious Diseases Society of America Emerging Infections Network (EIN) surveyed its members to characterize their involvement and experiences with OPAT.

**Results.** Of the 454 respondents (54%) who completed the questionnaire, 426 (94%) indicated that patients in their primary inpatient facility were "frequently" discharged while receiving OPAT, estimating that, on average, 19 patients are discharged from their hospitals while receiving OPAT each month. Although 86% of EIN members stated that they personally order OPAT for some patients, 18% indicated that they have no involvement, and 37% stated they only rarely or occasionally oversee OPAT. EIN members involved in OPAT estimated that ~90% of their patients who take OPAT received therapy at home, and the members described variable monitoring and oversight methods. Of the respondents, 68% of providers collectively estimated that they encountered 1951 infectious and serious noninfectious complications of OPAT in the past year. The most frequently used antibiotics included vancomycin, ceftriaxone, and cefazolin, most commonly used for bone and joint infections.

**Conclusions.** These results testify to the pervasive use of OPAT in today's health care system, the variable role of infectious diseases consultants, and the heterogeneity in oversight and management practices. The widespread use of OPAT and its frequent complications indicate the need for additional studies to establish optimal methods of delivery and management to insure the quality and safety of the process.

During the past 2 decades, physicians have increasingly used outpatient parenteral antimicrobial therapy (OPAT) to treat a variety of serious infections in both adults and children. Current estimates suggest that >250,000 Americans receive OPAT each year [1]. Although various review articles, guidelines, and other reports have shed light on OPAT practices [2–6], little is known about the role of infectious diseases consultants in the OPAT process. Knowledge about their level

of participation in OPAT delivery, their experience with patients, and their perceptions about the process itself are also lacking. Accordingly, the Infectious Diseases Society of America (IDSA) Emerging Infections Network (EIN) surveyed its members, who are infectious diseases consultants in clinical practice, to characterize their experiences with OPAT and their perspectives on the process itself.

## METHODS

The IDSA EIN is a provider-based, emerging infections sentinel network that was established through a Cooperative Agreement Program Award from the Centers for Disease Control and Prevention (CDC) in 1995 [7]. It comprises volunteers who practice adult and pediatric infectious diseases medicine and belong to either the IDSA or the Pediatric Infectious Diseases Society.

During May 2004, the IDSA EIN distributed a

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**Table 1. Physician oversight and day-to-day management of patients receiving outpatient parenteral antimicrobial therapy (OPAT) in Emerging Infections Network (EIN) member practice settings.**

Variable	No. (%) of EIN members who reported information
Physician oversight for most OPAT patients in the EIN member hospital or group	
Infectious diseases physicians	300 (70)
Patients' primary care providers	84 (20)
Non-infectious diseases physician(s) designated or assigned by hospital/clinic <sup>a</sup>	10 (2)
Other <sup>b</sup>	27 (6)
Party responsible for day-to-day management of OPAT patients	
Employees of a for-profit company contracting with hospital or office	171 (40)
Employees of a hospital-based service	89 (21)
Office staff of an infectious diseases practice group	48 (11)
Office staff of a patients' primary care providers	19 (4)
Other <sup>c</sup>	92 (22)

<sup>a</sup> Includes physicians from other medicine subspecialties (e.g., surgeons, orthopedists, home health agency physicians, and residents on an inpatient service).

<sup>b</sup> Includes discharging or ordering physician (not otherwise specified) and nurse practitioners.

<sup>c</sup> Includes home health agencies, Visiting Nurses Association nurses, for-profit companies without contractual arrangements with physicians/hospitals, or other unspecified sources.

1-page introduction and a 2-page questionnaire via e-mail and facsimile to all 848 members practicing in North America. Non-respondents received a second and third mailing 2 and 4 weeks after the original, respectively. Survey questions addressed OPAT practices in member hospitals, member use of the service, member involvement in the process, oversight of OPAT patients by physicians and nonphysicians, the role of infectious diseases consultants in delivery and monitoring, and complications. To identify the leading indications for OPAT, EIN members were asked to list the 3 most common indications in their practice. Similarly, they were asked to specify the 3 antibiotics most frequently used in their OPAT patients. Questions about catheters used, infusion devices used, antimicrobial agents used, and indications for OPAT were included as an option on the survey form. A majority of respondents completed the optional questions. Denominators for some questions vary because EIN members did not respond to all questions. Differences in frequencies were analyzed for statistical significance using  $\chi^2$  tests.

## RESULTS

Overall, 484 (57%) of the 848 EIN members responded. Of these, 454 (54%) provided relatively complete data sets. The respondents included 317 members (70%) who practice adult infectious diseases medicine, 110 members (24%) who practice pediatric infectious diseases medicine, and 27 members (6%) who practice both adult and pediatric infectious diseases medicine. The number of respondents per geographic division of the United States, as defined by the US Census Bureau [8], ranged from 24 in the West North Central Division to 90 in the South Atlantic Division. Respondents also included 6 mem-

bers from Canada and 2 from the US Territories. Data from prior EIN surveys for the majority of respondents to this survey indicated that ~50% practice in urban settings, ~16% in suburban locales, and ~7% in rural areas. These data also indicated that ~37% of respondents practice in university teaching hospitals, ~36% in nonuniversity teaching hospitals, and ~26% in nonteaching hospitals. The geographic and demographic characteristics of nonresponding EIN members paralleled those of members who responded to the survey.

**Utilization of OPAT services.** Respondents indicated that OPAT services are extensively used for patients discharged from their hospitals. In total, 426 EIN members (94%) reported that patients in their primary inpatient facility are "frequently" discharged receiving OPAT. Collectively, these infectious diseases consultants estimated that their facilities discharge an average of 19 patients (range, 1–100) per month receiving OPAT. EIN members in all geographic divisions of the United States reported comparable frequencies for OPAT availability and use. In addition, those 201 respondents (44%) who indicated that they oversee their facility's OPAT program estimated collectively that they had observed >13,287 patients in the previous year.

**Involvement of infectious diseases consultants and supervision of OPAT services.** Overall, 388 respondents (86%) indicated that they ordered OPAT for  $\geq 1$  of their patients during the preceding year; however, the degree of involvement by these infectious diseases consultants in the delivery of OPAT varied greatly. Although respondents indicated that infectious diseases consultants most frequently provide oversight for OPAT services in their principal facilities (table 1), 80 EIN members (18%) indicated that they have no involvement with the OPAT

**Table 2. Most common indications for outpatient parenteral antimicrobial therapy (OPAT) in Emerging Infections Network (EIN) member practice settings.**

Type of infection	No. of EIN respondents reporting infection as among the top 3 indications for OPAT in their patients
Bone and joint (skeletal) infection	377
Endocarditis	163
Skin and soft-tissue infection	81
Bacteremia or sepsis	78
Prosthetic device or orthopedic infection	48
Intra-abdominal infection and other visceral abscesses	44
Pneumonia, with or without empyema	34
CNS infection (e.g., meningitis or brain abscess)	28
Line-related or intravascular infection	25
Surgical wound infection	24
Miscellaneous <sup>a</sup>	68

**NOTE.** EIN respondents were asked to list the top 3 indications for OPAT therapy in their practices, and this table was constructed from their answers.

<sup>a</sup> Includes Lyme disease ( $n = 14$ ), otolaryngologic infection ( $n = 14$ ), diabetic infection ( $n = 11$ ), fungal infection ( $n = 9$ ), mediastinitis ( $n = 3$ ), neutropenic fever ( $n = 2$ ), cytomegalovirus infection ( $n = 3$ ), valley fever ( $n = 2$ ), and other infections that were mentioned only once.

program, and 166 (37%) reported rare or occasional participation in the oversight of patients who are receiving OPAT. In contrast, 201 EIN members (44%) indicated that they oversee the OPAT operation for their hospitals; 151 of these respondents share this responsibility with other physicians (82% of these members share it with other infectious diseases consultants). Responsibility for the day-to-day care of patients receiving OPAT lay with a variety of entities (table 1). For-profit companies headed the list in EIN member hospitals.

**Indications.** The EIN respondents reported a variety of indications for the use of OPAT by patients at their institutions. Overall, bone and joint infection (especially osteomyelitis and diskitis) and endocarditis accounted for the most frequent use of OPAT services in EIN member practices (table 2). Pediatric infectious diseases consultants also reported bone and joint infections as the number 1 indication for OPAT; however, they reported using OPAT for pulmonary infections more frequently than for endocarditis.

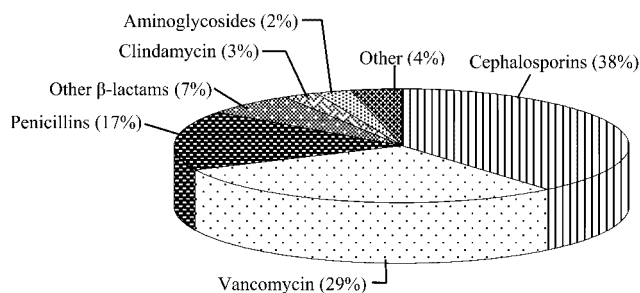
**Delivery of OPAT.** Most EIN members reported that patients who receive OPAT in their practice milieu most commonly receive therapy at home. Only 17 respondents (5%) indicated that most patients receive therapy in a hospital or clinic; 13 (4%) indicated that most patients receive OPAT in an infusion center or long-term care facility, and 6 (2%) indicated that most patients receive OPAT in a physician's office. With regard to intravenous catheter preference, 306 (86%) of 357 EIN members responding to this question indicated that peripherally inserted central venous catheters are used most frequently. Less than 5% of respondents indicated frequent use

of any particular alternative (e.g., tunneled central venous catheters, midline peripheral catheters, or peripheral intravenous catheters). In contrast, the 282 EIN members who reported about infusion devices indicated considerable variation in the choice of device for OPAT patients (table 3). When asked to list the 3 most frequently used antimicrobial agents in OPAT, respondents cited numerous drugs; however, vancomycin, ceftriaxone, and cefazolin accounted for approximately two-thirds of the agents mentioned (figure 1). EIN members also noted frequent use of antistaphylococcal agents and extended-spectrum penicillins, as well as carbapenems.

**Monitoring of OPAT.** Policies and protocols for the delivery of OPAT appeared to exhibit considerable variation. Of the respondents involved to some extent in OPAT delivery, 345

**Table 3. Most frequently used infusion devices for outpatient parenteral antimicrobial therapy (OPAT) in Emerging Infections Network (EIN) member practices.**

Type of infusion device used for OPAT ( $n = 282$ )	No. (%) of EIN members who reported that the device was the predominant one used in their OPAT patients
Electronic pump	88 (31)
Minibags plus gravity	82 (29)
Electronic syringe pump	37 (13)
Multiple-dose electronic pump	35 (12)
Elastomeric pump	34 (12)
Mechanical pump	6 (2)



**Figure 1.** The antimicrobial agents most commonly given by Emerging Infections Network (EIN) members to patients who receive outpatient parenteral antimicrobial therapy. Each EIN member listed the top 3 agents used in his or her practice, and these figures were used to construct the pie chart. The “other” antimicrobial agent category includes fluoroquinolones, linezolid, daptomycin, antivirals, and antifungals.

(92%) reported that they monitor appropriate laboratory studies at least once weekly. The remainder either did not monitor laboratory studies this frequently or did not know the frequency of monitoring. Of interest, 98% of respondents who reported overseeing their hospital OPAT programs stated that they monitor laboratory studies weekly, whereas only 67% of other respondents reported doing so ( $\chi^2 = 10.6$ ;  $P < .002$ ). Only 107 (29%) of the infectious diseases consultants who responded thought that physicians saw OPAT patients at least once weekly in their practice setting, whereas 230 (61%) reported that patients were not seen this frequently, and the remaining 33 (9%) did not know the frequency. Respondents who oversee their hospital OPAT programs were more likely to see OPAT patients weekly than were those who do not (39% vs. 15%;  $\chi^2 = 9.1$ ;  $P < .003$ ). When asked about administration of potentially toxic drugs, such as amphotericin B, cidofovir, and aminoglycosides, only 31 EIN members (8%) indicated that they obtained written, informed consent before the administration of such agents. Respondents who oversee their hospital OPAT programs were more likely to obtain informed consent than were other respondents (11% vs. 4%;  $\chi^2 = 3.9$ ;  $P < .05$ ). Finally, when asked if patients could directly contact an OPAT physician if issues arose on weekends or nights, 274 respondents (73%) affirmed that this was possible, 51 (14%) stated that it was not, and 45 (12%) were not sure. Of the respondents who oversee their hospital OPAT programs, 82% reported that OPAT patients could directly contact a designated physician at night or on weekends, whereas only 49% of the other respondents said that this was possible for their patients ( $\chi^2 = 4.6$ ;  $P < .05$ ).

**Complications.** In the year before the survey, 238 EIN members (64%) collectively encountered infectious complications related to OPAT in 960 patients. As a group, these infectious diseases consultants estimated that they had seen 529 cases of line-related bacteremia and 338 line-related exit-site or tunnel infections (table 4). The most common serious non-

infectious complication was thrombosis with occlusion and/or embolism; 189 EIN members (51%) collectively estimated that they encountered 643 cases during the prior year. Two EIN members reported cases of air embolism. Other noninfectious complications included less-severe line problems and adverse drug effects. Altogether, respondents indicated that 706 of the cases involving a serious noninfectious complication necessitated catheter removal.

Of note, 13 members reported that 14 of their patients had died unexpectedly during the previous year while they were engaged in OPAT therapy. Sixteen infectious diseases consultants also reported having been sued with regard to an OPAT issue at some time in the past.

## DISCUSSION

Since its first description in the 1970s [9], the use of OPAT in health care has increased steadily throughout the United States. It is estimated that >1 of every 1000 Americans use OPAT services each year [10]. The results of this EIN survey attest to the ubiquity of this practice in all geographic divisions of the United States. Almost 95% of respondents indicated that patients are frequently discharged from their primary hospitals while receiving OPAT. Moreover, the 201 EIN members who oversee OPAT operations collectively estimated that they had observed >13,000 patients receiving OPAT in the previous year. Estimates of this magnitude also bear witness to the relatively quiet revolution over the last 30 years that has transformed the management of serious infections. Factors responsible for this revolution likely include demonstrations of efficacy, cost-effectiveness, patient convenience, physician willingness to participate, incentives for hospitals to discharge patients more quickly, and the emergence of OPAT as a multibillion-dollar-a-year industry in its own right [4, 10–18].

Overall, 70% of EIN members reported that infectious diseases consultants oversee most OPAT patients for their hospital or group. Notwithstanding this, the results of the EIN survey indicate that participation of infectious diseases consultants in OPAT operations runs the gamut from no involvement to supervision of the program. Of the respondents, 18% indicated that they have no involvement with OPAT services, 44% indicated that they oversee their hospital’s or outpatient practice’s OPAT operation, and 37% indicated that they rarely or occasionally oversee OPAT for selected patients who require it. The survey did not address motives for participation, and no EIN member offered an explanation. However, several respondents wrote in their reasons for not participating in OPAT services, and there were common themes. As one member succinctly put it, “I bailed out of this type of care because of no reimbursement, enormous liability and no control.” Eleven other respondents echoed  $\geq 1$  of these sentiments.

Several limitations of this EIN survey require acknowledg-

**Table 4. Complications of outpatient parenteral antimicrobial therapy (OPAT) observed by Emerging Infections Network (EIN) members in the previous year.**

Complication	No. (%) of EIN respondents who reported complication	Collective estimate of the no. of cases in the previous year
Infectious complications		
All	238 (64)	960
Line-related bacteremia	171 (46)	529
Exit site or tunnel infection	142 (38)	338
Serious noninfectious complications		
All	238 (64)	991
Thrombosis with occlusion or embolism	189 (51)	643
Other <sup>a</sup>	60 (16)	143

<sup>a</sup> Included adverse drug effects (most commonly neutropenia, hypersensitivity reaction, or nephrotoxicity) and other catheter-related problems (most commonly line fractures, leaks, and malfunctions and local irritation).

ment. The EIN survey relies solely on member reports and does not attempt to verify them independently. Members practicing in institutions where infectious diseases consultants do not play a leading role in the delivery of OPAT may have only a cursory knowledge of its use and complications. In addition, all members may have made rough estimates on the day that they completed their surveys; thus, the potential role of recall bias must be recognized. Survey responses may have included data from >1 individual in the same practice; this, however, seems unlikely, because many EIN members have indicated that a designated person responds for the group.

The EIN survey documented the use of OPAT for a broad range of indications for which considerable evidence of efficacy exists [4]. The survey also documented considerable variation in practice, especially with regard to the type of infusion devices used. Monitoring practices also differed. Of note, only 29% of respondents indicated that OPAT patients were seen at least weekly, as is recommended in the IDSA guideline for OPAT [4]. The observation by 30% of EIN respondents that a diverse group of noninfectious diseases physicians oversee OPAT patients in their facilities offers one explanation for this variation. Additional variation in OPAT practices may arise from the differing entities that provide day-to-day oversight for OPAT patients (table 1). Several members indicated that use of these entities may vary within a single hospital depending upon the payer, who may have established contracts with one company or another for OPAT services. To date, the effect of these variations in practice on the efficacy and safety of OPAT has received little attention. Inconsistent practices, however, may contribute to the risks for complications, and they raise concern about the integrity of the delivery systems.

Complications of OPAT have been well described, including adverse drug effects, bacteremia, and infections related to indwelling intravenous lines, as well as noninfectious intravenous

line complications [2, 19–23]. The results of the EIN survey indicate that these complications arise fairly frequently in the practices of infectious diseases consultants. Almost 65% of respondents had encountered serious infectious and noninfectious complications in the year before the survey. Although details were not requested or supplied, 13 members reported unexpected mortality among their OPAT patients in the previous year, and 16 had been sued for matters that regarded an OPAT issue. These observations indicate that the risks entailed by OPAT therapy are far from trivial for patients and providers. These risks, the frequency of OPAT use, and the variations in delivery systems underscore the need for increased scrutiny and for studies to delineate best practices.

Despite its limitations, the results of the EIN survey provide a novel view of OPAT use and practices in the United States. At the same time, they raise a number of concerns about the current “system” for its delivery. Because the use of OPAT likely will increase in years to come, the need to establish optimal and standardized approaches to its delivery takes on a sense of urgency before new antimicrobials, new antimicrobial resistance patterns, new vascular access devices, and new reimbursement structures further influence local OPAT services and make comparative studies more difficult. The EIN survey results highlight the need to identify and promote optimal practices to reduce the drawbacks and vulnerabilities of current OPAT practices.

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