

# Antimicrobial Stewardship Practice in the Ambulatory Setting From a National Cohort

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**Background.** The majority of antimicrobial use occurs in the ambulatory setting. Antimicrobial stewardship programs (ASPs) are effective in improving appropriate prescribing and are now required by accreditation bodies.

**Methods.** This was a cross-sectional, multicenter survey describing the current state of ambulatory ASPs in a national cohort of Vizient member hospitals with ambulatory healthcare settings and serves as a benchmark for stewardship strategies related to program effectiveness.

**Results.** One hundred twenty-nine survey responses from a variety of institution types across 44 states were received. Survey respondents reported a fully functioning ASP in 7% (9 of 129) of ambulatory practices compared with 88% (114 of 129) of inpatient institutions. Effectiveness in at least 1 antibiotic use-related outcome (ie, utilization, resistance, *Clostridioides difficile* infection, or cost) in the past 2 years was reported in 18% (18 of 100) of ambulatory and 84% (103 of 123) of inpatient ASPs. Characteristics of ambulatory ASPs demonstrating effectiveness were institution guidelines (89%, 16 of 18), rapid diagnostic testing for respiratory viruses or group A *Streptococcus* (89% 16 of 18), outpatient antibiograms (78% 14 of 18), and dedicated pharmacist support (72%, 13 of 18). Ambulatory ASP effectiveness was shown to increase as programs met more of the Centers for Disease Control and Prevention (CDC) Core Elements of Outpatient Antimicrobial Stewardship ( $P < .001$ ).

**Conclusions.** Antimicrobial stewardship programs are needed in the ambulatory setting, but they are not common. Currently, few ambulatory ASPs in this survey self-identify as fully functioning. The CDC Core Elements of antimicrobial stewardship should remain foundational for ASP development and expansion.

**Keywords.** antimicrobial stewardship; antimicrobial use; ambulatory practice.

Antimicrobial resistance is an ongoing public health concern driven by antibiotic overuse across the care continuum [1]. It has been estimated that 80%–90% of all antibiotic use in humans occurs in the ambulatory setting [2, 3]. In 2016, there were 270.2 million outpatient antibiotic prescriptions written in the United States, surmounting to 5 prescriptions per 6 people, as reported by the Centers for Disease Control and Prevention (CDC) [4]. Furthermore, data suggest that 30%–52% of outpatient antibiotic prescriptions are unnecessary [5, 6]. This excessive use of antibiotics has been described as a primary cause of resistance and leads to adverse events such as secondary *Clostridioides difficile* infections [7–10].

With such data indicating the possible overuse and misuse of antibiotics, it is essential to evaluate and implement effective stewardship practices. Although antimicrobial stewardship programs (ASPs) vary in characteristics, they have been shown to be beneficial in the inpatient setting, and, although less common, ASPs in ambulatory settings have also been shown to improve antibiotic therapy selection and minimize inappropriate use of antibiotics [11–14]. As a result, The Joint Commission has published new standards for ASPs in the ambulatory setting effective January 2020 [15]. The CDC Core Elements of Antimicrobial Stewardship along with the Quality Innovation Network-Quality Improvement Organization (QIN-QIO) Field Guide help to provide guidance for stewardship programs in the ambulatory setting [16, 17]. Despite these resources, compared with inpatient ASPs, there are no recommendations regarding priority interventions for ambulatory ASP program success. Ambulatory antimicrobial stewardship remains generally uncharted, and detailed information on the current state of practice across the country is lacking.

Due to the high rates of unnecessary and inappropriate antibiotic use along with new regulatory requirements, it is prudent to assess ASP strategies currently established in the ambulatory

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setting. This study reports survey findings from a national cohort describing the current state of ambulatory ASPs and provides a benchmark of strategies leading to reported effectiveness in ambulatory ASPs.

## METHODS

### Survey

This was a cross-sectional survey of the Vizient network and associated provider care practices, characterizing the current state of ambulatory ASPs nationally. In addition, survey respondents were asked to compare their ambulatory ASP to their inpatient ASP where applicable. Vizient, Inc. is the largest member-driven, healthcare performance improvement company in the United States that encompasses more than 3200 acute care hospitals, and service to 95% of US academic medical centers, and more than 20% of the nation's ambulatory market. The survey was sent to pharmacy directors, antimicrobial stewardship listserv, and ambulatory/outpatient pharmacy listserv, and pharmacy contacts in the community-based network were invited to participate regardless of presence of any ASP. Incomplete or duplicate surveys were excluded.

The Institutional Review Board-approved electronic survey comprised 51 questions and was distributed to participants via email. Questions were designed to capture participant demographics, volume metrics, presence of stewardship program, compliance with CDC Core Elements of Outpatient Antimicrobial Stewardship, and components of ambulatory stewardship (Qualtrics, Provo, UT) (see [Supplementary Appendix](#)). Participants answering on behalf of health systems were directed to respond to questions based on the majority of their practice sites, when applicable. Survey responses were collected from September 19 to October 18, 2019 with 2 reminders sent via email.

### Definitions

Presence of ASPs were classified by respondents in 4 categories that include fully functional, in development, no program but considering a small project, or no program with no plans to develop one. Fully function was defined as stewardship activities at multiple ambulatory locations and/or for multiple diagnoses, whereas programs in development were those providing stewardship activities to 1 ambulatory location and/or 1 diagnosis. Stewardship interventions (eg, written justification in medical record, prescriber-level audit feedback, communication training) were all defined and grouped (ie, commitment, action and policy, tracking and reporting, education) according to the 2016 CDC Core Elements of Outpatient Antibiotic Stewardship [16]. Antimicrobial stewardship program effectiveness was defined as self-reported achievement in at least one of the following areas within the past 2 years: (1) cost savings or cost avoidance related to antimicrobials; (2) decreased antimicrobial

utilization; (3) decreased *C difficile* infection; (4) decreased rate of drug-resistant organisms [18]. For additional survey definitions, see [Supplementary Appendix](#).

### Analysis

Data were analyzed using statistical software, Stata (version 13.1; StataCorp LLC, College Station, TX). Participant survey responses were summarized using descriptive statistics. Inferential group comparisons were analyzed using  $\chi^2$  or Fisher's exact test for nominal data, as appropriate, and the Mann-Whitney *U* test for continuous non-parametric data. Kruskal-Wallis testing was used for ranked data. Statistical significance was defined as  $P < .05$ .

## RESULTS

### Demographics

Surveys were sent to 1662 individuals, and 172 (10.3%) responses were received. Forty-three responses were excluded (7 redundant and 36 incomplete) leaving 129 included surveys. Respondents represented a variety of institution types and were geographically distributed across 44 states ([Table 1](#)). A majority of respondents answered on behalf of a health system and identified an affiliation with an academic medical center.

Characteristics of ambulatory and inpatient ASPs are described in [Table 2](#). Ambulatory ASPs were reported as fully functional in 7% (9 of 129) of surveys compared with 88% (114 of 129) in the inpatient setting. Most respondents, 78% (100 of 129), expressed an interest in or current development of an ambulatory ASP, and 53% (68 of 129) of programs

**Table 1. Characteristics of Survey Participants<sup>a</sup>**

Characteristics	N = 129
Location	
South	39 (30.2)
Midwest	37 (28.6)
Northeast	27 (20.9)
West	26 (20.5)
Answering on behalf of a health system	68 (52.7)
Institution types <sup>b</sup>	
Academic medical center	76 (58.9)
Ambulatory care/outpatient clinic	61 (47.3)
Medium sized community hospital (100–300 beds)	36 (27.9)
Large community hospital (>300 beds)	34 (26.4)
Children's hospital	28 (21.7)
Critical access hospital	22 (17.1)
Behavioral health facility	20 (15.5)
Small sized community hospital (<100 beds)	17 (13.2)
Long-term acute care facility	16 (12.4)
Freestanding oncology hospital	6 (4.7)

<sup>a</sup>All data reported as n (%).

<sup>b</sup>Multiple selections possible when answering for health system.

**Table 2. Comparison of Ambulatory and Inpatient Stewardship Programs<sup>a</sup>**

Characteristics	Ambulatory N = 129	Inpatient N = 129
<b>Description of Program</b>		
Fully functional	9 (7)	114 (88)
In development	47 (36)	12 (9)
No program, considering small project	53 (41)	1 (1)
No program, no current plans to develop one	20 (16)	2 (2)
<b>Dedicated Support</b>		
Pharmacist	53 (41)	115 (89)
Informatics technology	47 (36)	82 (64)
Physician	45 (35)	109 (85)
Infection preventionist	44 (34)	88 (68)
Administrative	36 (28)	50 (39)
Microbiologist	22 (17)	93 (72)
<b>Core Element: Commitment</b>		
Commitment posters	44 (34)	35 (27)
Ambulatory stewardship is an institutional priority	68 (53)	-
<b>Core Element: Action and Policy</b>		
Institution-specific treatment guidelines	77 (60)	112 (87)
Cascade reporting	58 (45)	112 (87)
Cascade reporting	40 (31)	69 (54)
Set at least 1 annual goal	27 (21)	105 (81)
Electronic decision support	18 (14)	81 (63)
Provider incentives	14 (11)	22 (17)
Healthcare Effectiveness Data and Information Set	13 (10)	16 (12)
Required antimicrobial indications	13 (10)	82 (64)
Written accountable justification	8 (6)	32 (25)
<b>Core Element: Tracking and Reporting</b>		
Antibiogram	72 (56)	116 (90)
Antibiogram	59 (46)	106 (82)
Per-visit antibiotic prescription rates per diagnosis	19 (15)	6 (5)
Prescriber-level audit and feedback	18 (14)	72 (56)
Provider-level prescribing data	14 (11)	22 (17)
Special project outcomes	14 (11)	69 (53)
Prescribing rates	14 (11)	22 (17)
Progress on annual goals	10 (8)	75 (58)
<i>Clostridioides difficile</i> infection	5 (4)	101 (78)
Drug-resistant organisms	5 (4)	90 (70)
Antibiotic days of therapy	3 (2)	96 (74)
Pediatric-specific data	2 (2)	25 (19)
Purchasing costs	2 (2)	77 (60)
Antibiotic length of therapy	2 (2)	17 (13)
Daily defined doses	0	17 (13)
<b>Core Element: Education</b>		
Patient education materials	43 (33)	67 (52)
Patient education materials	37 (29)	56 (43)
Communication training	21 (16)	42 (33)
Symptomatic prescribing pad	13 (10)	3 (2)

<sup>a</sup>All data reported as n (%).

reported that ambulatory antimicrobial stewardship was a priority for their institution. The established duration of ASPs differed between ambulatory and inpatient programs with more ambulatory ASPs developed within the last year at 22% (29 of 129), whereas more inpatient ASPs were established for greater than 7 years at 44% (57 of 129). The minority of respondents noted somewhat (16%) or strongly (4%) agreed that financial resources were adequate for ambulatory ASP compared with inpatient ASP where 44% somewhat and 17% strongly agreed.

#### Antimicrobial Stewardship Program Characteristics and Core Elements

Commitment to ambulatory stewardship was present in 57% of programs as exhibited by the identification of ambulatory stewardship as an institutional priority. Institutional priority included programs with an approved statement of commitment from executive leadership, ambulatory stewardship-related duties in position descriptions, or the appointment of a single leader to direct stewardship activities. The most common stewardship personnel in both settings were pharmacists at 41% (53 of 129) in ambulatory programs and 89%

(115 of 129) in inpatient programs. This was closely followed by informatics support at 37% (48 of 129) and physician support at 35% (45 of 129) in ambulatory programs. For technology support, electronic health record (EHR) systems were used in 98% (127 of 129) of all ASPs, and the majority (82%) reported capabilities for sharing information between inpatient and ambulatory sites. Technology add-ons were only present in 13% (17 of 129) of ambulatory programs. The primary add-on technology for both ambulatory and inpatient ASPs was the use of Epic ASP Module at 5% (6 of 129) and 30% (39 of 129), respectively.

Broadly assessing ASP actions, inpatient programs consistently used more components than ambulatory programs (Table 2). The use of institution-specific treatment guidelines was the most common stewardship action in both ambulatory and inpatient programs (45% vs 87%, respectively). Ambulatory treatment guidelines targeted urinary tract infections at 21% (27 of 129), pharyngitis at 19% (25 of 129), sinusitis at 19% (25 of 129), and otitis at 16% (20 of 129). Second to treatment guidelines, cascade antimicrobial susceptibility testing reporting and the use of annual goals were reported in 31% and 21% of ambulatory ASPs, respectively. Microbiological testing support was most commonly seen with the use of rapid diagnostic testing (RDT) for respiratory viruses (59%), group A *Streptococcus* (62%), and blood cultures (40%) in ambulatory programs. Overall, stewardship actions less commonly reported included the use of EHR clinical decision support, provider incentives, antimicrobial indications, and written accountable justifications.

Antimicrobial tracking and reporting was less frequently used in the ambulatory setting with the exception of antibiograms, which were reported in 46% (59 of 129) of programs (Table 2). Additional reporting included per-visit antibiotic prescription rates for a particular diagnosis (ie, bronchitis, upper respiratory tract infection, and sinusitis) at 15% (19 of 129). Comparatively in the inpatient setting, almost all programs (90%) reported a component of tracking and reporting.

Education was a component of 33% of ambulatory ASPs and was primarily in the form of patient education materials (29%). Other described methods of education included communication training (16%) and the use of symptomatic prescribing pads (10%).

#### Antimicrobial Stewardship Program Outcomes

Only ASPs who reported measuring antimicrobial utilization, cost, resistance, and/or *C difficile* infections in the past 2 years were included in the effectiveness assessment (ambulatory programs = 100, inpatient programs = 123). Overall, self-reported effectiveness was less common in the ambulatory setting at 18% (18 of 100) compared with 84% (103 of 124) of inpatient ASPs (Table 3). For both ambulatory and inpatient ASPs,

**Table 3. Self-Reported Program Effectiveness<sup>a</sup>**

Type of Effectiveness Reported	Ambulatory	Inpatient
Effectiveness reported	18/100 (18) <sup>b</sup>	103/123 (84) <sup>b</sup>
Decreased antimicrobial utilization	17/18 (94)	90/103 (87)
Antimicrobial cost savings	4/18 (22)	87/103 (84)
Decreased <i>Clostridioides difficile</i> infection	3/18 (17)	67/103 (65)
Decreased antimicrobial resistance	2/18 (11)	38/103 (37)

<sup>a</sup>All data reported as n (%).

<sup>b</sup>Denominator includes programs who answered as tracking effectiveness.

effectiveness was most commonly reported as demonstrating decreased antibiotic utilization at 94% (17 of 18) and 87% (90 of 103), respectively. Decreases in antimicrobial resistance was the lowest reported measure of effectiveness for both ambulatory and inpatient ASPs (2 of 18 [11%] versus 38 of 103 [37%], respectively).

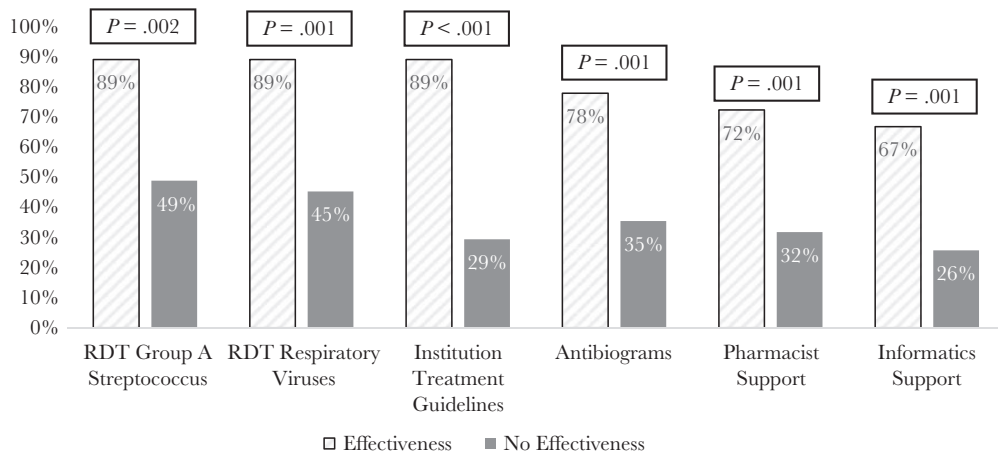
The ASP activities most commonly present in ambulatory programs that reported effectiveness included institutional guidelines, RDT for respiratory viruses, and RDT of group A *Streptococcus* (Figure 1). The 2 most common personnel support types in effective ambulatory ASPs were pharmacist at 72% (13 of 18) and informatics at 67% (12 of 18).

The relationship between the number of CDC Core Elements of Outpatient Antimicrobial Stewardship implemented and measured effectiveness is shown in Figure 2. For ASPs meeting only one Core Element, zero programs reported effectiveness compared with 59% when all 4 Core Elements were met ( $P < .001$ ).

## DISCUSSION

This national survey found that a minority of institutions reported a fully functional ambulatory ASP with only 13 institutions reporting they met all 4 CDC core elements of outpatient stewardship. A vast majority (78%) expressed an interest in or current development of an ambulatory ASP, whereas only 20% reported having adequate financial resources. Furthermore, results show inpatient stewardship programs to be more prevalent and consistently use more stewardship activities compared with ambulatory ASPs. This finding aligns with the higher rates of effectiveness seen in inpatient ASPs when compared with ambulatory ASPs. More importantly, the longer duration of ASPs and higher frequency of tracking and reporting in the inpatient setting likely had a significant contribution on this difference. The intent of this research is to serve as a benchmark to those ambulatory ASPs in development and provide a framework for stewardship activities that are commonly seen in effective programs.

The reporting of stewardship characteristics commonly seen in effective programs may help to guide institutions who are currently in development of ambulatory ASPs. Rapid diagnostics

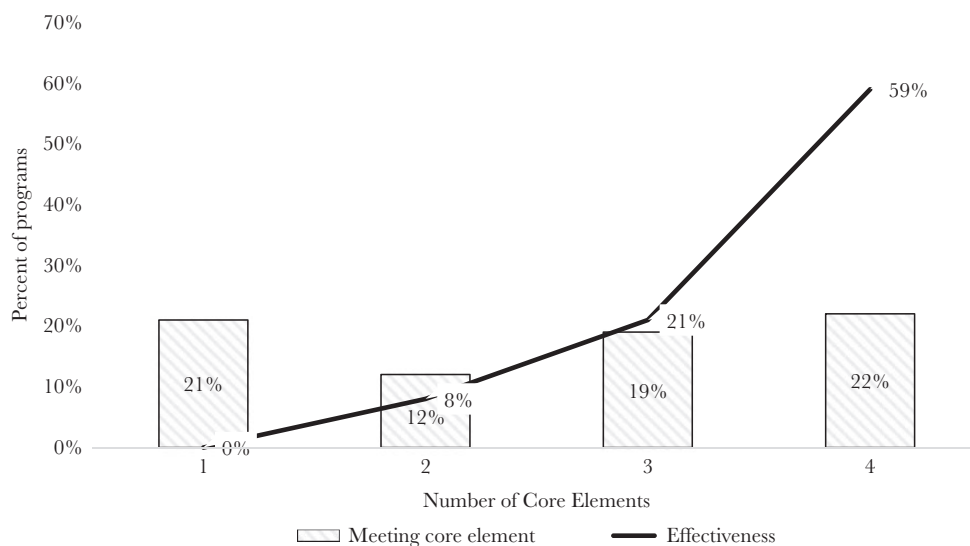


**Figure 1.** Characteristics and activities of ambulatory antimicrobial stewardship programs based on program effectiveness. Percentages calculated as presence of characteristic with programs demonstrating effectiveness (n = 18) or within programs not demonstrating effectiveness (n = 82). Excludes those programs not tracking effectiveness (n = 29). RDT, rapid diagnostic testing.

for group A *Streptococcus* and respiratory viruses, antibiotics, and institutional-specific guidelines were common in programs who reported effectiveness, suggesting possible target areas for ASPs in development. Use of RDT to improve diagnosis of group A *Streptococcus* or respiratory virus infections during an ambulatory office visit can assist with antibiotic selection and make a large impact given the high rates of inappropriate or unnecessary antibiotic prescriptions for these disease states [5, 6, 19–21]. Adopting these tests requires economic commitment, electronic medical record integration, personnel training, collaboration with microbiology, and prescriber support, which may pose road blocks to quick implementation [22]. However, for institutions who currently use these tests in their inpatient setting, expansion to ambulatory sites may be a logical first step

to ambulatory ASP development. Effective ambulatory ASPs in this survey often incorporated institutional guidelines for urinary tract infections and otitis, providing additional conditions to target. Previous literature has also suggested that pursuing ASP activities for these disease states may improve antimicrobial therapy [23, 24]. More research is needed to guide effective ambulatory antimicrobial stewardship interventions. In addition, research into the sustainability of these intervention is desperately needed given the dearth of resources in this area.

Although we identify high-priority areas for ambulatory ASPs, it is important to note that successful ASPs are multifaceted, as seen with our survey respondents reporting greater rates of effectiveness as more CDC Core Elements of Outpatient Antimicrobial Stewardship are met [16, 25, 26]. Likewise,



**Figure 2.** Centers for Disease Control and Prevention (CDC) Core Elements for ambulatory stewardship and reported effectiveness. Relationship between ambulatory antimicrobial stewardship programs meeting core elements and reporting effectiveness.

March-López et al [25] report that a multilayered outpatient study using interventions in line with the CDC Core Elements resulted in a 17% reduction in overall antibiotic utilization. A key component of this success was dependent on the personnel support provided to the ASP. In our survey, in ambulatory programs that demonstrated effectiveness, 72% had pharmacist support and 67% had informatics support. This integral role of pharmacist support and technology add-ons on ASP effectiveness is essential given the high (98%) prevalence of EHRs and has also been described in the acute-care setting [18, 27]. More importantly, physician support was more common in the inpatient setting as were overall rates of effectiveness. Although studies have evaluated physician and pharmacist full-time equivalent (FTE) support and effectiveness in inpatient ASPs, information is lacking in the ambulatory setting [18]. Further evaluation of FTE support in the ambulatory ASPs is warranted.

This study was not without limitations. First, the use of Vizient-affiliated institutions and low response rates may have resulted in selection bias and overestimated the actual current state of ambulatory ASP. However, the survey respondents comprised of a variety of institutional types and were well represented geographically from 44 states. Second, the use of self-reported effectiveness and lack of standardization for degree of effectiveness seen by ASPs may have led to an over- or underreporting of outcomes. In addition, although these definitions have been previously used in studies to demonstrate inpatient antimicrobial stewardship effectiveness, it is unknown whether all components are applicable to outpatient ASP effectiveness [18]. The survey did not capture other additional infection control or hospital-related interventions that may impact rates of *C difficile* infection and multidrug-resistant infections. Finally, a large percentage of participants answered on behalf of a health system and were directed to answer questions based on the practice at the majority of their affiliated sites. This may make it difficult to apply the results of our study to all institution types. In light of new regulatory requirements and need for ambulatory antimicrobial stewardship, future assessments to evaluate this evolving field will be informative. Assessing more discrete markers of program effectiveness in future surveys may be beneficial because programs that are currently in development will have more time to drive change in antimicrobial utilization.

## CONCLUSIONS

In summary, this study serves as a benchmark to ambulatory antimicrobial stewardship that has been largely undescribed, demonstrates the importance of a multifaceted program on success, and provides stewardship areas of focus for institutions with ambulatory ASPs currently in development.

## Supplementary Data

Supplementary materials are available at *Open Forum Infectious Diseases* online. Consisting of data provided by the authors to benefit the reader, the posted materials are not copyedited and are the sole responsibility of the authors, so questions or comments should be addressed to the corresponding author.

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**Potential conflicts of interest.** G. L. B. is an employee of Vizient, Inc. All authors have submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest. Conflicts that the editors consider relevant to the content of the manuscript have been disclosed.

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