

Evaluation of the Infectious Diseases Society of America's Core Antimicrobial Stewardship Curriculum for Infectious Diseases Fellows

- Jennifer O. Spicer, MD, MPH, Department of Medicine, Emory University School of Medicine, Atlanta, GA, USA.
- Wendy S. Armstrong, MD, Department of Medicine, Emory University School of Medicine, Atlanta, GA, USA.
- Brian S. Schwartz, MD, Division of Infectious Diseases, University of California, San Francisco, CA, USA.
- Lilian M. Abbo, MD, Department of Medicine, Division of Infectious Diseases, University of Miami Miller School of Medicine and Jackson Health System, Miami, FL, USA.
- Sonali D. Advani MBBS, MPH, Department of Medicine, Duke University School of Medicine, Durham, NC, USA.
- Alice E. Barsoumian, MD, Infectious Disease Service, Brooke Army Medical Center, San Antonio, TX, USA.
- Cole Beeler, MD, Department of Medicine, Indiana University School of Medicine, Indianapolis, IN, USA.
- Kenza Bennani, Infectious Diseases Society of America, Arlington, VA, USA.
- Marisa Holubar, MD MS, Department of Medicine, Stanford University School of Medicine, Stanford, CA, USA.
- Misha Huang, MD, MS, Department of Medicine, University of Colorado School of Medicine, Aurora, CO, USA.

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- Dilek Ince, MD, Department of Internal Medicine, University of Iowa Carver College of Medicine, Iowa City, IA, USA.
- Julie Ann Justo, PharmD, MS, Department of Clinical Pharmacy and Outcomes Sciences, University of South Carolina College of Pharmacy, Columbia, SC, USA.
- Matthew S. L. Lee, MD, Department of Medicine, Beth Israel Deaconess Medical Center, Boston, MA, USA.
- Ashleigh Logan, Infectious Diseases Society of America, Arlington, VA, USA.
- Conan MacDougall, PharmD, MAS, Department of Clinical Pharmacy, University of California San Francisco School of Pharmacy, San Francisco, CA, USA.
- Priya Nori, MD, Department of Medicine, Division of Infectious Diseases, Albert Einstein College of Medicine, Bronx NY, USA.
- Christopher Ohl MD, Department of Medicine, Wake Forest School of Medicine, Winston-Salem, NC, USA.
- Payal K. Patel MD, MPH, Department of Medicine, University of Michigan Medical School and VA Ann Arbor Healthcare System, Ann Arbor, MI, USA.
- Paul S Pottinger, MD, Department of Medicine, University of Washington School of Medicine, Seattle, WA, USA.
- Rachel Shnekendorf, MPH, Infectious Diseases Society of America, Arlington, VA, USA.
- Conor Stack, MD, Department of Medicine, Beth Israel Deaconess Medical Center, Boston, MA, USA.
- Trevor C. Van Schooneveld, MD, Department of Internal Medicine, University of Nebraska Medical Center, Omaha, NE, USA.
- Zachary I. Willis, MD, MPH, Department of Pediatrics, University of North Carolina School of Medicine, Chapel Hill, NC, USA.

- Yuan Zhou, MD, MPH, Department of Infectious Diseases, The PolyClinic, Seattle, WA, USA.
- Vera P. Luther, MD, Department of Medicine, Wake Forest School of Medicine, Winston-Salem, NC, USA.

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Corresponding Author:

Jennifer O. Spicer, MD, MPH

46 Armstrong Street

Woodruff Extension Building, Office 211

Atlanta, GA 30303

Phone: 404-251-1321

Email: jennifer.spicer@emory.edu

Summary: Evaluation of the IDSA Core Antimicrobial Stewardship Curriculum indicates that infectious diseases fellows and program directors perceived that the curriculum effectively taught foundational stewardship content. The evaluation also suggests that programs implementing the curriculum should prioritize its interactive components.

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ABSTRACT

Background: Antimicrobial stewardship (AS) programs are required by Centers for Medicare and Medicaid Services and should ideally have infectious diseases (ID) physician involvement; however, only 50% of ID fellowship programs have formal AS curricula. The Infectious Diseases Society of America (IDSA) formed a workgroup to develop a core AS curriculum for ID fellows. Here, we study its impact.

Methods: ID program directors and fellows in 56 fellowship programs were surveyed regarding the content and effectiveness of their AS training before and after implementation of the IDSA curriculum. Fellows' knowledge was assessed using multiple-choice questions. Fellows completing their first year of fellowship were surveyed before curriculum implementation ("pre-curriculum") and compared to first-year fellows who complete the curriculum the following year ("post-curriculum").

Results: Forty-nine (88%) program directors and 105 (67%) fellows completed the pre-curriculum surveys; 35 (64%) program directors and 79 (50%) fellows completed the post-curriculum surveys. Prior to IDSA curriculum implementation, only 51% of programs had a "formal" curriculum. After implementation, satisfaction with AS training increased among program directors (16% to 68%) and fellows (51% to 68%). Fellows' confidence increased in 7/10 AS content areas. Knowledge scores improved from a mean of 4.6 to 5.1 correct answers of 9 questions ($P=0.028$). The major hurdle to curriculum implementation was time, both for formal teaching and for e-learning.

Conclusion: Effective AS training is a critical component of ID fellowship training. The IDSA Core AS Curriculum can enhance AS training, increase fellow confidence, and improve overall satisfaction of fellows and program directors.

Keywords: curriculum evaluation, antimicrobial stewardship, infectious diseases training, fellowship education, infectious diseases fellows

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Evaluation of the Infectious Diseases Society of America's Core Antimicrobial Stewardship Curriculum for Infectious Diseases Fellows



Evaluation of the IDSA Core Antimicrobial Stewardship Curriculum suggests that ID fellows and program directors felt the curriculum effectively taught foundational stewardship content, with emphasis on its interactive components.

Key Components

Customizable activities allow content to be tailored to fit program needs and various learning styles



eLearnings



Presentation slides for lectures



Application Activities



Communication Exercises



Assessment Tools

4 Main Sections

- Introduction to AS
- AS in Everyday Practice
- Educating and Coaching on AS
- AS Program Logistics

Results & Challenges

Fellows stressed the most valuable components were the **interactive, in - person sessions**



Program Director stewardship curriculum **satisfaction increased**

52%

after implementation



Both groups describe **time as biggest barrier** to curriculum implementation



Fellows who experienced the curriculum showed **higher levels of confidence** in stewardship content areas



INTRODUCTION

Antimicrobial resistance is an increasingly significant public health threat [1]. Because antibiotic misuse contributes to antibiotic resistance, strengthening antimicrobial stewardship (AS) in healthcare settings is one way to combat antimicrobial resistance and improve health outcomes. In 2014, the Centers for Disease Control and Prevention (CDC) recommended that hospitals develop AS programs based on seven core elements [2]. Subsequently, the Centers for Medicare and Medicaid Services and the Joint Commission announced the requirement for acute care hospitals to have active antimicrobial stewardship programs [3].

Professional societies have advocated for infectious diseases (ID) physician involvement in, and leadership of, AS programs [4, 5], and many ID fellows will be asked to participate in these programs at some point in their career, especially if they practice in a community setting. AS activities differ from traditional consultative medicine because they focus on improving quality, efficiency, and standardization of patient care. Thus, targeted education must be incorporated into ID fellowship training to help trainees develop basic competence in AS and, for some, to prepare them for careers in AS.

Although most ID fellows participate in AS activities during fellowship, a survey of ID fellowship program directors (PDs) published in 2017 revealed that only 50% of ID training programs had a “formal” AS curriculum [6]. Formal curricula refer to a planned sequence of educational activities with well-defined learning objectives. Moreover, only 20% of ID PDs were very or extremely satisfied with their ID fellows’ education in AS, indicating a national need for an AS curriculum for ID fellows that could be adapted for programs of differing sizes and resources [6]. A national, standardized curriculum would ensure that all ID fellows receive foundational AS training, regardless of training site, and would be especially helpful for those programs with limited AS faculty and resources.

While AS curricula have been developed for trainees, few specifically target ID fellows [6]. The Society for Healthcare Epidemiology of America offers both in-person training courses or asynchronous

web-based modules, but neither contain content that can be tailored by ID fellowship training programs or incorporated into their existing curricula. Moreover, they have a heavy emphasis on healthcare epidemiology with limited AS content.

The Infectious Diseases Society of America (IDSA) convened an Antimicrobial Stewardship Curriculum Workgroup to develop two antimicrobial stewardship curricula. The first curriculum was a core antimicrobial stewardship curriculum (hereafter, “the IDSA Core Curriculum”) meant to provide ID fellows with foundational knowledge and skills in AS. The goal was to provide ID training programs with curricular materials using various instructional methods that could be adapted to their local context based on their program’s existing resources. The second curriculum is an advanced AS curriculum designed for ID fellows who intend to pursue a career in AS; it is undergoing pilot testing during the 2020-2021 academic year. Below we describe a pilot of the IDSA Core Curriculum among ID fellowship programs.

METHODS

Curriculum Design

The development and structure of the IDSA Core Curriculum was previously described [6]. The IDSA Antimicrobial Stewardship Curriculum Workgroup developed the curriculum, which consists of a curriculum bundle containing multiple e-learning modules (web-based electronic platforms blending instruction and assessment tools) plus additional educational resources that include lecture slides, case-based questions, small group activities, role-play videos, readings, simulations, and clinical application exercises. The curriculum contains a general introduction followed by four curricular sections (Table 1).

Implementation of Curriculum

Participating ID fellowship programs were instructed to review the curriculum and faculty guide and determine how to implement it at their own program based on their local needs and priorities. Options included asynchronous e-learning modules, in-person sessions, or a combination. PDs were asked to review the curriculum and were given the option to lead the curriculum themselves or identify another faculty lead. Programs were encouraged, but not required, to implement the curriculum with first-year ID fellows, yet they were allowed to use the curriculum with fellows in any year of training. ID fellows and faculty were given access to the curriculum on August 1, 2018 and had access for one year.

Instrument Development

Surveys for ID fellowship PDs and fellows were developed by three of the authors (J.O.S., B.S.S., & W.S.A.) and underwent modification upon review by the IDSA Antimicrobial Stewardship Curriculum Workgroup, which included ID physicians, fellows, and pharmacists with expertise in antimicrobial stewardship. All surveys were created in SurveyMonkey (San Mateo, CA) and distributed to participants via email.

PD Surveys: Pre- and post-curriculum surveys were sent to the PDs of all participating ID fellowship programs (see Supplementary Materials). The 27-item pre-curriculum survey included: 1) linear scales assessing PDs' satisfaction with and perceived effectiveness of their current curriculum; 2) selected-response questions regarding the content and structure of programs' current AS training activities, plans for implementation of the IDSA Core Curriculum, potential implementation challenges identified, and fellowship program demographics; and 3) open-ended questions addressing the rationale for IDSA Core Curriculum implementation plans. The 25-item post-curriculum survey included: 1) linear scales assessing PDs' satisfaction with and perceived effectiveness of the IDSA Core Curriculum, 2) selected-response questions regarding the actual implementation of the IDSA Core Curriculum, satisfaction with the curriculum, challenges with implementation, and future plans for the curriculum; and 3) open-ended

questions addressing their rationale for curriculum implementation, satisfaction with the curriculum, and suggestions for improvement. An email with the pre-implementation survey was sent in July 2018 and the post-implementation survey in July 2019. Weekly reminders were sent for two weeks. No incentives were provided.

Fellow Surveys: Surveys were completed by first-year fellows at the end of their first year of training. The 35-item pre-curriculum survey included: 1) nine selected-response questions assessing fellows' AS knowledge; 2) selected-response questions regarding their training program and current and prior participation in AS activities; and, 3) linear scales assessing fellows' satisfaction with and perceived effectiveness of their AS training and confidence in their skills. The knowledge questions were created to assess individual learning objectives from each module that were testable using a selected-response question type. Questions were reviewed by AS content experts and medical educators within the workgroup to ensure content was important and question format followed best practices. The 46-item post-curriculum survey included the same content as the pre-curriculum survey with the addition of 1) selected-response questions related to their completion of the IDSA Core Curriculum and perceived quality of the curriculum, and 2) open-ended questions assessing their enjoyment of the curriculum, barriers to completion, and suggestions for improvement. Five ID fellows piloted the ID fellow survey using cognitive interviews to ensure response process validity, and minor changes were made based on feedback prior to distribution. Surveys were sent to ID fellows completing their first year of training in June 2018 (pre-curriculum [control] group), and then to ID fellows completing their first year of ID fellowship in June 2019 who utilized the curriculum (post-curriculum [intervention] group). Survey links were emailed, and weekly reminders were sent for two weeks.

Statistical Analysis

Descriptive statistics were calculated for numerical data. For open-ended questions, two authors (J.O.S., V.P.L.) independently reviewed responses, categorized based on themes, and discussed results to achieve a consensus. Participants were not required to answer all survey questions, so denominators vary for each question. Percentages were calculated using the true denominator for each question. Survey responses for 5-point linear scales were merged into the following categories: not at all/slightly/moderately and very/extremely. The Pearson chi-square test or t-test were used, where appropriate, to assess for differences between groups. All statistical analyses were conducted in SAS 9.4 (SAS Institute, Cary, NC). The study was deemed exempt by the Emory University Institutional Review Board.

RESULTS

All ID fellowship training programs in the United States were invited to participate in the pilot. Fifty-six ID fellowship training programs responded to the open invitation to participate in the pilot during the 2018-2019 academic year, representing 33% (50/151) of adult training programs and 9% (6/64) of pediatric training programs.

Characteristics of Participating Programs

PDs of 49 (88%) of the 56 participating ID fellowship programs completed the pre-curriculum pilot survey describing their current AS training for ID fellows (Table 2). Most programs had some form of AS education in their fellowship program, but only 51% of programs had a formal curriculum. AS exposure most commonly consisted of lectures, attending stewardship meetings, and participating in quality improvement projects; however, when reporting the number of hours spent on activities, covering the antibiotic approval pager was the most time-intensive activity (mean 578 hours; standard deviation

[SD], 1630). Average time spent on other activities included: 19 hours performing prospective audit and feedback of patient records (SD, 46), 10 hours attending stewardship meetings (SD, 22), 5 hours on small group discussions (SD, 6), and 4 hours on lectures (SD, 3).

Curriculum Implementation

Fifty-five/56 programs who originally agreed to participate implemented the curriculum during the pilot period. Sixty-four percent (35/55) of the PDs responded to at least some of the post-curriculum survey questions. Of those programs, 89% (31/35) had their first-year ID fellows participate in the curriculum, and 69% (24/35) had their first-year fellows complete all of the curriculum during the pilot year. Sixty-five percent (22/34) of responding programs implemented the complete curriculum, with the remaining programs implementing only a portion due to limited curricular time or presence of similar content in their existing curriculum. Participation in the curriculum was mandatory for fellows in 81% (26/32) of responding programs.

Survey Respondent Characteristics

To determine the impact of the curriculum on ID fellows, two cohorts of first-year ID fellows from the 55 participating programs were surveyed: 1) fellows completing their first-year of fellowship in June 2018, who had not been exposed to the curriculum (pre-curriculum group), and 2) fellows completing their first-year of fellowship in June 2019, who had been exposed to the curriculum (post-curriculum group). Survey response rates were 67% (105/157) for the pre-curriculum group, of which 90% (94/105) were adult ID fellows, and 50% (79/157) for the post-curriculum group, of which 95% (71/75) were adult ID fellows.

Satisfaction with Antimicrobial Stewardship Training

Prior to curriculum implementation, only 16% (8/49) of PDs were very or extremely satisfied with their existing curriculum, which increased to 68% (21/31) after implementation of the IDSA Core Curriculum. Of the ID fellows surveyed prior to curriculum implementation, 51% (54/105) were very or extremely satisfied with their fellowship program's training in antimicrobial stewardship as compared to 68% (53/78) of ID fellows after curriculum implementation.

PDs felt their fellowship program was significantly more effective in teaching multiple key stewardship content areas after implementation of the IDSA Core Curriculum (Table 3). Fellows who experienced the IDSA Core Curriculum rated their fellowship stewardship curriculum higher than fellows who did not experience the curriculum, although not all content areas reached statistical significance.

Antimicrobial Stewardship Knowledge and Skills

Compared with pre-curriculum assessments, first-year ID fellows reported significantly higher confidence in seven of ten antimicrobial stewardship skill domains after completing the curriculum (Table 4).

Mean knowledge test score increased slightly from 4.6 (SD 1.4) to 5.1 (SD 1.3) out of 9 points ($P = 0.028$). Although statistically significant, this result appeared to be primarily driven by changes in only a few questions (Table 5). Results were unchanged even after limiting the analysis only to those fellows who completed the entire curriculum.

Strengths and Challenges to Curriculum Implementation

The majority of PDs were either extremely (16%, 5/31) or very (52%, 16/31) satisfied with the IDSA Core Curriculum, and 93% (28/30) of PDs responded they would recommend the curriculum to others. Fifty percent (15/30) of PDs experienced some challenges with implementing the curriculum including not having enough time for formal teaching (50%; $n=15$), not having enough time for fellows to

complete e-learning content (37%; n=11), or lack of sufficient faculty facilitators (17%; n=5). PDs had planned to target first-year fellows; however, programs reported that scheduling logistics made it difficult to schedule in-person sessions. Some programs implemented the curriculum during their antimicrobial stewardship rotations or fellows' "boot camp" at the beginning of the year to ensure that fellows had adequate time to complete the curriculum.

Forty-three percent (33/76) of fellow survey respondents reported completing all sections of the curriculum. Fellow-reported completion rates for each of the four main sections of the curriculum ranged from 45% to 64%. When asked about barriers to completing the curriculum, twenty fellows provided open-ended responses, which included comments about lack of time due to clinical service obligations, technical difficulties accessing the curriculum, forgetting about the curriculum due to lack of reminders, and disengagement with the online training. When asked what they enjoyed most about the curriculum, 45 fellows provided open-ended responses, which indicated that they appreciated the following: the interactive format, including role play videos and small group discussions with faculty and colleagues; the use of practical and realistic case examples; the presence of a structured, comprehensive curriculum; and, the accessibility of the online portion of the curriculum.

PDs and fellows both suggested adding additional content in the following areas: microbiology and pharmacology concepts, advanced stewardship topics, and additional difficult communication scenarios.

DISCUSSION

We describe the evaluation of the IDSA Core Antimicrobial Stewardship Curriculum, which is a national curriculum providing foundational training in antimicrobial stewardship for ID fellows. PDs were satisfied with the quality and effectiveness of the curriculum, and most would recommend the curriculum to others.

Similarly, ID fellows reported the curriculum was effective at teaching antimicrobial stewardship concepts; however, changes in fellows' perception of effectiveness of antimicrobial stewardship training pre- and post-curriculum implementation did not differ quite as drastically as PDs' perceptions. This difference appears to be due to ID fellows in the pre-curriculum implementation group rating the effectiveness of their antimicrobial stewardship training much higher than PDs did, leaving less room for improvement after curriculum implementation. After implementation of the curriculum, ID fellows and PDs responded with similar ratings for the effectiveness of AS training. It is unclear why PDs initially had a less favorable view of their program's AS training effectiveness as compared to fellows, but a similar trend has been seen when comparing trainee and PD perspectives on effectiveness of quality improvement training [7] and may represent PDs' broader perspective of the scope of the field when compared to the perception of trainees.

The mean knowledge test score was only slightly higher for fellows who experienced the curriculum as compared to the pre-curriculum fellows. The lack of a striking knowledge difference between these groups could be attributed to a few factors. First, the use of multiple-choice questions may not be the best strategy to measure the higher-order cognitive processes that AS requires [8, 9]. Based on fellows' scores, many of our test items appeared to be either too difficult or too easy, thus making it difficult to discriminate between learners. Second, multiple-choice questions are inherently limited in their ability to assess social and behavioral sciences [10], which constitute a substantial portion of the material taught in antimicrobial stewardship curricula.

A promising finding was that fellows who experienced the curriculum showed significantly higher levels of confidence in many key AS content areas. It will be important to assess whether increased confidence correlates with improvement in fellows' AS practices. Future studies should consider using chart reviews, simulations, or direct observation to evaluate for objective changes in fellows' behaviors.

PDs and fellows both described time as the biggest barrier to curriculum implementation, including time for formal teaching sessions and for completion of e-learning content. Given the increasingly urgent threat of antimicrobial resistance, ID fellowship programs should reassess their curricular content and ensure that all ID fellows receive foundational training in AS concepts. Fellows highlighted the need to have dedicated time to devote to e-learning content, such as during an AS elective or fellowship orientation. Fellows stressed the most valuable components of the curriculum were the interactive, in-person sessions which provided an opportunity for experiential learning in the setting of practical, realistic cases, an essential component of medical education [11]. The curriculum allows customization to their institutional resources and needs; however, based on fellow feedback, programs planning to implement the curriculum should consider how they can incorporate as many interactive, in-person sessions as possible, such as during fellows' orientation or their core didactic series.

Our study has a few limitations. First, our primary outcomes were PD and fellow perceptions of curriculum effectiveness, and fellow confidence in stewardship skills. We did not evaluate changes in fellows' performance or patient outcomes. Our only objective outcome was multiple-choice test scores, which showed a small, albeit, statistically significant increase. These self-reported outcome measures, however, are commonly used in curriculum evaluation studies, and they are similar to outcome measures published in other studies assessing stewardship curricula [12-15]. Second, we used an observational study design with historical controls rather than a randomized design. In this case, our pre-curriculum "historical control" group were fellows who had completed their first year of fellowship training immediately prior to the implementation of the curriculum. We felt this group represented the best comparator since they were from the same institution as the fellows included in the study; however, it is possible there are other unmeasured confounders present between the two fellowship classes compared in this study that accounted for the differences that we observed. Third, we had lower response rates for our post-curriculum surveys, and individuals completing the post-curriculum surveys may have had a more favorable view of the curriculum than those who did not. Additionally, PDs who participated in this pilot

may have been more likely to believe that their existing antimicrobial stewardship curriculum was inadequate.

In conclusion, the IDSA AS Fellow's Core Curriculum is a national curriculum providing foundational training in AS, developed in response to a need identified by ID fellowship training PDs. When implemented in the context of an existing ID fellowship program, this curriculum can enhance AS training, increase ID fellow confidence, and improve overall satisfaction of fellows and PDs. The findings of our study would suggest programs planning to implement the curriculum should prioritize the incorporation of interactive components over asynchronous activities when feasible. These evaluation results have been used to inform development of the IDSA AS Fellow's Advanced Curriculum and revision of the Core Curriculum.

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NOTES

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Table 1. Infectious Diseases Society of America Core Antibiotic Stewardship Curriculum Content and Educational Resources.

Section	Purpose/Learning Objectives	Educational Resources
Introduction to the Curriculum	Upon completion of this section, faculty and fellows will understand how to use the curriculum	Video, clinical rounding tool, antibiotic stewardship communication skills pocket card, reading materials
Introduction to Antibiotic Stewardship	<p>Upon completion of this section, fellows will be able to:</p> <ul style="list-style-type: none"> • Define antibiotic stewardship, its programmatic goals, and key strategies to achieve the goals • Relate trends and patterns between antibiotic use and resistance • Understand adverse events associated with the use of specific antibiotics, including the risk for development of <i>C. difficile</i> infections • Understand the role of clinical and laboratory diagnostic tools in improving antibiotic use • Define expected outcomes of an antibiotic stewardship program (ASP) 	eLearnings, lecture slides, assessment tools
Antibiotic Stewardship in Everyday Practice	<p>Upon completion of this section, fellows will be able to:</p> <ul style="list-style-type: none"> • Judge when to recommend formal ID consultation or ASP intervention • Recognize the major “infectious diseases syndromes” where antibiotics are over- and misused in acute care inpatient and outpatient settings, and the stewardship techniques to improve prescribing for these infections • Demonstrate a basic understanding of common process and outcome measures/metrics • Compare and contrast effective stewardship techniques in the inpatient vs. outpatient settings 	Case-based questions, assessment tools, eLearnings, clinical rounding tool and educational activity, reading materials
Educating and	Upon completion of this section, fellows will be able to:	Reading materials, video,

Coaching on Antibiotic Stewardship	<ul style="list-style-type: none"> • Explain key behavioral psychology concepts that influence antibiotic prescribing • Propose effective techniques to change antibiotic prescribing practices • Use provider education techniques to effect change in antibiotic prescribing • Demonstrate communication skills to influence antibiotic prescribing habits of others 	role play exercises, small group discussion, case-based questions, eLearnings, antibiotic stewardship communication skills scoring rubric, pocket card, and mini-CEX
Antibiotic Stewardship Program Logistics	<p>Upon completion of this section, fellows will be able to:</p> <ul style="list-style-type: none"> • Describe key steps in establishing an ASP • Identify multidisciplinary collaborations necessary for the success of an ASP • Describe how to implement the core elements of ASPs into practice • Recognize regulatory and reporting aspects of ASPs • Understand stewardship-related principles of quality improvement and patient safety • Recommend strategies for responding to antibiotic shortages 	Simulation exercise, slides, reading materials, eLearning, assessment tools, meeting attendance and interview activity

Footnote: Adapted from [7].

Table 2. Characteristics of participating Infectious Diseases fellowship programs

Program Characteristics	No. (%) (N = 49)
Type of training program	
Adult infectious diseases fellowship training program	44 (90%)
Pediatric infectious diseases fellowship training program	5 (10%)
Presence of formal antimicrobial stewardship curriculum	
Yes	25 (51%)
No	24 (49%)
Antimicrobial stewardship activities included in fellows' education	
Lectures	42 (86%)
Small group discussions	22 (45%)
Attending hospital antimicrobial stewardship meetings	39 (80%)
Covering the antibiotic approval pager	24 (49%)
Audit and feedback of patient records	22 (45%)
Quality improvement projects	35 (71%)
No formal educational activities related to antimicrobial stewardship	2 (4%)

Table 3. Rating of fellowship training effectiveness in key antimicrobial stewardship content areas by program directors and first-year infectious diseases fellows before and after curriculum implementation.

Effectiveness of curriculum in teaching fellows to:	Very/Extremely effective, %			Very/Extremely effective, %		
	Fellows			Program Directors		
	Pre-curriculum (N = 105)	Post-curriculum (N = 78)	<i>P</i> value	Pre-curriculum (N = 48)	Post-curriculum (N = 32)	<i>P</i> value
Educate other healthcare professionals on the importance of stewardship in individual patient care	50%	72%	0.002	29%	72%	<0.001
Educate other healthcare professionals on the importance of stewardship for the community	34%	54%	0.008	10%	59%	<0.001
Model stewardship in the inpatient setting	68%	81%	0.047	40%	81%	<0.001
Model stewardship in the outpatient setting	44%	60%	0.034	13%	47%	<0.001
Determine when an infectious diseases consultation would be more appropriate than a stewardship intervention	67%	74%	0.262	38%	68%	0.009

Use effective communication techniques to change antimicrobial prescribing practices of other healthcare professionals	52%	63%	0.159	21%	72%	<0.001
Identify the elements of an effective hospital-based antimicrobial stewardship program	56%	67%	0.151	15%	78%	<0.001
Identify the inter-professional collaborations necessary for an effective hospital-based antimicrobial stewardship program	61%	76%	0.036	23%	81%	<0.001
Describe the day-to-day activities of a leader of an antimicrobial stewardship program	41%	58%	0.025	21%	75%	<0.001

Table 4. Infectious Diseases fellows' confidence in key antimicrobial stewardship content areas.

	% Very/Extremely Confident		<i>P</i> value
	Pre-curriculum group (N = 105)	Post-curriculum group (N = 78)	
Level of confidence in ability to:			
Educate other healthcare professionals on the importance of stewardship in individual patient care	45%	62%	0.025
Educate other healthcare professionals on the importance of stewardship for the community	35%	44%	0.252
Model stewardship in the inpatient setting	58%	74%	0.023
Model stewardship in the outpatient setting	47%	62%	0.046
Determine when an infectious diseases consultation would be more appropriate than a stewardship intervention	68%	82%	0.032
Use effective communication techniques to change antimicrobial prescribing practices of other healthcare professionals	50%	62%	0.112
Identify the elements of an effective hospital-based antimicrobial stewardship program	46%	55%	0.264
Identify the inter-professional collaborations necessary for an effective hospital-based antimicrobial stewardship program	50%	70%	0.005
Describe the day-to-day activities of a leader of an antimicrobial stewardship program	34%	52%	0.017
Identify the initial steps the stewardship team would use to respond to an antibiotic shortage at your hospital	32%	46%	0.049

Table 5. Summary of Infectious Diseases fellows' performance on knowledge test

Learning objective assessed in question	% Correct Responses		P value
	Pre-curriculum	Post-curriculum	
	group (N = 106)	group (N = 79)	
Define antimicrobial stewardship	56%	77%	0.003
Identify stewardship techniques used by microbiology laboratory to improve antimicrobial prescribing	4%	11%	0.158
Recall percentage of inappropriate antibiotic prescriptions in the inpatient setting	67%	58%	0.241
Recognize adverse effects of antimicrobials	94%	95%	0.863
Judge when to recommend formal ID consultation or antimicrobial stewardship intervention	10%	19%	0.096
Propose effective techniques to change antimicrobial prescribing practices	20%	20%	0.941
Explain key behavioral psychology concepts that influence antimicrobial prescribing	85%	87%	0.637
Use provider education techniques to effect change in antimicrobial prescribing	43%	62%	0.012
Recommend strategies for responding to antimicrobial shortages	80%	82%	0.720