

Faces of Resistance: Using Real-World Patients and Their Advocates to Teach Medical Students About Antimicrobial Stewardship

Priya Nori,¹ Kelsie Cowman,¹ Amanda Jezek,² Joshua D. Nosanchuk,^{1,3} Magdalena Slosar-Cheah,¹ Uzma Sarwar,¹ Rachel Bartash,¹ and Belinda Ostrowsky^{1,4}

¹Division of Infectious Diseases, Department of Medicine, Montefiore Medical Center, Albert Einstein College of Medicine, Bronx, New York, USA, ²Public Policy and Government Relations, Infectious Diseases Society of America, Arlington, Virginia, USA, ³Department of Microbiology and Immunology, Albert Einstein College of Medicine, Bronx, New York, USA, ⁴Division of Healthcare Quality Promotion, Centers for Disease Control and Prevention, New York, New York, USA

We engaged medical students with antimicrobial stewardship (AS) and antimicrobial resistance (AMR) through patient stories and a panel on AMR advocacy with experts from the Centers for Disease Control and Prevention and the Infectious Diseases Society of America. Students were surveyed on their perceptions about AS and AMR (response rate = 139 of 166, 84%).

Keywords. antimicrobial resistance; antimicrobial stewardship; undergraduate medical education.

Student engagement with public health, antimicrobial resistance (AMR), and emerging pathogens has potential to spark enthusiasm for infectious diseases (ID) as a future career path [1, 2]. Prior studies of medical students showed that 90% desired further education on antimicrobial prescribing, but only 40% were familiar with the role of antimicrobial stewardship (AS) in promoting judicious antimicrobial use and preventing multidrug resistance [3]. Prior studies show that AS and emerging infections are not emphasized in more than one third of medical schools [4].

Introduction of stewardship and infection prevention fundamentals within the preclinical curriculum has occurred annually at the Albert Einstein College of Medicine since 2014 [5]. Our AS program (ASP) committed to the Centers for Disease Control and Prevention (CDC)'s AMR challenge by pledging to educate students and residents about stewardship [6]. In 2019,

we implemented a novel seminar to (1) introduce preclinical students to programmatic goals of AS, (2) better inform students' future prescribing behaviors, and (3) empower students to serve as stewards and patient advocates striving to prevent AMR. To our knowledge, this is the first seminar to use real AMR stories as an educational tool and was developed in collaboration with the Infectious Diseases Society of America (IDSA)

METHODS

In partnership with the IDSA's "Faces of Resistance" campaign [7], we coordinated a mandatory seminar for second-year students at Einstein medical college in January 2019 during their Microbiology course featuring (1) a patient survivor of a multidrug-resistant infection, (2) a family member of a patient who succumbed to a fulminant infection, (3) the Senior Vice President (VP) of Public Policy and Government Relations for IDSA's AMR committee, (4) a CDC Field Medical Officer on faculty, and (5) the director of Montefiore/Einstein's ASP.

Seminar

Moderators presented a brief overview of AS, AMR, and the following learning goals: (1) Learn about ASPs and their role in preventing multidrug-resistant infections; (2) Hear real patient stories to understand the societal impact of AMR; and (3) Learn how IDSA and CDC-funded healthcare-associated infection programs are leading AMR policy and advocacy efforts—What is your role as medical students?

Each speaker shared personal AMR stories for 20 minutes. (1) A patient survivor of a multidrug-resistant *Mycobacterium abscessus* infection acquired abroad spoke about the physical and psychological toll of her infection. She described multiple debridements and months of grueling intravenous and oral antimicrobials. She shared pictures and personal blog posts of her journey. This particular case was selected because lipotourism-associated nontuberculous mycobacteria outbreaks occur frequently in New York City, requiring close collaboration between public health and ID physicians [8]. (2) The son of a patient who succumbed to septic shock from a fulminant *Clostridioides difficile* infection spoke about his mother's initial exposure to clindamycin for a dental infection resulting in overwhelming infection. Since then, the family has created a foundation in her name raising public awareness and research funding for *C difficile*. (3) An IDSA Senior VP described how IDSA works with lawmakers to advance AMR legislation, research initiatives, new antibiotic development, and tackle workforce challenges for ID physicians. She highlighted social media activities and IDSA's member advocacy program appropriate for medical students.

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Correspondence: Priya Nori, MD, 3411 Wayne Avenue #4H, Bronx, NY 10467 (pnori@montefiore.org).

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The seminar concluded with a panel discussion moderated by a CDC Field Medical Officer and Montefiore/Einstein's ASP director. Students were encouraged to ask speakers more in-depth questions about personal AMR experiences.

Using an audience-response system, we surveyed students before and after the seminar on their knowledge, attitudes, and perceptions about AS and AMR (primary endpoints). Surveys were designed using a 5-point Likert scale, adapted from previously validated surveys [3, 5]. For analysis, responses were dichotomized as "strongly agree/agree" and "neutral/disagree/strongly disagree."

Secondary endpoints were students' self-reported (1) course satisfaction (2) understanding of the impact of AMR and goals of AS and (3) likelihood of the seminar to inform future prescribing behaviors. The percentage who agreed with each statement was calculated based on the number who responded to each question. Participants who had missing responses were not excluded from analysis on the items to which they did respond. The study was approved by the Montefiore/Einstein institutional review board (IRB no. 2018-9860).

RESULTS

Participants

There are 183 students in the second-year class. The mean age is 25.5 years, 47% are female, and 53% are male. Ethnicity breakdown is as follows: non-Hispanic white 50%, Hispanic 2%, non-Hispanic black 5%, Asian/South East Asian 33%, other 2%, declined to answer 8%.

Of the 166 students who signed in to the seminar, 139 of 166 (84%) responded to at least 1 question. Only 6 (4%) students

answered all questions; 109 (66%) answered at least 1 question from both surveys. The last question on the preseminar survey was only answered by 16 respondents.

Preseminar

Ninety-four percent (n = 95 of 101) agreed that AMR is an important public health issue, 98% (n = 84 of 89) agreed that overprescribing is a major cause of resistance and *C difficile*, and 85% (n = 75 of 88) agreed that antibiotics are overprescribed by all types of healthcare providers. Thirty-nine percent (n = 39 of 99) reported taking antibiotics for a cold or upper respiratory infection in the past. Only 26% (n = 27 of 102) were familiar with the concept of AS. Eighty percent (n = 82 of 102) reported a desire to improve knowledge of antimicrobials (Table 1).

Postseminar

Eighty-one percent (n = 87 of 107) agreed that they would modify their future prescribing behaviors, and 83 (n = 91 of 110) reported an improved understanding of AS and AMR. Most agreed that hearing personal stories from a patient (n = 101 of 111, 91%) and a family member (n = 94 of 109, 86%) is an effective way to learn about AMR. Sixty-two percent (n = 66 of 107) stated that the program had "good" or "excellent" success at achieving stated objectives (Figure 1).

Mandatory overall course evaluations completed in March 2019 revealed the following feedback (from individual responses):

"Keep the antimicrobial stewardship large groups..."

"The antibiotic stewardship was important but I don't think we should be tested on that material unless we are given a power point with the information from it."

Table 1. Survey Responses

	Question	Agree, n (%)	Respondents, n (% total)
Presurvey	Antibiotics are overprescribed nationally by all types of healthcare providers (eg, doctors, dentists, NPs, PAs, etc)	75 (85)	88 (63)
	Overprescribing of antibiotics is a major cause of drug resistance and <i>Clostridioides difficile</i> infection	84 (98)	86 (62)
	I have taken antibiotics for a cold or upper respiratory infection (URI) in the past	39 (39)	99 (71)
	Antimicrobial resistance is a major public health issue that should concern everyone	95 (94)	101 (73)
	I am familiar with the concept of antimicrobial stewardship	27 (26)	102 (73)
	I would like to improve my knowledge on the spectrum of activity, the benefits, and potential harms of antimicrobials	82 (80)	102 (73)
Postsurvey	I would like to get more involved in antimicrobial stewardship and efforts to combat drug resistance	11 (69)	16 (12)
	I will make changes to my future prescribing behaviors based on today's session	87 (81)	107 (77)
	This session improved my understanding of the problem of multidrug resistance and the goals of antimicrobial stewardship	91 (83)	110 (79)
	Hearing a personal story from a patient is an effective way to learn about the consequences of antimicrobial resistance	101 (91)	111 (80)
	Hearing a personal story from a patient's family member/advocate is an effective way to learn about the harms of antibiotic overuse	94 (86)	109 (78)
	As a medical student and patient advocate, I would like to get involved in stewardship and national efforts to combat drug-resistant infections and <i>C difficile</i>	42 (38)	110 (79)

Abbreviations: NP, nurse practitioner; PA, physician's assistant.

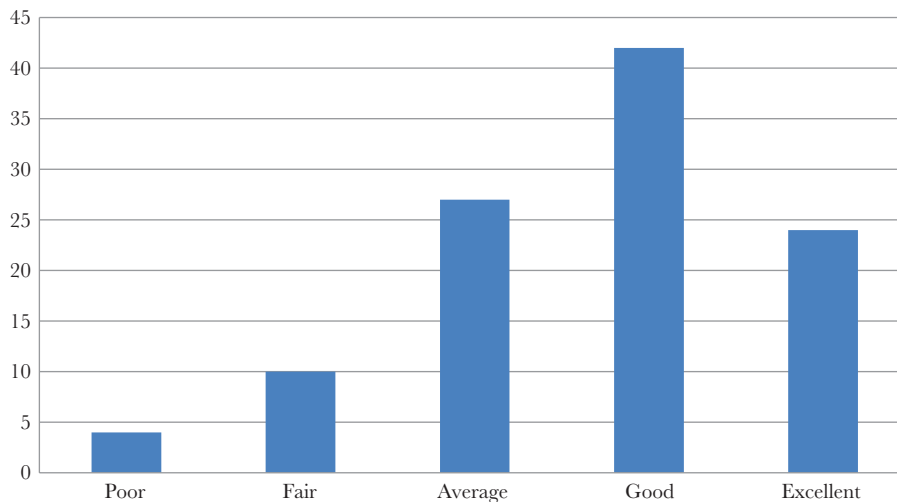


Figure 1. Students' rating of program's success at achieving stated goals and objectives.

"The antimicrobial stewardship seminar ... was excellent, but really should be a part of the 1 week orientation for third years"

One student commented on the "infomercial" feel of the session. Two students felt that AS could be covered within the other antibiotic lectures.

DISCUSSION

We hypothesized that engaging preclinical students with AS has the potential to influence future prescribing behaviors and connect students with the societal impact of AMR, and our data support this. We suggest that all medical, dental, physician assistant, nursing, and pharmacy schools consider collaborating with IDSA and public health partners to introduce students to stewardship and AMR advocacy.

Similar to prior studies, many of our preclinical students were unfamiliar with the concept of AS, and a majority (80%) indicated a desire to improve their knowledge on the spectrum of activity, benefits, and harms of antimicrobials [3]. This reveals an existing knowledge gap and need for intensified education before postgraduate training. Although 79% of students answered the postsurvey item related to patient advocacy, only 39% wished to become further involved in stewardship and AMR advocacy efforts. However, it is unknown how practicing physicians would respond, and therefore we consider this a favorable response.

A major limitation is a lack of refined and measurable learning objectives. In the future, we plan to work with the IDSA Medical Education Community of Practice to develop a more robust program. Our use of audience response technology to survey students had limitations and benefits. This platform requires students to use their smartphones or laptops to connect to the platform,

which can lead to delays [9]. Questions were presented sequentially; if students missed one, they were unable to answer it later. We were also unable to compare characteristics of responders and nonresponders using this platform. Benefits of electronic platforms include efficiency and user-friendly interface, which likely led to a high response rate of students who answered at least 1 question (84%) [9]. However, only 4% responded to every item likely due to time constraints. Another limitation is that material was not immediately testable on licensing exams, which is a major concern for preclinical students. Several students suggested that the optimal timing of this seminar is just before clinical rotations. Others felt that stewardship should be embedded in antibiotic lectures, rather than a separate large group session.

We plan to survey the same student cohort at the conclusion of their third year after sufficient clinical exposure. This follow-up survey would ask students to reflect on lessons learned and practical applications of the seminar.

As part of a sustained academic-public health partnership, we plan to engage other health sciences graduate programs to adopt our "Faces of Resistance" seminar, harnessing expertise from IDSA, CDC, and state and local health departments. Each year presents a new opportunity to introduce students to timely emerging infectious diseases [10], such as measles or *Candida auris*.

Total costs were <\$1400/year, which is feasible and reproducible. We encourage faculty to consider the optimal timing of their seminar as per feedback from our students.

CONCLUSIONS

We hope to inspire students to tackle the next generation of ID challenges, through innovations in medical education, personal connections with patients, and instruction by enthusiastic faculty members [1, 10].

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