PREVENT HAIs Healthcare-Associated Infections

AHRQ Safety Program for Improving Antibiotic Use

Ambulatory Care Cohort
Final Report

Agency for Healthcare Research and Quality

CUSP

AHRQ Safety Program for Improving Antibiotic Use

Ambulatory Care Cohort Final Report
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Prepared by:
Johns Hopkins Medicine
NORC at the University of Chicago

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EXECUTIVE SUMMARY

E.1. Background

The AHRQ Safety Program for Improving Antibiotic Use

The Agency for Healthcare Research and Quality (AHRQ) Safety Program for Improving Antibiotic Use (Safety Program) is a multiyear program (2016–2021) focused on developing and enhancing antibiotic stewardship programs (ASPs) across the continuum of care—acute care hospitals, long-term care facilities, and ambulatory care practices throughout the United States—as well as equipping frontline providers with the necessary knowledge and skills to enhance their antibiotic prescribing practices. The Safety Program is a collaborative intervention funded and guided by AHRQ and led by Johns Hopkins Medicine (JHM) and NORC at the University of Chicago (NORC). JHM/NORC engaged with three organizations that also function as Quality Innovation Networks/Quality Improvement Organizations—Health Services Advisory Group, Stratis Health, and Health Quality Innovators—to assist with implementing the Safety Program.

The Safety Program uses a multipronged approach to guide participating sites in developing and improving their ASPs. The Safety Program assisted sites with identifying local AS leaders, if not already identified, and then proceeded to teach them how to establish effective and sustainable ASPs. The Safety Program also worked closely with clinicians to assist them with understanding how to address the attitudes, beliefs, and culture that often pose challenges to appropriate antibiotic use in the ambulatory care setting. Additionally, participants were introduced to the Four Moments of Antibiotic Decision Making framework, which provides guidance on learning and incorporating best practices for the diagnosis and treatment of common infections into routine practices in the ambulatory care setting. The Four Moments of Antibiotic Decision Making, an approach to evaluating and re-evaluating the need for antibiotic use in real time, was developed as part of the Safety Program.[1]

The Safety Program consisted of a pilot period, followed by three distinct cohorts: acute care, long-term care, and ambulatory care. The ambulatory care component of the program was implemented from December 2019 through November 2020.

This report focuses on the activities of the Safety Program in the ambulatory care cohort, tasked to include 250–500 practices. Participants in the ambulatory care cohort enrolled from July through December 2019. Safety Program implementation began in December 2019. Lessons learned from implementation of the pilot Safety Program and the acute care and long-term care cohorts—such as quality and scope of the educational material, ease of data collection, clarity of outcomes, and feedback from the Safety Program's Technical Expert Panel and participating sites—were used to refine the Safety Program for the ambulatory care cohort. These refinements included reordering some aspects of the educational content, developing audio presentations, developing additional materials to support communication among team members and with patients and family members, increasing opportunities to attend webinars, establishing office hours, revising data collection templates, including certificates for

Safety Program participation, and providing continuing medical education, continuing education, and nursing contact hours for physicians, pharmacists, and nurses, respectively.

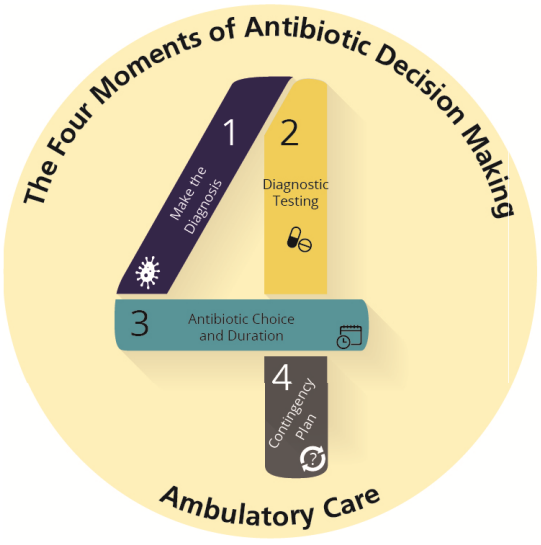
Program Rollout and Educational Content

The Safety Program incorporated of the following: (1) developing antibiotic stewardship teams, (2) fostering cultural and behavioral change surrounding antibiotic decision making, (3) improving understanding of the diagnosis and treatment of common infections, and (4) communicating concerns about infections with prescribers and patients. These topics were addressed in Webinars and audio presentations describing the diagnosis and management of common clinical syndromes. The Safety Program also offered office hours as an opportunity for participants to communicate with each other and ask questions of experts in infectious disease and antibiotic stewardship. The Safety Program provided participants with access to an array of other educational tools, including presentations with accompanying facilitator guides, audio presentations, one-page documents to succinctly summarize infectious concerns in the outpatient setting, patient handouts, discussion guides to facilitate discussion within practices to standardize the optimize the care of patients with infectious concerns, and antibiotic commitment posters.

The Four Moments of Antibiotic Decision Making framework, developed specifically for the Safety Program, was incorporated throughout the educational content. It reminds prescribers to consider the following questions every time antibiotics are considered (**Exhibit E-1**):

1. Does my patient have an infection that requires antibiotics?
2. Do I need to order any diagnostic tests?
3. If antibiotics are indicated, what is the narrowest, safest, and shortest regimen I can prescribe?
4. Does my patient understand what to expect and the follow up plan?

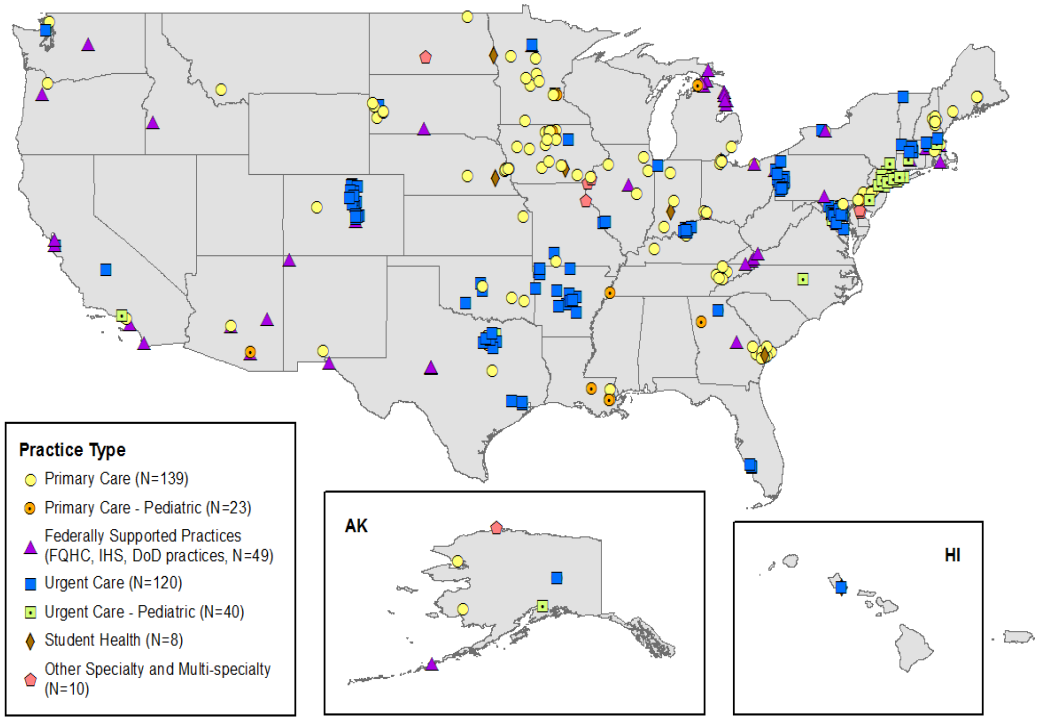
EXHIBIT E-1: THE FOUR MOMENTS OF ANTIBIOTIC DECISION MAKING



Participating Ambulatory Care Practices

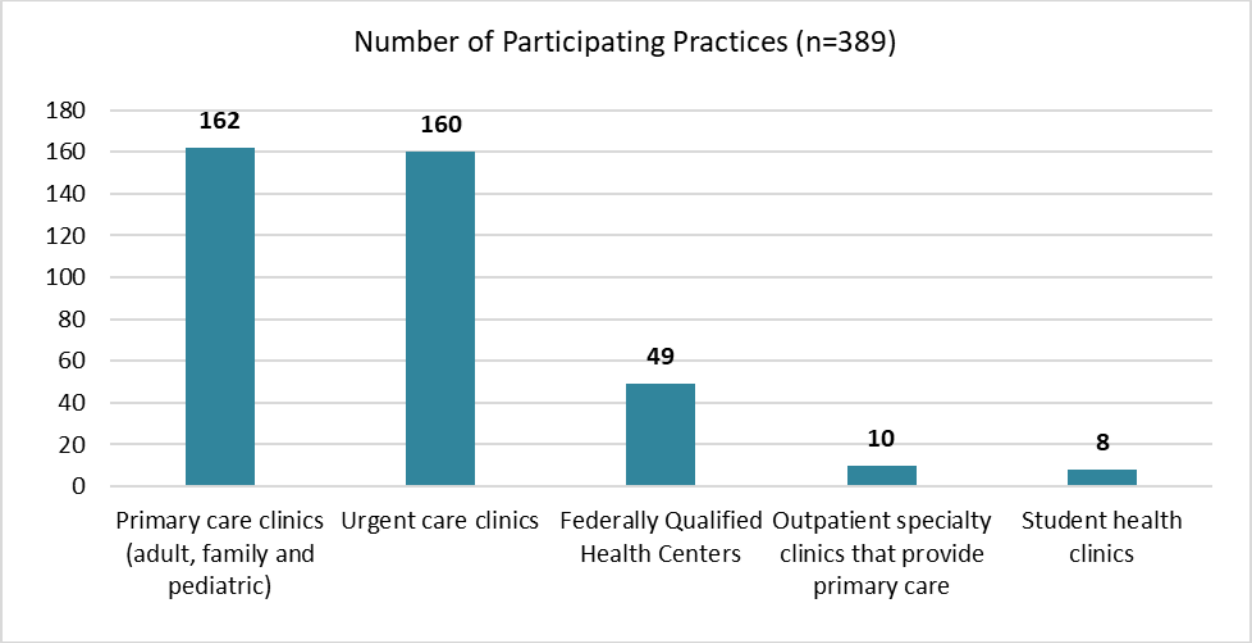
During the ambulatory care cohort, 389 practices in all 10 U.S. Department of Health and Human Services (HHS) regions completed the Safety Program. The 389 participating practices consisted of primary care clinics, urgent care clinics, federally supported clinics qualified health centers, outpatient specialty clinics that provide primary care, and student health clinics. **Exhibit E-2** shows the distribution of participating practices across the United States. Please refer to **Appendix A-3** for the breakdown of participating practices by HHS region.

EXHIBIT E-2: LOCATION OF PARTICIPATING PRACTICES BY TYPE



Of the 389 participating practices, the majority were either primary care clinics or urgent care clinics. **Exhibit E-3** shows the number of participating practices by type.

EXHIBIT E-3: NUMBER OF PARTICIPATING PRACTICES BY TYPE



Program Metrics

To evaluate the adoption, effectiveness, and variation of the Safety Program, we collected antibiotic prescription data at the practice level, along with a practice-level Structural Assessment and provider/staff perspective on safety culture using the AHRQ Medical Office Survey on Patient Safety Culture (MOSOPS) at baseline and endline.

Metrics specific to the ambulatory care cohort included:

1. Structural assessment to understand the general infrastructure, local stewardship practices (if any), and experience with quality improvement initiatives at each participating site and how they changed during the course of the Safety Program
2. MOSOPS completed by individual participants at each site at the beginning and end of the cohort
3. Monthly practice-level number of antibiotic prescriptions per 100 total visits, and per 100 acute respiratory infection (ARI) visits

The ambulatory care component of the Safety Program was implemented from December 2019 through November 2020. The implementation time period coincided with early stages of the COVID-19 pandemic in the United States, which had national implications for antibiotic prescribing. Beginning in March 2020, for many practices there was a transition from in-person visits to telemedicine.[2,3,4] Between September 2019 and February 2020, only in-person visits were included in the monthly number of antibiotic prescriptions per visits and acute respiratory infection visits submitted by participating practices. As many practices began offering significantly more telemedicine visits or converting primarily to telemedicine visits at the onset of the COVID-19 pandemic, in-person and synchronous telemedicine visits were included from March 2020 through the end of the Safety Program.

E.2. Results and Impact

Evaluation Domains

The evaluation aimed to answer three major questions:

1. To what extent was the AHRQ Safety Program for Improving Antibiotic Use adopted by participating ambulatory care practices?
2. What is the effectiveness of the Safety Program in the ambulatory care context? What changes in safety culture and antibiotic usage have resulted from the Safety Program?
3. Is there any variation in the effectiveness of the Safety Program (i.e., change in antibiotic usage) by practice type?

Key Impacts

The timing of the ambulatory care cohort program implementation coincided with the early stages of the COVID-19 pandemic, which impacted antibiotic prescribing across the United States. Transitions from in-person visits to telemedicine occurred at many participating practices. Across the ambulatory care cohort, total and ARI visits declined between March and May 2020. The COVID-19 pandemic also affected antibiotic prescribing beyond seasonally expected national patterns March–May 2020.[5] Reduction in ambulatory visits overall and for ARIs likely contributed to a decline in antibiotic prescribing.[6]

Adoption of Safety Program

Practice infrastructure factors related to antibiotic stewardship improved significantly from the beginning to the end of the Safety Program: practices that formally tracked antibiotic prescriptions increased from 21 percent to 76 percent ($p<0.001$); practices that have developed a list of conditions for which antibiotics are discouraged increased from 40 percent to 66 percent ($p<0.001$); and practices that have developed local guidelines for conditions for which antibiotics are commonly prescribed increased from 48 percent to 61 percent ($p<0.001$).

Patient Safety Culture /MOSOPS

From the beginning to the end of the Safety Program, composite scores for all MOSOPS domains improved, with statistically significant improvement in five domains: work pressure and pace increased by 7.1 percentage points (95% confidence interval [CI]: 2.3 to 12, $p=0.005$), owner/managing partner/leadership support for patient safety increased by 5.1 percentage points (95% CI: 1.3 to 8.9, $p=0.009$), communication openness increased by 4.6 percentage points (95% CI: 0.6 to 8.6, $p=0.024$), overall perceptions of patient safety and quality increased by 4.3 percentage points (95% CI: 0.7 to 7.8, $p=0.019$), and communication about error increased by 3.7 percentage points (95% CI: 0.5 to 6.9, $p=0.024$).

Antibiotic Use

From the baseline (Sept–Nov 2019) to the endline quarter (Sept–Nov 2020), antibiotic prescriptions per 100 total visits decreased by 8.5 (95% CI: -9.6 to -7.4, p<0.001) for the entire cohort. Urgent care practices observed the largest reduction at 15.8 prescriptions per 100 total visits (95% CI: -17.3 to -14.3, p<0.001). The largest decrease by antibiotic class was penicillins; penicillin use decreased by 4.2 prescriptions per 100 visits (95% CI: -4.8 to -3.7, p<0.001).

Antibiotic prescriptions per 100 ARI visits decreased by 11.6 (95% CI: -13.3 to -9.9, p<0.001) for the entire cohort, and 17.2 (95% CI: -20.5 to -14.5, p<0.001) for urgent care practices, which had the largest reduction among all types of practices. The largest decrease by antibiotic class was also penicillins, which decreased by 5.5 prescriptions per 100 ARI visits (95% CI: -6.7 to -4.3, p<0.001).

E.3. Conclusions

The AHRQ Safety Program included a diverse cohort of 389 ambulatory care practices and had a positive impact on developing and enhancing ASPs in participating practices across the United States. The Safety Program successfully equipped frontline providers with tools and resources to incorporate AS principles into their practice culture. The Safety Program provided ambulatory care settings with the novel framework of the Four Moments of Antibiotic Decision Making coupled with education on the best practices in the diagnosis and treatment of common infections, to support integration of AS principles into ambulatory care. Moreover, the Safety Program reinforced the science of safety, teamwork, and communication among practice staff to develop a culture of safety around antibiotic prescribing. The implementation of the ambulatory care cohort (December 2019 through November 2020) coincided with the early stages of the COVID-19 pandemic in the United States, which impacted overall and acute respiratory infection related antibiotic prescribing. Despite national antibiotic prescribing changes in the early months of the COVID-19 pandemic, the AHRQ Safety Program appeared to independently contribute to the reduction in antibiotic use. The Safety Program led to reductions in antibiotic prescriptions, with the largest decrease occurring in the penicillin antibiotic class. Antibiotic prescriptions for acute respiratory infections also decreased, led by a decrease in the penicillin antibiotic class. Ambulatory care practices across the United States are encouraged to use the toolkit developed for the Safety Program that will be publicly available to improve the culture of antibiotic prescribing in their practices.

CHAPTER 1: BACKGROUND

Chapter Summary

This chapter describes the purpose of the AHRQ Safety Program for Improving Antibiotic Use (Safety Program) as a tool for antibiotic stewardship (AS) efforts aimed at changing the culture of antibiotic prescribing in ambulatory care. We also describe Johns Hopkins Medicine/NORC at the University of Chicago (JHM/NORC) program team, which worked closely with the Agency for Healthcare Research and Quality (AHRQ) in the design and execution of the Safety Program. Additionally, we discuss the roles of the Technical Expert Panel (TEP) and the three organizations, which also operate as Quality Improvement Network-Quality Improvement Organizations (QIN-QIOs), that assisted the JHM/NORC team throughout the Safety Program.

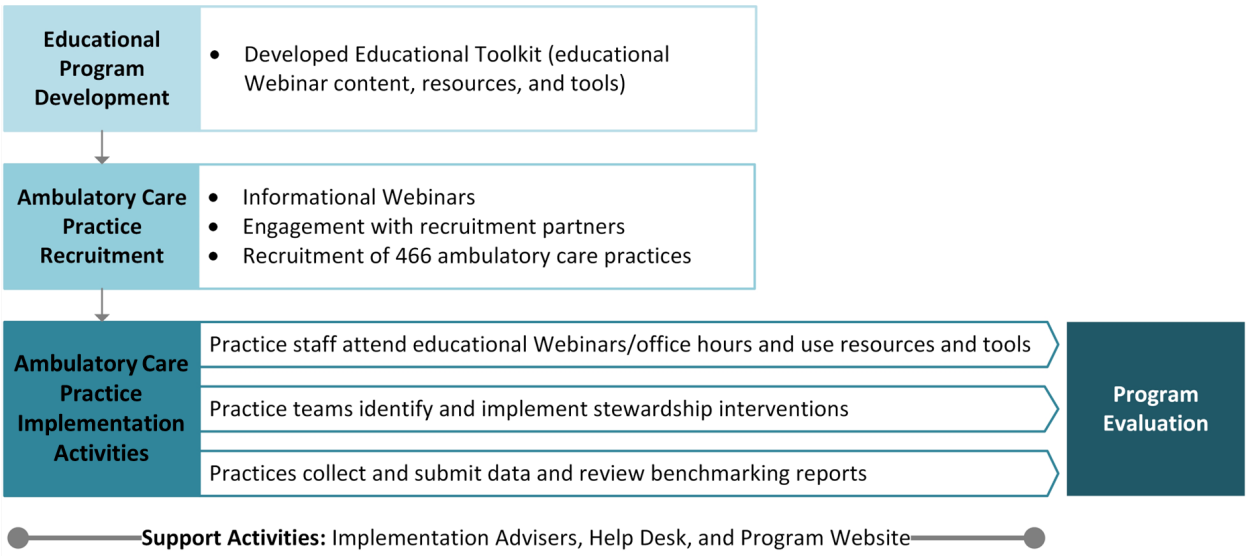
Overview of the AHRQ Safety Program for Improving Antibiotic Use

The fundamental goal of the Safety Program is to improve the culture of antibiotic prescribing across the United States. The overarching goals of this multiyear program for participating sites are to—

- Develop and/or enhance existing antibiotic stewardship programs (ASPs) that allow for sustained optimized antibiotic use
- Understand how to address the attitudes, beliefs, and culture that often pose challenges to improving antibiotic prescribing
- Incorporate best practices for the diagnosis and treatment of common infections into daily practice using the Four Moments of Antibiotic Decision Making framework

The ambulatory care component of the program was implemented from December 2019 through November 2020. Findings are presented in this report. **Exhibit 1** provides an overview of the ambulatory care cohort program.

EXHIBIT 1: OVERVIEW OF AMBULATORY CARE COHORT PROGRAM



The JHM/NORC Program Team

The AHRQ Safety Program for Improving Antibiotic Use is a collaborative intervention funded and guided by AHRQ and led by JHM and NORC. A TEP provided input into the design of the Safety Program and implementation strategies. The TEP consisted of 27 subject matter experts representing leaders in ASPs across acute care, long-term care, and ambulatory care settings, patient leaders/patient advocacy groups, experts with experience conducting large-scale interventional studies involving adaptive changes, executives from integrated healthcare delivery systems, and ex-officio members from government agencies.

Three quality improvement organizations that also function as QIN-QIOs—Health Quality Innovators (HQI), Health Services Advisory Group (HSAG), and Stratis Health—also supported the Safety Program. Individuals from these organizations served as Implementation Advisers for the participating ambulatory care practices.

1.1. Program Governance

The Safety Program was developed and executed by JHM/NORC under the close guidance of AHRQ and a TEP. Additional program support was provided by a group of Implementation Advisers. **Exhibit 2** describes the respective roles in the design, implementation, and evaluation of these groups in the ambulatory care cohort.

EXHIBIT 2: NATIONAL PROGRAM TEAM PLUS PARTNERS, AHRQ SAFETY PROGRAM FOR IMPROVING ANTIBIOTIC USE

Organization	Role
Johns Hopkins Medicine (JHM)	JHM faculty led development of the educational toolkit for the Safety Program. JHM was responsible for leading Webinars and office hours, assisting participating sites with site-specific clinical questions that arose over the course of the Safety Program, overall program management, and budget oversight.
NORC at the University of Chicago (NORC)	NORC led recruitment of ambulatory care practices; onboarded participating ambulatory care practices to the cohort; and supported a range of implementation activities, including hosting the Webinars and office hours, developing and hosting the program Web site for the educational materials and data collection tools, collecting and analyzing data from participating practices, and conducting program evaluation.
Technical Expert Panel (TEP)	The TEP was composed of physicians, pharmacists, nurse practitioners, representatives from integrated healthcare delivery systems, representatives from patient advocacy groups, and ex-officio members of government agencies. The TEP provided guidance on program content, implementation, and evaluation. Appendix A-1 details the members and qualifications of the TEP.
Implementation Advisers	Three quality improvement organizations—Health Quality Innovators (HQI), Health Services Advisory Group (HSAG), and Stratis Health—served as Implementation Adviser organizations. Staff members at each organization provided one-on-one support to participating sites. Each organization was responsible for providing assistance on program implementation to designated practices.

The next two sections, respectively, describe the program roles and responsibilities of the TEP and the Implementation Advisers.

1.1.1. Technical Expert Panel

Development of the AHRQ Safety Program for Improving Antibiotic Use included establishing a TEP—a panel of subject matter experts from crosscutting disciplines with knowledge of AS approaches in acute, long-term care, and ambulatory settings that provided input into the design of the Safety Program. Totaling 27 members, this multidisciplinary group exemplified a broad range of expert representation including leaders of ASPs, leaders of patients/patient advocacy groups, experts with experience conducting largescale interventional studies, executives from healthcare systems, and ex-officio government officials. **Appendix A-1** details the TEP members and their professional affiliations.

TEP National Ambulatory Care Meeting

The AHRQ Safety Program for Improving Antibiotic Use TEP met to discuss the ambulatory care cohort on October 17, 2019, at the NORC offices in Bethesda, MD. The goals of the TEP meeting specific to the ambulatory care cohort were to discuss—

1. Guidance on recruiting practices for the Ambulatory Care Safety Program
2. Guidance on additional material to include in the educational toolkit for the Ambulatory Care Safety Program
3. Suggestions for keeping practices engaged throughout the Ambulatory Care Safety Program
4. Suggestions for increasing compliance with data collection requirements for the Ambulatory Care Safety Program

The TEP discussed lessons learned from the pilot cohort, as well as preliminary results from the pilot evaluation. The JHM/NORC team used the TEP findings to improve the ambulatory care cohort educational toolkit materials, recruitment, and implementation efforts.

The TEP members provided numerous recommendations and suggestions throughout the discussions, including—

- Additional strategies to increase recruitment
- Suggestions to enhance educational content geared toward stewardship leaders as well as frontline staff at sites participating in the Safety Program
- Strategies to encourage more engagement during Webinars and office hours

1.1.2 Implementation Advisers

JHM/NORC partnered with three QIN-QIOs to serve as Implementation Adviser organizations for the Safety Program:

- **HQI** is an independent, nonprofit consulting organization established in 1984. HQI serves as the Maryland and Virginia Quality Improvement Organization, and closely partners with two major Hospital Improvement Innovation Networks. HQI has experience working with healthcare professionals developing internal improvement capacity.
- **HSAG** provides healthcare quality expertise to both care providers and care recipients. Established in 1979, HSAG is a multi-State quality improvement organization that, among other successes, has experience in improvement in antibiotic stewardship in outpatient settings and improvement in infection control practices in ambulatory surgical centers.
- **Stratis Health** is an independent nonprofit organization that leads collaboration and innovation in healthcare quality and patient safety. Stratis Health has more than 40 years of experience, specializing in reducing healthcare-associated infections in hospitals and nursing homes. Stratis Health has supported quality improvement on behalf of Medicare for Minnesota since 1971.

Dedicated staff members at each of these quality improvement organizations provided frequent and consistent one-on-one support to enrolled practices to assist with ensuring successful implementation of the Safety Program. Of note, the three quality improvement organizations were assigned to practices in States for which they did not have other federally-funded activities underway. The Implementation Advisers were the primary point-of-contact for practice staff members and either addressed questions that arose or forwarded questions to JHM/NORC, as appropriate. Throughout the 12-month implementation period of the ambulatory care cohort, the Implementation Advisers provided ongoing support to practices for Safety Program implementation and data collection activities, with communication between the participating sites and Implementation Advisers occurring at least monthly.

CHAPTER 2: PROGRAM IMPLEMENTATION

Chapter Summary

This chapter describes the different facets of Safety Program implementation for the ambulatory care cohort, including: (1) development and refinement of the educational content, (2) recruitment and retention of ambulatory care practices, (3) Webinars and office hours, and (4) additional technical assistance and support for the ambulatory care cohort.

Development and Refinement of the Educational Content

During the 12-month Safety Program, there were 14 webinars, each repeated twice and recorded for participants. Webinars focused on the diagnosis and management of infectious diseases and used the Four Moments of Antibiotic Decision Making framework. This framework encourages clinicians to answer four questions to determine (1) whether antibiotics are necessary, (2) what diagnostic testing is needed, and (3) what the safest and most effective antibiotic agent is, and (4) ensure an appropriate followup plan is provided to patients.

Additional educational content included audio presentations, one-page summary documents, patient handouts, and discussion guides to foster standardization of patient care across the practice. Posting of commitment posters was encouraged at each participating site to highlight the practice's commitment to safe antibiotic prescribing; sites were encouraged to include the signatures or photographs of clinicians on the poster and to display the poster in an area visible to patients and clinicians. Participants had access to the Safety Program team via question-and-answer sessions after Webinars, virtual office hour sessions held twice monthly, and a Safety Program email account.

The clinical and administrative AS leads were encouraged to meet with all staff monthly to accomplish the following: (1) review any updates since the last meeting and seek feedback, (2) introduce the educational topic for the month and associated material in the toolkit and webinar dates, (3) summarize key points from the one-page document on the monthly topic, and (4) review questions in the discussion guide with the practice (e.g., Are there local laboratories or hospitals we can contact to determine antibiotic susceptibilities for urinary pathogens?) The AS leads summarized comparative, practice-level antibiotic feedback received from the Safety Program.

Recruitment and Retention of Ambulatory Care Practices

Johns Hopkins Medicine/NORC at the University of Chicago (JHM/NORC) utilized a systematic strategy to recruit, enroll, and retain practices for the ambulatory care cohort of the Safety Program. The target enrollment was 250–500 practices encompassing the 10 HHS regions. Recruitment took place from July 2019 through December 2019. JHM/NORC used a multipronged recruitment approach, working with a wide range of recruitment partners, including the following partners for recruitment:

Federal Partners

- Centers for Disease Control and Prevention (CDC)
- Centers for Medicare & Medicaid Services (CMS)
- Health Resources & Services Administration (HRSA)

Professional Organizations[a]

- American Academy of Family Physicians
- American Medical Association
- The Joint Commission
- The Medical Group Management Associates
- The National Committee for Quality Assurance
- The Practitioner Dissemination and Research Network
- The Urgent Care Association

Urgent Care Corporations

- American Family Care
- Concentra
- MedExpress Urgent Care

State entities[a]

- State health departments
- State health department Healthcare-Associated Infections committee and subcommittee participants
- State-level QIN-QIOs that lead quality improvement activities with ambulatory care practices
- State medical societies

Recruitment Strategies

- JHM/NORC targeted regional and national ambulatory care meetings and conferences with an antibiotic stewardship and patient safety focus. The recruitment strategy included senior program staff presenting, displaying program booths/exhibits, and working with AHRQ staff to share recruitment materials at conferences and meetings.
- JHM/NORC enlisted help from the program's Implementation Advisers such as Stratis Health in reviewing recruitment strategies and refining recruitment materials.
- JHM/NORC leveraged the social media capabilities of AHRQ, JHM, and program partners to recruit ambulatory care practices (e.g., Twitter, and Facebook).
- The program used the AHRQ Safety Program for Improving Antibiotic Use's public-facing Web site to field requests to join the program. The JHM/NORC team developed a recruitment page to include frequently asked questions (FAQs), information about upcoming Webinars, a recording of an informational Webinar, and the program email address.

[a] Refer to **Exhibit 8** for a comprehensive list.

- JHM/NORC worked with TEP members from the ambulatory care field to work with their respective institutions to gauge interest in program participation.
- The program conducted email outreach to participants in State health department Healthcare-Associated Infections committees and subcommittees, as well as national and regional nonprofit organizations, healthcare consulting companies, public and private health systems, university health systems, state and county public health departments and entities, and individual ambulatory care practices.
- JHM/NORC created the public-facing Web site SafetyProgram4AntibioticStewardship.org to inform interested sites about the Safety Program and develop recruitment material.
- JHM/NORC led 14 Informational Webinars to inform interested sites about the Safety Program and to field questions about the Safety Program.

In total, 467 ambulatory care practices enrolled in the Ambulatory Care Cohort; 389 practices remained in the cohort for the duration of the Safety Program. These 389 practices consisted of—

- Primary care clinics (adult, family, and pediatric)
- Urgent care clinics
- Federally Qualified Health Centers outpatient specialty clinics that provide primary care
- Student health clinics

Webinars and Office Hours

Over the 12-month Cohort implementation period, participating practices were invited to attend 14 national educational Webinars. Each of these Webinars was offered two to three times on different days and times, to give participating practices an opportunity to find a time that worked for their teams. The Webinars focused on changing the culture of antibiotic prescribing and improving antibiotic prescribing for common infections, and on best practices.

Continuing Education Credits. All content also was available on the Safety Program Web site. Live Webinars and office hours provided an opportunity for direct engagement between JHM/NORC and participating sites. Physicians, Nurse Practitioners, and Physician Assistants could receive continuing medical education (CME) for participating in Webinars or audio presentations. Each Webinar or audio presentation provided 0.25 CMEs. Physicians are also eligible to receive maintenance of certification (MOC) credit for participation in Webinars and audio presentations. Each Webinar or audio presentation provided 0.25 MOCs. Physicians could receive the quality improvement/safety MOC for participation in the program. If a physician spent 2 hours per month including Office Hours and clinic meetings, among other items, the program could provide as many as 24 MOCs in this category.

Practices were also able to meet Merit-based Incentive Payment System (MIPS) criteria, one of two tracks under the Medicare Access and CHIP Reauthorization Act (MACRA). This allows practices to receive a Medicare payment adjustment based on four categories of performance measures related to several different conditions such as adult sinusitis, acute bronchitis, chronic sinusitis, and acute otitis media. Program participation allows sites to improve their MIPS score. Additionally, effective January 1,

2020, all ambulatory centers accredited by The Joint Commission that routinely prescribe antimicrobial medications needed to demonstrate compliance with the Ambulatory Antibiotic Stewardship Standard.

In addition to participation on Webinars, sites were encouraged to participate in optional Office Hours led by JHM/NORC, which were held 1 to 2 weeks following each Webinar. Twenty-two Office Hours sessions were held over the course of the ambulatory care cohort. The main goal of these calls was to give sites a venue for informal discussion on how antibiotic stewardship efforts were progressing at their sites. Along with discussions on implementation of antibiotic stewardship efforts, changing antibiotic prescribing culture, guideline development, and general clinical questions. These calls facilitated peer-to-peer sharing. Participants could learn about: (1) others that were struggling with the same issues and (2) strategies other sites developed to address barriers.

Implementation Adviser Activities

Within each Implementation Adviser organization there were several individual Implementation Advisers working with an assigned set of practices (usually grouped by State). The program team evenly divided assignments across implementation adviser organizations. Implementation adviser organizations were often assigned to practices that were in different States from where the organizations performed other quality improvement work with healthcare facilities. In addition, multiple practices within the same health system that were across multiple HHS regions and states were grouped with a single Implementation Adviser organization.

Implementation Adviser Assignments. An Implementation Adviser was assigned to each practice to provide assistance with program implementation, as well as technical aspects of the Safety Program (e.g., ensuring all participants had access to the educational toolkit, ensuring awareness of when Webinars or office hours were held, and assisting with data submission questions). During the implementation period, the JHM/NORC team had scheduled calls with all Implementation Advisers every other week, both to receive regular updates of Safety Program progress and to assist with troubleshooting.

Implementation Adviser Training. JHM/NORC held a Stakeholder/Train-the-Trainer meeting for Implementation Adviser organizations to review and understand their key role in orienting and advising recruited practices for the Ambulatory Care Cohort regarding program goals, educational content of the toolkit, and data collection requirements. The Stakeholder/Train-the-Trainer meeting took place on October 11, 2019, at NORC's offices in Bethesda, MD. Its purpose was to train Health Quality Innovators, Health Services Advisory Group, and Stratis Health on their role as Implementation Adviser organizations during the Ambulatory Care Cohort—with the following specific discussion goals:

1. Provide an overview of the AHRQ Safety Program focusing on the Ambulatory Care Cohort program
2. Review the Educational Toolkit content
3. Discuss lessons learned from the pilot for the Ambulatory Care setting
4. Provide an overview of practice recruitment for the Ambulatory Care Cohort
5. Provide examples of daily, weekly, and monthly activities of participating practices

6. Review roles and responsibilities of the Implementation Advisers
7. Review the schedule of Webinars and office hours
8. Review the data requirements and the data submission process for the Ambulatory Care Cohort

The stakeholder meeting focused on the program's general goals, scope, and timeline, as well as clarification of roles and responsibilities. The meeting helped ensure attendees understood their required tasks and the overarching goals of the Safety Program. The meeting also enabled the group to quickly identify and address any potential barriers to success before the implementation phase of the Ambulatory Care Cohort began. In addition, the meeting attendees reviewed data collection requirements and data submission process and clarified the Implementation Adviser's role in helping practices with data collection and submission. **Appendix A-2** lists the Stakeholder/Train-the-Trainer attendees.

The meeting solicited the Implementation Adviser organizations' suggestions and ideas in the following areas:

- Recommendations to keep sites engaged throughout the Ambulatory Care Cohort
- Approaches to evaluate the progress of participating practices
- Additional information necessary to support participating sites in the Ambulatory Care Cohort
- Additional technical issues for which the JHM/NORC team should develop further guidance

Throughout the 12-month implementation period of the ambulatory care cohort, the Implementation Advisers provided ongoing support to practices for Safety Program implementation and data collection activities. The Implementation Advisers were the primary point of contact for participating staff and helped to answer questions and troubleshoot issues that arose. Questions and issues beyond the scope of their expertise or existing resources were relayed to the JHM/NORC team who subsequently contacted the relevant site.

Implementation Adviser Communication and Ambulatory Practice Support. Communication between participating sites and Implementation Advisers occurred at least monthly through prearranged telephone calls. The Implementation Advisers also triaged their respective practices both qualitatively (through monthly phone calls) and quantitatively (through reviewing data collection status updates and Webinar attendance metrics) to identify sites that needed additional support—based on program participation, program activity implementation, and data collection progress. **Exhibit 3** details how the Implementation Advisers provided support for the ambulatory care practices' activities.

EXHIBIT 3: IMPLEMENTATION ADVISER SUPPORT ACTIVITIES

Practice Activity	Implementation Adviser Support Activity
1. Antibiotic Stewardship (AS) team engagement with Implementation Advisers	▪ Have an initial call with the AS team with all participating practices to assess current state of the practice AS efforts and what they hope to achieve from their participation in the program. ▪ Hold at a minimum monthly calls with each participating practice to assess progress, identify issues and provide technical assistance.
2. Participate in Safety Program Webinars	▪ Promote participation on Webinars to enrolled practices. ▪ Track attendance.
3. Hold regular AS team meetings reviewing educational content, discussion guides, and reviewing antibiotic prescription data	▪ On an ongoing basis, check in with practices' staff to ensure that AS meetings are being conducted.
4. Identifying local interventions	▪ Assist practices with their self-identified interventions.
5. Assist with uploading data and reviewing quarterly benchmarking reports	▪ Register users as needed to the program Web site (private section of the Web site). ▪ Review data collection status reports from NORC at the University of Chicago to identify practices that need additional assistance with data submission. ▪ Review quarterly benchmarking reports with AS teams.
6. Participate in Office Hours (optional)	▪ Participate in office hours for practices to provide a forum to discuss challenges, areas where further assistance is needed, and share lessons learned with peers.

Additional Technical Assistance and Support

In addition to the Webinars and Office Hours, healthcare professionals at participating sites had access to the Program Web site and the Help Desk, created specifically for the AHRQ Safety Program.

Program Web site

The NORC-developed Program Web site (SafetyProgram4AntibioticStewardship.org) included both a public-facing component with general information on the program and a secure log-in component that served as both a repository for content developed for the Safety Program, as well as a data submission portal. The Web site hosted content for users. Within each participating practice, staff members involved in the Safety Program were given log-in credentials for the user side of the program Web site. By the end of the cohort, the Web site had 2,083 individual or unique users. The program materials were heavily used by participating practices. The 20 most popular materials on the Web site had more than 1,843 unique downloads (averaging approximately 92 downloads per material).

Help Desk

JHM/NORC also established a Safety Program email address antibioticsafety@norc.org as a centralized resource for information and technical assistance for participating practices, Implementation Advisers, and JHM/NORC staff. The Help Desk provided a point of contact for questions, concerns, and participation requests for information.

JHM/NORC received implementation inquiries via the Help Desk from practice staff or their Implementation Advisers. Help Desk staff followed up with appropriate parties to ensure all questions were answered. For calendar year 2020, the Help Desk received a total of 1,296 inquiries. Examples of implementation inquiries included questions regarding data submissions and benchmarking reports, as well as clinical questions, among others.

Retention Strategies

The program structured the overall cohort to foster ambulatory care practice engagement and support via the following retention strategies:

- **Clearly defined program expectations**
  - JHM/NORC provided practices with clearly defined participation requirements through informational Webinars, online FAQs, and other program materials throughout the recruitment period to clarify program expectations and address questions.
  - This allowed sufficient time to address any potential or initial barriers to participation (e.g., ambulatory care practice medical director approval and signoff, programming for electronic health record [EHR] data extraction) well in advance of program implementation.
- **Flexible Webinar schedules**
  - JHM/NORC held Webinars at different days and times to accommodate busy schedules.
  - Webinars were recorded and posted to the program Web site for participating staff to listen to at their convenience.
- **Continuing Education credits and certificates of program involvement**
  - JHM/NORC offered CME and MOC credits for participating in live Webinars or audio presentations.
  - Provided participating staff and ambulatory care practices certificates of program involvement and completion for attending a majority of Webinars or submitting a majority of monthly EHR data elements.
- **Implementation support**
  - JHM/NORC held regular office hours to allow for informal discussions and assistance regarding program implementation, access to subject matter experts for questions, and to facilitate peer-to-peer learning.
  - Implementation Advisers provided one-on-one support to participating practices, answering questions, directing staff to available program resources, and following up regarding data collection and submission issues.

- A series of EHR technical assistance sessions were offered, including a brief presentation on how to extract data and specifics by EHR vendor product
- For any sites considering withdrawal, one of the program's subject matter experts reviewed the site's concerns with program participation and often personally reached out to the site to assist with troubleshooting any issues limiting participation.

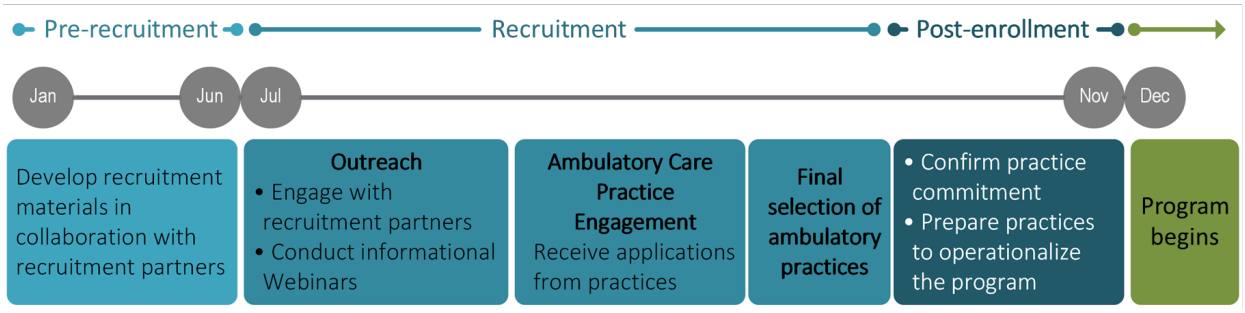
2.1. Recruitment and Retention of Ambulatory Care Practices

Target enrollment for the Ambulatory Care Cohort was 250–500 practices encompassing the 10 HHS regions (See Appendix A-3). JHM/NORC undertook a systematic strategy to recruit, enroll, and retain practices for the Safety Program. The multistep process is described in the next sections.

2.1.1. Recruitment Strategy

Outreach and recruitment were broken into three distinct phases to ensure program targets were met. Pre-recruitment activities, which spanned January through June 2019, involved development and refinement of recruitment materials, and development and finalization of a recruitment plan. Active recruitment spanned July through December 2019 (with some final practice enrollment in January 2020) and involved engagement with recruitment partners, 14 informational Webinars, receipt and processing of practice applications and signed letters of commitment, and preparation of practices for program activities (particularly around development of their antibiotic stewardship team and data collection activities). Enrolled practices started program participation in December 2019. **Exhibit 4** provides an overview and timeline for program activities during the ambulatory care cohort's recruitment and immediate post-enrollment period.

EXHIBIT 4: RECRUITMENT PROCESS FLOW, JANUARY–DECEMBER 2019



Federal Recruitment Partners

JHM/NORC used a multipronged recruitment approach, working with a wide range of recruitment partners, including Federal and non-Federal groups (see **Exhibits 5-9**). JHM/NORC and AHRQ worked with Federal partners—including CMS, HRSA, and CDC—to ensure synergy across Federal antibiotic stewardship initiatives and programs. CMS staff disseminated information on the AHRQ Safety Program via monthly newsletters and Webinars. CDC staff disseminated AHRQ Safety Program information and recruitment efforts via their listservs, and also made announcements and distributed recruitment materials at relevant ambulatory care conferences. HRSA agreed to share program information with

their Federally Qualified Health Center (FQHC) grantees. In addition, JHM/NORC coordinated with AHRQ to increase awareness of the Safety Program on AHRQ's weekly electronic newsletter (118,000+ subscribers) and listserv (55,000+ subscribers).

Other Recruitment Partners

Concurrently, JHM/NORC worked with a multitude of non-Federal groups (e.g., ambulatory care associations, The Joint Commission, Institute for Healthcare Improvement) to recruit ambulatory practices within their networks. JHM/NORC also contacted health systems that had participated in the pilot program—Geisinger Health System, Lorien Health System, and Atrium Health—as well as other health systems that had not participated in the pilot (e.g., Lee Health). In addition, JHM/NORC leveraged the Institute for Healthcare Improvement and JHM listservs and newsletters as dissemination channels.

EXHIBIT 5: AMBULATORY CARE RECRUITMENT EFFORTS

Recruitment Role for Implementation Advisers

The Implementation Advisers were also an integral recruitment partner for the ambulatory care cohort. The Implementation Advisers helped to disseminate program information advertised in the QIN-QIO National Coordinating Center newsletter, which supports a network of 14 QIN-QIOs nationally. Implementation Advisers also funneled program information through local networks, including the Lake Superior Quality Improvement Network newsletter and channels. QIN-QIO representatives recognize the value of the AHRQ Safety Program and were eager to inform ambulatory care practices they worked with about this quality improvement program.

As mentioned, the JHM/NORC team leveraged numerous listservs and newsletters to promote the ambulatory care cohort. These are summarized in **Exhibits 6–9** below.

EXHIBIT 6: NATIONAL LISTSERVS AND NEWSLETTERS FOR AMBULATORY CARE COHORT RECRUITMENT

National Listservs/Newsletters	Reach/Contacts
AHRQ email list for ambulatory care	25,000
AHRQ patient safety email list	55,000
Armstrong Institute contact list	9,200
QIN-QIO National Coordinating Team listserv	2,000+
QIN Lake Superior newsletter (Michigan, Minnesota, and Wisconsin)	2,500+

EXHIBIT 7: STATE PROFESSIONAL ORGANIZATION LISTSERVS AND NEWSLETTERS FOR AMBULATORY CARE COHORT RECRUITMENT

State Professional Organization Listservs and Newsletters
Arizona Medical Association
Association for Utah Community Health
District of Columbia Primary Care Association
Medical Association of Georgia
Missouri Academy of Family Physicians
Nebraska Medical Association
New Hampshire Medical Society
New York State Academy of Family Physicians
Oklahoma Primary Care Association
Oklahoma State Medical Association
Oregon Medical Association
Oregon Primary Care Association
Pennsylvania Academy of Family Physicians
Pennsylvania Association of Community Health Centers
South Carolina Medical Association
Tennessee Primary Care Association
Texas Academy of Family Physicians - Harris County Chapter
Virginia Community Healthcare Association
Washington Academy of Family Physicians
Washington Association for Community Health
Western Carolina Medical Society

EXHIBIT 8: AREA AND LOCAL LISTSERVS AND NEWSLETTERS FOR AMBULATORY CARE COHORT RECRUITMENT

Area Health Education Centers (AHECs) and Local Professional Organizations Listservs and Newsletters
Capital Region AHEC
Charlotte AHEC
Eastern Washington University (EWU) Eastern Washington AHEC
Harris County Medical Society (Texas)
High Sierra AHEC
Southeast Nebraska Area Health Education Center (AHEC)
Texas AHEC East Program

Informational Webinars

A total of 886 individuals attended one of the 14 informational Webinars, which averaged approximately 63 attendees per Webinar. The informational Webinars were held from early July through early December 2019 on the following topics:

- Program overview
- Benefits of participation
- Data submission requirements

- Program timeline
- Key points of contact for program staff at JHM/NORC
- How to learn more about the program

Email Outreach

The program team conducted extensive email outreach, sharing program recruitment materials across local, regional, state, and national audiences. The JHM/NORC team leveraged contacts from the program's Principal Investigators, Co-Investigators, TEP members, and Implementation Advisers.

One of the many recruitment efforts centered on outreach to the State health department Healthcare-Associated Infections committee and subcommittee participants, where antibiotic stewardship is a core component. The program team reached out to its network of contacts within these committees by state. Many of these state contacts then shared program information within their respective state public health departments, as well as their committee and subcommittee networks. The JHM/NORC team also reached out to participating sites from the AHRQ Safety Program Acute Care Cohort to inquire if they had an affiliated ambulatory practice that may be interested in the Ambulatory Care Cohort. In addition, JHM/NORC team also reached out to all State and U.S. territory Academies of Family Physicians, State and county Medical Societies, State Primary Care Associations, and State and regional Area Health Education Centers (AHECs). **Exhibit 9** lists the State entities that agreed to assist with recruitment efforts by sharing materials with their membership, as well as examples of organizations and other groups the program team included in this email outreach.

EXHIBIT 9: RECRUITMENT EMAIL OUTREACH FOR AMBULATORY CARE COHORT

Recruitment Email Outreach
National and Regional Nonprofit Organizations ▪ America's Physicians Groups ▪ American Academy of Family Physicians* ▪ American Academy of Pediatrics * ▪ American Academy of PAs* ▪ American Academy of Nurse Practitioners* ▪ American College of Physicians* ▪ American Medical Group Association ▪ Association for Professionals in Infection Control and Epidemiology * ▪ Association of Primary Care Physicians* ▪ Catholic Health Association* ▪ HCA Healthcare* ▪ Institute for Healthcare Improvement* ▪ Integrated Healthcare Association ▪ The Joint Commission* ▪ Lake Superior Quality Improvement Network* ▪ Medical Group Management Association ▪ National Association of Pediatric Nurse Practitioners* ▪ National Committee for Quality Assurance ▪ National Coordinating Center* ▪ Urgent Care Association* ▪ Vizient*

Recruitment Email Outreach

Urgent Care Corporations

- BayCare Health System*
- Hometown Urgent Care*
- PM Pediatrics*
- Penn Medicine
- Righttime Medical Care
- UCHealth Medical Group
- WellNow Urgent Care

Insurance Companies

- Aetna
- Anthem Blue Cross
- Blue Cross Blue Shield of Massachusetts

Public and Private Health Systems

- Altamed
- Ascension*
- Brigham Health
- Christiana Care Health System*
- Duke
- Emory University
- Geisinger Medical Center*
- Hawaii practices
- HealthCore
- Johns Hopkins Community Physicians
- Lee Health*
- Northwell Health (NY)
- Northwestern Medicine
- NYC Health + Hospital Jacobi Medical Center
- University of Chicago hospitals*
- University of Colorado Anschutz Medical Campus
- University of Maryland practices
- University of North Carolina Healthcare*

Recruitment Email Outreach

State Medical Associations and Entities

- Arizona Medical Association*
- Association for Utah Community Health*
- Berkshire AHEC (Massachusetts)*
- Bi-State Primary Care Association (New Hampshire and Vermont)*
- California Primary Care Association
- Capital Region AHEC (Texas)*
- Charlotte AHEC*
- District of Columbia Primary Care Association*
- Eastern Washington University Eastern Washington AHEC*
- Gulfcoast South AHEC, Inc.*
- Harris County Medical Society (Texas)*
- High Sierra AHEC (Nevada)*
- Illinois State Medical Society*
- Indiana Primary Health Care Association*
- Indiana State Medical Association*
- Medical Association of Georgia*
- Medical Society of Delaware*
- Mid-Carolina AHEC, Inc.*
- Minnesota Association of Community Health Centers*
- Missouri Academy of Family Physicians*
- Nebraska Medical Association*
- New Hampshire Medical Society*
- New Jersey Primary Care Association*
- New York State Academy of Family Physicians*
- North Carolina Department of Health and Human Services
- Oklahoma Primary Care Association*
- Oklahoma State Medical Association*
- Oregon Medical Association*
- Oregon Primary Care Association*
- Pennsylvania Academy of Family Physicians*
- Pennsylvania Association of Community Health Centers*
- South Carolina Medical Association*
- Southeast Nebraska AHEC*
- Tennessee Primary Care Association*
- Texas Academy of Family Physicians - Alamo Chapter*
- Texas Academy of Family Physicians - Harris County Chapter*
- Texas AHEC East Program*
- University of Cincinnati College of Medicine (AHEC)*
- Virginia Community Healthcare Association*
- Washington Academy of Family Physicians*
- Washington Association for Community Health*
- West Central Illinois AHEC*
- Western Carolina Medical Society*
- State health departments

Individual ambulatory practices

- Via affiliated acute care hospitals that previously participated in the acute care program cohort

**Indicates followup recruitment outreach phone call and/or subsequent assistance with program recruitment efforts.*

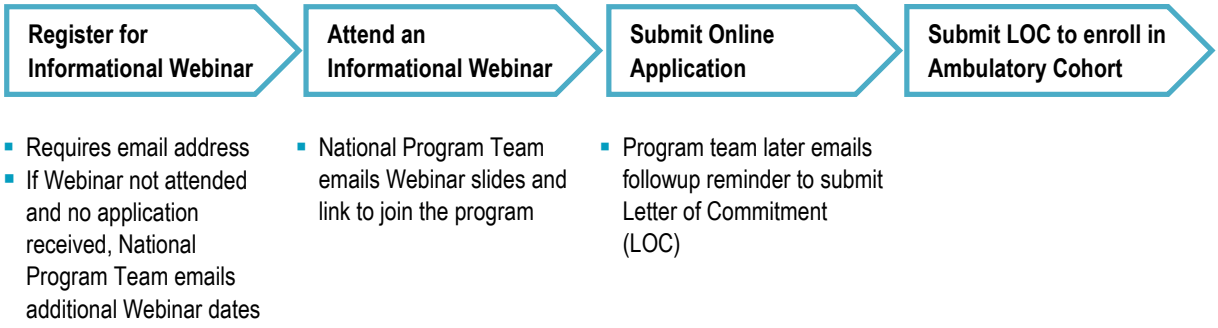
Recruitment Outreach Calls

Based on initial outreach emails, networking at conferences, informational Webinars, and other recruitment outlets, the JHM/NORC team held recruitment calls with a number of organizations (**Exhibit 9**). During these calls the team provided an overview of the program, detailed the program's eligibility and data collection requirements, and answered any questions about the program. These calls included both organizations to assist with recruitment efforts and organizations who may have had ambulatory practices interested in participating directly in the program.

Recruitment Followup Strategy

The program also employed a well-coordinated series of followup emails for interested sites at various points throughout the recruitment, application, and enrollment process, which culminated in a Letter of Commitment (LOC) from each ambulatory practice (see **Exhibit 10**).

EXHIBIT 10: TIMING OF COORDINATED FOLLOWUP EMAILS TO SITES INTERESTED IN PARTICIPATING



These emails reminded interested parties of the multiple opportunities to learn more about the program, ask questions, or learn how to apply (**Exhibit 11**).

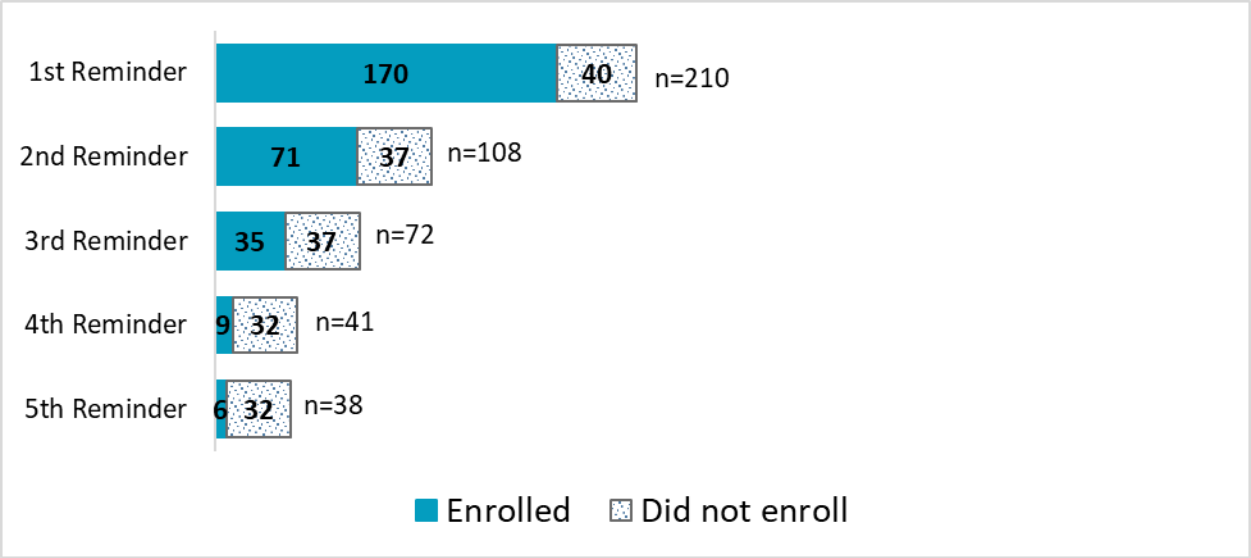
EXHIBIT 11: EXAMPLES OF FOLLOWUP EMAIL CONTENT

Examples of Followup Email Content
How to learn more about the program? ▪ Attend informational Webinar ▪ Visit program Web site frequently asked questions ▪ Listen to online informational Webinar recording ▪ Contact the program (antibioticsafety@norc.org) **How to ask questions about the program?** ▪ Attend informational Webinar, which includes Q&A session ▪ Contact the program (antibioticsafety@norc.org) **How to apply to participate in the program?** ▪ Program Web site link provided to online application

The program found the followup emails to sites that submitted applications a successful strategy to enrolling ambulatory practices into the program. Given the multiple demands of ambulatory practice medical directors, these prompts served as important reminders to Medical Directors and

Administrators. **Exhibit 12** details the number of followup emails the JHM/NORC team sent to ambulatory practices that had applied for the program but not yet returned a signed LOC, as well as the overall number of practices that ended up enrolling in the program. The program typically saw an increase in the number of submitted LOCs/enrollees in the days following one of these email reminders, suggesting that the repeated outreach attempts helped bolster program participation.

EXHIBIT 12: FOLLOWUP EMAIL REMINDERS TO RETURN A SIGNED LOC AND SUBSEQUENT ENROLLMENT



Program Web Site for Recruitment

JHM/NORC created the public-facing Web site SafetyProgram4AntibioticStewardship.org to field requests to join the program, and developed a recruitment page to include FAQs, information about upcoming informational Webinars, an informational Webinar recording, and the program email address should interested practices have any questions. The Web site FAQs covered a broad range of topics, including general ambulatory care cohort questions (e.g., benefits of participation, timeline), eligibility, data collection requirements, and the educational content.

Application for Program Enrollment

In addition, the Web site hosted the online application to begin enrollment into the Ambulatory Care cohort. The application captured practice characteristics (e.g., size, type, urbanicity), affiliation with a larger health system, EHR information, and practice contact information. Please refer to **Appendix A-4** for a copy of the online application. The online application instructed larger urgent care chains or health systems to complete a Multiple Facility Contact Form. The program sent a followup email to the main contact from the Multiple Practice Contact Form with instructions on how to complete the Multiple Practice Application spreadsheet. A total of nine urgent care organizations completed the Multiple Facility Contact Form; these organizations applied to enroll from 3 to 257 urgent care sites each.

Recruitment Informational Webinars

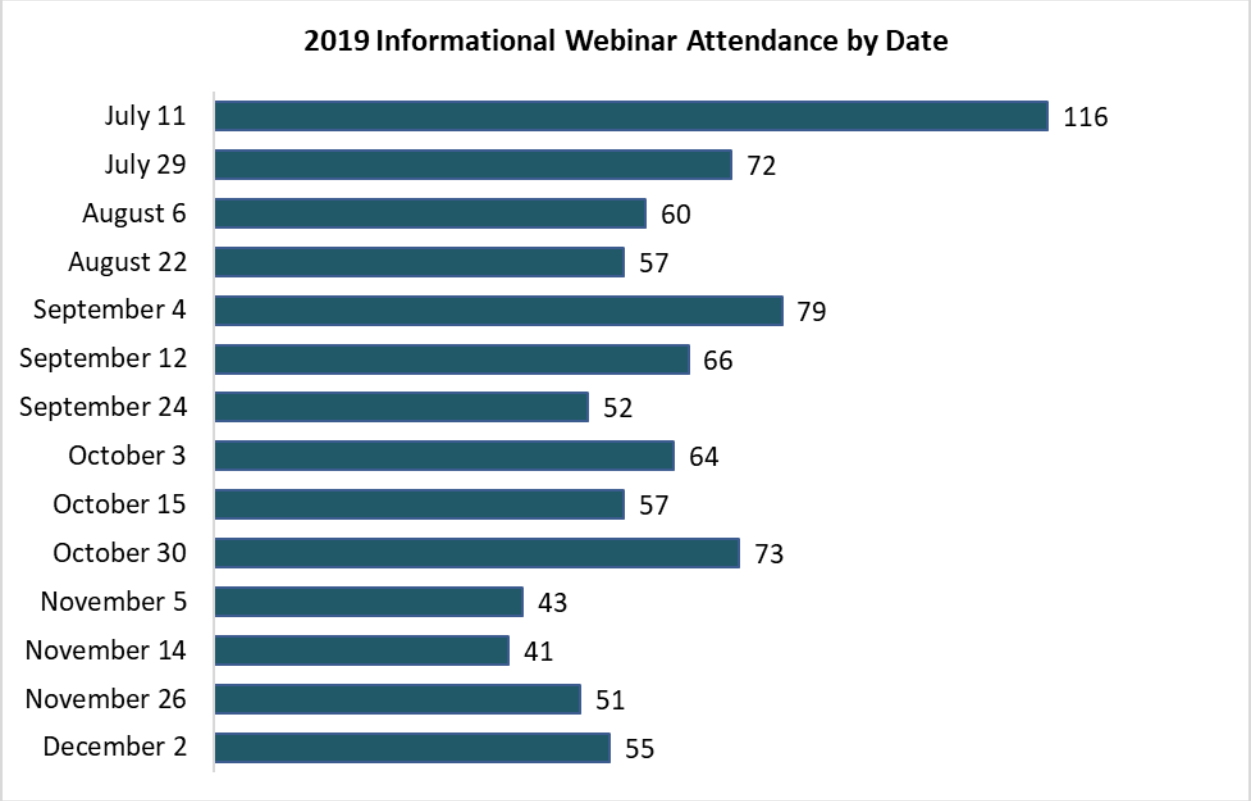
Instrumental to the ambulatory care recruitment efforts, JHM/NORC held 14 informational Webinars, from early July through early December 2019, for practices interested in joining the program. These

informational Webinars provided an overview of the program and addressed questions and concerns of practices considering joining the program. The JHM/NORC team arranged these Webinars to occur on different days of the week and at varying times to accommodate a broad range of schedules and time zones across the country. In addition, the program Web site provided a recording of an informational Webinar that could be viewed at any time. Informational Webinar topics included:

- Program overview
- Benefits of participation
- Ambulatory care practice participation requirements
- Data submission requirements
- Program timeline
- Key points of contact for program staff at JHM/NORC
- How to learn more about the program

Exhibit 13 provides an overview of attendance at each of the informational Webinars. A total of 886 individuals attended one of the Webinars.

EXHIBIT 13: 2019 INFORMATIONAL WEBINAR ATTENDANCE BY DATE



After each Informational Webinar, JHM/NORC sent a thank-you email to participants for attending, along with a copy of the Webinar slides, a link to the online application to join the program, and a reminder to email the program team with any questions (antibioticsafety@norc.org).

Eligibility for Participation

Exhibit 14 details the ambulatory care practice eligibility for the cohort:

EXHIBIT 14: ELIGIBILITY CRITERIA FOR PARTICIPATING IN AMBULATORY CARE COHORT

Eligible Ambulatory Care Practices:	Ineligible Ambulatory Care Practices:
▪ Primary care clinics (adult and pediatric) ▪ Urgent-care clinics (adult and pediatric) ▪ Student health clinics ▪ Community-based health clinics (e.g., Federally Qualified Health Centers or FQHCs) ▪ Outpatient specialty clinics that provide primary care (adult and pediatric)	▪ Emergency departments ▪ Dialysis centers ▪ Ambulatory surgery centers ▪ Retail clinics

Recruitment Materials

JHM/NORC developed the following recruitment and enrollment materials to provide to recruitment partners and ambulatory practices:

General Recruitment Materials

- Outreach fliers
- Informational Webinar outreach materials
- Email blasts for professional societies
- Posts on healthcare blogs
- Recruitment letters
- Recruitment FAQs
- Templates for email communications with ambulatory care practices/recruitment partners
- Pitch letter for partner communications
- Social media messaging

Enrollment and Post-Enrollment Materials

- Online enrollment application
- Commitment form
- "Next Steps" document

Enrollment Strategy

The ambulatory care recruitment materials emphasized the benefits of program participation to eligible ambulatory care practices, including continuing education credits and MOC for the American Board of Internal Medicine, the American Board of Pediatrics, and the American Board of Family Medicine at no charge for participants. This free program also helped clinics meet the CMS MIPS requirements and helped demonstrate compliance with The Joint Commission's Ambulatory Antimicrobial Stewardship Standard. Additional benefits of participating include:

- Monthly Webinars to review best practices in the management of common infectious syndromes, as well as approaches to improve teamwork and communication around antibiotic decision making
- Free continuing education credits and MOC for physicians who attend the educational Webinars
- Assistance with developing and/or sustaining effective antibiotic stewardship programs
- Online presentations with facilitator guides that can be used to train clinicians
- Office hours with experts to provide personalized guidance on antibiotic decision making or antibiotic stewardship activities
- Patient and family education materials, such as posters and handouts
- Certificates of Participation for practices submitting monthly data and completing the program

Exhibit 15 summarizes the overall recruitment statistics for the Ambulatory Care Cohort.

EXHIBIT 15: SUMMARY OF RECRUITMENT STATISTICS

Recruitment	Total
Multiple Facility Contact form/applications received	9
Applications received	748
Letters of Commitment received	467
Total practice withdrawals	78
Final enrollment at end of cohort	389

Early on during the recruitment period the program began tracking the number of applications and LOCs received from specific types of practices to ensure they were not overrepresented. These practice types included Department of Defense, Indian Health Services, pediatric-only, urgent care clinics, and FQHCs. Urgent care clinic enrollment was initially limited to 100 clinics to ensure a diversified group of enrolled practices; however, the program increased the limit to accommodate the number of urgent care applications received. The program received applications from 422 urgent care clinics, which included 57 applications and 257 applications from two large urgent care chains. The remaining urgent care systems that submitted multi-enrollment applications included fewer than 20 clinics per health system, all of which were invited to submit LOCs. At the end of the enrollment period, JHM/NORC reviewed enrollment numbers by region and invited a percentage of clinics from the two larger urgent care chains to enroll in the program. The multi-clinic organizations were divided proportionately by Implementation Adviser. **Exhibits 16a-c** detail final enrollment by specialty group, practice type, and total practice enrollment.

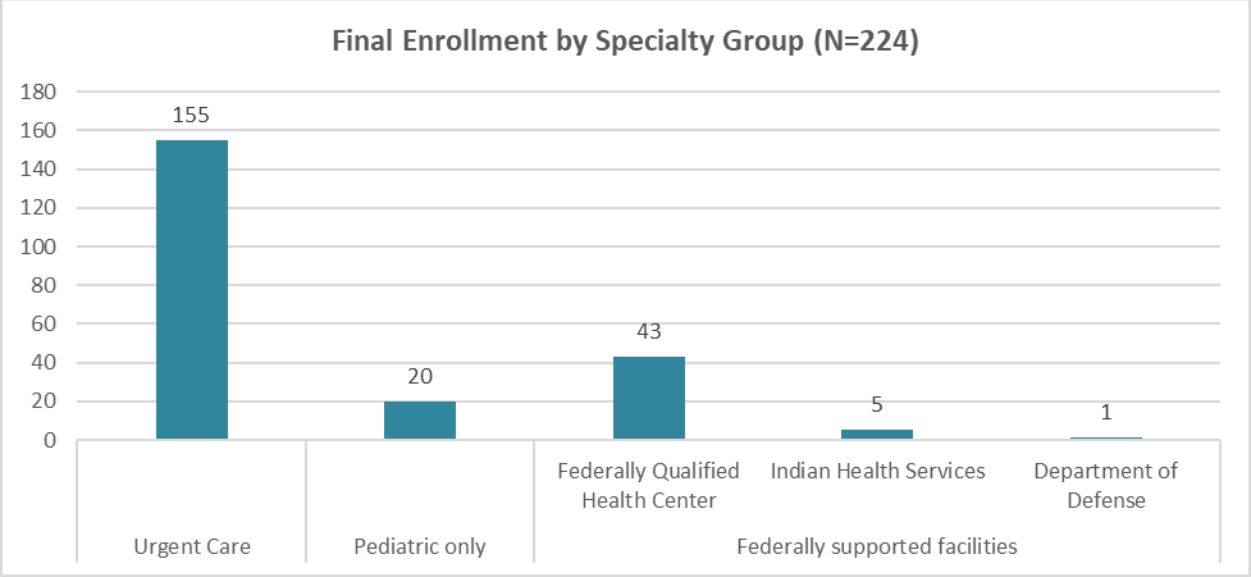
EXHIBIT 16A: FINAL ENROLLMENT BY SPECIALTY GROUP

Specialty Group	Total at Program End
Urgent care (adult and pediatric)	160
Federally Qualified Health Center	43
Pediatric-only	20
Indian Health Services	5
Department of Defense	1
Total Specialty Groups	**227**

EXHIBIT 16B: SPECIALTY GROUP AND TOTAL ENROLLMENT

Practice Type	Total	Percent of Total Enrollment
Specialty group total (including urgent care)	227	58%
Non-urgent care, non-specialty group	162	42%
Total	**389**	**100%**

EXHIBIT 16C: SPECIALTY GROUP AND PRACTICE TYPE



Help Desk for Recruitment Inquiries

The AHRQ Safety Program for Improving Antibiotic Use email address antibioticsafety@norc.org provided a centralized point of contact for recruitment questions, concerns, and requests for information from ambulatory care practices interested in participating in the Safety Program. Program enrollment or recruitment inquiries often related to specific actions to enroll (e.g., submitting an online application or a signed letter of commitment), data collection requirement, and/or questions related to the 14 informational recruitment Webinars offered. The Help Desk received 305 inquiries related to ambulatory recruitment between July 1, 2019, and November 30, 2019. The Help Desk continued to

reply to recruitment inquiries through February 2020, during the program's implementation period. Please refer to Section 2.5 for more details regarding the Safety Program's dedicated Help Desk.

2.1.2. Retention Strategies

The Implementation Advisers served as a key retention strategy, playing a principal role in keeping ambulatory practices engaged in the cohort. As detailed earlier, Implementation Advisers provided one-on-one support to participating ambulatory practices, and were responsible for practice engagement and active participation. They served as the main facilitators for the program—offering continued support and guidance to practices regarding data collection, accessing program resources, Webinar attendance, and other program requirements.

Implementation Adviser engagement activities included:

1. Initial onboarding call to discuss any ambulatory practice questions or concerns regarding participation
2. Monthly calls to discuss current issues and questions
3. Monthly and weekly prompting calls and email reminders of upcoming data submissions
4. Ad hoc calls and emails to discuss upcoming program activities, as well as questions regarding benchmarking reports, the waitlist, and other inquiries

The program also implemented numerous engagement strategies at the program level:

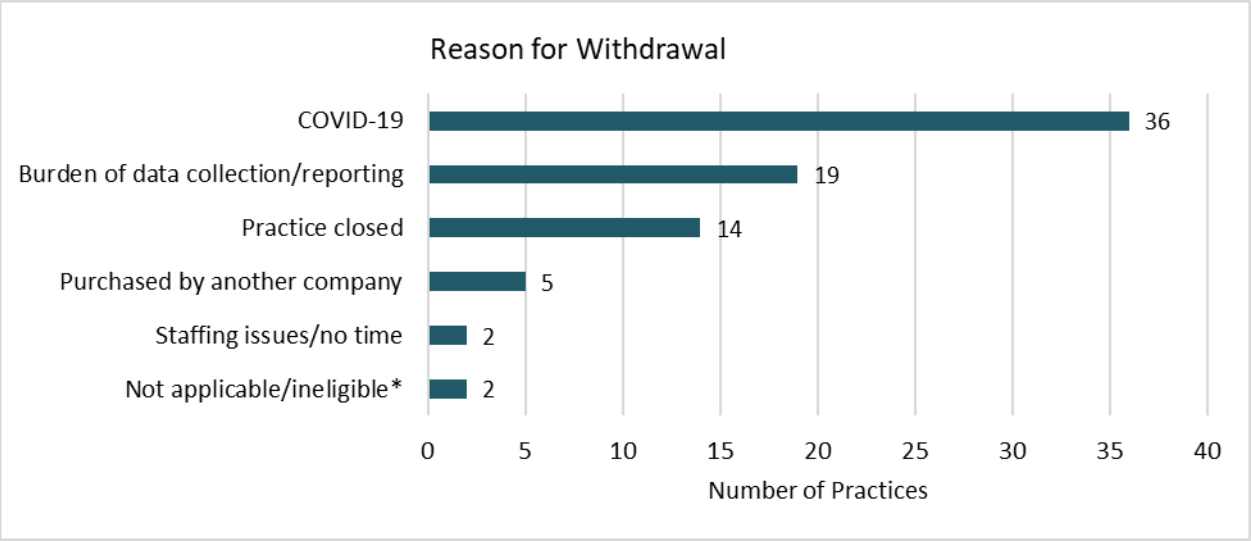
1. Three antibiotic stewardship experts developed and led Webinars and office hours to provide consistency of messages, support continuity across the span of the program, and build the opportunity for ongoing relationships between the experts and the participants. These experts were all infectious disease physicians with experience in the caring for ambulatory care patients.
2. Monthly office hours calls enabled practices to engage regularly with stewardship experts on a broad range of topics.
3. Educational Webinars and office hours were offered on several different dates and at several times of day to accommodate participants' schedules.
4. JHM/NORC staff worked with sites to facilitate data submission and allowed data submission via the program's online secure portal to better meet practices' needs.
5. JHM/NORC staff organized 10 EHR workgroups by platform that included a brief presentation on how to pull the data, specifics by software reporting code, and a question-and-answer session (**Exhibit 34**).

2.1.3. Retention Challenges

From the initial recruitment stage on, JHM/NORC emphasized flexibility and the Safety Program's willingness to work with practices to remain in the cohort. Implementation Advisers alerted JHM/NORC anytime their practices had questions or concerns regarding their continued participation. Implementation Advisers contacted JHM/NORC when an ambulatory practice was considering withdrawing. Then one of the Safety Program Principal Investigators evaluated the reasons provided, and if warranted, reached out directly to practice staff to answer any questions or concerns, and tried to work with the practice to remain in the cohort.

The Ambulatory Care Cohort began with 467 enrolled practices. Over the course of the ambulatory care cohort implementation, 78 of the practices withdrew. **Exhibit 17** summarizes the reasons ambulatory practices provided for withdrawal.

EXHIBIT 17: REASONS FOR PRACTICE WITHDRAWAL (N=78)



**Practices indicated eligibility on their applications and confirmed eligibility again at the start of the program. Once program activities began, these practices determined the program content was not applicable for their practice and withdrew.*

The main challenge for the ambulatory care cohort was the COVID-19 pandemic. The pandemic stretched most ambulatory care practice staffs thin. Practice staff time became more limited, and many participating practice staff were instructed to prioritize COVID-19 treatment and response over ASP team activities. Limited IT resources/staff available to work on program data collection requirements was the second largest reason for withdrawal.

2.2. National Educational Webinars and Office Hours

This section highlights the process of engaging ambulatory practices once they agreed to take part in the Ambulatory Care Cohort.

2.2.1 Onboarding of Ambulatory Care Practices

Once practices had agreed to participate in the program and returned a signed LOC to JHM/NORC, onboarding activities began. During this period, practices established their antibiotic stewardship team and started building the needed infrastructure for a successful ASP. Additional onboarding activities included:

- **Introductory Webinar.** JHM/NORC hosted the first educational Webinar, "Why Your Practice Should Focus on Antibiotic Use," which served as an onboarding Webinar for sites.
- **Assembling an AS team and identifying site leaders**. The program team encouraged an AS team with a multidisciplinary background, including a clinical and administrative leader at each site to

encourage action at the local level. Practices identified a clinician lead willing to be trained to become the antibiotic stewardship lead (if leads were not already present at participating sites), as well as an administrative lead (e.g., office or practice manager). The clinical lead was typically a prescribing clinician at the practice. The program team recommended that the clinician lead be a staff member with the time and interest in improving stewardship at the individual clinic level. The administrative lead was typically an office manager or other staff member who could assist with data collection issues and help the practice set aside time to attend webinars.
    - The program team envisioned having these team leads, and then the entire practice as the AS team. They also encouraged others in the practice (e.g., pharmacists, medical assistants) to be involved.
- **Speaking with information technology (IT) staff to establish the data submission process.** Sites were encouraged to connect with their IT staff prior to the official start of the program to develop a process for data extraction and submission.

2.2.2. Educational Webinars

Over the 12-month ambulatory care cohort implementation period, participating practices were invited to attend 14 educational Webinars. Each Webinar lasted for 30 minutes, and there was generally 15–30 minutes after the end of each Webinar for questions and answers. The target audience for the Webinars was either ASP members or both ASP members and frontline staff. JHM developed content for the Webinars in close consultation with AHRQ; NORC provided operational support.

Most Webinars were offered two times on different days and times, to give participating practices an opportunity to find a time that worked for their teams. The first Webinar was an onboarding webinar that familiarized participants with the goals of the Safety Program and the components of the educational toolkit. It also informed sites about data collection and submission requirements.

The remaining 13 Webinars included both adaptive content, which focused on changing the culture of antibiotic prescribing, and technical content, with the goal of improving antibiotic prescribing for infections common among ambulatory patients. **Exhibit 18** outlines the content and timing of the 14 Webinars.

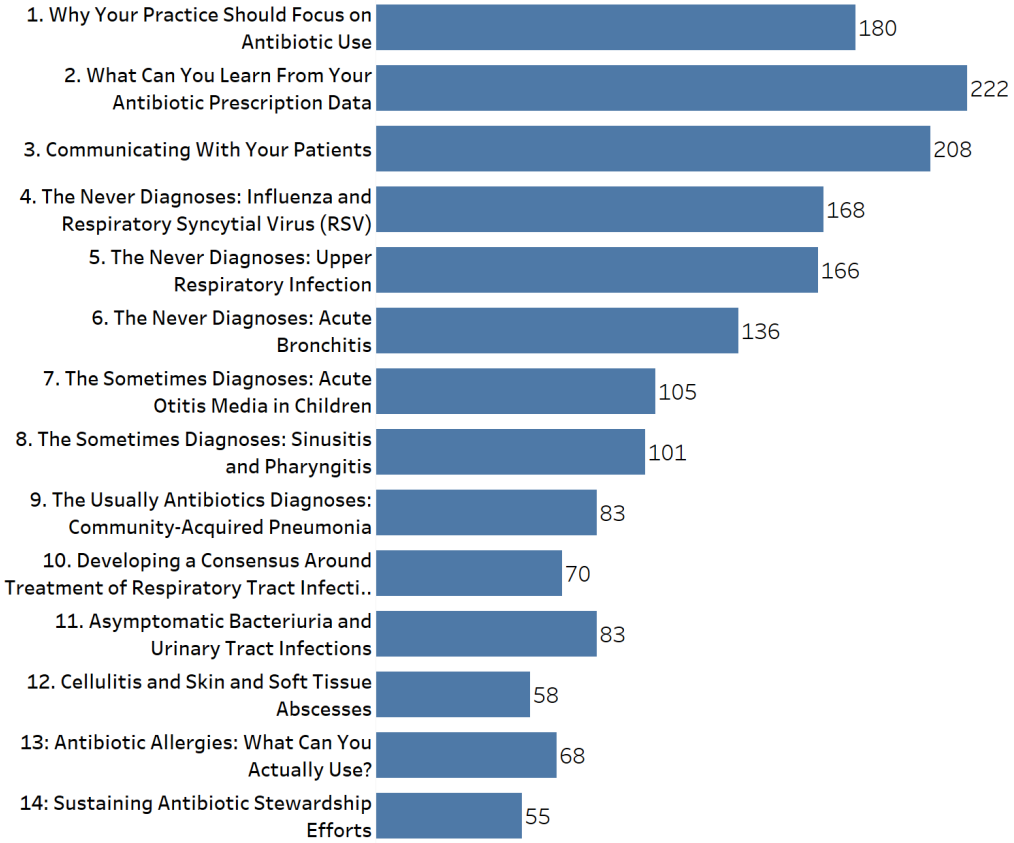
EXHIBIT 18: OVERVIEW OF AMBULATORY CARE COHORT WEBINAR TOPICS

Order	Month	Webinar Title
1	Dec 2019	Onboarding Call: Why Your Practice Should Focus on Antibiotic Use
2	Dec 2019	What You Can Learn From Your Antibiotic Prescription Data
3	Jan 2020	Communicating With Your Patients and Families Around Antibiotic Decisions
4	Jan 2020	The Never Antibiotics Diagnoses: Influenza and RSV
5	Feb 2020	The Never Antibiotics Diagnoses: Viral Acute Upper Respiratory Infection: The Common Cold
6	Mar 2020	The Never Antibiotics Diagnoses: Acute Bronchitis
7	Apr 2020	The Sometimes Antibiotics Diagnoses: Otitis Media

Order	Month	Webinar Title
8	May 2020	The Sometimes Antibiotics Diagnoses: Sinusitis and Pharyngitis
9	Jun 2020	Usually Antibiotics Diagnoses: Community-Acquired Pneumonia
10	July 2020	Developing a Consensus in Your Practice Around Symptomatic Treatment of Respiratory Tract Infections
11	Aug 2020	Asymptomatic Bacteriuria and Urinary Tract Infections
12	Sep 2020	Cellulitis and Skin Abscesses
13	Oct 2020	Antibiotic Allergies: What Can You Actually Use
14	Nov 2020	Sustaining Antibiotic Stewardship Efforts

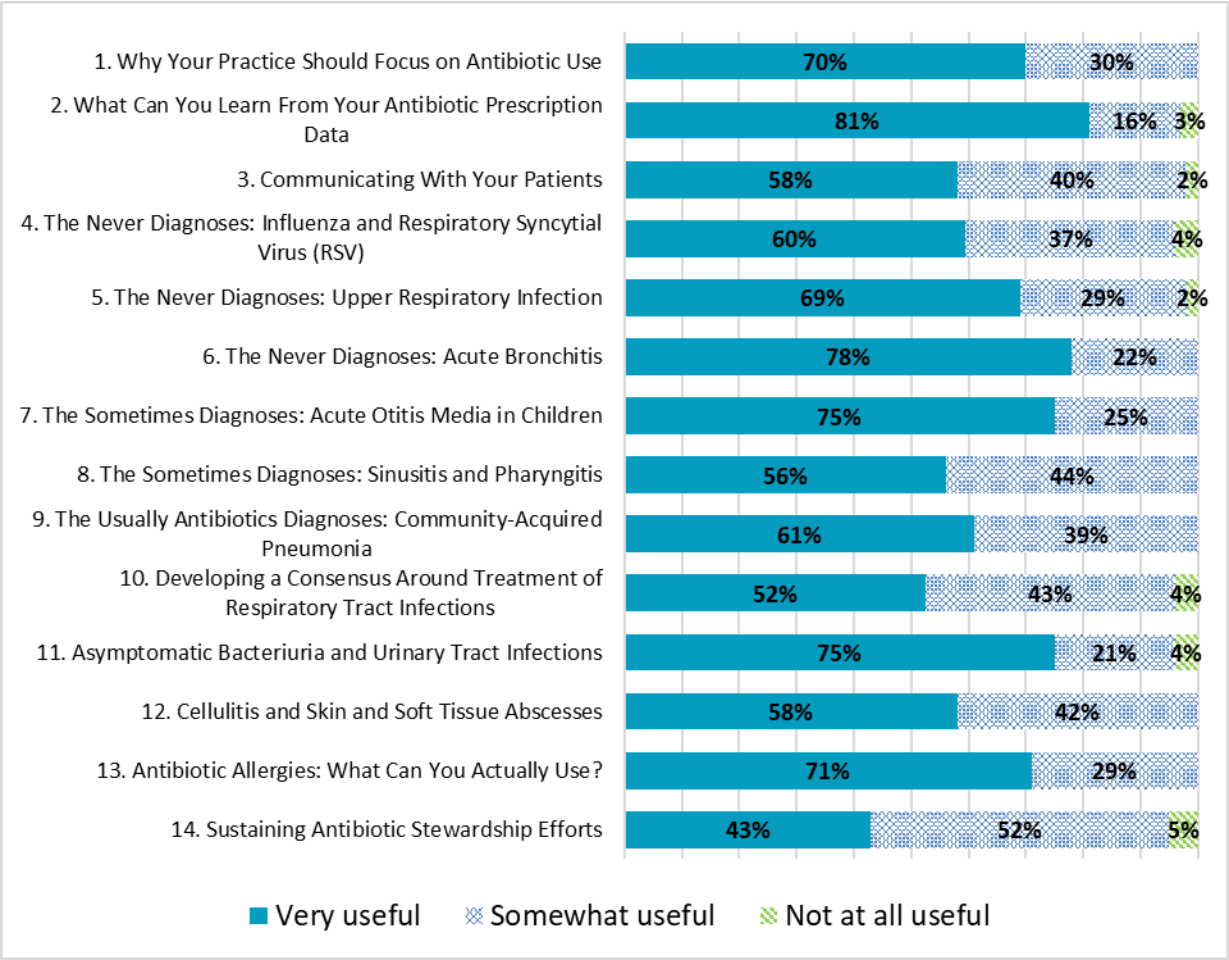
The Webinars were well attended throughout the program, averaging approximately 122 attendees per topic (**Exhibit 19**). In some practices staff members gathered in a room together to view the Webinars as a team; to capture this, the Webinars were set up so that participants were able to indicate how many attendees from their location were in attendance as they logged in to the Webinar. The attendance numbers reflect the total attendance of individuals, rather than simply the number of telephone lines or IP addresses used.

EXHIBIT 19: WEBINAR ATTENDANCE BY TOPIC



Overall, participants found the Webinars to be helpful based on feedback requested after each Webinar (**Exhibit 20**).

EXHIBIT 20: PARTICIPANT RATINGS OF USEFULNESS OF WEBINAR



The Safety Program offered continuing education credit for participating in program activities (webinars and audio presentations). Two types of credits were available for clinical staff participating in the program:

1. *Per topic:* Credit for listening to audio presentation and for attending/watching webinars. For each topic 0.5 credits were granted.

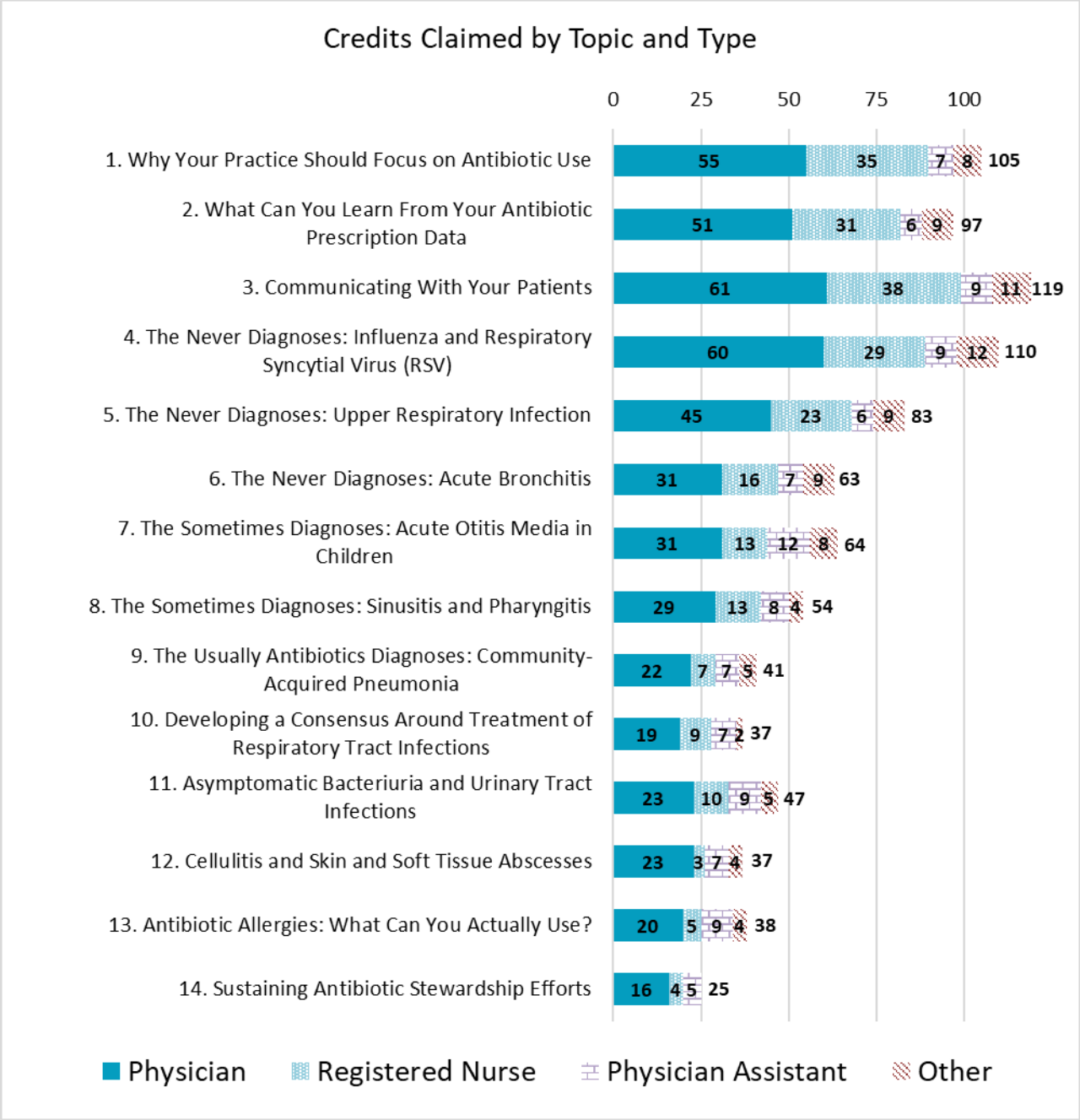
Clinical Staff	Credit Available
Physician	Continuing Medical Education (CME) and Maintenance of Certification (MOC)
Physician Assistant	Continuing Education (CE)
Registered Nurse/Nurse Practitioner	Continuing Education Units (CEU)

2. *End-of-program CME and MOC:* Physicians who listened to 70 percent (7 topics) of the content either via Webinar or audio presentation and whose enrolled practice submitted at least 80 percent of the required monthly data, were eligible to claim 20 MOC credits. Physicians needed

to claim per-topic credits for at least 7 of the topics, and their site needed to submit the required data, in order to be eligible to claim the end-of-program CME and MOC credits.

By the end of the program, participants claimed 920 credits. **Exhibit 21** shows the number of participants who claimed credits, by topic.

EXHIBIT 21: CREDITS CLAIMED BY TOPIC AND TYPE

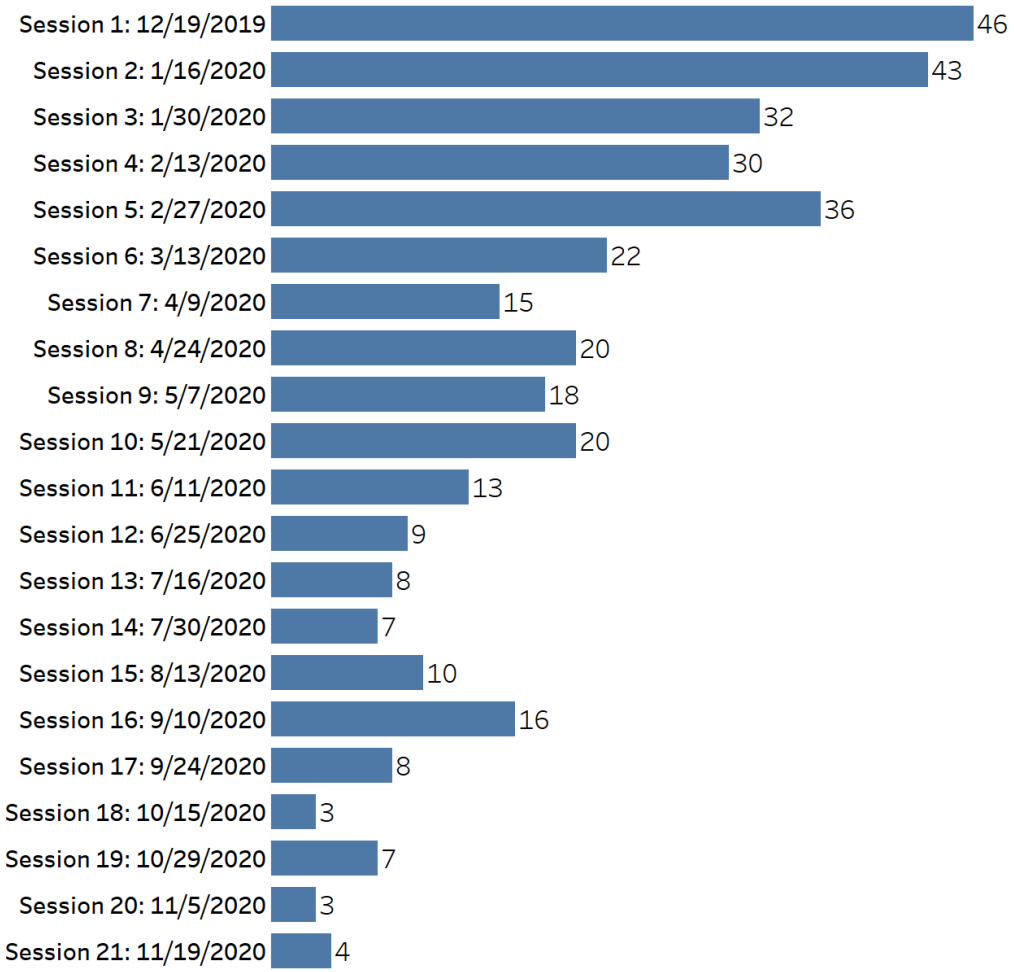


2.2.3. Office Hours

In addition to participation on Webinars, sites were encouraged to participate in optional office hours led by JHM/NORC. The main goal of these calls was to give sites a venue for informal discussion on how program implementation was progressing at their sites. Along with discussions on implementation of antibiotic stewardship practices, changing antibiotic prescribing behavior, guideline development, and clinical questions. These calls also facilitated peer-to-peer sharing. Participants could learn about: (1) other sites that were struggling with the same issues and (2) strategies other sites developed to address barriers. The JHM/NORC team also prepared discussion topics with questions and answers, if needed, to facilitate further conversation during office hours.

Office hours sessions were held 1 to 2 weeks following each Webinar, with 22 office hours sessions held over the course of the ambulatory care cohort year. Attendance averaged approximately 18 participants per session (see **Exhibit 22**).

EXHIBIT 22: OFFICE HOURS ATTENDANCE BY DATE



2.2.4. Other Implementation Activities

As part of their participation in the ambulatory care cohort, each practice received quarterly benchmarking reports to compare their progress to those of similar practices. These reports contained individualized results for all the data the practices submitted (**Appendix A-5** has a sample quarterly benchmarking report):

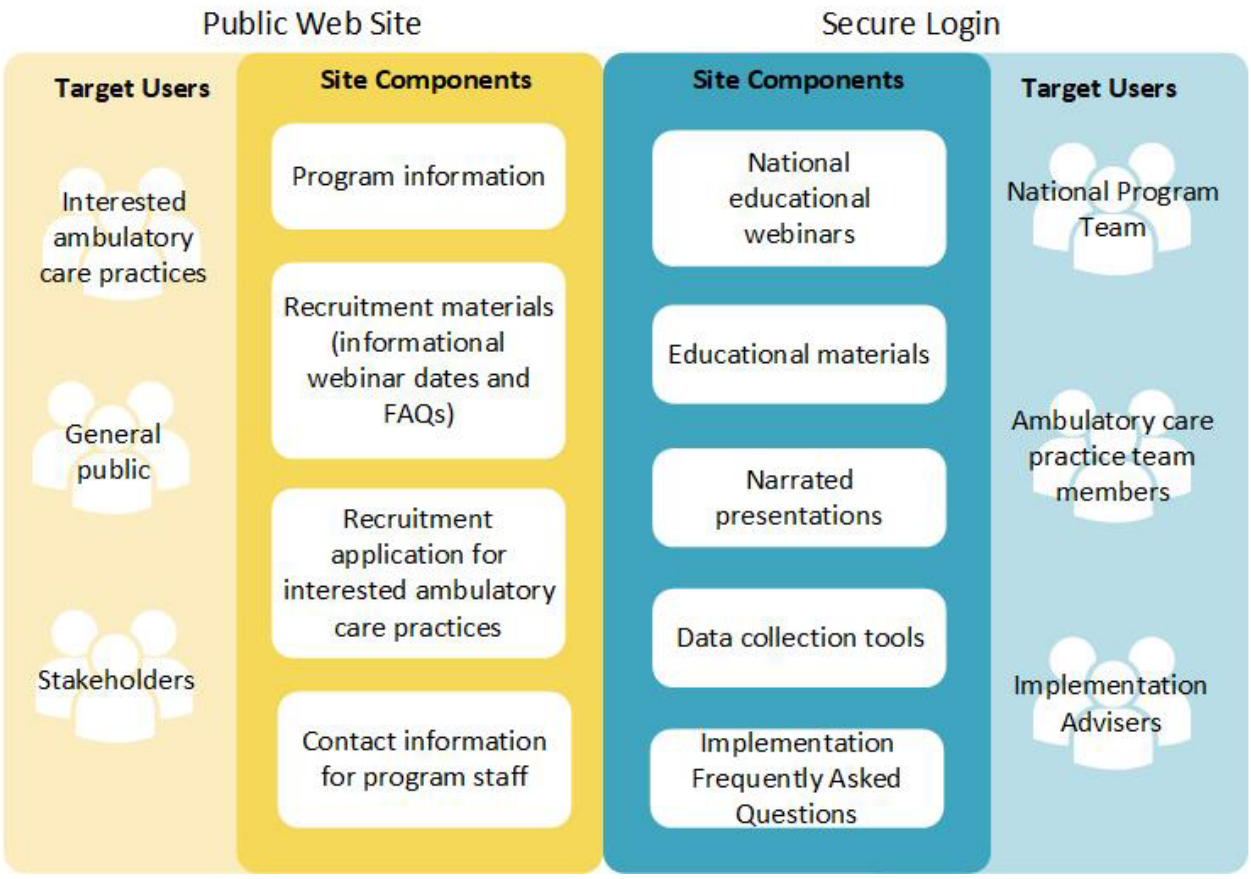
- Baseline and endline Structural Assessment
- Baseline and endline Medical Office Survey on Patient Safety Culture
- Q1, Q2, Q3, and Q4 antibiotic days of therapy per 1,000 patient-days
- Q1, Q2, Q3, and Q4 *Clostridioides difficile* laboratory-identifiable events

The reports also included aggregate data results from all similar participating practices. The Quarterly Benchmarking Reports enabled practices to compare their progress to that of similar practices, to see their relative progress over the course of the Safety Program. AS leaders were encouraged to share and discuss these reports with the rest of the practice. Sharing progress in this way allowed for a celebration of success and/or a renewed effort to improving antibiotic use.

2.3. Program Web Site

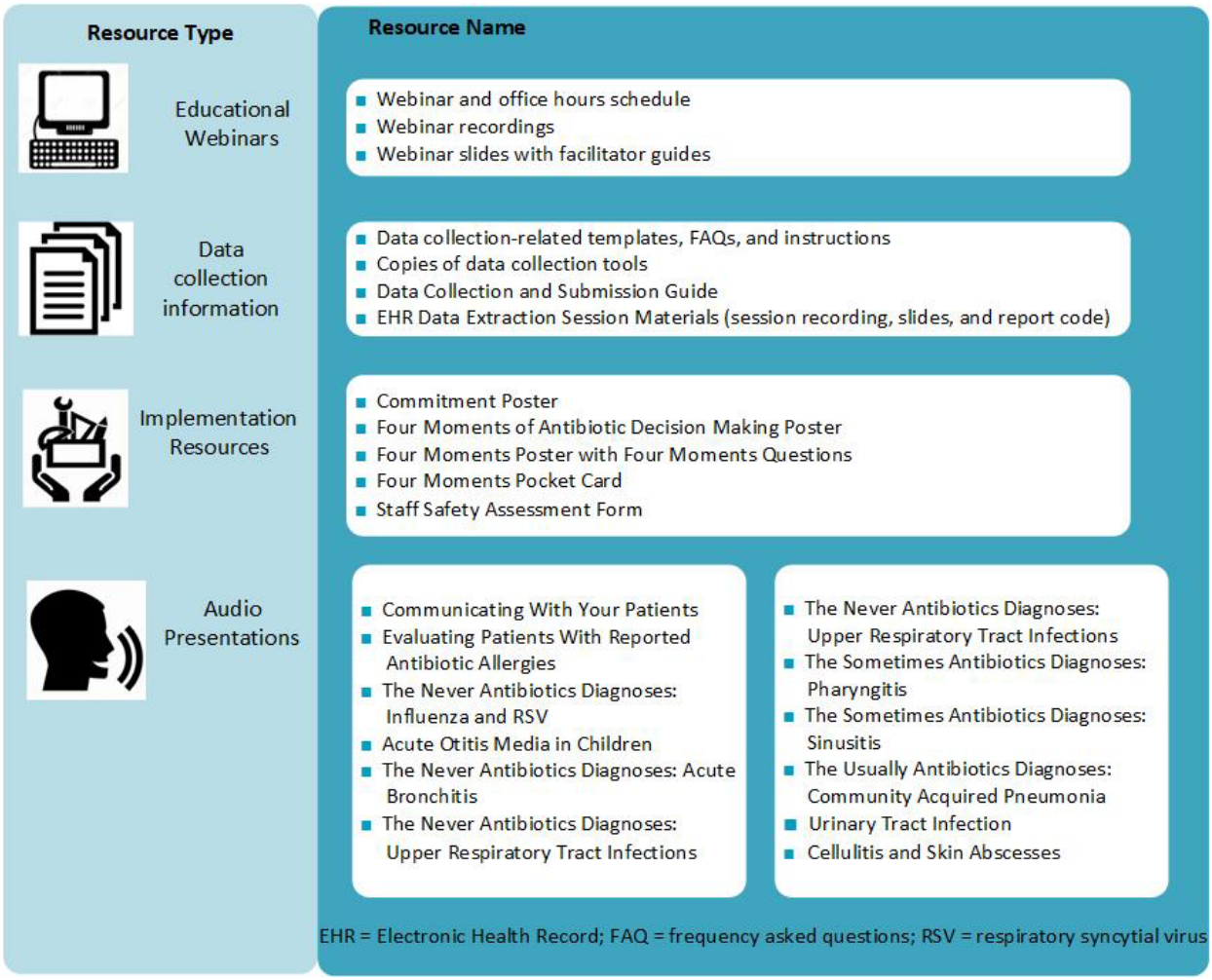
To ensure all participants had 24/7 access to the Ambulatory Care educational toolkit, NORC developed a Program Web site (SafetyProgram4AntibioticStewardship.org). The Web site included both a public-facing component with general information on the program, and a secure log-in component that served as a repository for content developed for the Safety Program as well as a data submission platform. Within each participating practice, staff members involved in the Safety Program were given log-in credentials for the user side of the program Web site. By the end of the cohort, the Web site had 2,083 users. **Exhibit 23** outlines the structure of the program Web site.

EXHIBIT 23: STRUCTURE OF THE PROGRAM WEB SITE



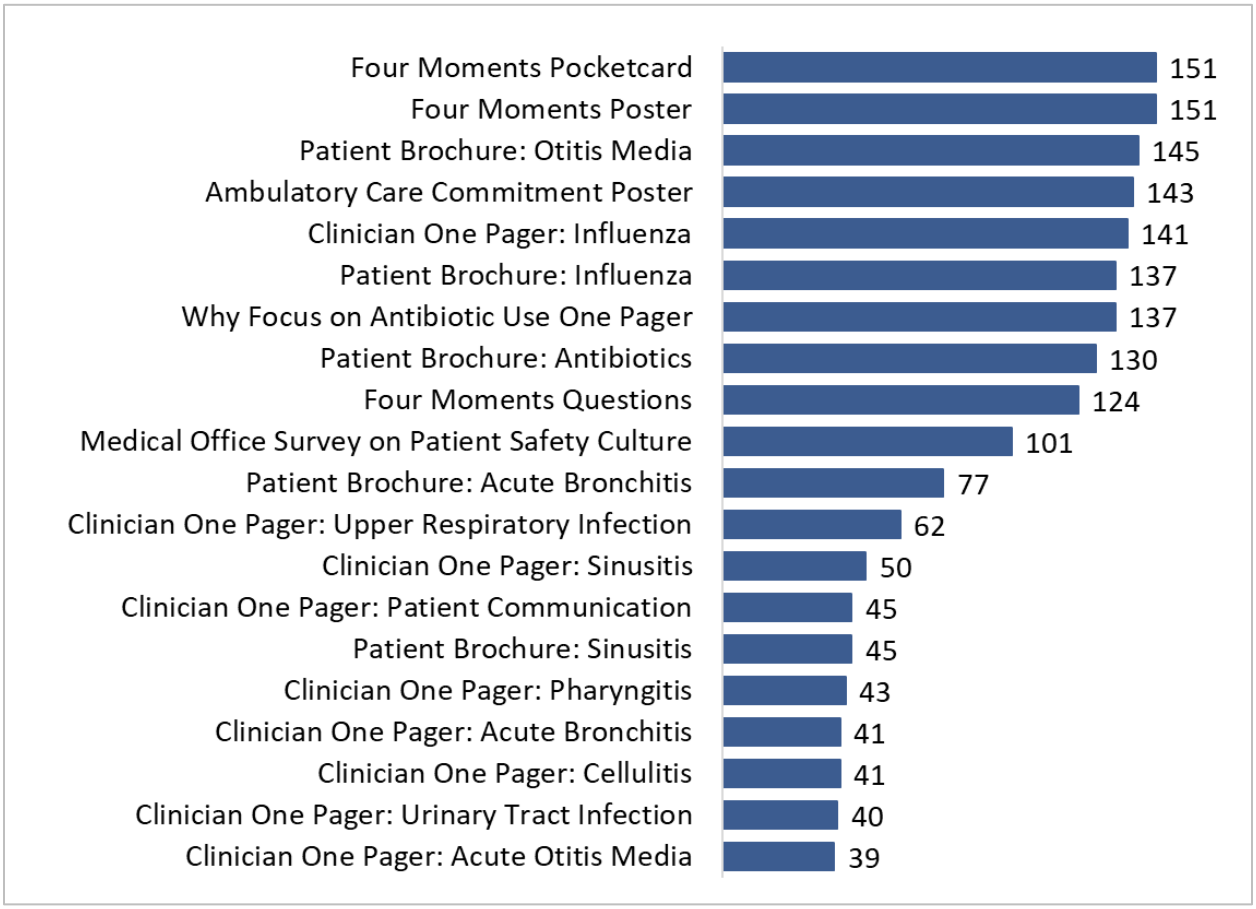
JHM/NORC continued to add content over the course of the ambulatory care cohort. By the end of the 1-year period, the Web site contained the following resources (see **Exhibit 24**):

EXHIBIT 24: AVAILABLE RESOURCES IN PROGRAM WEB SITE



Participants appeared to be regularly accessing Safety Program Web site content. By the end of the Ambulatory cohort, the 20 most popular materials on the Web site had over 1,800 unique downloads (averaging 90 downloads per material). **Exhibit 25** shows the 20 most frequently downloaded materials from the Safety Program Web site.

EXHIBIT 25: TOP 20 MOST DOWNLOADED AHRQ SAFETY PROGRAM FOR IMPROVING ANTIBIOTIC USE MATERIALS



2.4. Help Desk for Implementation Inquiries

NORC established the AHRQ Safety Program for Improving Antibiotic Use email address antibioticsafety@norc.org as a centralized resource for information and technical assistance for participating practices and Implementation Advisers. The Help Desk provided a point of contact for questions, concerns, and requests for information from participants. The Help Desk developed a central repository for issues, concerns, suggestions, and most importantly, resolutions that came through the Help Desk. JHM/NORC monitored all requests in a systematic and thorough manner and assigned questions to the appropriate subject matter expert or team member (e.g., infectious diseases physicians answered clinical questions, Safety Program staff answered questions about Web site log-in details)

Upon contacting the Help Desk, inquirers received an automated response confirming that the Safety Program had received their email and would respond in full as soon as possible. NORC staff monitored the emails daily, and typically responded to all inquiries within one to two business days. For calendar year 2020, the Help Desk received a total of 1,296 initial inquiries, of which 84 percent (n=1,088) related to the Ambulatory Care Cohort and the remaining 16 percent (n=208) to inquiries about the ending of the Long-Term Care Cohort Ambulatory Care Cohort, which overlapped the Ambulatory Care Cohort implementation period.

JHM/NORC received implementation inquiries via the Help Desk either directly from staff at participating sites or through their Implementation Advisers (Section 1.2.2). If Implementation Advisers did not have adequate information to address any issues that arose with the ambulatory practices, they forwarded these issues to the Help Desk. NORC followed up with contacting the appropriate person to answer the question, so the Implementation Adviser could return the correct guidance to the ambulatory practice. Examples of implementation inquiries included questions regarding data submissions and benchmarking reports, as well as clinical questions, among many others. When the Help Desk staff noticed frequently recurring inquiries, these became part of the internal FAQs document for Help Desk staff, and/or part of a weekly Implementation Adviser question-and-answer resource available throughout the implementation period.

CHAPTER 3: PROGRAM IMPACT

Chapter Summary

In this chapter, we describe the goals of the ambulatory care cohort evaluation, the data collection timeline for the evaluation quarters, the primary and secondary data sources, the data analysis methods, and key findings.

Evaluation Goals

The evaluation of the ambulatory care cohort sought to answer three major questions:

1. To what extent was the AHRQ Safety Program for Improving Antibiotic Use adopted by participating ambulatory care practices?
2. What is the effectiveness of the Safety Program in the ambulatory care context? What changes in safety culture, antibiotic usage have resulted from the Safety Program?
3. Is there any variation in the effectiveness of the Safety Program (i.e., change in antibiotic usage) by practice type?

Data Collection

To evaluate the adoption, effectiveness, and variation of the Safety Program, we collected monthly antibiotic prescription data at practice level for September 2019–November 2020 (i.e., 3 months prior and the entire period for Safety Program), along with practice-level Structural Assessment and provider/staff perspective on safety culture using AHRQ Medical Office Survey on Patient Safety Culture (MOSOPS) at baseline and endline. **Exhibit 29** summarizes the data sources including data collection tools, target population, and frequency of data collection.

Participating practices completed the baseline structural assessment during program application from July to December 2019. After completing the enrollment process, practices began collecting and submitting relevant data elements in December 2019, beginning with the baseline MOSOPS surveys completed by eligible staff. The endline structural assessment and MOSOPS were completed at the end of the program from November 2020 to February 2021.

Participating practices were asked to collect antibiotic prescription data via electronic health record (EHR) extraction or hand collection and submit them to the Safety Program Web site for September 2019–November 2020, by downloading the template from the Safety Program Web site and uploading the completed template to the same Web site. September–November 2019 retrospective data were submitted on December 2019, and monthly data during December 2019–November 2020 were to be submitted by the end of the following month (e.g., March 2020 data submitted by April 30, 2020). The submission for data for the ambulatory care cohort lasted until February 2021. **Exhibit 33** displays the percentage of units that completed the Safety Program that submitted monthly antibiotic prescription data.

Analytic Methods

The program evaluation used a pre-post longitudinal study design. The study population included 389 ambulatory care practices nationwide. The unit of analysis is the participating practice. **Exhibit 26** summarizes the analytic methods used for each evaluation domain.

EXHIBIT 26: ANALYTIC METHODS USED FOR EACH EVALUATION DOMAIN

Evaluation Domain	Analytic Method(s)
Adoption of AHRQ Safety Program	We looked at descriptive statistics for antibiotic stewardship–related infrastructure collected from the structural assessment form and used the Chi-square test to compare the difference between baseline and end-of-intervention.
Patient safety culture as measured using MOSOPS	We collected MOSOPS data among participating practices at baseline and end-of-intervention to measure the change in patient safety culture and assess the effectiveness of the Safety Program. We used a linear mixed model with random intercept for ambulatory care practice to examine the change in composite scores for each of the 10 MOSOPS domains from baseline to the end-of-intervention.
Antibiotic use	In addition to MOSOPS data, we also collected monthly antibiotic prescription data to assess the effectiveness of the Safety Program. These data included antibiotic prescription per 100 total visits (overall and by therapeutic class) and antibiotic prescription per 100 acute respiratory infection (ARI) visits (overall, by therapeutic class, and by ARI diagnosis). For monthly tracked measures, negative binomial or linear mixed model with random intercept for ambulatory care practice was used to assess the change from retrospective baseline (i.e., September–November 2019) to each of the quarter during the program period (i.e., December 2019–November 2020) for each measurement. The difference between September–November 2019 and September–November 2020 represented the change from baseline to end-of-intervention. To assess the variation in effectiveness, a stratified analysis was used to examine changes in antibiotic prescription per 100 total visits and per 100 ARI visits over time by practice type. The practice type variable and its interaction with time (i.e., quarter indicator) were included in the mixed model as independent variables in addition to quarterly period indicators.

Results

- **Characteristics of participating practices**

Of the 389 participating practices that completed the Safety Program, 41 percent were primary care practices, and another 41 percent were urgent care centers. The average number of providers for each practice was 14, ranging from 1 to 240. Nearly 60 percent of practices were owned or affiliated with health system or hospital. Three quarters of practices located in urban or suburban areas.

- **Adoption of AHRQ Safety Program**

Practice infrastructure aspects that are related to antibiotic stewardship improved significantly from the beginning to the end of the Safety Program: practices that formally tracked antibiotic prescriptions increased from 21 percent to 76 percent ($p<0.001$); practices that have developed a list of conditions for which antibiotics are discouraged increased from 40 percent to 66 percent ($p<0.001$); and practices that have developed local guidelines for conditions for which antibiotics are commonly prescribed increased from 48 percent to 61 percent ($p<0.001$).

- **Patient safety culture**

From the beginning to the end of the Safety Program, composite scores for all MOSOPS domains improved, with statistically significant improvement in five domains: work pressure and pace increased by 7.1 percentage points (95% confidence interval [CI]: 2.3 to 12, $p=0.005$), owner/managing partner/leadership support for patient safety increased by 5.1 percentage points (95% CI: 1.3 to 8.9, $p=0.009$), communication openness increased by 4.6 percentage points (95% CI: 0.6 to 8.6, $p=0.024$), overall perceptions of patient safety and quality increased by 4.3 percentage points (95% CI: 0.7 to 7.8, $p=0.019$), and communication about error increased by 3.7 percentage points (95% CI: 0.5 to 6.9, $p=0.024$), out of a total 100 percentage points.

- **Antibiotic use**

From the baseline (Sept–Nov 2019) to the endline quarter (Sept-Nov 2020), antibiotic prescriptions per 100 total visits decreased by 8.5 (95% CI: -9.6 to -7.4, $p<0.001$) for the entire cohort. Urgent care practices had the largest reduction at 15.8 prescriptions per 100 total visits (95% CI: -17.3 to -14.3, $p<0.001$). The largest decrease by antibiotic class was penicillins, which declined by 4.2 prescriptions per 100 visits (95% CI: -4.8 to -3.7, $p<0.001$).

Antibiotic prescriptions per 100 ARI visits decreased by 11.6 (95% CI: -13.3 to -9.9, $p<0.001$) for the entire cohort, and 17.2 (95% CI: -20.5 to -14.5, $p<0.001$) for urgent care practices, which had the largest reduction among all types of practices. The largest decrease by antibiotic class was also penicillins, which reduced by 5.5 prescriptions per 100 visits (95% CI: -6.7 to -4.3, $p<0.001$).

3.1 Evaluation Goals

The evaluation of the ambulatory care Cohort sought to answer three major questions:

1. To what extent was the AHRQ Safety Program for Improving Antibiotic Use adopted by participating ambulatory care practices?
2. What is the effectiveness of the Safety Program in the ambulatory care context? What changes in safety culture, antibiotic usage have resulted from the Safety Program?
3. Is there any variation in the effectiveness of the Safety Program (i.e., change in antibiotic usage) by practice type?

To address these questions, the three major data sources the evaluation used were a structural assessment, patient safety culture surveys, and practice-level antibiotic use.

The evaluation used a pre-post longitudinal design to evaluate:

1. Changes in the antibiotic stewardship (AS) infrastructure among the participating sites, assess by responses to Structural Assessment Tool before and after implementation of the program.
2. The effectiveness of the intervention, with monthly practice-level number of antibiotic prescriptions per 100 total visits, and per 100 ARI visits as primary outcomes, and antibiotic prescribing at specific in-person ARI visits (e.g., pneumonia, pharyngitis) and for specific therapeutic classes as the secondary outcomes.

Exhibit 27 presents the evaluation goals, research questions, data sources, and analytic methods used to evaluate the Ambulatory Care Cohort.

EXHIBIT 27: AHRQ SAFETY PROGRAM FOR IMPROVING ANTIBIOTIC USE IN THE AMBULATORY CARE CONTEXT: EVALUATION GOALS/DOMAINS, RESEARCH QUESTIONS, DATA SOURCES, AND ANALYTIC METHODS

Evaluation Domains	Research Questions	Data Sources and Measures	Analytic Methods
Goal 1: Implementation of AHRQ Safety Program for Improving Antibiotic Use	What is the extent to which the AHRQ Safety Program for Improving Antibiotic Use has been adopted by sites participating in the ambulatory cohort?	**Structural Assessment:** The AHRQ Safety Program lead at each practice participating in the ambulatory care cohort completed a five- to seven-question form to collect information on each practice's infrastructure to conduct the program, as well as prior involvement in quality improvement programs.	Descriptive statistics and Chi-squared test to assess change in antibiotic stewardship infrastructure from baseline to end-of-intervention

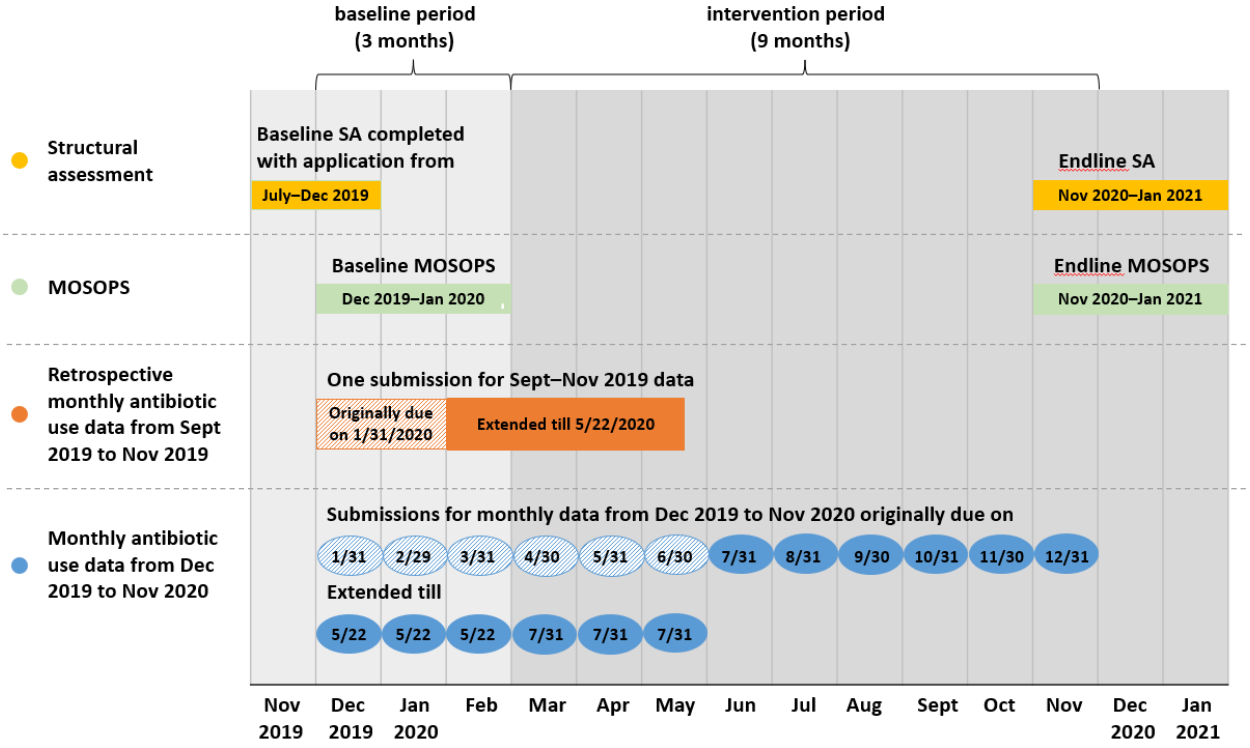
Evaluation Domains	Research Questions	Data Sources and Measures	Analytic Methods
GOAL 2: Effectiveness of the AHRQ Safety Program for Improving Antibiotic Use	(1) What is the effectiveness of the Safety Program for Improving Antibiotic Use in the ambulatory care context? (2) What changes in safety culture, antibiotic usage, and/or clinical outcomes have resulted from the Ambulatory Care Cohort?	**Patient Safety Culture Surveys:** composite scores for each of the 12 domains in AHRQ Medical Office Survey on Patient Safety Culture (MOSOPS)	Linear mixed effect model to assess practice-level change in each of the 10 MOSOPS composite scores from baseline to end-of-intervention
		Electronic health record (EHR) extracts for antibiotic usage for each participating practice (monthly for September 2019 through November 2020)**:** ▪ EHR extracts for number of antibiotics per 100 visits, total ▪ EHR extracts for number of antibiotics per 100 visits with acute respiratory infection (ARI)–related visits, total ▪ EHR extracts for number of antibiotics per 100 visits stratified by therapeutic class ▪ EHR extracts for number of antibiotics per 100 visits with ARI–related visits stratified by therapeutic class ▪ EHR extracts for number of antibiotics per 100 visits with ARI–related visits stratified type of respiratory illness	Generalized linear mixed model (GLMM) or linear mixed model to assess practice-level change in antibiotic usage over time
GOAL 3: Variation in effectiveness of the AHRQ Safety Program for Improving Antibiotic Use	What is the variation in the change in antibiotic usage and other outcomes by selected practice characteristics?	▪ EHR extracts for antibiotic usage data ▪ Practice characteristics from registration information and baseline structural assessment	GLMM or linear mixed effect (LME) model to assess practice-level change in antibiotic use over time by practice characteristics

3.2 Data Collection Timeline

Participating practices completed the baseline Structural Assessment during program application from July to December 2019. After completing the enrollment process, practices began collecting and submitting relevant data elements in December 2019, beginning with the baseline MOSOPS surveys completed by eligible staff. The endline Structural Assessment and MOSOPS were completed at the end

of the program, beginning in November 2020, and through February 2021.[b] Practices also began collecting monthly antibiotic usage and other outcomes in December 2019 and submitted 3 months of retrospective data (Sept–Nov 2019). **Exhibit 28** shows the data collection and submission timelines for the data elements collected during the ambulatory care cohort.

EXHIBIT 28: DATA COLLECTION AND SUBMISSION TIMELINES



3.3 Data Sources

The evaluation employed primary data collection and secondary data sources to meet the research goals. **Exhibit 29** details the evaluation domains, data collection tools, target population, and frequency of data collection. Further details of the data collection tools and data sources are described in the following subsections.

[b] The official deadline for data collection was January 31, 2021, but late submission and resubmissions were still accepted for certain data in February 2021.

EXHIBIT 29: AMBULATORY CARE COHORT EVALUATION DOMAINS AND DATA SOURCES

Evaluation Domain	Data Source/Measurement	Person(s) Responsible for Collection	Frequency of Data Collection
Adoption	Structural Assessment	A member of the antibiotic stewardship program (ASP) at participating sites	Baseline and endline
Effectiveness	Medical Office Survey on Patient Safety Culture (MOSOPS)	All eligible staff from participating practices	Baseline and endline
	Electronic health record (EHR) extracts for number of antibiotics per 100 visits, total	ASP in conjunction with information technology	Monthly from September 2019 to November 2020
	EHR extracts for number of antibiotics per 100 visits with acute respiratory infection (ARI)-related visits, total	ASP in conjunction with information technology	Monthly from September 2019 to November 2020
	EHR extracts for number of antibiotics per 100 visits stratified by therapeutic class	ASP in conjunction with information technology	Monthly from September 2019 to November 2020
	EHR extracts for number of antibiotics per 100 visits with ARI-related visits stratified type of respiratory illness	ASP in conjunction with information technology	Monthly from September 2019 to November 2020
	EHR extracts for number of antibiotics per 100 visits with ARI-related visits stratified by therapeutic class	ASP in conjunction with information technology	Monthly from September 2019 to November 2020
Variation	EHR extracts for antibiotic use with Structural Assessment and program registration data	N/A (no additional data collection)	N/A (no additional data collection)

3.3.1. Structural Assessment

The Ambulatory Care Structural Assessment form consisted of seven questions to understand the practice's infrastructure and capacity to carry out the AHRQ Safety Program for Improving Antibiotic Use. The forms were completed online, via the AHRQ Safety Program Web site. The Structural Assessment form is contained in Appendix A-6.

The Structural Assessment was administered twice—at baseline and again at the endline—to measure the extent to which the program was adopted by the participating practices. The baseline Structural Assessment forms were completed between July and December 2019; the endline forms were completed between November 23, 2020, and January 31, 2021. Of the participating practices that completed the program, 99.7 percent completed the baseline Structural Assessment form[c] and 79 percent of those practices submitted the endline Structural Assessment form.

[c] Baseline Structural Assessment was integrated with program application, so we expected the response rate was 100 percent. One practice joined the program during the program implementation without submitting application data and missed the

3.3.2. MOSOPS

The AHRQ MOSOPS is a widely used, validated survey to assess provider and staff perspectives on safety culture. It contains 38 survey items grouped into 10 composite measures, examining organizational perceptions of 10 domains of safety culture (ranging from communication openness to staff training). The MOSOPS survey asks questions about staff perceptions of patient safety, communication, leadership commitment, staffing, and teamwork. The MOSOPS survey was sent to practice providers and staff twice during the program, once at baseline and again at the endline, to measure changes in safety culture and assess the effectiveness of the program. The baseline MOSOPS was collected between December 9, 2020, and February 28, 2020, and the endline between November 1, 2020, and February 15, 2021.

To accommodate the varying capabilities of the participating practices to administer the MOSOPS within their practice, MOSOPS data for the ambulatory care cohort were collected using two different methods. Each participating practice had two options for MOSOPS data for both baseline and endline MOSOPS:

- **Option A**: Participating practices that had recently administered the MOSOPS survey for other purposes within a 6-month period before the start of the intervention (August 2019–February 2020 for the baseline survey), or within the last 3 months of the Cohort (October–December 2020 for the endline survey), submitted their MOSOPS data file. The previously administered MOSOPS data were accepted if the practice could: (1) provide practice-level summary data with calculated composite scores, or (2) submit the respondent-level data in accordance with the AHRQ MOSOPS Data File Specifications (AHRQ MOSOPS data file specifications). Participating practices were provided with step-by-step instructions for submitting the MOSOPS data files to the program Web site.
- **Option B:** Participating practices that had not administered the MOSOPS within a 6-month period before the start of the Cohort, or who preferred to administer the MOSOPS specifically for the Cohort, were given the option to distribute the MOSOPS survey link directly to their eligible staff. The survey link, which was distributed by one point of contact at the practice, enabled providers and staff members to easily complete the MOSOPS survey on the program Web site.

For the baseline MOSOPS, 6.4 percent of practices selected Option A, and 47.3 percent selected Option B. The remaining practices (46.2 percent) did not select an option or opted out for baseline MOSOPS. For the endline MOSOPS, 2.3 percent of practices selected Option A, and 21.3 percent selected Option B. The remaining practices (76.3 percent) did not select an option or opted-out for endline MOSOPS. **Exhibit 30** displays the response rates for each baseline and endline MOSOPS option for those practices that completed the program. The overall rate for practices that either uploaded MOSOPS data via Option A tool or had a least 1 response via Option B tool was 49 percent at baseline and 46 percent at endline.

baseline structural assessment. The response rate for baseline Structural Assessment was calculated as 99.7 percent (388 out of 389 practices).

EXHIBIT 30: BASELINE AND ENDLINE MOSOPS SELECTIONS BY PRACTICES AND RESPONSE RATES

MOSOPS Options	Number (%) of Practices Selected for Baseline Survey	Number (%) of Practices Submitted Baseline Data	Number (%) of Practices Selected for Endline Survey	Number (%) of Practices Submitted Endline Data
Option A	25 (6.4%)	6 (24.0%)*	9 (2.3%)	8 (88.9%)*
Option B	184 (47.3%)	146 (79.4%)†	83 (21.3%)	66 (79.5%)†
Did not select an option	169 (43.4%)	39 (23.1%)‡	181 (46.5%)	46 (25.4%)‡
Opt-out	11 (2.8%)	1 (9.1%)¶	116 (29.8%)	2 (1.7%)¶
Total	389 (100%)	192 (49.4%)§	389 (100%)	202 (46.0%)§

* Calculated as number of practices that submitted MOSOPS data (i.e., either uploaded data file via option A tool or had at least 1 response via option B tool) divided by number that selected Option A.
† Calculated as number of practices that submitted MOSOPS data divided by number that selected Option B.
‡ Calculated as number of practices that submitted MOSOPS data divided by number that did not select an option.
¶ Calculated as number of practices that submitted MOSOPS data divided by number that opted-out for the survey.
§ Calculated as number of practices that submitted MOSOPS data by total number of practices that completed the program.

3.3.3. Antibiotic Use

To evaluate the effectiveness of the program to change antibiotic use, participating practices were asked to extract, compile, and submit antibiotic usage data, including measures for antibiotic prescription overall and for ARI-related visits. Data were extracted from EHR systems or through clinical chart review and entered into standardized Excel-based templates developed by the program, which were then uploaded onto the Safety Program Web site. The template for the monthly antibiotic use is contained in Appendix A-7.1 (original version) and Appendix A-7.2 (modified version since the COVID-19 pandemic). To facilitate accurate and in-time data extraction, the program provided participating sites the template and instructions for their EHR extracts (e.g., National Drug Codes for selected antibiotics). **Exhibit 31** details the measurements and their definition that were collected in the monthly template.

EXHIBIT 31: MONTHLY EHR DATA ELEMENTS

Data	Description
Number of antibiotic prescriptions per 100 visits, total and stratified by therapeutic class	An antibiotic prescription is defined as any amount of an antibiotic prescribed to a patient in a single calendar day. Each drug is counted independently. Total visits are defined as aggregate number of patient visits in the practice.
Number of antibiotic prescriptions per 100 acute respiratory infection (ARI)-related visits, total, stratified by therapeutic class and by ARI diagnosis	An antibiotic prescription during ARI-related visit is defined as any amount of an antibiotic prescribed to a patient with ARI diagnosis in a single calendar day. Each drug is counted independently. Each visit and prescription are only counted once based on antibiotic appropriateness. Total ARI-related visits are defined as aggregate number of patient visits for patients with ARI diagnosis in the practice. Visits for specific ARI diagnosis are defined as aggregate number of patient visits for patients with specific ARI diagnosis based on antibiotic appropriateness in the practice.

Participating practices were asked to submit data to the program Web site on a monthly basis during the cohort (December 2019–November 2020), by downloading the template from the program Web site

and uploading the completed template to the Safety Program Web site. Practices were also asked to submit retrospective data for 3-month period prior to the cohort started (September–November 2019). Data for each month were to be submitted by the last day of following month, e.g., April 30 for March data. The 3-month retrospective data submission were to be submitted by the first month of program (i.e., December 2019).

We used multiple strategies to mitigate data collection burden and increase response rates (i.e., reduce missing responses).

1) For the MOSOPS, we allowed practices who already collected MOSOPS data within the eligible timeframe to submit the same data for the Safety Program.
2) Data submission templates for monthly antibiotic use were simplified to ensure that we collected only the minimum necessary data.
3) Johns Hopkins Medicine/NORC at the University of Chicago (JHM/NORC) organized a series of EHR "workgroups" to help sites that were struggling with EHR data extraction. The program team organized these sessions by platform and included a brief presentation on how to pull the data, specifics by business reporting software program, the tables and joins involved, and the data collection template. Sessions also included time for Q&A and sharing helpful best practices across sites. The program team posted these recorded sessions on the program website and distributed these to the applicable sites for reference. See **Exhibit 32** for a summary of the EHR workgroup sessions.
4) Throughout the implementation we proactively monitored data quality issues and quickly identified participating practices with outstanding data issues. In collaboration with the Implementation Advisers we reached out to those practices and corrected data issues in a timely manner.
5) Finally, participating practices were encouraged to communicate any questions regarding data collection to the program, and we developed and continuously updated data collection FAQs to answer those questions.

EXHIBIT 32: TOTAL ATTENDANCE AT EHR WORKGROUPS BY PLATFORM

Platform	Number of Sessions	Number of Attendees
eCW	2	25
AllScripts	1	4
Epic	2	57
Cerner	2	23
NextGen	2	13
Athena	1	3

3.4 Data Analysis Methods

3.4.1. Summary of Analysis

Data submissions were assessed for quality and usability in our analysis. **Exhibit 33** summarizes the number of practices with any data submissions and the number of practices that contributed to the final analytic dataset for each tool/measurement.

EXHIBIT 33: SUMMARY OF PRACTICES WITH DATA SUBMISSIONS AND CONTRIBUTING TO FINAL ANALYTIC DATASET

Data Submission Type	Number of Practices with Data Submissions	% of Practices with Data Submissions	Number of Practices that Contributed to Final Analysis	% of Practices that Contributed to Final Analysis
Total cohort	389	100%	-	-
Structural Assessment, baseline & endline	308	79.2%	308	83.6%
Structural Assessment, baseline	388	99.7%	388	100%
Structural Assessment, endline	308	79.2%	308	83.6%
MOSOPS, baseline & endline	97	24.9%	58	14.9%
MOSOPS, baseline	192	49.4%	157	40.4%
MOSOPS, endline	122	31.4%	67	17.2%
Antibiotic usage data, any month	351	90.2%	292	75.1%

The program evaluation used a pre-post longitudinal study design. We first described characteristics of participating practices, including the number of healthcare practitioners (doctors, nurse practitioners, physician assistants), practice type, affiliation/ownership, use of EHR to track antibiotic use, and geographic location. To evaluate the adoption of the program among participating units, practice AS infrastructure change was assessed from the baseline period to the endline as measured by the Structural Assessment.

To evaluate the effectiveness of the program, linear mixed effect models were used to assess the change in composite scores for patient safety culture from MOSOPS; generalized linear or linear mixed models were employed to examine change over time for antibiotic usage outcomes. Antibiotic use over time for selected antibiotic classes and for selected ARI diagnosis were examined for the entire cohort as well.

We used modified Park test[7], histograms, and residual plots to decide the distribution assumption for each outcome,[d] and assumed Gaussian distribution for all antibiotic use outcomes, except for total number of antibiotic prescriptions per 100 visits, for which we assumed negative binomial distribution. A generalized linear mixed model was specified as:

[d] When the modified Park test indicated a Poisson distribution, the dispersion parameter was further examined to choose between Poisson and negative binomial distributions.

$$g\big(E(Y_{it})\big) = X\beta = \beta_0 + r_{0i} + \beta_1 Time_{it}$$

In the specification, i indexes the practice, t indexes the time for the measurement, Y_{it} is the outcome for the practice i at time t—for example, MOSOPS composite score at baseline, or total antibiotic prescription per 100 visits in a given month. In addition, β_0 represents the expected value of Y when time is zero (i.e., baseline). β_1 is a vector and represents the average rate at which $X\beta$ changes from baseline to followup time point in the population. r_{0i} is the random intercept, which captures practice differences in the level of $X\beta$ at baseline. In a generalized linear model for all EHR-based outcomes, the outcome $E(Y)$ is linked with the linear predictor $X\beta$ by: $E(Y) = g^{-1}(X\beta)$, where $g(.)$ is the log link function.

We did not impute missing data. Instead, we excluded practices from our analysis if they presented too many missing values. For the rest of the unbalanced data, we assumed a missing at random pattern,[e] which would not bias the results in mixed models.[8] Another advantage of mixed models is that they incorporate heterogeneity across practices via practice-level random effects.[f] A two-sided p-value of less than 0.05 was considered a statistically significant finding.

To evaluate the variation of the effectiveness, stratified analyses were performed to examine the change in antibiotic use by practice type including federally supported practices (i.e., Federally Qualified Health Centers, Indian Health Service, Department of Defense practices), primary care practices, urgent care practices, and other (e.g., other specialty care and multispecialty). Among primary care and urgent care practices, we further stratified by pediatric only and general practices (i.e., not only serving pediatric patients).

Finally, sensitivity analyses that included practices submitted usable data for all 12 months for antibiotic prescription per 100 visits and per 100 visits with ARI diagnosis were performed for the entire cohort and by subgroups, using same modeling approach as the base analyses.

3.4.2. Structural Assessment

We compared the AS infrastructure among the participating practices at baseline and end of intervention, and then conducted a Chi-squared test to examine the differences in selected items between baseline and endline.

[e] Missing at random (MAR) denotes units with missing data that are not a random subset of the sample, but their missingness is unrelated to the specific missing values that should have been observed. Compared with missing completely at random (MCAR, which assumes that missing data is a completely random subset of the sample), we think MAR is a more tenable assumption because more practices had missing data in later months than earlier months.

[f] Specifically, in addition to the population-averaged (or fixed) intercept, we allowed each practice to have its own random intercept, where this random component follows a normal distribution. The slope coefficients, however, are fixed (i.e., not random), so practices can start from different baseline levels but will have parallel outcome trajectories over the intervention period.

3.4.3. MOSOPS

The AHRQ MOSOPS is a widely used, validated survey to assess provider and staff perspectives on safety culture. It contains 38 survey items grouped into 10 composite measures, examining organizational perceptions of 10 domains of safety culture (ranging from communication openness to staff training). The MOSOPS survey asks questions about staff perceptions of patient safety, communication, leadership commitment, staffing, and teamwork. MOSOPS data were collected at baseline (or within a 6-month period prior to program implementation) and endline to measure average provider and staff perspectives of patient safety culture in the practice. For practices that submitted previously collected MOSOPS data, we excluded practices whose data were collected prior to six months of the program baseline (i.e., allowable date period was from August 2019 to February 2020) for baseline MOSOPS, or prior to 3 months of the program endline (i.e., allowable date period was from October to December 2020) for endline MOSOPS. For practices whose staff completed the online MOSOPS survey, when there were at least five respondents for the unit, responses were rolled up to the unit level to create composite scores.[9]

Linear mixed models were used to examine the change of each composite score from baseline to endline. A sensitivity analysis was performed that tested the results of the model only for practices that submitted data for both time points.

3.4.4. Antibiotic Use

JHM/NORC reviewed a comprehensive list of antibiotics currently available in the National Healthcare Safety Network Antimicrobial Use module and selected 39 antibiotics that were likely to be administered in ambulatory care practices. The team selected all antibiotics anticipated to be administered orally to ambulatory care patients in the United States. Monthly antibiotic use data was requested for the 39 selected agents from all participating sites. Patient visits, antibiotic prescription for each of the antibiotics, ARI visits, and antibiotic prescription during ARI visits were extracted and reported by participating practices on a monthly basis.

The primary outcomes measured were: change in antibiotic prescription per 100 visits, and change in antibiotic prescription per 100 ARI related visits between September–November 2019 and each of the subsequent quarter (i.e. 3-month intervals, not the calendar quarter) from December 2019 to November 2020.

The change in antibiotic use from September–November 2019 to September–November 2020 among practices reflected changes in antibiotic use from the beginning to the end of the Safety Program. The comparison between the first and last quarter is of particular interest for two major reasons. The primary reason is that these time periods allow for comparison of the beginning and end of the formal Safety Program. Another reason is that comparing these two periods automatically take the seasonality in antibiotic use into account.

Data with invalid values (i.e., inconsistent sum of antibiotic prescription during ARI-related visits when breaking down by ARI diagnosis and breaking down antibiotic classes) were excluded. Practices were

excluded if they provided less than 8 months of data (i.e., less than half of the data points), and/or missed more than two months of data for September–November 2019 (i.e., baseline) data, and/or missed all data for September–November 2020 (i.e., endline) data from July to December (i.e., second half of the program period). Appendix B-2.1 presents the restrictions applied to antibiotic usage data in order to obtain the final sample that contributed to the analysis.

Linear mixed models with random practice effect were used to examine changes in total antibiotic use over time (generalized linear mixed model assuming negative binomial distribution was used for total antibiotic prescription per 100 visits). For total antibiotic use and antibiotic prescription during ARI related visits, we also performed analysis stratified by practice type, and estimated the change over time for each stratum as well.

In addition to total antibiotic use, changes in antibiotic use by antibiotic classes over time were also examined for the entire cohort using same modeling approach. **Exhibit 34** details the list of antibiotics for the antibiotic classes.

EXHIBIT 34: SELECTED ANTIBIOTIC CLASSES

Antibiotic Class	Antibiotics
Penicillins	Amoxicillin, amoxicillin-clavulanate, ampicillin, dicloxacillin, penicillin V
Macrolides	Azithromycin, clarithromycin, erythromycin
Cephalosporins	Cefadroxil, cephalexin, cefaclor, cefprozil, cefuroxime, cefdinir, cefditoren, cefixime, cefpodoxime, ceftibuten
Fluoroquinolones	Ciprofloxacin, delafloxacin, levofloxacin, moxifloxacin, ofloxacin
Other antibiotics	Clindamycin, doxycycline, fosfomycin, clindamycin, linezolid, metronidazole, minocycline, nitrofurantoin, omadacycline, rifampin, sulfadiazine, trimethoprim-sulfamethoxazole, tedizolid, tetracycline, trimethoprim, vancomycin

A sensitivity analysis including practices with all 15 months of usable data was performed for each outcome. Lastly, we performed interrupted time series (ITS) analysis with panel data for the two primary outcomes (i.e., antibiotic prescriptions per 100 total visits and antibiotic prescriptions per 100 ARI visits). Due to the limited number of data points for pre-intervention period (n=6 for our analysis), the results from the ITS analysis should be interpreted with caution. (**Appendix B-3**.)

3.5 Results

The sections below describe findings in evaluating the adoption and effectiveness of the Safety Program in the context of the Ambulatory Care Cohort beginning with characteristics of participating practices, followed by a structural assessment to assess adoption of the program, MOSOPS to assess the change in staff perspectives of safety culture, and monthly antibiotic prescription overall and during visits with ARI diagnosis to assess the change in antibiotic usage over time.

3.5.1. Characteristics of Participating Practices

Of the 389 participating practices that completed the Safety Program, 41 percent were primary care practices including 6 percent pediatric practices, and another 41 percent were urgent care centers including 10 percent serving pediatric population only. The rest of participating practices were federally supported practices (13 percent), other types such as student health and multispecialty practices. The number of providers (including medical doctors, nurse practitioners, and physician assistants) was 14 on average, ranging from 1 to 240. Fifty-eight percent of the participating practices were owned or affiliated by health systems or hospitals, and 23 percent were owned by physicians. One quarter of practices were in urban areas and half were in suburban areas. Sixty-one percent of participating practices used EHR to track antibiotic use at baseline. **Exhibit 35** shows selected characteristics for these practices.

EXHIBIT 35: PRACTICE CHARACTERISTICS FOR PARTICIPATING PRACTICES (TOTAL N=389)

Characteristics (N=389 in total)	Category	# Participating Practices (%)
Practice type	Primary care excluding pediatric practices	139 (35.7%)
	Pediatric practices	23 (5.9%)
	Urgent care centers excluding pediatric urgent care	120 (30.8%)
	Pediatric urgent care centers	40 (10.3%)
	Federally supported practices including Federally Qualified Health Centers, Indian Health Service, and Department of Defense practices	49 (12.6%)
	Other practices including student health and other specialty or multispecialty	18 (4.6%)
Provider count	Mean number of providers (standard deviation), range	14.1 (22.6), 1-240
	1 provider (solo practice)	9 (2.3%)
	2–5 providers	133 (34.2%)
	6–10 providers	118 (30.3%)
	11–30 providers	88 (22.6%)
	31 or more providers	41 (10.5%)
Affiliation and ownership	Health system owned	68 (17.8%)
	Health system affiliated	82 (21.1%)
	Hospital affiliated	73 (18.8%)
	Physician owned	91 (23.4%)
	Academic affiliated	13 (3.3%)
	None	62 (15.9%)
Experience with pulling data from electronic health record for antibiotic use	Yes	236 (60.7%)
	No	153 (39.3%)

Characteristics (N=389 in total)	Category	# Participating Practices (%)
Geographic location	Urban	93 (23.9%)
	Suburban	193 (49.6%)
	Rural	103 (26.5%)

Compared with practices who completed the Safety Program, the 17 percent (n=78) of practices which withdrew from the Safety Program were more likely to be urgent care practices, owned or affiliated with a health system or hospital, or were more likely to report having experience pulling EHR data for antibiotic use at baseline. These risk factors were likely related. More specifically, 58 percent of practices that withdrew were urgent care practices.

3.5.2. Structural Assessment

The Structural Assessment consisted of seven questions to understand the general infrastructure, local stewardship practices (if any), and experience with quality improvement initiatives at each participating practice, and how responses changed over the course of the Safety Program.

A total of 388 participating practices that completed the Safety program responded to the baseline assessment, but only 308 (79 percent) responded to the endline assessment. Compared with practices completing the endline assessment, practices who did not complete the endline assessment were more likely to be non-urgent care practices (response rate 75%, p=0.009), in rural areas (70%, p=0.007), owned or affiliated by health system or hospital (69%, p<0.001), have no experience in pulling EHR data for antibiotic use before the program (71%, p<0.001).

At the beginning of the Safety Program, only 21 percent of participating practices formally tracked antibiotic prescriptions, and this percentage increased to 76 percent at the end of intervention. Similarly, practices that had developed a list of conditions for which antibiotics are discouraged changed from 40 percent at baseline to 66 percent at the end of intervention; practices that had developed local guidelines for conditions for which antibiotics are commonly prescribed changed from 48 percent to 61 percent. **Exhibit 36** presents infrastructure characteristics related to antibiotic stewardship and quality improvement for participating practices at baseline and endline.

EXHIBIT 36: INFRASTRUCTURE CHARACTERISTICS FOR PARTICIPATING AMBULATORY CARE PRACTICES AT BASELINE AND ENDLINE

Assessed Items	Baseline (N=388)	Endline (N=308)	p-value
Having regular meetings	93.8	98.4	0.003
Experience with team-based approach for quality improvement initiatives	37.4	42.3	0.187
Developing local guidelines for conditions for which antibiotics are commonly prescribed	47.9	60.7	<0.001

Assessed Items	Baseline (N=388)	Endline (N=308)	p-value
Developing a list of conditions for which antibiotics are discouraged	39.8	66.0	<0.001
Formally tracking antibiotic prescriptions	20.9	75.7	<0.001
Patient satisfaction score impacting provider compensation	44.7	59.0	<0.001
Reporting quality measures to monitor health care quality	80.8	79.2	0.607

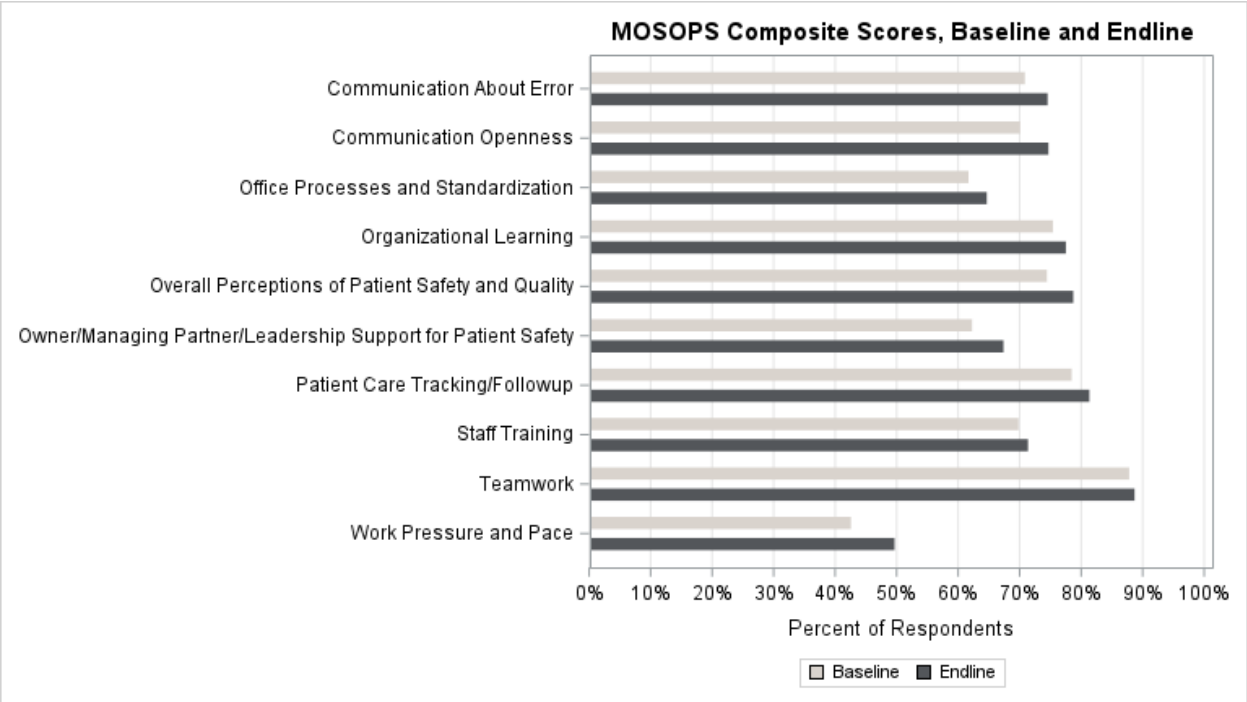
3.5.3. MOSOPS

Our analysis included MOSOPS data from participating practices, unless these practices (1) previously collected MOSOPS data were not collected during the designated time period for this project (i.e., August 2019–February 2020 for the baseline survey, and October–December 2020 for the endline survey), or (2) had fewer than five individuals responding to the survey.

The analysis included 157 practices for baseline MOSOPS and 67 practices for endline MOSOPS with usable data. Among them, 58 practices responded to both baseline and endline MOSOPS. At baseline, primary care and federally supported practices ($p<0.001$), practices that were owned or affiliated by health system or hospital ($p<0.001$), and practices without experience pulling EHR data for antibiotic use ($p=0.001$) had a higher likelihood of submitting MOSOPS data compared with their counterparts respectively. Although this last factor appears counterintuitive, a large portion of urgent care practices that had a centralized approach to extracting EHR data opted out of submitting MOSOPS data. Among the 157 practices that submitted MOSOPS data, those who submitted endline data had no difference in practice characteristics compared with those who did not submit data.

At baseline, teamwork received the highest composite score (88 percent), followed by patient care tracking/followup (78 percent), and organizational learning (75 percent). The dimension that received the lowest composite score was work pressure and pace (42 percent). Other dimensions received composite scores between 60 percent and 75 percent. After program implementation, all composite scores increased from baseline, with statistically significant improvements in five domains, including: work pressure and pace (improved by 7.1 percentage points, 95% CI: 2.3 to 12, $p=0.005$), owner/managing partner/leadership support for patient safety (improved by 5.1 percentage points, 95% CI: 1.3 to 8.9, $p=0.009$), communication openness (improved by 4.6 percentage points, 95% CI: 0.6 to 8.6, $p=0.024$), overall perceptions of patient safety and quality (improved by 4.3 percentage points, 95% CI: 0.7 to 7.8, $p=0.019$), and communication about error (improved by 3.7 percentage points, 95% CI: 0.5 to 6.9, $p=0.024$). **Exhibit 37** displays the MOSOPS composite scores for each domain at baseline and endline.

EXHIBIT 37: MOSOPS COMPOSITE SCORES FOR PARTICIPATING PRACTICES BEFORE AND AFTER THE PROGRAM



Sensitivity analysis (Appendix B-1) including only ambulatory care practices that submitted both usable baseline and endline data (n=58) showed a similar pattern of MOSOPS composite scores before and after the program, with statistically significant improvements in the same five domains.

3.5.4. Antibiotic Use

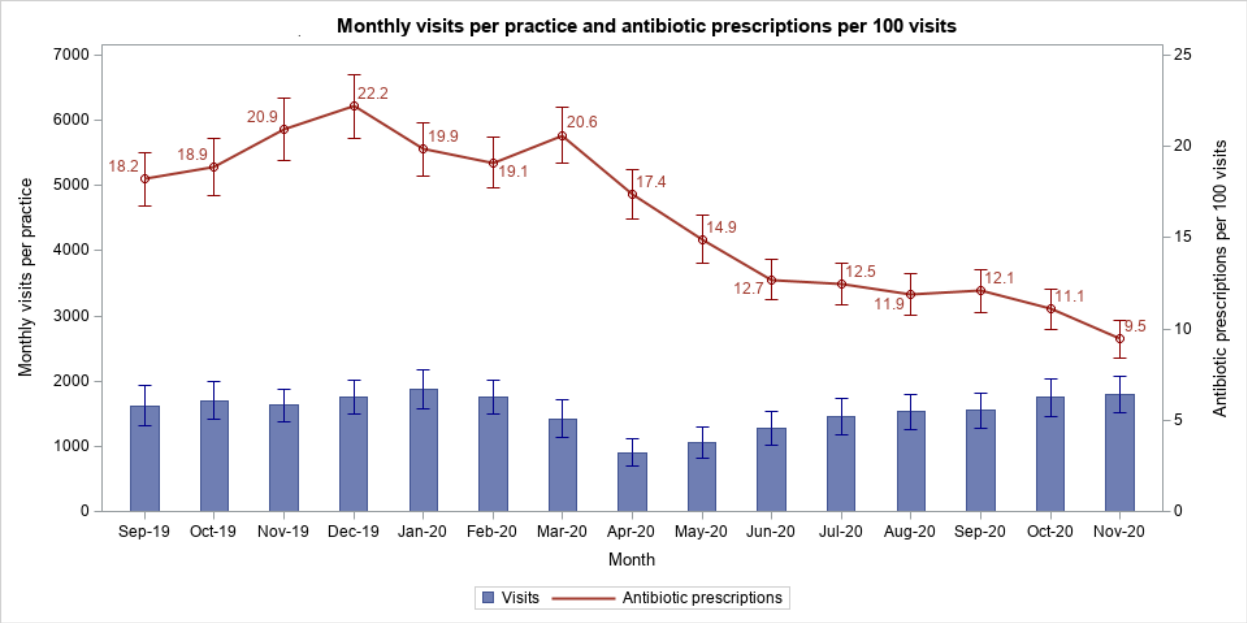
We included 292 practices that submitted adequate and valid data for antibiotic use analysis. We examined the changes in antibiotic prescriptions per 100 visits and per 100 ARI visits from retrospective baseline quarter (Sept–Nov 2019) to every quarter of the program period (Dec 2019–Nov 2020) for the entire cohort and for each practice type, with primary comparisons between the baseline quarter (Sept–Nov 2019) and endline quarter (Sept–Nov 2020). Antibiotic prescriptions for selected antibiotic classes and for each ARI diagnosis were also assessed for the entire cohort.

Antibiotic Prescriptions per 100 Total Visits

We examined the changes in total antibiotic prescriptions per 100 total visits over time for the entire cohort, for each practice type, and for selected antibiotic class. Total number of antibiotic prescriptions and total number of visits were the numerator and denominator, respectively. We found that the average number of total visits dropped in March and April 2020, then returned to baseline numbers at the end of intervention, reflecting the impact of COVID-19 epidemic on the pattern in seeking and accessing to ambulatory care. **Exhibit 38** presents the average monthly visits and antibiotic prescriptions per 100 visits for the retrospective baseline and program period.

Change in antibiotic prescriptions per 100 total visits for the entire cohort. For the entire cohort, antibiotic prescriptions per 100 total visits decreased by 8.5 (95% CI: -9.6 to -7.4, p<0.001) from 19.3 at baseline (Sept–Nov 2019) to 10.9 at endline (Sept–Nov 2020).

EXHIBIT 38: MONTHLY VISITS PER PRACTICE AND ANTIBIOTIC PRESCRIPTIONS PER 100 VISITS



Change in antibiotic prescriptions per 100 total visits by practice type. From baseline (Sept–Nov 2019) to endline (Sept–Nov 2020), the reduction in antibiotic prescriptions per 100 visits was found largest in urgent care centers (-15.8, 95% CI: -17.3 to -14.3, p<0.001), followed by pediatric practices (-5.4, 95% CI: -7.9 to -3, p<0.001), federally support practices (-1.9, 95% CI: -3.5 to -0.32, p=0.018), and primary care practices (-1.8, 95% CI: -2.5 to -1, p<0.001). **Exhibit 39** presents the monthly antibiotic prescription per 100 total visits by practice type and **Exhibit 40** summarizes the change in antibiotic prescriptions per 100 total visits from baseline by each quarter during the program period (December 2019–November 2020) for the entire cohort and each practice type.

EXHIBIT 39: MONTHLY ANTIBIOTIC PRESCRIPTIONS PER 100 TOTAL VISITS BY PRACTICE TYPE

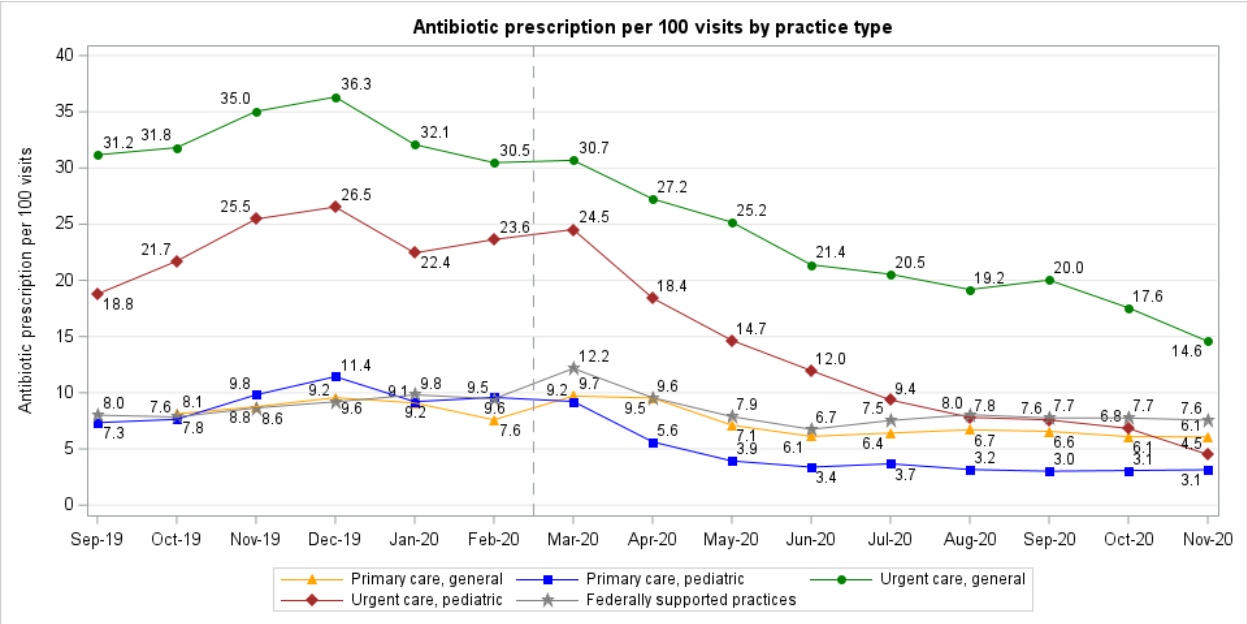


EXHIBIT 40: CHANGE IN ANTIBIOTIC PRESCRIPTIONS PER 100 TOTAL VISITS FROM BASELINE (SEPT–NOV 2019)

Practice Type	N	Dec 2019–Feb 2020	Mar–May 2020	June–Aug 2020	Sept–Nov 2020
Entire cohort	291	1.1 (0.71, 1.4) ‡	-1.7 (-2.5, -0.88) ‡	-7 (-8.0, -6) ‡	-8.5 (-9.6, -7.4) ‡
Primary care practice	103	1.0 (0.61, 1.3) ‡	0.17 (-0.71, 1.1)	-2.2 (-3.1, -1.3) ‡	-2.6 (-3.4, -1.8) ‡
General	82	0.67 (0.35, 1) ‡	0.77 (-0.21, 1.7)	-1.4 (-2.3, -0.48) †	-1.8 (-2.5, -1) ‡
Pediatric	21	1.9 (0.94, 2.9) ‡	-2.1 (-3.8, -0.38) *	-5.2 (-7.7, -2.6) ‡	-5.4 (-7.9, -3) ‡
Federally supported practice	34	1.4 (0.67, 2.1) ‡	1.2 (-0.37, 2.7)	-2.8 (-4.4, -1.2) ‡	-1.9 (-3.5, -0.32) *
Urgent care center	141	0.84 (0.16, 1.5) *	-4.6 (-5.7, -3.6) ‡	-12.7 (-14.1, -11.4) ‡	-15.8 (-17.3, -14.3) ‡
General	102	0.17 (-0.72, 1.1)	-5.3 (-6.7, -3.8) ‡	-12.5 (-14.3, -10.6) ‡	-15.4 (-17.4, -13.3) ‡
Pediatric	39	2.2 (1.3, 3) ‡	-3 (-4, -2.1) ‡	-12.6 (-13.7, -11.5) ‡	-16 (-17.3, -14.6) ‡
Other type	13	-1 (-2.2, 0.22)	1.3 (-5.0, 7.6)	0.21 (-7.5, 7.9)	0.1 (-6.9, 7.1)

Note: 291 practices with 4,235 practice-months contributed to this analysis. A negative binomial mixed model with random intercept of practice was used to generate the estimate. The entire cohort model includes quarter as the independent variable; the model by practice type includes quarter, practice type, and their interaction terms as the independent variables. Pediatric practices and pediatric urgent care centers provide care only to pediatric population (infants, children, and adolescents); and the rest of practices providing primary care and urgent care are in the "general" category. Federally supported practices include Federally Qualified Health Centers, Indian Health Service practices, and Department of Defense practices. Other type includes student health, and specialty or multispecialty care.
* denotes p-value<0.05; † denotes p-value<0.01; ‡ denotes p-value<0.001.

In the sensitivity analysis that included 233 practices with all 12 months usable data (Appendix B-2.2), total antibiotic prescriptions per 100 visits reduced by 9.32 (95% CI: -10.6 to -8.06, p<0.001) from baseline to endline. Urgent care practices also showed the largest reduction in total antibiotic prescription per 100 visits (-15.8, 95% CI: -17.4 to -14.2, p<0.001), followed by pediatric practices (-5.2, 95% CI: -7.6 to -2.7, p<0.001), and primary care practices (-2.1, 95% CI: -3.0 to -1.2, p<0.001).

Change in antibiotic prescriptions per 100 total visits for selected antibiotic classes. From baseline (Sept–Nov 2019) to endline (Sept–Nov 2020), antibiotic prescriptions per 100 total visits dropped 4.2 for penicillins (95% CI: -4.8 to -3.7, p<0.001), 1.0 for macrolides (95% CI: -1.2 to -0.8, p<0.001), 0.8 for cephalosporins (95% CI: -1.0 to -0.6, p<0.001), and 0.1 for fluroquinolones (95% CI: -0.2 to -0.06, p<0.001). **Exhibit 41** presents the monthly antibiotic prescriptions per 100 total visits for selected antibiotic classes and **Exhibit 42** summarizes change from the retrospective baseline to each quarter for the program period.

Sensitivity analysis (Appendix B-2.3) also showed significant reductions in antibiotic prescription per 100 total visits for all selected antibiotic classes from baseline (Sept–Nov 2019) to endline (Sept–Nov 2020), where penicillins use had the largest reduction of 4.6 per 100 visits (95% CI: -5.2 to -3.9, p<0.001).

EXHIBIT 41: MONTHLY ANTIBIOTIC PRESCRIPTIONS PER 100 TOTAL VISITS BY ANTIBIOTIC CLASS

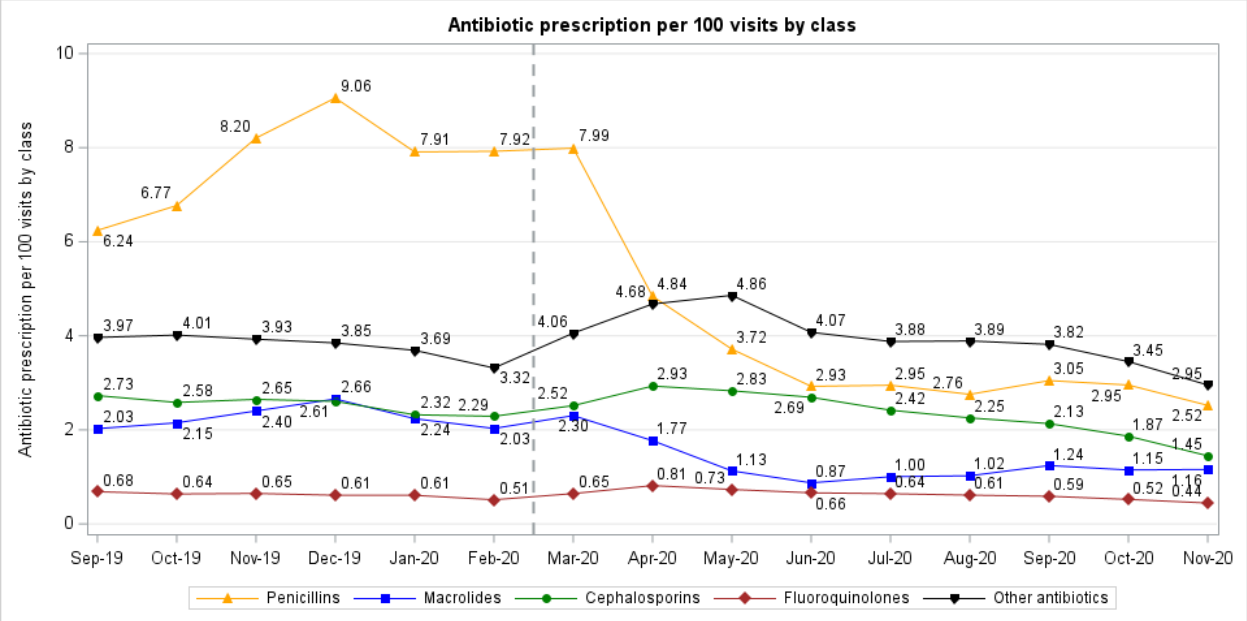


EXHIBIT 42: CHANGE IN ANTIBIOTIC PRESCRIPTIONS PER 100 TOTAL VISITS BY ANTIBIOTIC CLASS

Antibiotic Class	Dec 2019–Feb 2020	Mar–May 2020	June–Aug 2020	Sept–Nov 2020
Penicillins	1.22 (1, 1.45) ‡	-1.54 (-1.88, -1.2) ‡	-4.2 (-4.72, -3.68) ‡	-4.23 (-4.79, -3.67) ‡
Macrolides	0.12 (0.01, 0.22) *	-0.45 (-0.66, -0.25) ‡	-1.23 (-1.42, -1.03) ‡	-1.01 (-1.2, -0.82) ‡
Cephalosporins	-0.25 (-0.36, -0.14) ‡	0.1 (-0.04, 0.24)	-0.2 (-0.37, -0.03) *	-0.84 (-1.03, -0.64) ‡
Fluoroquinolones	-0.08 (-0.13, -0.03) †	0.07 (-0.01, 0.16)	-0.02 (-0.11, 0.07)	-0.14 (-0.22, -0.06) ‡
Other antibiotics	-0.35 (-0.5, -0.2) ‡	0.56 (0.18, 0.93) †	-0.02 (-0.43, 0.39)	-0.56 (-1, -0.13) *

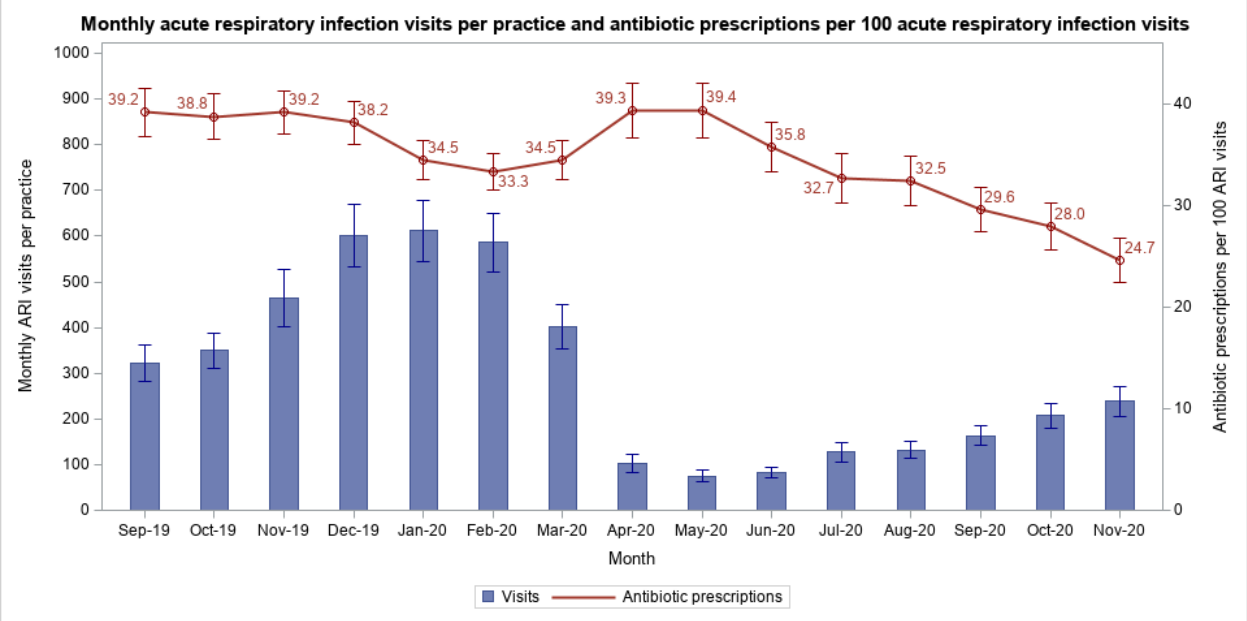
Note: 291 practices with 4,235 practice-months contributed to the antibiotic class analysis. Linear mixed model with random intercept of practice was used to generate the estimate; quarter was the independent variable.
* denotes p-value<0.05; † denotes p-value<0.01; ‡ denotes p-value<0.001.

Antibiotic Prescriptions per 100 Acute Respiratory Infection Visits

We examined the changes in total antibiotic prescriptions per 100 ARI visits over time for the entire cohort, for each practice type, and for selected antibiotic class. Total number of antibiotic prescriptions for visits with ARI diagnosis was the numerator and total number of visits with ARI diagnosis was the denominator. We found that average number of ARI visits increased starting in November 2019, dropped in March–May 2020, then again increased, but still below the baseline numbers at the end of intervention, reflecting the peak season of ARI visits in winter and the impact of COVID-19 epidemic. **Exhibit 43** presents the average monthly ARI visits and antibiotic prescriptions per 100 ARI visits for the retrospective baseline and program period.

Change in antibiotic prescriptions per 100 ARI visits for the entire cohort. For the entire cohort, antibiotic prescriptions per 100 ARI visits decreased by 11.6 (95% CI: -13.3 to -9.9, p<0.001) from 39.0 at baseline (Sept–Nov 2019) to 27.4 at endline (Sept–Nov 2020) (**Exhibit 44**).

EXHIBIT 43: MONTHLY ARI VISITS PER PRACTICE AND ANTIBIOTIC PRESCRIPTIONS PER 100 ARI VISITS



Change in antibiotic prescriptions per 100 ARI visits by practice type. From baseline (Sept–Nov 2019) to endline (Sept–Nov 2020), the reduction in antibiotic prescriptions per 100 visits was found largest in urgent care centers (-17.2, 95% CI: -19.4 to -14.9, p<0.001), followed by general primary care practices (-8.4, 95% CI: -11.1 to -5.7, p<0.001), and other types of practices (-7.7, 95% CI: -15.1 to -0.35, p=0.040). **Exhibit 4** presents the monthly antibiotic prescription per 100 ARI visits by practice type and **Exhibit 45** summarizes the change in antibiotic prescriptions per 100 ARI visits from baseline by each quarter during the program period for the entire cohort and each practice type.

EXHIBIT 44: MONTHLY ANTIBIOTIC PRESCRIPTIONS PER 100 ARI VISITS BY PRACTICE TYPE

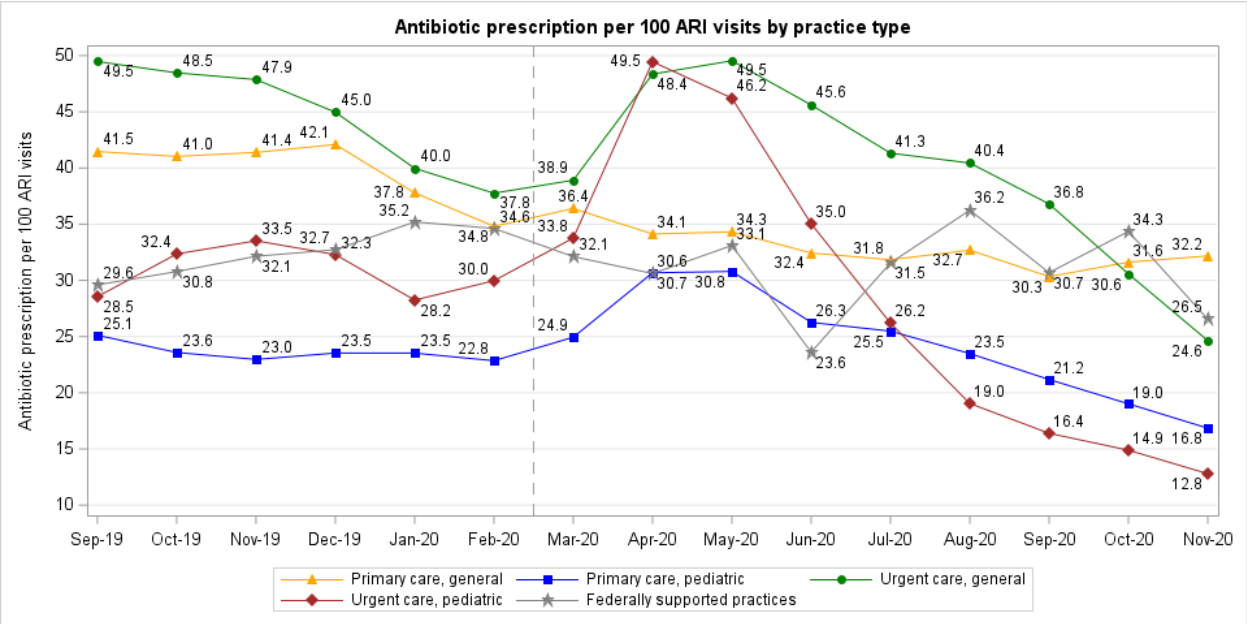


EXHIBIT 45: CHANGE IN ANTIBIOTIC PRESCRIPTIONS PER 100 ARI VISITS FROM BASELINE (SEPT–NOV 2019)

Practice type	N	Dec 2019–Feb 2020	Mar–May 2020	June–Aug 2020	Sept–Nov 2020
Entire cohort	292	-3.7 (-4.6, -2.8) ‡	-1.3 (-2.8, 0.1)	-5.4 (-7.1, -3.7) ‡	-11.6 (-13.3, -9.9) ‡
Primary care practice	103	-2.8 (-4.1, -1.4) ‡	-4 (-6.2, -1.9) ‡	-6.9 (-9.3, -4.4) ‡	-7.9 (-10.5, -5.4) ‡
General	82	-3.3 (-4.9, -1.7) ‡	-6.9 (-8.8, -4.9) ‡	-8.7 (-11.1, -6.3) ‡	-8.4 (-11.1, -5.7) ‡
Pediatric	21	-0.76 (-3.3, 1.8)	6.3 (1.6, 11) †	0.22 (-6.2, 6.7)	-5.9 (-12.3, 0.44)
Federally supported practice	34	2.9 (-0.36, 6.2)	0.28 (-4.4, 4.9)	3 (-2.9, 8.9)	-0.06 (-5.7, 5.6)
Urgent care center	141	-6.1 (-7.3, -5) ‡	0.34 (-1.8, 2.5)	-6 (-8.4, -3.6) ‡	-17.2 (-19.4, -14.9) ‡
General	102	-8 (-9.3, -6.6) ‡	-3.8 (-6.2, -1.4) †	-6.5 (-9.7, -3.3) ‡	-17.5 (-20.5, -14.5) ‡
Pediatric	39	-1.4 (-2.4, -0.47) †	11.3 (9, 13.6) ‡	-4.7 (-6.5, -3) ‡	-16.3 (-18.3, -14.4) ‡
Other type	14	-1.3 (-4.2, 1.7)	-4.7 (-9.4, 0.07)	-9.4 (-16.5, -2.2) *	-7.7 (-15.1, -0.35) *

Note: 292 practices with 4,229 practice-months contributed to this analysis. A mixed model with random intercept of practice was used to generate the estimate. The entire cohort model includes quarter as the independent variable; the model by practice type includes quarter, practice type, and their interaction terms as the independent variables. Pediatric practices and pediatric urgent care centers provide care only to pediatric population (infants, children, and adolescents); and the rest of practices providing primary care and urgent care are in the "general" category. Federally supported practices include Federally Qualified Health Centers (FQHCs), Indian Health Service (IHS) practices, and Department of Defense (DoD) practices. Other type includes student health, and specialty or multi-specialty care.

* denotes p-value<0.05; † denotes p-value<0.01; ‡ denotes p-value<0.001.

The sensitivity analysis of antibiotic prescription per 100 ARI visits (Appendix B-2.4) showed similar findings for the entire cohort (Sept–Nov 2020 vs Sept–Nov 2019: -12.9, 95% CI: -14.8 to -11.1, p<0.001), and urgent care practices (Sept–Nov 2020 vs Sept–Nov 2019: -17.6, 95% CI: -19.8 to -15.4, p<0.001). However, there was larger effect in primary care practices (-9.9, 95% CI: -13.1 to -6.7, p<0.001) and the finding for pediatric practices was no longer significant.

Change in antibiotic prescriptions per 100 ARI visits for selected antibiotic classes. From baseline (Sept–Nov 2019) to endline (Sept–Nov 2020), antibiotic prescriptions per 100 ARI visits dropped 5.5 for Penicillins (95% CI: -6.7 to -4.3, p<0.001), 2.4 for Macrolides (95% CI: -3 to -1.9, p<0.001), 1.2 for cephalosporins (95% CI: -1.5 to -0.9, p<0.001), and 0.3 for fluoroquinolones (95% CI: -0.47 to -0.12, p<0.001). **Exhibit 46** presents monthly antibiotic prescriptions per 100 ARI visits for selected antibiotic class and **Exhibit 47** summarizes the change from retrospective baseline to each quarter in the program period.

EXHIBIT 46: MONTHLY ANTIBIOTIC PRESCRIPTIONS PER 100 ARI VISITS BY ANTIBIOTIC CLASS

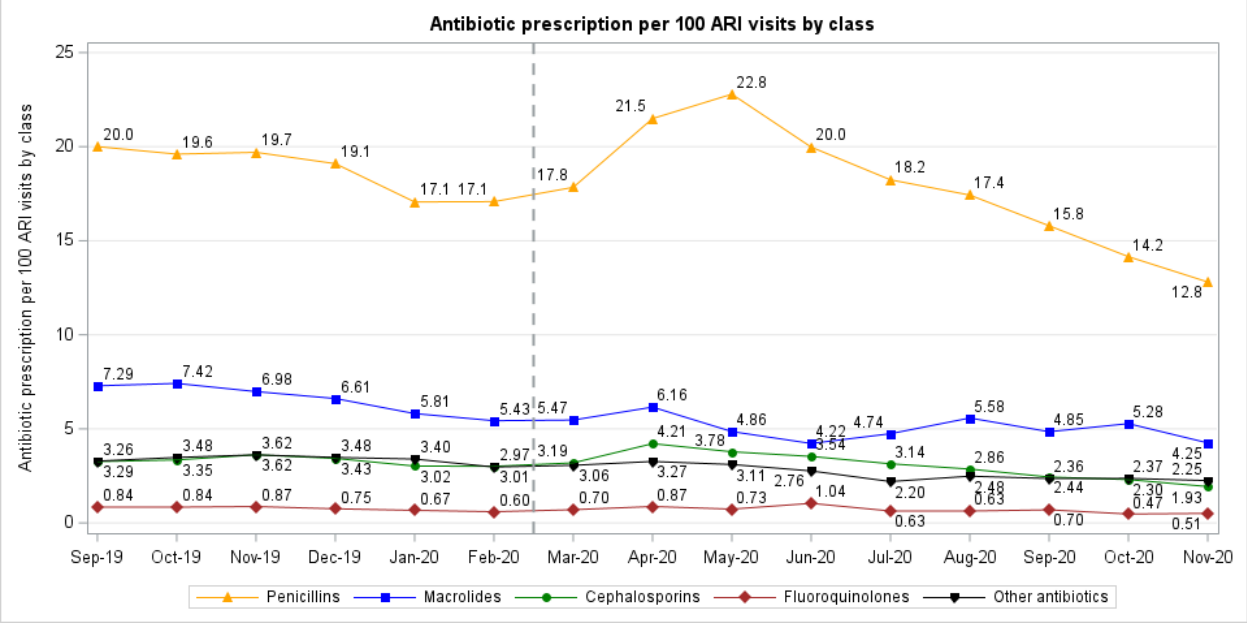


EXHIBIT 47: CHANGE IN ANTIBIOTIC PRESCRIPTIONS PER 100 ARI VISITS BY ANTIBIOTIC CLASS

Antibiotic Class	Dec 2019–Feb 2020	Mar–May 2020	June–Aug 2020	Sept–Nov 2020
Penicillins	-2.02 (-2.66, -1.38) ‡	0.91 (-0.2, 2.02)	-1.23 (-2.37, -0.09) *	-5.52 (-6.71, -4.33) ‡
Macrolides	-1.27 (-1.7, -0.85) ‡	-1.73 (-2.24, -1.23) ‡	-2.38 (-2.97, -1.78) ‡	-2.43 (-3, -1.86) ‡
Cephalosporins	-0.26 (-0.5, -0.02) *	0.31 (-0.06, 0.68)	-0.23 (-0.57, 0.1)	-1.19 (-1.47, -0.9) ‡
Fluoroquinolones	-0.18 (-0.29, -0.07) ‡	-0.08 (-0.24, 0.08)	-0.08 (-0.33, 0.16)	-0.29 (-0.47, -0.12) ‡
Other antibiotics	-0.18 (-0.4, 0.04)	-0.32 (-0.63, -0.01) *	-0.98 (-1.34, -0.61) ‡	-1.14 (-1.47, -0.8) ‡

Note: 292 practices with 4,229 practice-months contributed to the antibiotic class analysis. Linear mixed model with random intercept of practice was used to generate the estimate; quarter indicator was the independent variable.
* denotes p-value<0.05; † denotes p-value<0.01; ‡ denotes p-value<0.001.

Sensitivity analysis (Appendix B-2.5) also showed significant reductions in antibiotic prescription per 100 ARI visits for all selected antibiotic classes from baseline (Sept–Nov 2019) to endline (Sept–Nov 2020), where penicillins use had the largest reduction of 6.3 per 100 ARI visits (95% CI: -7.6 to -5.0, p<0.001).

Antibiotic Prescriptions per 100 Acute Respiratory Infection Visits by Diagnosis

This measure was created for each ARI diagnosis, with numerators and denominators associated with the specific diagnosis – number of antibiotic prescriptions for visits associated with the specific ARI diagnosis was the numerator and number of visits associated with the specific ARI diagnosis was the denominator. From baseline (Sept–Nov 2019) to endline (Sept–Nov 2020), antibiotic prescriptions per 100 ARI visits decreased by 7.8 (95% CI: -11.7 to -3.9, p<0.001) for pneumonia, 5.9 (95% CI: -8.7 to -3.1, p<0.001) for acute sinusitis, 11.5 (95% CI: -13.6 to -9.4, p<0.001) for pharyngitis, and 3.4 (95% CI: -6.4 to -0.54, p=0.020) for acute bronchitis. **Exhibit 48** presents monthly antibiotic prescriptions per 100 ARI visits by ARI diagnosis and **Exhibit 49** summarizes the change from the retrospective baseline for each quarter of the program period.

EXHIBIT 48: MONTHLY ANTIBIOTIC PRESCRIPTIONS PER 100 ARI VISITS BY ARI DIAGNOSIS

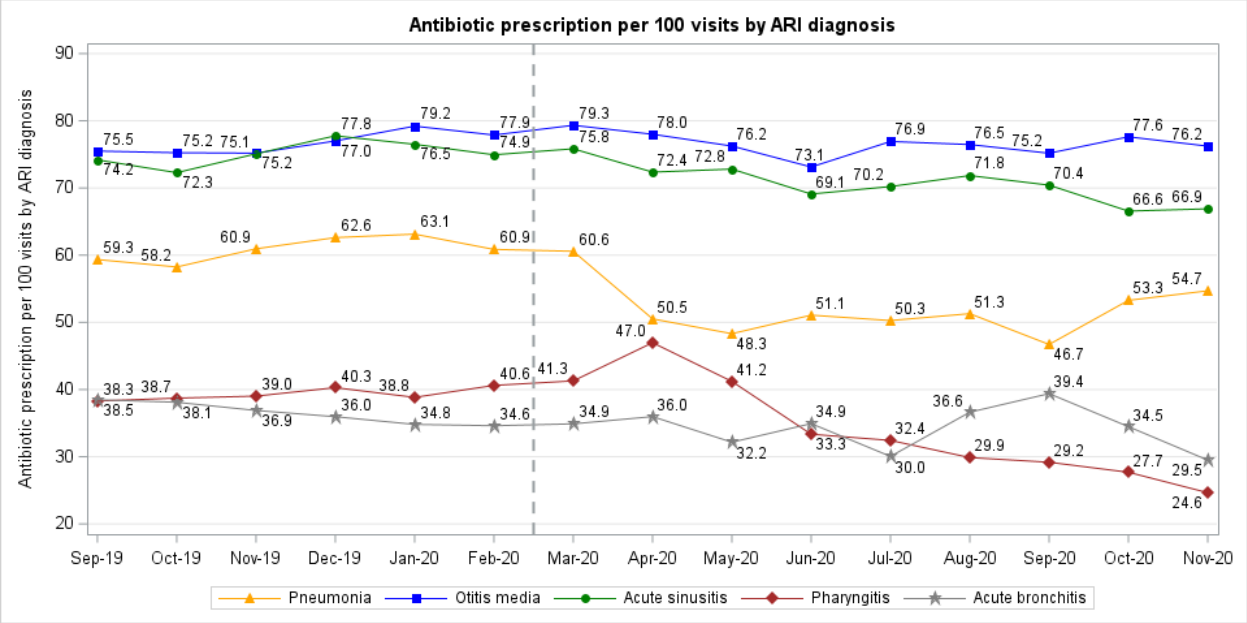


EXHIBIT 49: CHANGE IN ANTIBIOTIC PRESCRIPTIONS PER 100 ARI VISITS BY ARI DIAGNOSIS

ARI Diagnosis	Dec 2019–Feb 2020	Mar–May 2020	June–Aug 2020	Sept–Nov 2020
Pneumonia	2.68 (-0.03, 5.39)	-5.28 (-8.48, -2.09) †	-8.57 (-13.0, -4.12) ‡	-7.81 (-11.7, -3.95) ‡
Otitis media	2.72 (1.1, 4.35) ‡	2.61 (0.07, 5.15) *	0.19 (-2.39, 2.77)	1.05 (-1.76, 3.87)
Acute sinusitis	2.56 (0.44, 4.69) *	-0.01 (-2.46, 2.43)	-3.4 (-6.24, -0.55) *	-5.9 (-8.67, -3.13) ‡
Pharyngitis	1.23 (-0.27, 2.74)	4.48 (2.23, 6.72) ‡	-6.81 (-8.88, -4.75) ‡	-11.5 (-13.6, -9.41) ‡
Unspecified acute lower respiratory infection	4.36 (-2.8, 11.5)	-8.68 (-17.1, -0.25) *	1.19 (-9.7, 12.1)	-4.38 (-13.9, 5.19)
Acute bronchitis	-2.68 (-4.54, -0.82) †	-3.26 (-6.04, -0.48) *	-3.87 (-7.43, -0.32) *	-3.44 (-6.35, -0.54) *
Influenza	-0.26 (-1.61, 1.08)	-0.23 (-1.88, 1.43)	-0.84 (-4.09, 2.42)	1.42 (-1.5, 4.34)
Acute laryngitis and tracheitis	-0.22 (-2.74, 2.3)	2.14 (-1.56, 5.85)	-0.6 (-4.06, 2.86)	-1.33 (-4.05, 1.4)

Note: number of practices and practice-months contributing to the analysis varied by ARI diagnosis due to zero visits for some diagnosis. Linear mixed model with random intercept of practice was used to generate the estimate; quarter indicator was the independent variable.
* denotes p-value<0.05; † denotes p-value<0.01; ‡ denotes p-value<0.001.

Sensitivity analysis (Appendix B-2.6) showed similar change patterns for antibiotic prescription by ARI diagnosis, where we found significant reduction in antibiotic prescription per 100 ARI visits for pneumonia (-9.3, 95% CI: -13.5 to -5.1, p<0.001), acute sinusitis (-8.0, 95% CI: -10.8 to -5.1, p<0.001), pharyngitis (-11.9, 95% CI: -14.1 to -9.7, p<0.001), and acute bronchitis (-4.7, 95% CI: -7.7 to -1.7, p=0.002).

3.6 Evaluation Limitations

The Safety Program for Ambulatory Care Cohort had several limitations:

We observed a reduction in all EHR-based outcomes from baseline to the intervention period. Particularly, the reductions were statistically significant for antibiotic prescriptions per 100 total visits and per 100 ARI visits for the entire cohort and by antibiotic class. The reductions varied by practice type, where urgent care practices were found to have the largest reduction in antibiotic prescriptions from baseline to the intervention period.

Although we would like to fully attribute the decrease in antibiotic use and other outcomes to the success of the Safety Program, there are other possible explanations for this observation including the following: (a) COVID-19 Public Health Emergency, (b) expected secular trends, or (c) inaccuracies with submitted antibiotic use and other outcomes data, each of which is described in further detail below. Our evaluation collected data from a 3-month retrospective period so that our comparison between baseline (i.e., September–November 2019) and endline (i.e., September–November 2020) can take the seasonal trends into account.

a) The Safety Program's implementation coincided with early stages of the COVID-19 pandemic in the United States, which had national implications for antibiotic prescribing. Beginning in March 2020, physical distancing guidelines led to a transition from in-person visits to telemedicine.[10,11,12]Despite this, primary care visits declined nationally March–May 2020.[13] Similarly, as COVID-19 mitigation measures reduced common respiratory viruses nationally,[14,15] visits for non-COVID ARIs decreased. Across our cohort, we similarly observed declines in total and ARI visits March–May 2020. Further, COVID-19 affected antibiotic prescribing beyond seasonally expected national patterns March–May 2020. Reduction in ambulatory visits overall and for ARIs likely contributed to this national decline in antibiotic prescribing. Despite national antibiotic prescribing changes in the early months of the COVID-19 pandemic, there is evidence that the AHRQ Safety Program independently contributed to the reduction in antibiotic use. The period of participation in the Safety Program was associated with decreases in antibiotic prescribing as well as changes to visits March–May 2020. However, between June and November 2020, while visits and ARI visits increased to or near baseline levels, antibiotic prescribing overall and for ARIs continued to

decline. Furthermore, by the end of the program, practices had demonstrated improvements in the infrastructure needed to facilitate sustained AS.

b) Because of the ecological study design, it remains unknown if the significant decreases in overall antibiotic usage during the course of the Safety Program were reflective of secular trends. With a growing understanding of the need for judicious antibiotic prescribing due to public health campaigns emphasizing increasing rates of antibiotic resistance, an upsurge in both the lay and scientific literature focusing on antibiotic-associated harm, a broadening of the evidence base indicating shorter durations of therapy than historically prescribed are safe and effective and increased recommendations for judicious antibiotic prescribing for common indications, it is possible that antibiotic use would have naturally decreased in the participating ambulatory practices independent of implementation of the Safety Program.

c) We cannot discount the possibility of inaccuracies with antibiotic use and other outcomes data collected and submitted by participating sites. The number of practices enrolled and our lack of access to protected health information precluded our ability to ensure the integrity of data submitted from practices or to an evaluation of "appropriate" antibiotic use. Nonetheless, several rigorous steps were followed to maximize the likelihood of valid data submission. At the beginning of the Safety Program an informational webinar was held to assist sites with step-by-step instructions regarding data collection. Sites with electronic health records who were unfamiliar with how to extract antibiotic use data, were connected to other sites enrolled in the Safety Program who had successfully navigated the same electronic health record system to access their antibiotic use data. Furthermore, a standardized template with detailed instructions was distributed to sites for collecting and uploading data. The Implementation Adviser assigned to each practice worked closely with each site through at least monthly contact to trouble shoot any data collection issues. Finally, if practices reported antibiotic use and other outcomes that were much higher than expected, suggesting an error in the numerator or denominator, they were contacted to confirm that standardized practices were used to obtain data collection and sites were requested to re-extract data if necessary.

There are some limitations with the Safety Program findings. First, despite the findings, it is difficult to distinguish the impact of the COVID-19 pandemic from the impact of the program on antibiotic prescriptions. National antibiotic prescribing data come from pharmacies and are not tied to visits. Therefore, national data are not directly comparable to practice-based prescribing data. Instead, the data was qualitatively compared with published reports. Second, the Safety Program depended on practices submitting accurate data. Practices were contacted to verify out-of-range data to improve the accuracy of the data. Third, as data abstraction tools were built prior to the COVID-19 pandemic, data was not collected about COVID-19 diagnoses, although these could have been considered ARI visits. Fourth, the focus was on prescriptions, so delayed prescriptions (i.e., an antibiotic prescription provided to a patient for an antibiotic-inappropriate condition with instructions to not fill the prescription unless they were still feeling poorly after several days) would have been counted as active prescriptions. However, it is unlikely that this practice changed during the intervention as it was not part of the

recommendations of the Safety Program. Additionally, called-in and handwritten prescriptions would have been missed as only electronic prescriptions were captured. However, as all practices used EHRs, the vast majority of prescriptions would have been sent electronically. Finally, although the educational content in the AHRQ Safety Program was developed after a comprehensive review of the literature, the medical literature continues to evolve at a relatively rapid pace. Developing an approach to ensuring the AHRQ Safety Program Toolkit content that is publicly available accurately reflects best practices moving forward may be challenging.

3.7 Lessons Learned

Although the AHRQ Safety Program in the Ambulatory Care setting was generally a success, there were challenges and a number of lessons learned over the course of the year. Early on it became clear that there were different levels of engagement at participating sites, with some with healthcare practitioners and other staff attending the majority of webinars and coming to office hours with questions and observations and others engaging minimally with the project. Efforts to enhance engagement included access to the Safety Program faculty via office hours and emails and monthly calls to sites by the implementation advisers. Recognizing that neither of these resources would be available to sites who did not participate in the live Safety Program but wish to mimic it using materials from the AHRQ Safety Program Toolkit, we decided to develop content to address this issue. The Toolkit contains detailed gap analyses and implementation guides for each cohort, including the ambulatory cohort. The ambulatory gap analysis allows practices to assess the current status of their AS activities as well as track them over time, and the implementation guide provides detailed instructions for how to use the material in the toolkit to implement AS activities.

It also became apparent that sites were limited by how much time they could devote to the project and that some healthcare practitioners preferred live content while others preferred on-demand content (e.g., audio presentations). Ambulatory providers usually have full schedules with patient visits during working hours. Further, there are generally numerous competing topics for discussion during practice-wide meetings leaving only a small amount of time to discuss AS issues. While the Safety Program asked sites to invest time in attending webinars and engaging with front-line staff, realizing the time constraints in the ambulatory setting, efforts were made to make participation easier by ensuring that the webinars were short, recording the webinars for individuals to view at their convenience, and providing simple and accessible materials (e.g., one-page documents, audio presentations) available on demand from the project Web site.

In addition to engagement, throughout the course of the Safety Program, the team realized that it would be challenging for sites to sustain the work that occurred during the intervention period. Unfortunately, it has not been possible to perform followup with sites to determine how much AS work started during the Safety Program continued after it ceased. To assist sites, the importance of sustainability and changing long-term practice was considered while creating all material and interventions for the Safety Program. Specific content developed includes a Gap Analysis Tool to assist sites with internally determining what resources they currently have and what additional resources

might be of benefit to them to continue to see positive results with their local ASP. This content was paired with a "Guide to Sustainability Planning," which provides a template to help healthcare practitioners continue to apply what they learned throughout the course of the Safety Program and incorporate these strategies into everyday practice. The guide addresses six key components to consider when assessing sustainability: leadership, culture of improvement, hardwiring change, data collection and feedback, assessment, and resources.

Another common issue that became apparent early was challenges with collection of antibiotic use data. While larger academic hospital-affiliated outpatient practices, particularly those in large health systems, had developed approaches to extract antibiotic use data from the EHR, many smaller or independent ambulatory practices had not developed approaches to obtain antibiotic use data electronically. Sites participating in the ambulatory cohort were required to be able to extract antibiotic use data electronically; however, this likely led to exclusion of smaller practices from participating in the project. Because many participating sites were inexperienced with collecting antibiotic prescription data, rigorous quality control processes were implemented and included data quality checks and timely follow up with sites that provided incomplete data. Collectively, this underscores the need for standardized and not overly burdensome approach for ambulatory practices of all sizes to be able to accurately extract antibiotic use data.

Finally, it became clear early on that future largescale AS interventions will likely have greater engagement when not coinciding with other major healthcare events – such as the COVID-19 pandemic. The ambulatory care cohort was implemented from November 2019 through December 2020 and coincided with the COVID-19 pandemic. Many participating sites had to shift their staff and resources to different work patterns during the pandemic which led to less time to devote to the project and the associated data collection. Further, some sites were forced to withdraw because of leadership changes due to mergers and acquisitions of practices followed by a reduction in prioritization of AS activities. Finally, some sites went out of business. While these issues may have been exacerbated by the pandemic, they occur routinely and are difficult to mitigate. However, evaluating external factors with competing time demands is important to ensure implementation efforts for a new program/intervention are successful.

CHAPTER 4: CONCLUSION

Chapter Summary

The Safety Program demonstrated that establishing ASPs and training frontline staff can improve antibiotic use. We observed a reduction in antibiotic prescribing in ambulatory care settings, with a notable and sustained decrease in the overall use of penicillin class antibiotics specifically. These outcomes suggest that the Ambulatory Care Safety Program contributed to improved antibiotic prescribing, potentially reducing patient harm. As the content from the Safety Program is publicly available, we believe that utilizing Safety Program resources provides exciting opportunities for ambulatory care practices across the United States seeking to establish or strengthen existing ASPs and

to teach frontline staff to advocate for antibiotic stewardship and to communicate those values to their colleagues, prescribing clinicians, patients, and their family members.

4.1. Sustainability

The Safety Program materials remained available to the sites through the project Web site through June 2021; thereafter, Safety Program content will be posted and available to the public on the AHRQ Web site in the near future. After the completion of the Ambulatory Cohort Safety Program cohorts, enduring content will be available on a public-facing website (www.ahrq.gov/antibiotic-use/index.html). The final toolkit explains the Four Moments of Antibiotic Decision Making and includes tools to develop and improve an antibiotic stewardship team, create a safety culture around antibiotic prescribing, and disseminate best practices for common infectious diseases. An Implementation Guide on how the content in the Safety Program toolkit can be integrated into practice efforts to improve antibiotic use also will be provided.

APPENDIXES

Appendix A-1. Technical Expert Panel Members

Name	Title	Affiliation	Representation
Elizabeth Dodds-Ashley, Pharm.D.	Antibiotic Stewardship Pharmacist	Duke Antimicrobial Stewardship Outreach Network	Acute Care Setting
Neil Fishman, M.D.	Associate Chief Medical Officer, Chief Patient Safety Officer	University of Pennsylvania	Acute Care Setting
Kristi Kuper, Pharm.D.	Antibiotic Stewardship Pharmacist	Vizient, Inc.	Acute Care Setting
Andrew Morris, M.D., SM(Epi), FRCPC	Medical Director, Antimicrobial Stewardship Program	Sinai Health System/University Health Network	Acute Care Setting
Jeffrey Gerber, M.D., Ph.D.	Assistant Professor of Pediatrics, Director of Antimicrobial Stewardship	Children's Hospital of Philadelphia	Ambulatory Care Setting
Daniella Meeker, Ph.D.	Assistant Professor of Preventative Medicine	University of Southern California	Ambulatory Care Setting
Julia Szymczak, Ph.D.	Medical Sociologist	Dept. of Epidemiology and Biostatistics, University of Pennsylvania	Ambulatory Care Setting
Marjory Cannon, M.D.	Medical Director, Quality Improvement Group Centers for Clinical Standards and Quality	Centers for Medicare & Medicaid Services	Ex-Officio
James Cleeman, M.D.	Director, Division of Healthcare-Associated Infections	AHRQ Center for Quality Improvement and Patient Safety	Ex-Officio
Shelly Coyle, R.N., M.S., M.B.A.	Nurse Consultant	CMS/Center for Clinical Standards and Quality (CCSQ)	Ex-Officio
Kali Crosby, M.S.N., R.N., CIC	Nurse Consultant	AHRQ Center for Quality Improvement and Patient Safety	Ex-Officio
Lauri Hicks, D.O.	Director, Office of Antibiotic Stewardship	Centers for Disease Control and Prevention	Ex-Officio
Melissa Miller, M.D., M.S.	Medical Officer	AH/RQ Center for Quality Improvement and Patient Safety	Ex-Officio
Arjun Srinivasan, M.D.	Associate Director of HAI Prevention Programs	Centers for Disease Control and Prevention	Ex-Officio
Nimalie Stone, M.D., M.S.	Medical Epidemiologist for Long-Term Care	Centers for Disease Control and Prevention	Ex-Officio
Anita Thomas, Pharm.D.	Quality Improvement Organizations Patient Safety Program Team Lead	CMS/Center for Clinical Standards and Quality (CCSQ)	Ex-Officio
Whitney Buckel, Pharm.D.	Infectious Disease Specialist	Intermountain Healthcare	Integrated Healthcare Delivery Systems

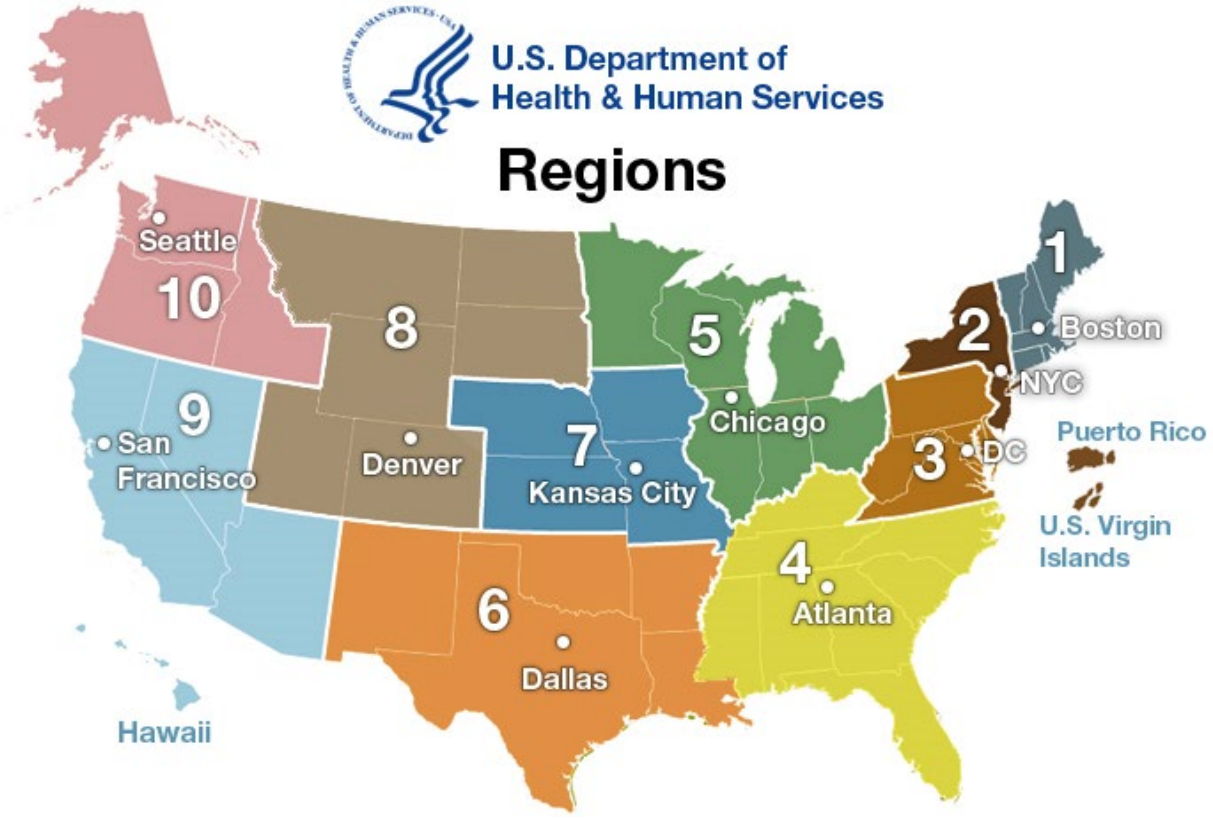
Name	Title	Affiliation	Representation
Lisa Davidson, M.D.	Medical Director, Antimicrobial Stewardship Network	Atrium Health	Integrated Healthcare Delivery Systems
Stanley Martin, M.D.	Director of Infectious Diseases	Geisinger Health System	Integrated Healthcare Delivery Systems
Edward Septimus, M.D., FACP, FIDSA, FSHEA	Infectious Disease Specialist	Memorial Hermann Southwest Hospital	Integrated Healthcare Delivery Systems
Linda Behan, B.S.N., R.N., CWCN, CIC	Corporate Director of Infection Prevention and Control	Genesis Health	LTC Setting
Joseph Marek, R.Ph., CGP, FASCP	Director of Pharmacy Services	CommuniCare Health Services, American Society of Consultant Pharmacists (ASCP)	LTC Setting
David Nace, M.D., M.P.H.	Director, Long-Term Care Program	University of Pittsburgh Medical Center	LTC Setting
Rita Olans, D.N.P., R.N., CPNP, APRN-BC	Assistant Professor, School of Nursing	MGH Institute of Health Professions	Nursing/Nurse Practitioner
Christian Lillis	Patient Advocacy Group	Peggy Lillis Foundation	Patient Representative

Appendix A-2. Stakeholder/Train-the-Trainer Meeting Attendees

Attendees	Organization
Melissa Miller	Agency for Healthcare Research and Quality
Sarah Legare	Health Quality Innovators
Katie Richards	Health Quality Innovators
Simi Chabra	Health Services Advisory Group, Inc.
Una Fraser	Health Services Advisory Group, Inc.
Emilie Sundie*	Health Services Advisory Group, Inc.
Tania Caballero	Johns Hopkins Medicine
Sara Cosgrove	Johns Hopkins Medicine
Sara Keller	Johns Hopkins Medicine
Pranita Tamma	Johns Hopkins Medicine
Roy Ahn	NORC at the University of Chicago
Prashila Dullabh	NORC at the University of Chicago
Julie Gasparac	NORC at the University of Chicago
Laurie Imhof	NORC at the University of Chicago
Gillian Lawrence	NORC at the University of Chicago
Savyasachi Shah	NORC at the University of Chicago
Tricia Stauffer	NORC at the University of Chicago
Samantha Martocci	NORC at the University of Chicago
Jeffrey Linder	Northwestern University
Jerri Hiniker	Stratis Health
Betsy Jeppesen*	Stratis Health
Kathie Nichols*	Stratis Health
Marilyn Reierson	Stratis Health

*Indicates remote attendees

Appendix A-3. 10 HHS Regions and Number of Participating Practices by Region



HHS Region	States & Territories	Total Number of Participating Practices (after withdrawals)
1	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont	32
2	New Jersey, New York, Puerto Rico, and the Virgin Islands	48
3	Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia	67
4	Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee	40
5	Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin	52
6	Arkansas, Louisiana, New Mexico, Oklahoma, and Texas	43
7	Iowa, Kansas, Missouri, and Nebraska	36
8	Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming	31
9	Arizona, California, Hawaii, Nevada, U.S.-Affiliated Pacific Islands (American Samoa, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, Guam, Marshall Islands, and Republic of Palau)	27
10	Alaska, Idaho, Oregon, and Washington	13
	TOTAL	389

Appendix A-4. Program Application Process and Online Application

Program Application Process

The program provides two options for enrolling sites in the ambulatory care cohort:

Option A)

1. Complete an online application for each site here: https://safetyprogram4antibioticstewardship.org/page/AHRQ-Safety-Program-for-Improving-Antibiotic-Use.
2. From the homepage, click on the green "Join the Program" button to access the online application.

Option B)

1. You can fill out the attached spreadsheet (provide information for each site in a separate row).
2. Please use this Word document of the program's online application as a reference to complete the attached spreadsheet with abbreviated questions and numbering to match the application for reference.
3. *Please note embedded in the application are required structural assessment questions that the program asks to collect information on each practice's infrastructure and existing antibiotic stewardship activities.* We will ask these questions again of all participating practices at the end of the program.
4. If you choose to complete the spreadsheet instead of the online application, please return the completed spreadsheet to antibioticsafety@norc.org.

Program Overview

The Agency for Healthcare Research and Quality (AHRQ) created the AHRQ Safety Program for Improving Antibiotic Use in conjunction with Johns Hopkins Medicine's Armstrong Institute for Patient Safety and Quality and NORC at the University of Chicago to develop and implement a bundle of technical and behavioral interventions designed to improve the use of antibiotics in ambulatory care practices across the United States.

Antibiotics are a precious resource and can be critical for improving the outcomes of patients with serious infections. However, antibiotics also have the potential to cause patient harm including allergic reactions, adverse drug events, and antibiotic resistance both at the individual patient level and for society as a whole. It is important that antibiotics are available and effective for future generations, and that is only possible through the judicious use of antibiotics.

Potential Benefits of Participation

The Agency for Healthcare Research and Quality (AHRQ) offers your ambulatory care practice an opportunity to participate in the AHRQ Safety Program for Improving Antibiotic Use. It will help your organization to—

- Reduce unnecessary antibiotic use and increase appropriate antibiotic use
- Enhance teamwork and communication around diagnosis and treatment of infections and antibiotic prescribing in your practice
- Improve patient safety and safety culture
- Improve workflow, especially during the busy cold and flu season
- Maintain and improve patient and family satisfaction

Participation in this program will help your clinic meet the **Centers for Medicare and Medicaid Services Merit-based Incentive Payment System (MIPS) requirements** and demonstrate compliance with the new **Joint Commission Ambulatory Antimicrobial Stewardship Standard** as many of the concepts are similar. **Continuing education credits** including **Continuing Medical Education (CME)** and **Maintenance of Certification (MOC)** for ABIM, ABP, and ABFM will be offered at no charge for participants.

Expectations for Participating Practices
Your practice will need to identify team leaders to assist with overseeing staff participation in the program. If there is no existing quality improvement team, we ask that the participating practice select a clinician/leader who would like to be trained in becoming an antibiotic stewardship leader. At practices with an existing quality improvement team, the program will work with team members to enhance their antibiotic stewardship efforts.

Throughout the 12 months, the Antibiotic Stewardship Team and available frontline staff will participate in bimonthly or monthly calls that will include both content and coaching. These calls will include a formal discussion of technical or behavioral work to improve antibiotic prescribing and will also include open dialogue about successes and challenges related to improving antibiotic use.

You will use your electronic health record data to provide monthly data regarding your antibiotic prescribing practices from September 2019 through November 2020 (September through November 2019 should be pulled retrospectively).

Please note that the online application is for an *individual* ambulatory care practice to apply for the program. If you represent a large chain or health system and are interested in enrolling multiple ambulatory care practices, please follow the above instructions provided at Option B on page 1 and for any questions contact antibioticsafety@norc.org.

Upon submitting a program application you will then receive an email from antibioticsafety@norc.org (within 5 business days of submission) that will include additional information and a Letter of Commitment for your practice to review and sign.

Online Application Form

Please provide the following information about your practice (mandatory):

1. Legal Name of Ambulatory Care Practice
2. Street Address Line 1
3. Street Address Line 2
4. City
5. State
6. Zip Code
7. Fax Number:
8. Practice Web site URL address (optional):
9. Practice National Provider Identifier (NPI) (10-digit) number (mandatory):
   NPI is a unique 10-digit identification number CMS issues to U.S. healthcare providers and organizations. To find the NPI for your organization, visit https://npiregistry.cms.hhs.gov.

10. In which Department of Health & Human Services region is your practice located:
    _Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont)
    _Region 2 (New Jersey, New York, Puerto Rico, Virgin Islands)
    _Region 3 (Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, West Virginia)
    _Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee)
    _Region 5 (Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin)
    _Region 6 (Arkansas, Louisiana, New Mexico, Oklahoma, Texas)
    _Region 7 (Iowa, Kansas, Missouri, Nebraska)
    _Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming)
    _Region 9 (Arizona, California, Hawaii, Nevada, American Samoa, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, Guam, Marshall Islands, Republic of Palau)
    _Region 10 (Alaska, Idaho, Oregon, Washington)

Practice Contact Information (mandatory)
The primary contacts may not have an official role in the program. We request two contacts to ensure a main point of contact during the application process, as well as an alternate contact.

11. Primary Clinical Contact Name:
12. Title:
13. Highest Role/Degree:
    - M.D., D.O., Pharm.D., M.B.B.S.
    - N.P., P.A.
    - R.N.
    - Other – please specify
14. Phone Number:
15. Email:

16. Primary Administrative Contact Name:
17. Title:
18. Phone Number:
19. Email:

GENERAL PRACTICE INFORMATION

20. Is your practice— (select all that apply)
    -Affiliated with an academic institution
    -Affiliated with a hospital
    -Affiliated with a health system
    -Physician-owned
    -Health system owned
    -None of the above

21. **How many clinicians work in your practice, including—**

- M.D.s, D.O.s, and/or M.B.B.s: __
- N.P.s: __
- P.A.s: __

22. What is your practice location?
    -Rural
    -Suburban
    -Urban

23. Is your practice designated a(n) (select all that apply)—
    -Community-based health clinic (e.g. Federally Qualified Health Center or FQHC)
    -Internal medicine
    -Family medicine
    -Pediatric
    -Other primary care (adult)
    -Other primary care (pediatric)
    -Other primary care (adult and pediatric)
    -Outpatient specialty clinic that provides primary care
    -Outpatient multispecialty clinic that provides primary care
    -Student health clinic
    -Urgent care clinic

More information about eligible ambulatory care practices is available for reference in the FAQs, or please contact antibioticsafety@norc.org.

ELECTRONIC HEALTH RECORD INFORMATION

24. Who is your electronic health records vendor?
    Dropdown menu:
    -Allscripts
    - Cerner
    - eCW
    - Epic
    - GE Centricity
    - Meditech
    - NextGen
    - Optimus
    - Siemens

- Other (please specify)

25. How long have you been using this electronic health record?
    Dropdown menu:
    < 6 months
    6–12 months
    > 12 months

26. Do staff at your practice have experience with pulling data reports from your electronic health record (EHR)?
    __Y/N

27. Do staff at your practice have experience pulling EHR data for antibiotic use?
    __Y/N

QUALITY IMPROVEMENT INITIATIVES

28. Does your practice have regular meetings? Y/N
29. [IF YES] -Who attends these meetings? (select all that apply)
-Clinicians
-Nurses
-Medical assistants
-Front desk staff
-Others

30. -How often do you meet?
-more than once a week
-once a week
-2-3 times a month
-once a month
-less than once a month

31. -What time of day do you meet?
-Before clinic
-During morning clinic hours
-During lunch
-During afternoon clinic hours
-After clinic
-Other (please specify)

32. Has your practice used a team-based approach (such as the Comprehensive Unit-based Safety Program [CUSP]) for quality improvement initiatives in the past? Y/N

33. [IF YES] Please describe previous initiatives that have used a team-based approach.

[Enter response here]

34. Have clinicians in your practice developed local guidelines for conditions for which antibiotics are commonly prescribed? Y/N

35. [IF YES] Please describe.

[Enter response here]

36. Have clinicians in your practice developed a list of conditions for which antibiotics are discouraged? Y/N

37. [IF YES] Please describe.

[Enter response here]

38. Does your practice formally track antibiotic prescriptions? Y/N

39. [IF YES] Please describe how tracking occurs and what the data are used for.

[Enter response here]

40. Do patient satisfaction scores impact clinician compensation in your practice? Y/N

41. [IF YES] Are all clinic visits eligible for patient satisfaction scores? Y/N

42. Does your practice report any quality measures or quality indicators to either payers or to organizations that monitor health care quality? Y/N

43. Is your practice certified as a patient-centered medical home (PCMH)? Y/N
44. [IF YES] By whom? _____

45. [IF YES] What is your practice's level of certification for the National Committee for Quality Assurance (NCQA)?
    -PCMH level 1
    -PCMH level 2
    -PCMH level 3

46. Is your practice accredited by the Joint Commission? (Y/N)

47. In a few words, please explain why you would like to participate in this program.

[Enter response here]

For more information on the AHRQ Safety Program for Improving Antibiotic Use, please visit:
https://safetyprogram4antibioticstewardship.org

Appendix A-5. Sample Quarterly Benchmarking Report

Benchmarking Report 4, September 2019 to November 2020

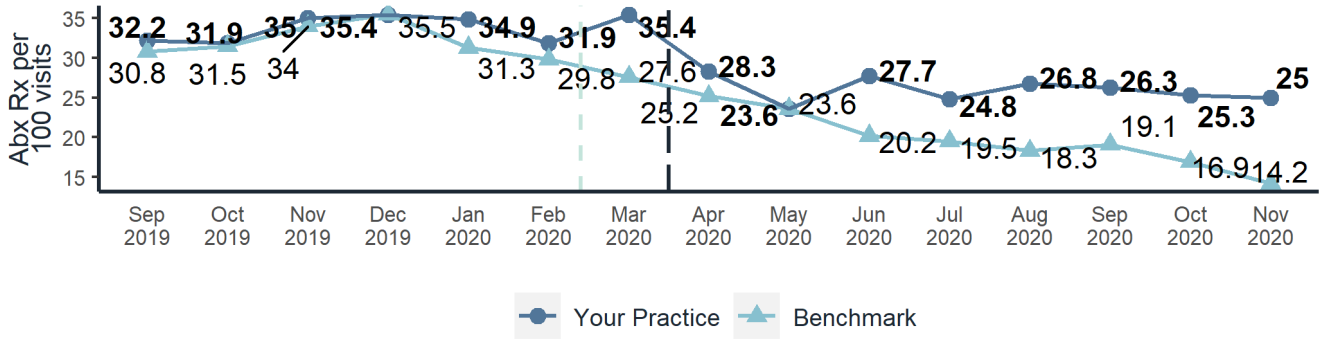
Practice:
Benchmarking group: Urgent Care practices

1. Antibiotic Prescriptions per 100 Visits, Total

Table 1. Antibiotic Prescriptions per 100 Visits, Total, Your Practice vs. Benchmark

Label	Sep 2019	Oct 2019	Nov 2019	Dec 2019	Jan 2020	Feb 2020	Mar 2020	Apr 2020	May 2020	Jun 2020	Jul 2020	Aug 2020	Sep 2020	Oct 2020	Nov 2020
Top Performing	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Prescribing rate, Practice	32.2	31.9	35	35.4	34.9	31.9	35.4	28.3	23.6	27.7	24.8	26.8	26.3	25.3	25
Total abx rx, Practice	717	695	785	906	994	855	710	232	267	373	396	442	428	438	426
Total visits, Practice	2,224	2,178	2,240	2,559	2,847	2,684	2,003	820	1,129	1,347	1,600	1,649	1,629	1,732	1,702
Practices in benchmark	83	83	84	84	83	82	78	99	100	103	103	101	101	103	103
Data in the benchmark	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Figure 1. Total Antibiotic Prescriptions per 100 Visits, Your Practice (**indicated by bolded numbers**) vs. the Benchmark



To correctly interpret these results and to understand the measure calculations, please refer to Section 3 of the Appendix.

Your practice's antibiotic data may not be presented or may not be included in the benchmark in this section for several reasons. Below, we summarize relevant reasons for your practice by month.

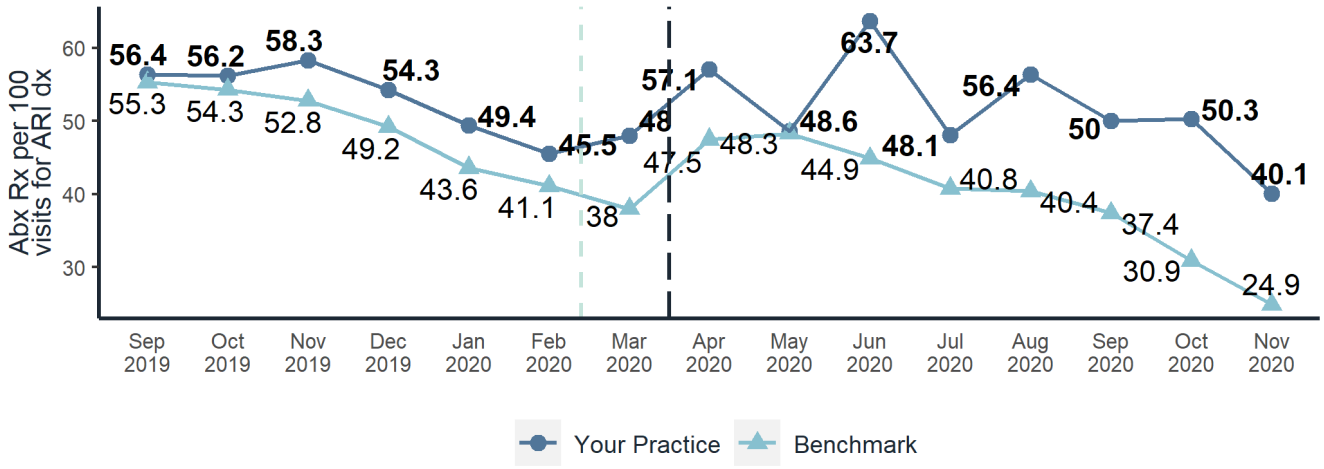
- Benchmark not available for the selected template for Mar 2020

2. Antibiotic Prescriptions per 100 Visits With Acute Respiratory Infection (ARI) Diagnosis, Total

Table 2. Antibiotic Prescriptions per 100 Visits with ARI Diagnosis, Total, Your Practice vs. Benchmark

Label	Sep 2019	Oct 2019	Nov 2019	Dec 2019	Jan 2020	Feb 2020	Mar 2020	Apr 2020	May 2020	Jun 2020	Jul 2020	Aug 2020	Sep 2020	Oct 2020	Nov 2020
Top Performing	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Prescribing rate, Practice	56.4	56.2	58.3	54.3	49.4	45.5	48	57.1	48.6	63.7	48.1	56.4	50	50.3	40.1
Total abx rx, Practice	380	402	483	585	686	608	460	96	86	100	112	127	142	177	168
Total visits, Practice	674	715	828	1,077	1,389	1,335	958	168	177	157	233	225	284	352	419
Practices in benchmark	83	80	84	83	83	82	78	97	99	103	101	101	102	103	102
Data in the benchmark	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Figure 2. Total Antibiotic Prescriptions per 100 Visits with ARI Diagnosis, Your Practice (**indicated by bolded numbers**) vs. the Benchmark



To correctly interpret these results and to understand the measure calculations, please refer to Section 3 of the Appendix.

Your practice's antibiotic data may not be presented or may not be included in the benchmark in this section for several reasons. Below, we summarize relevant reasons for your practice by month.

- Benchmark not available for the selected template for Mar 2020

3. Structural Assessment

Table 3 summarizes the data from the baseline and endline Structural Assessment forms completed by your practice at the time of program registration, and at the end of the program. It also includes comparative Structural Assessment data from all participating practices in your benchmark.

Table 3. Structural Assessment Items from Your Practice and Benchmark, Baseline and Endline

Item	Your Practice (Baseline)	Benchmark (Baseline)	Your Practice (Endline)	Benchmark (Endline)
Number of medical doctors in practice	6	18.52	3	2.34
Number of nurse practitioners	3	25.77	1	2.23
Number of physician assistants	11	53.97	6	2.69
The practice has regular meetings	Yes	98% Yes	Yes	100% Yes
Meeting time	Morning (before/during clinic hours)	26% Morning (before/during clinic hours)	Morning (before/during clinic hours)	25% Morning (before/during clinic hours)
Patient satisfaction scores impact clinician compensation	Yes	83% Yes	Yes	95% Yes
All clinic visits are eligible for patient satisfaction scores	Yes	100% Yes	Yes	100% Yes
Track antibiotic prescriptions	No	28% Yes	Yes	93% Yes
Practice has developed a list of conditions for which antibiotics are discouraged	No	69% Yes	Yes	95% Yes
Experience with team-based approach for quality improvement initiatives	No	62% Yes	No	72% Yes
Meeting occurrence	Less than once a week	80% Less than once a week	Less than once a week	78% Less than once a week
Presence of local guidelines for conditions for which antibiotics are commonly prescribed	No	71% Yes	No	80% Yes
Report quality measures/indicators to payers or to organizations that monitor health care quality	No	58% Yes	No	47% Yes

4. Medical Office Survey on Patient Safety Culture (MOSOPS)

Please see the Data Collection Information Section on the program website for a copy of the MOSOPS form.

Figure 3 compares your practice's baseline and endline MOSOPS composite scores to the composite scores from all participating practices in your benchmarking category.

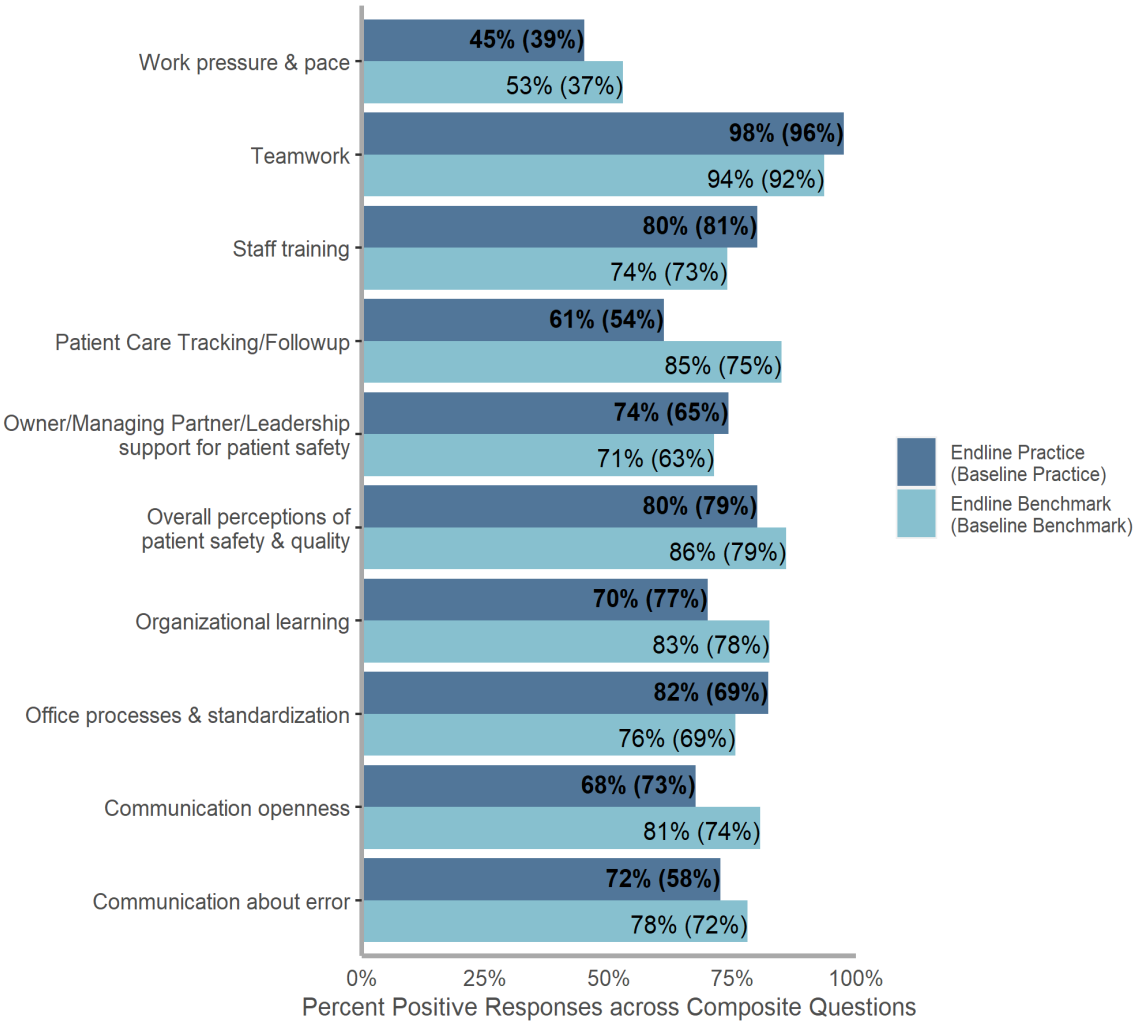
When both the baseline and endline data are available, the endline score is represented by a horizontal bar, while the baseline score is written as a percentage in parentheses inside the bar.

Please note that individual MOSOPS results may not be displayed for the following reasons:

- If fewer than 5 respondents from your practice completed the survey; or
- If the data submitted did not follow the AHRQ MOSOPS data file specifications for all questions.

Composite scores might not be calculated for some questions if your practice used a different format of question or did not have enough respondents answering that question.

Figure 3. Medical Office Survey on Patient Safety Culture Composites, Baseline and Endline



Appendix - Antibiotic Prescriptions by Antibiotic Therapeutic Class and ARI Diagnosis Category

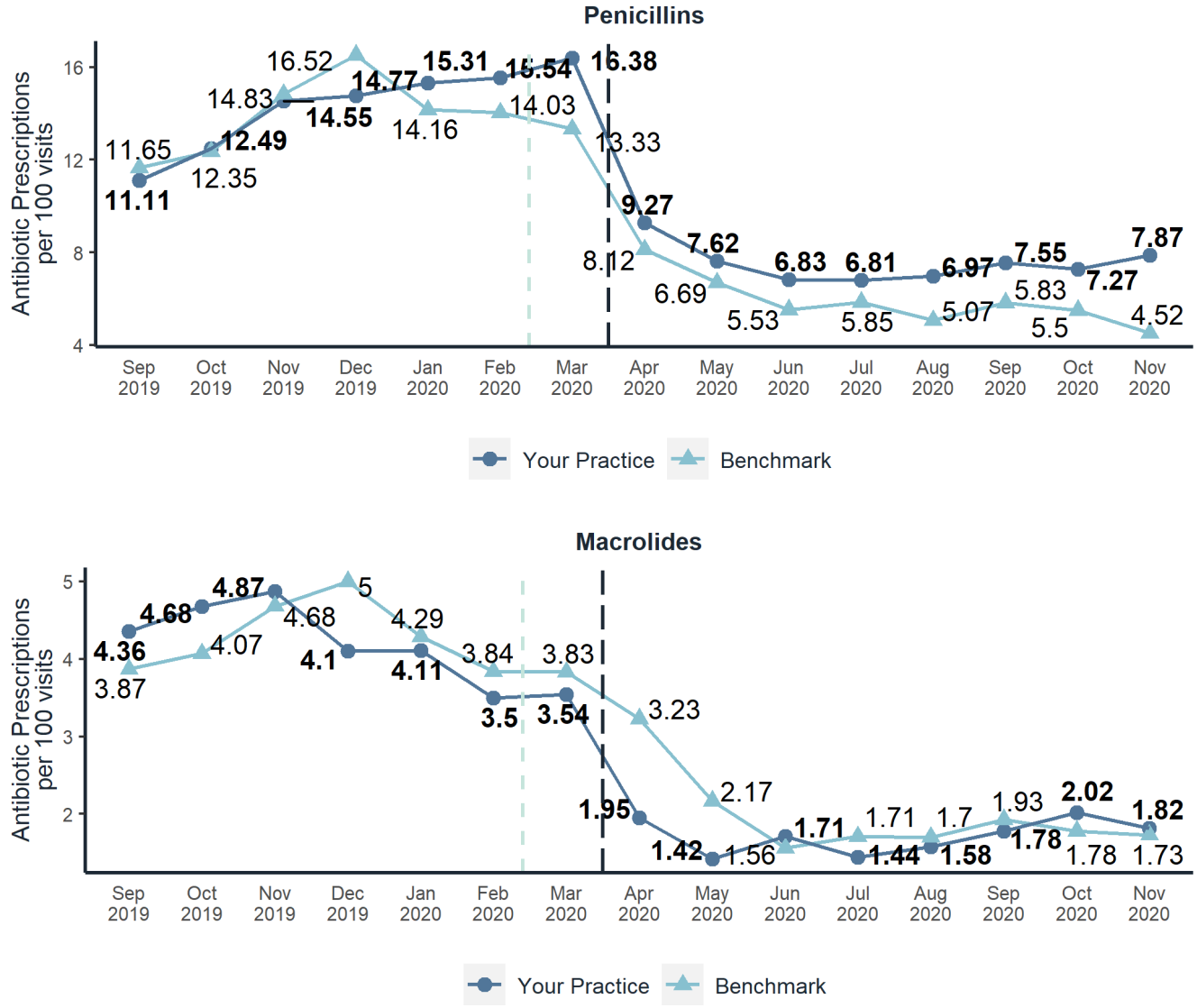
1.1 Antibiotic Prescriptions per 100 Visits, by Antibiotic Therapeutic Class

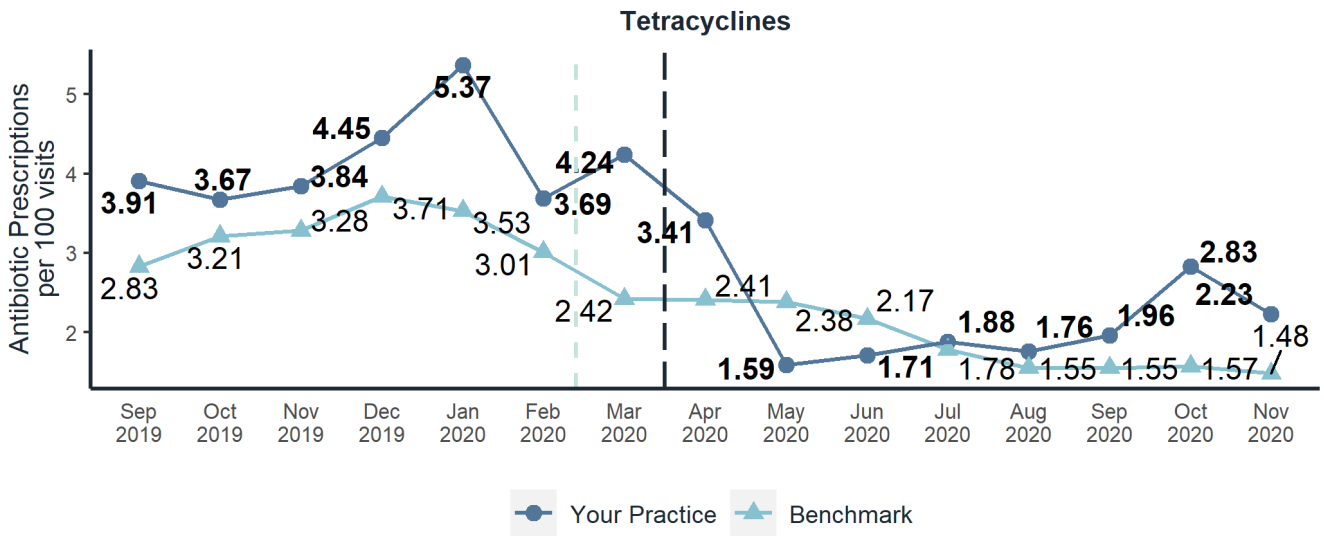
Figure 4 shows the antibiotic therapy prescriptions per 100 visits for select antibiotic therapeutic classes. Data are shown for your practice (**indicated by bolded numbers**) vs. the benchmark. To correctly interpret these results and to understand the measure calculations, please refer to Section 3 of the Appendix.

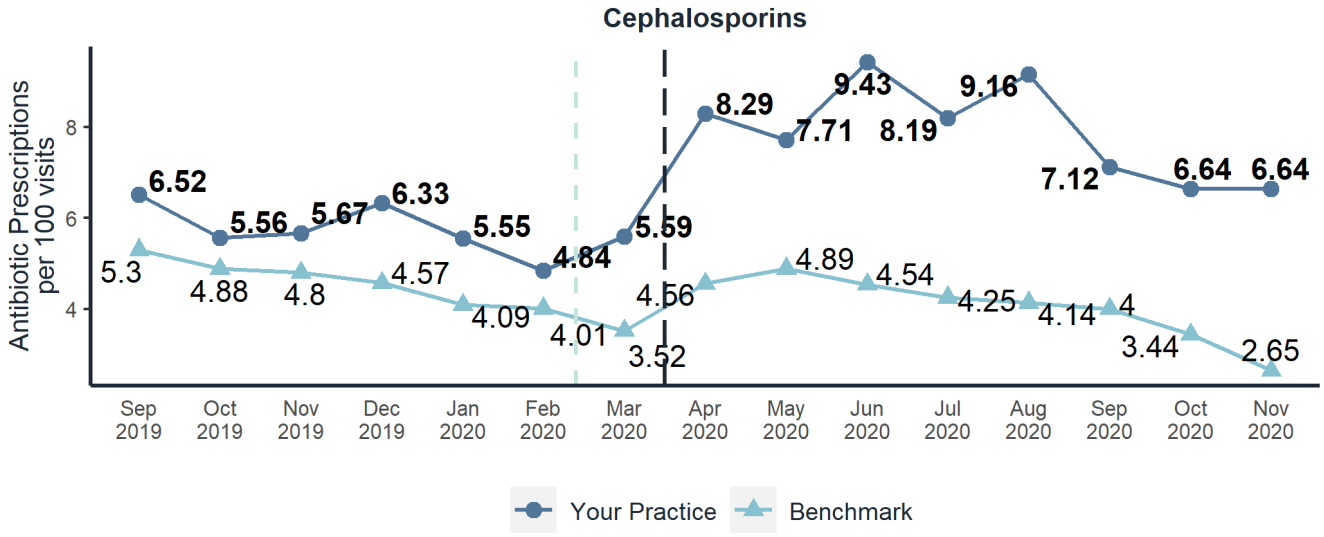
Your practice's antibiotic data may not be presented or may not be included in the benchmark in this section for several reasons. Below, we summarize relevant reasons for your practice by month.

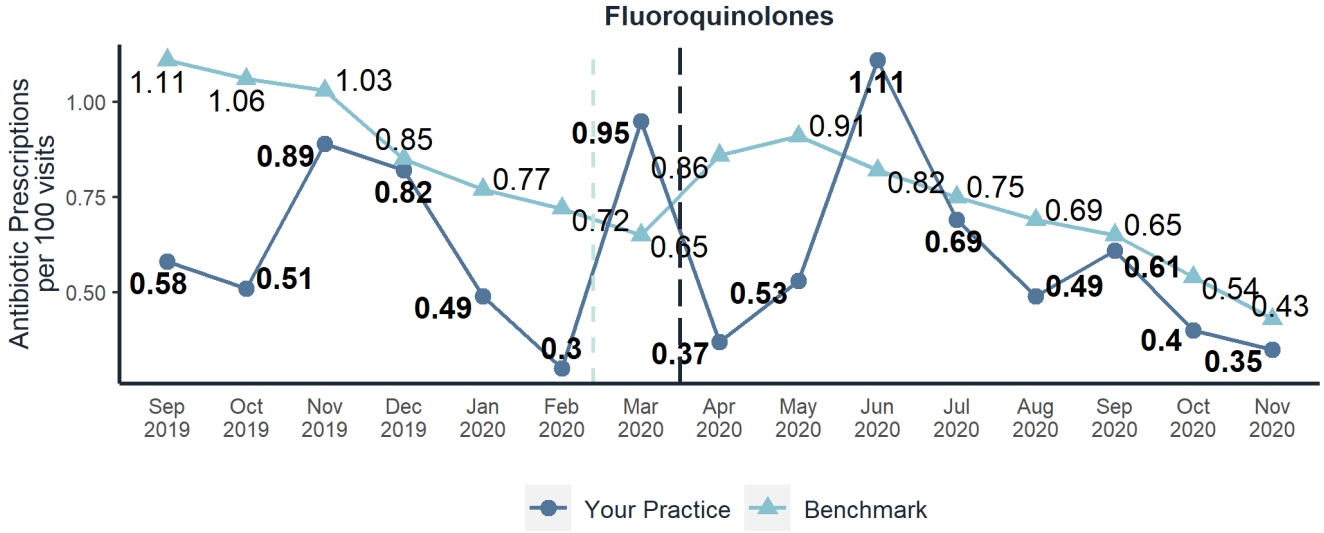
- Benchmark not available for the selected template for Mar 2020

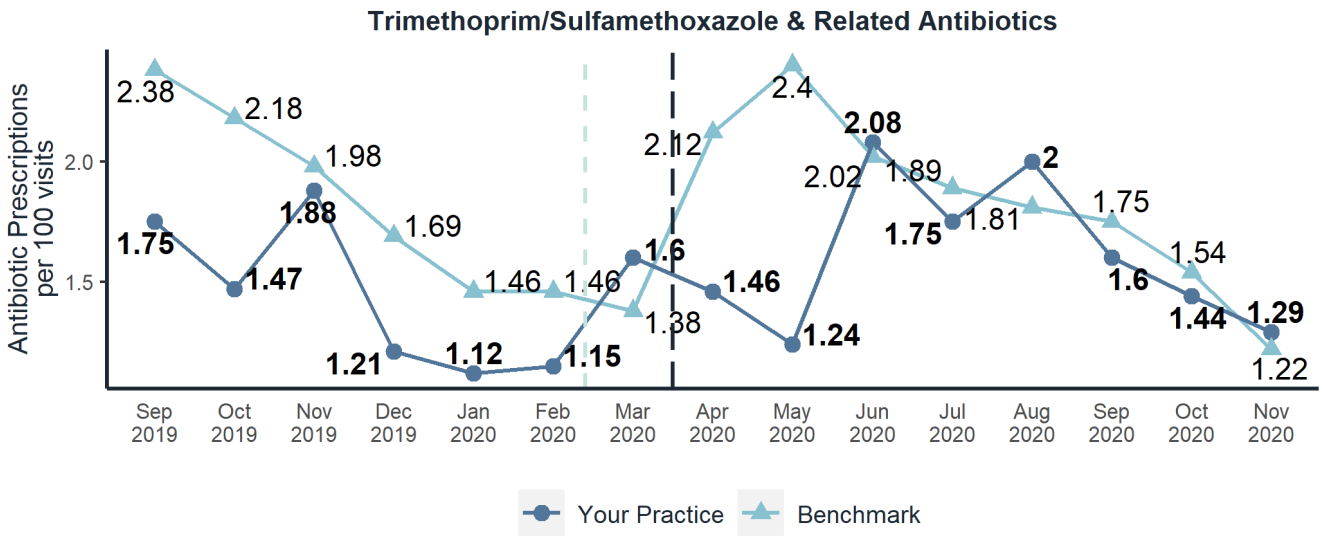
Figure 4. Antibiotic Prescriptions per 100 Visits, by Antibiotic Therapeutic Class

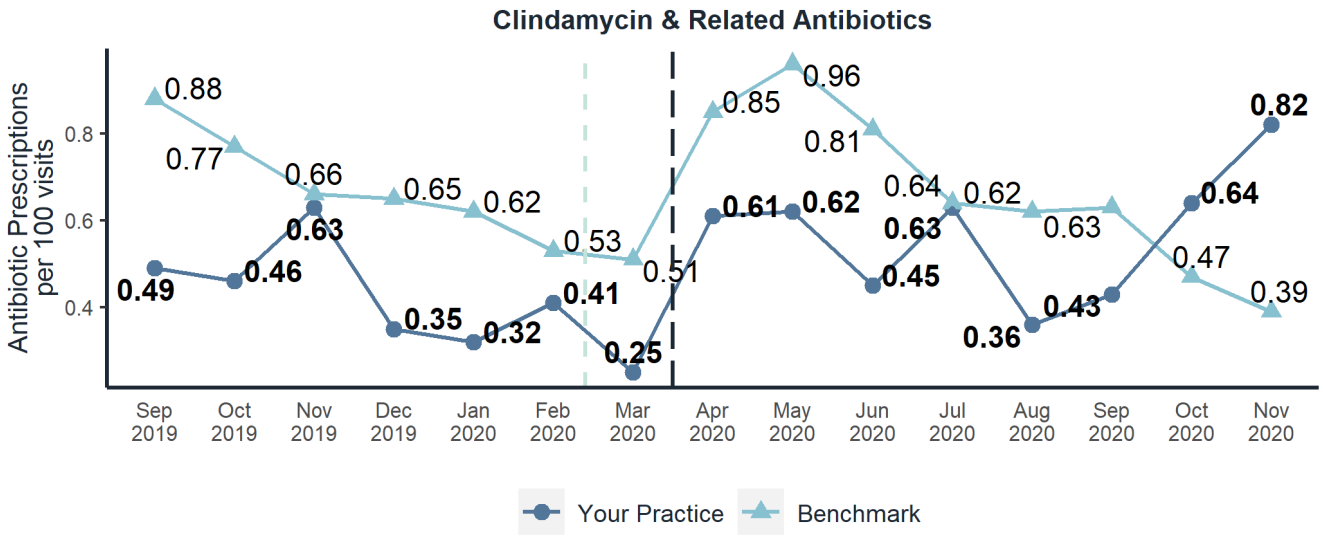


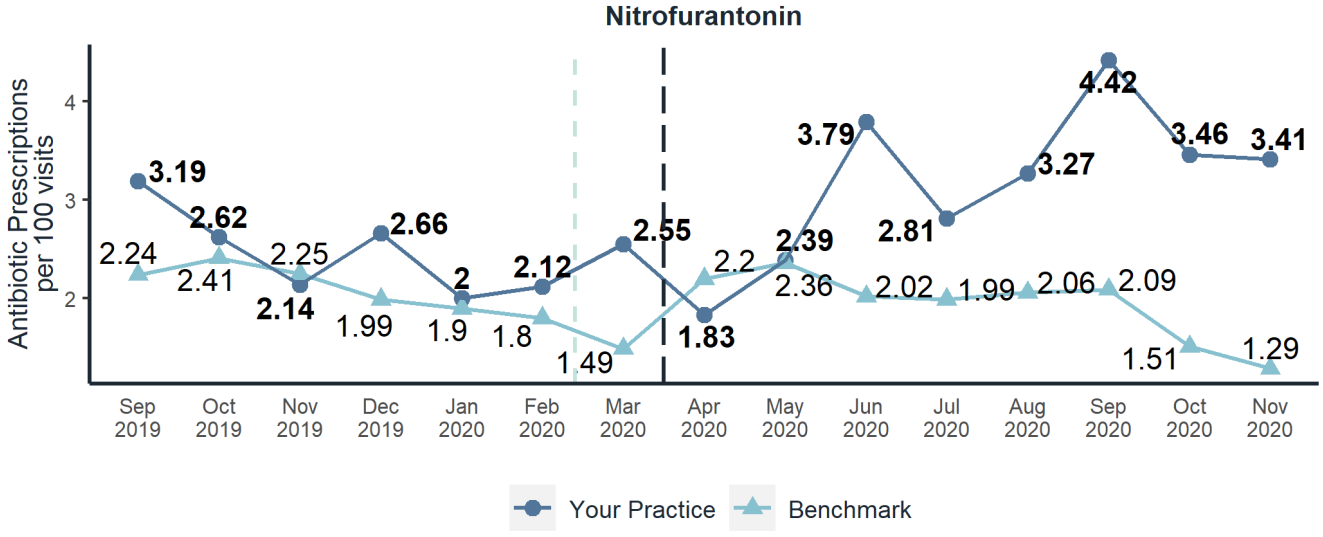

Tetracyclines
Antibiotic Prescriptions per 100 visits
5
4
3
2
3.91
3.67
3.84
4.45
5.37
3.69
4.24
3.41
1.59
1.71
1.88
1.76
1.96
2.83
2.23
1.48
2.83
3.21
3.28
3.71
3.53
3.01
2.42
2.41
2.38
2.17
1.78
1.55
1.55
1.57
Sep 2019
Oct 2019
Nov 2019
Dec 2019
Jan 2020
Feb 2020
Mar 2020
Apr 2020
May 2020
Jun 2020
Jul 2020
Aug 2020
Sep 2020
Oct 2020
Nov 2020
Your Practice
Benchmark

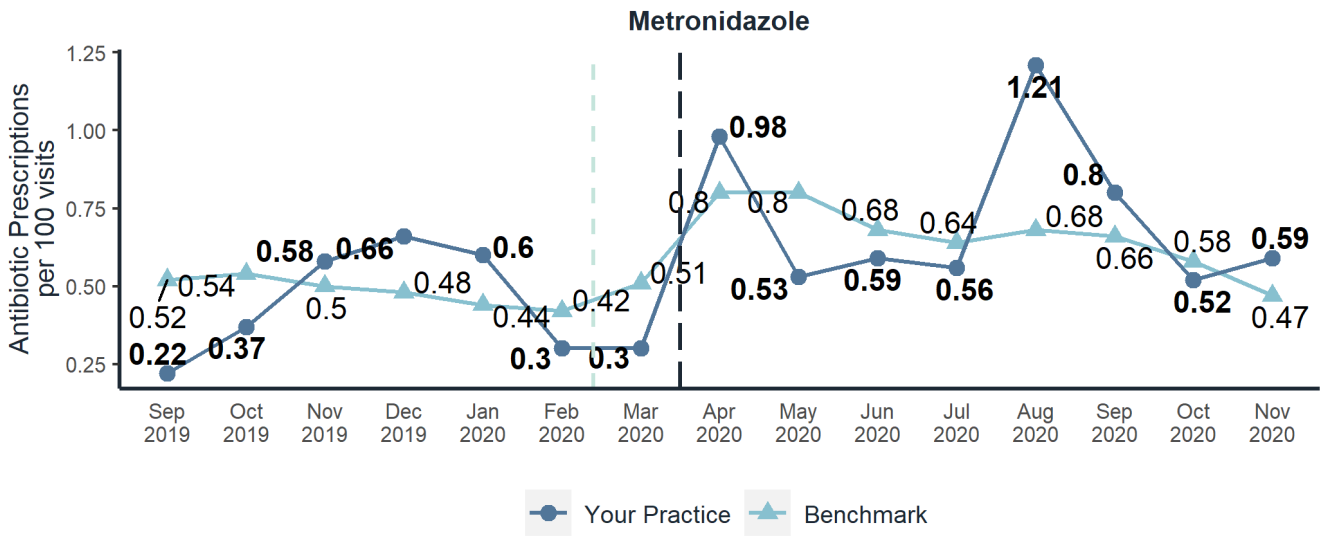

Cephalosporins
Antibiotic Prescriptions per 100 visits
8
6
4
6.52
5.56
5.67
6.33
5.55
4.84
5.59
8.29
7.71
9.43
8.19
9.16
7.12
6.64
6.64
5.3
4.88
4.8
4.57
4.09
4.01
4.56
3.52
4.89
4.54
4.25
4.14
4
3.44
2.65
Sep 2019
Oct 2019
Nov 2019
Dec 2019
Jan 2020
Feb 2020
Mar 2020
Apr 2020
May 2020
Jun 2020
Jul 2020
Aug 2020
Sep 2020
Oct 2020
Nov 2020
Your Practice
Benchmark

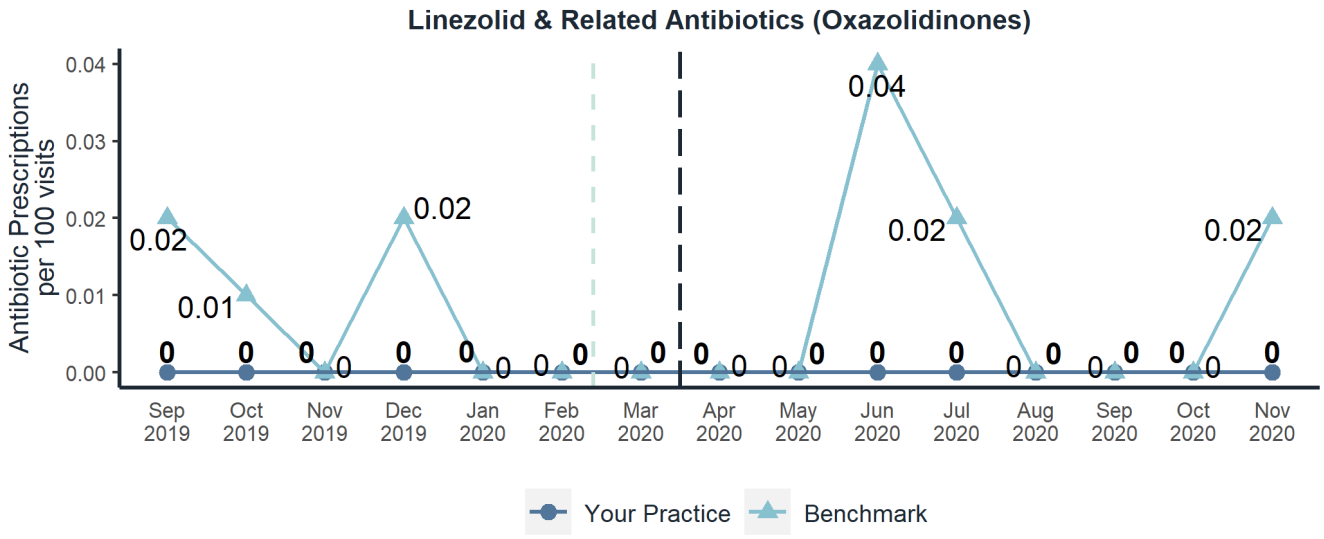

Fluoroquinolones
Antibiotic Prescriptions per 100 visits
1.00
0.75
0.50
1.11
1.06
1.03
0.85
0.77
0.72
0.86
0.91
0.82
0.75
0.69
0.65
0.54
0.43
0.58
0.51
0.89
0.82
0.49
0.3
0.95
0.65
0.37
0.53
1.11
0.69
0.49
0.61
0.4
0.35
Sep 2019
Oct 2019
Nov 2019
Dec 2019
Jan 2020
Feb 2020
Mar 2020
Apr 2020
May 2020
Jun 2020
Jul 2020
Aug 2020
Sep 2020
Oct 2020
Nov 2020
Your Practice
Benchmark

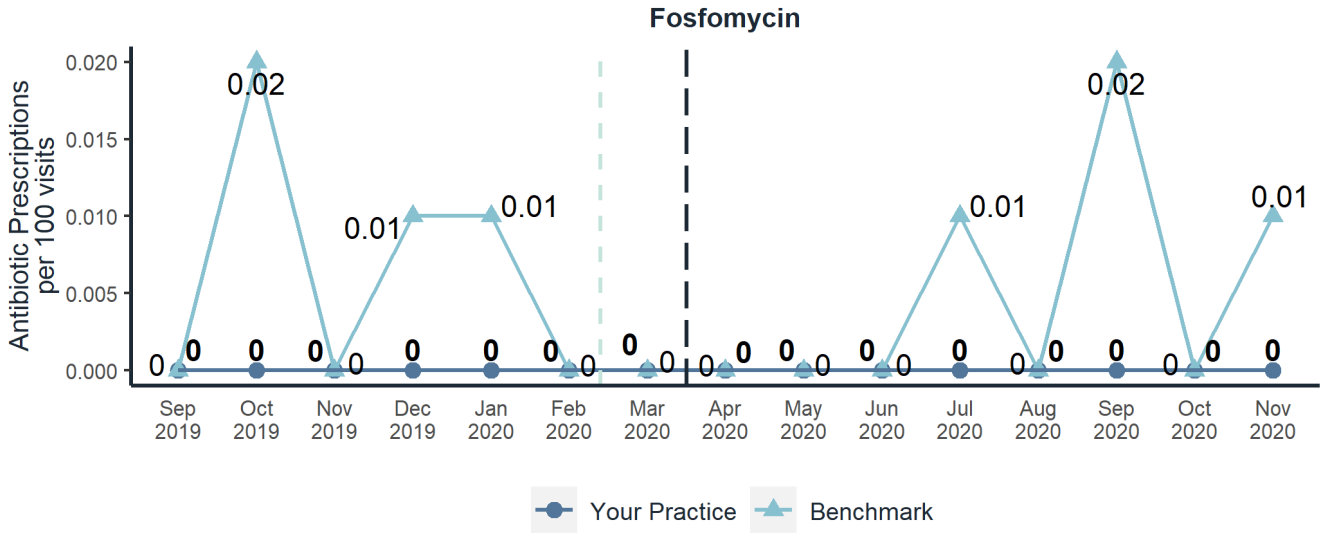

Trimethoprim/Sulfamethoxazole & Related Antibiotics
Antibiotic Prescriptions per 100 visits
2.0
1.5
2.38
2.18
1.98
1.69
1.46
1.46
1.38
2.12
2.4
2.02
1.89
1.81
1.75
1.75
1.54
1.75
1.88
1.47
1.21
1.12
1.15
1.6
1.46
1.24
2.08
2
1.6
1.44
1.29
1.22
Sep 2019
Oct 2019
Nov 2019
Dec 2019
Jan 2020
Feb 2020
Mar 2020
Apr 2020
May 2020
Jun 2020
Jul 2020
Aug 2020
Sep 2020
Oct 2020
Nov 2020
Your Practice
Benchmark


Clindamycin & Related Antibiotics
Antibiotic Prescriptions per 100 visits
0.8
0.6
0.4
0.88
0.77
0.66
0.65
0.62
0.53
0.51
0.85
0.96
0.81
0.64
0.62
0.63
0.47
0.39
0.49
0.46
0.63
0.35
0.32
0.41
0.25
0.61
0.62
0.45
0.36
0.43
0.64
0.82
Sep 2019
Oct 2019
Nov 2019
Dec 2019
Jan 2020
Feb 2020
Mar 2020
Apr 2020
May 2020
Jun 2020
Jul 2020
Aug 2020
Sep 2020
Oct 2020
Nov 2020
Your Practice
Benchmark


Nitrofurantonin
Antibiotic Prescriptions per 100 visits
4
3
2
3.19
2.62
2.14
2.66
2
2.12
2.55
1.83
3.79
2.81
3.27
4.42
3.46
3.41
2.24
2.41
2.25
1.99
1.9
1.8
1.49
2.2
2.39
2.36
2.02
1.99
2.06
2.09
1.51
1.29
Sep 2019
Oct 2019
Nov 2019
Dec 2019
Jan 2020
Feb 2020
Mar 2020
Apr 2020
May 2020
Jun 2020
Jul 2020
Aug 2020
Sep 2020
Oct 2020
Nov 2020
Your Practice
Benchmark


Metronidazole
Antibiotic Prescriptions per 100 visits
1.25
1.00
0.75
0.50
0.25
0.52
0.54
0.22
0.37
0.58
0.66
0.5
0.48
0.6
0.44
0.3
0.42
0.3
0.51
0.8
0.98
0.8
0.53
0.68
0.59
0.64
0.56
1.21
0.8
0.68
0.66
0.58
0.59
0.52
0.47
Sep 2019
Oct 2019
Nov 2019
Dec 2019
Jan 2020
Feb 2020
Mar 2020
Apr 2020
May 2020
Jun 2020
Jul 2020
Aug 2020
Sep 2020
Oct 2020
Nov 2020
Your Practice
Benchmark


Linezolid & Related Antibiotics (Oxazolidinones)
Antibiotic Prescriptions per 100 visits
0.04
0.03
0.02
0.01
0.00
0.02
0.01
0.02
0.04
0.02
0.02
Sep 2019
Oct 2019
Nov 2019
Dec 2019
Jan 2020
Feb 2020
Mar 2020
Apr 2020
May 2020
Jun 2020
Jul 2020
Aug 2020
Sep 2020
Oct 2020
Nov 2020
Your Practice
Benchmark


Fosfomycin
Antibiotic Prescriptions per 100 visits
0.020
0.015
0.010
0.005
0.000
0.02
0.01
0.01
0.02
0.01
0.02
0.01
Sep 2019
Oct 2019
Nov 2019
Dec 2019
Jan 2020
Feb 2020
Mar 2020
Apr 2020
May 2020
Jun 2020
Jul 2020
Aug 2020
Sep 2020
Oct 2020
Nov 2020
Your Practice
Benchmark

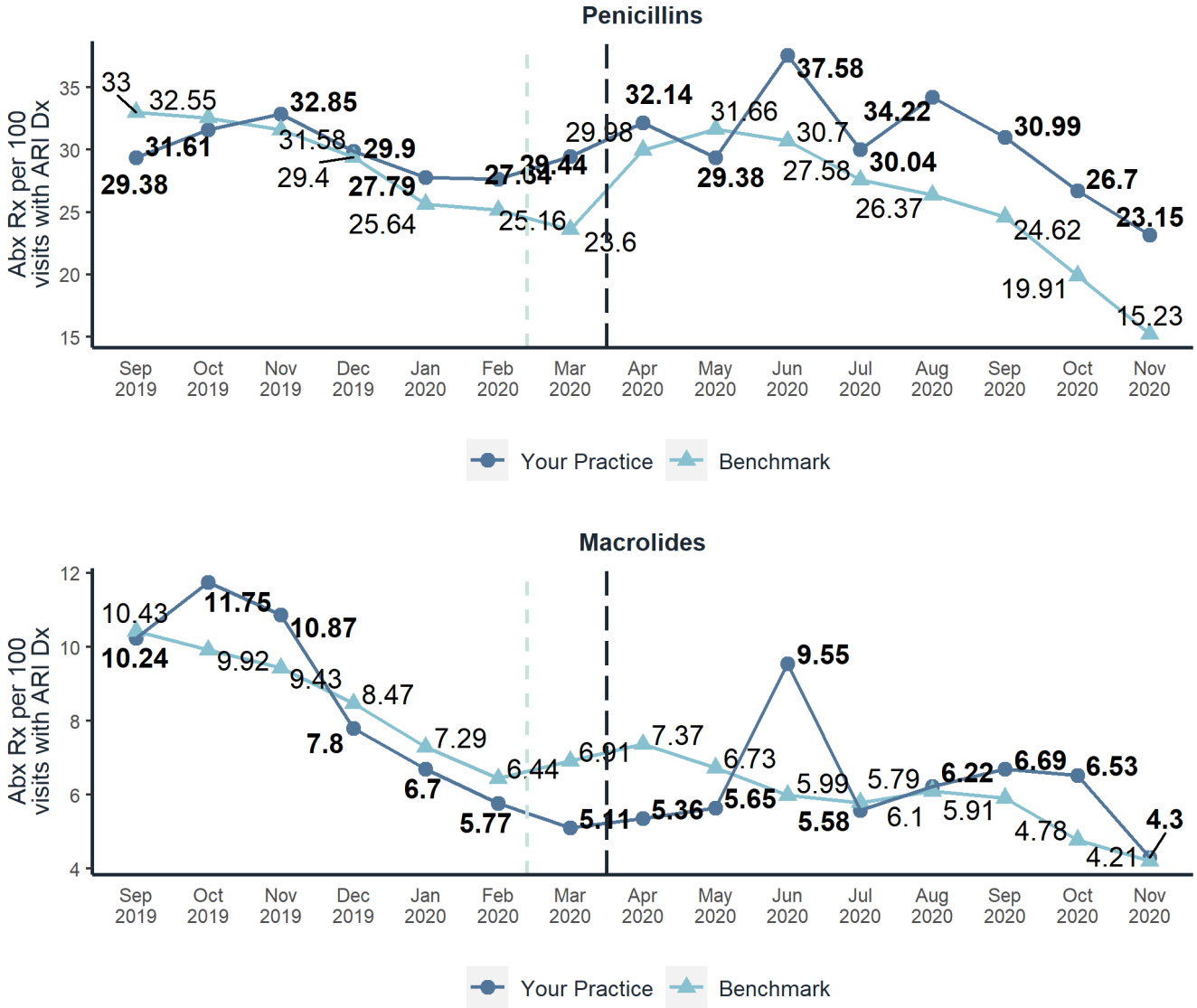
2.1 Antibiotic Prescriptions per 100 Visits With ARI Diagnosis, by Antibiotic Therapeutic Class

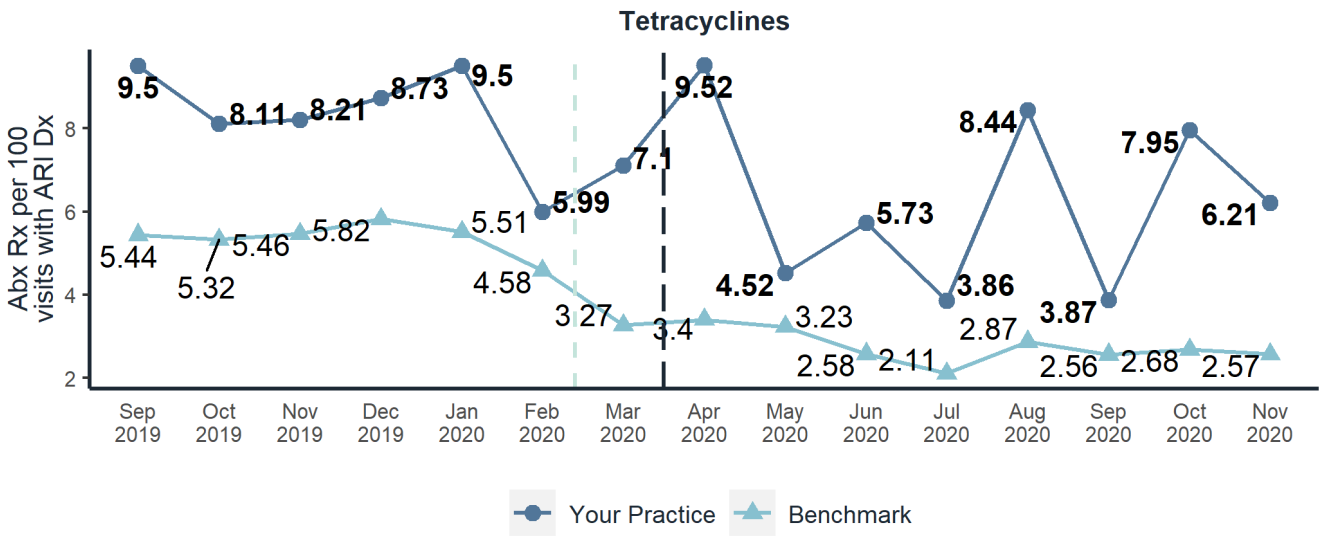
Figure 5 shows the antibiotic therapy prescriptions per 100 visits with ARI diagnosis for antibiotic therapeutic classes that are found to be frequently prescribed in visits with ARI diagnosis. Data are shown for your practice (**indicated by bolded numbers**) vs. the benchmark. To correctly interpret these results and to understand the measure calculations, please refer to Section 3 of the Appendix.

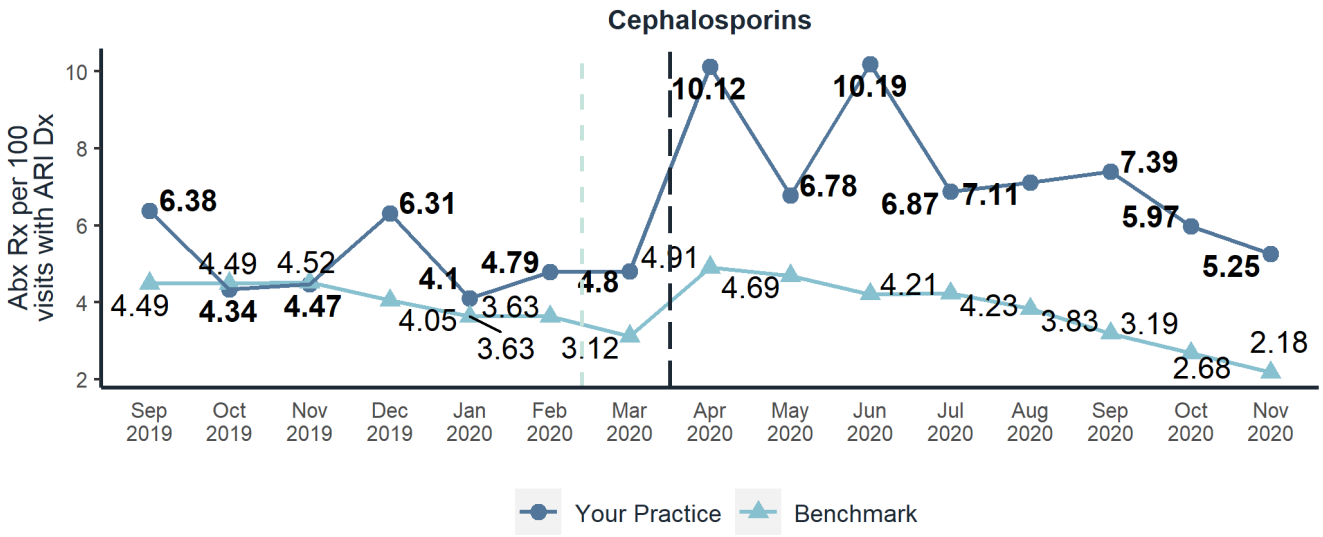
Your practice's antibiotic data may not be presented or may not be included in the benchmark in this section for several reasons. Below, we summarize relevant reasons for your practice by month.

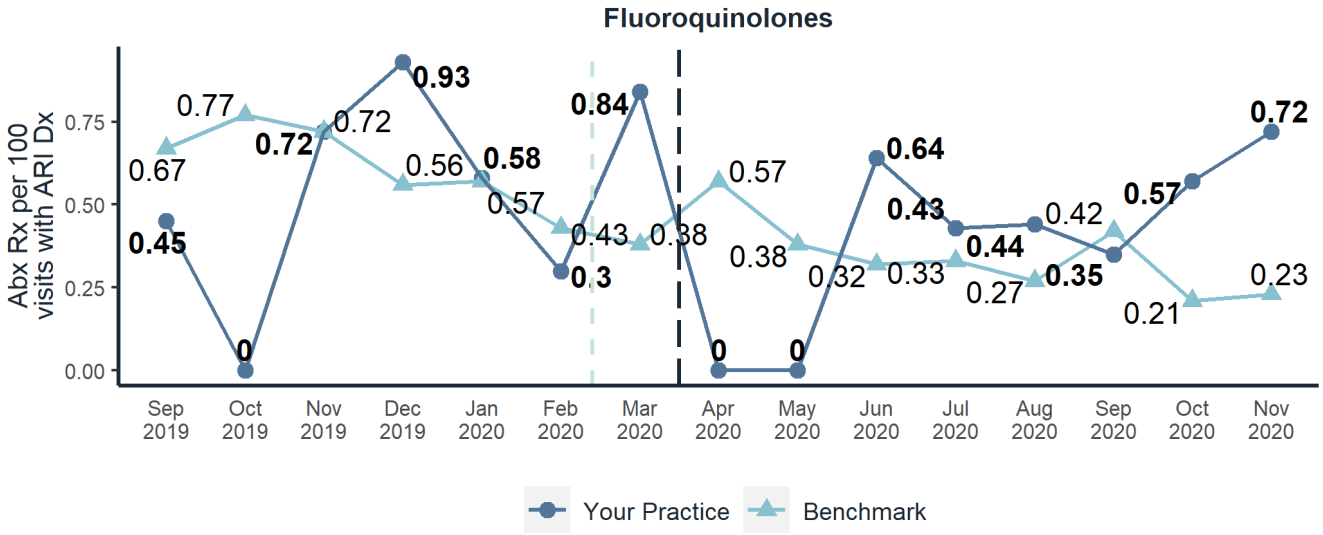
- Benchmark not available for the selected template for Mar 2020

Figure 5. Antibiotic Prescriptions per 100 Visits with ARI Diagnosis, by Antibiotic Therapeutic Class




Tetracyclines
Abx Rx per 100 visits with ARI Dx
Sep 2019
Oct 2019
Nov 2019
Dec 2019
Jan 2020
Feb 2020
Mar 2020
Apr 2020
May 2020
Jun 2020
Jul 2020
Aug 2020
Sep 2020
Oct 2020
Nov 2020
Your Practice
Benchmark


Cephalosporins
Abx Rx per 100 visits with ARI Dx
Sep 2019
Oct 2019
Nov 2019
Dec 2019
Jan 2020
Feb 2020
Mar 2020
Apr 2020
May 2020
Jun 2020
Jul 2020
Aug 2020
Sep 2020
Oct 2020
Nov 2020
Your Practice
Benchmark


Fluoroquinolones
Abx Rx per 100 visits with ARI Dx
Sep 2019
Oct 2019
Nov 2019
Dec 2019
Jan 2020
Feb 2020
Mar 2020
Apr 2020
May 2020
Jun 2020
Jul 2020
Aug 2020
Sep 2020
Oct 2020
Nov 2020
Your Practice
Benchmark

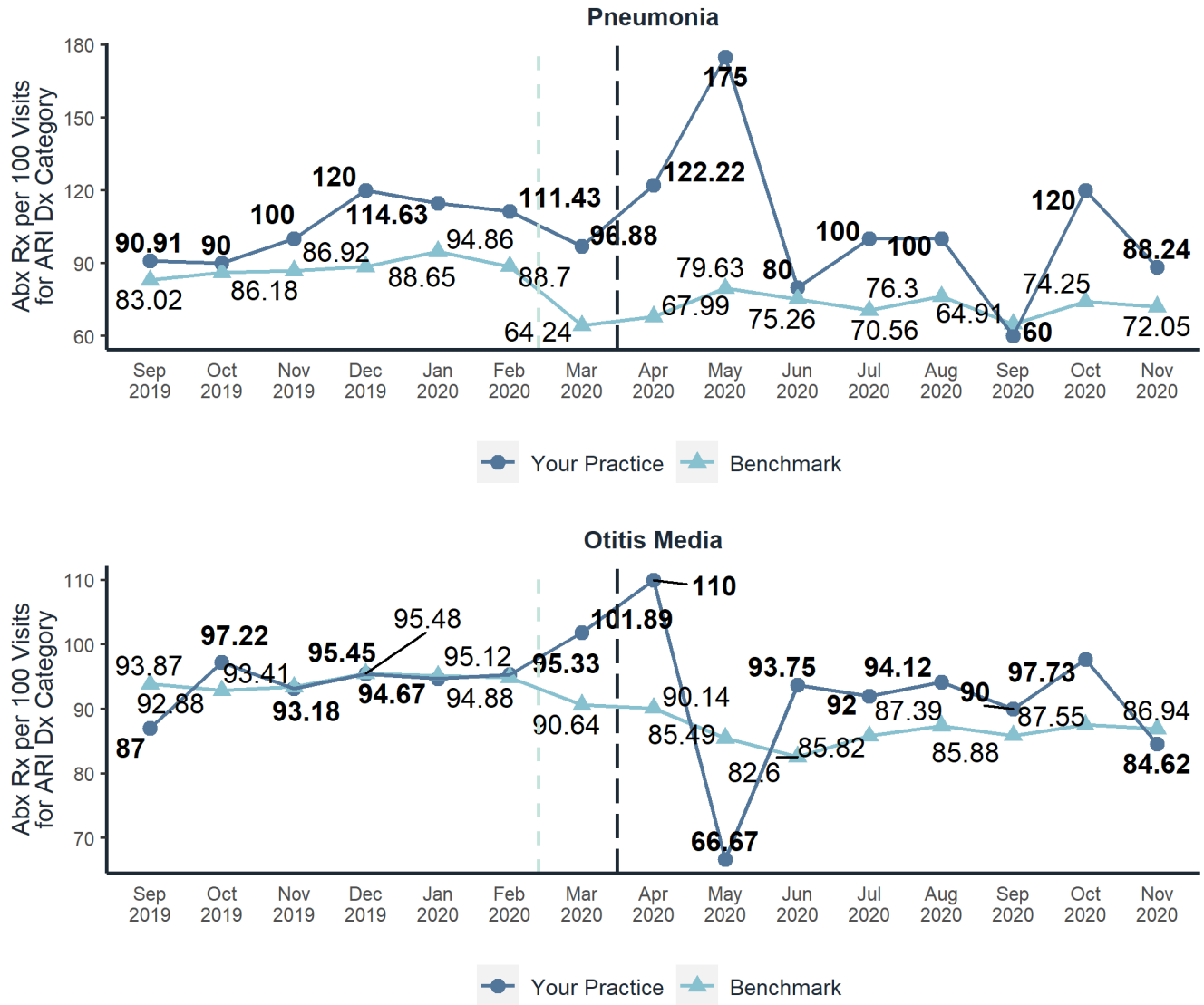
2.2 Antibiotic Prescriptions per 100 Visits With ARI Diagnosis, by ARI Diagnosis Category

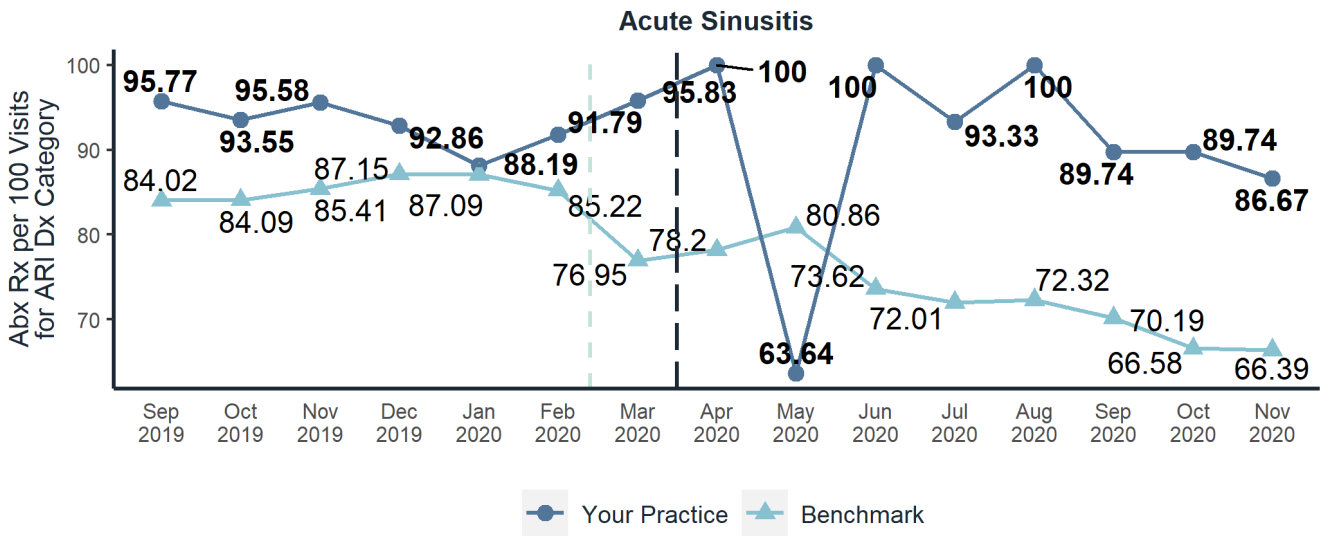
Figure 6 shows the antibiotic prescriptions per 100 visits with ARI diagnosis, by ARI diagnosis category. Data are shown for your practice (**indicated by bolded numbers**) vs. the benchmark. To correctly interpret these results and to understand the measure calculations, please refer to Section 3 of the Appendix.

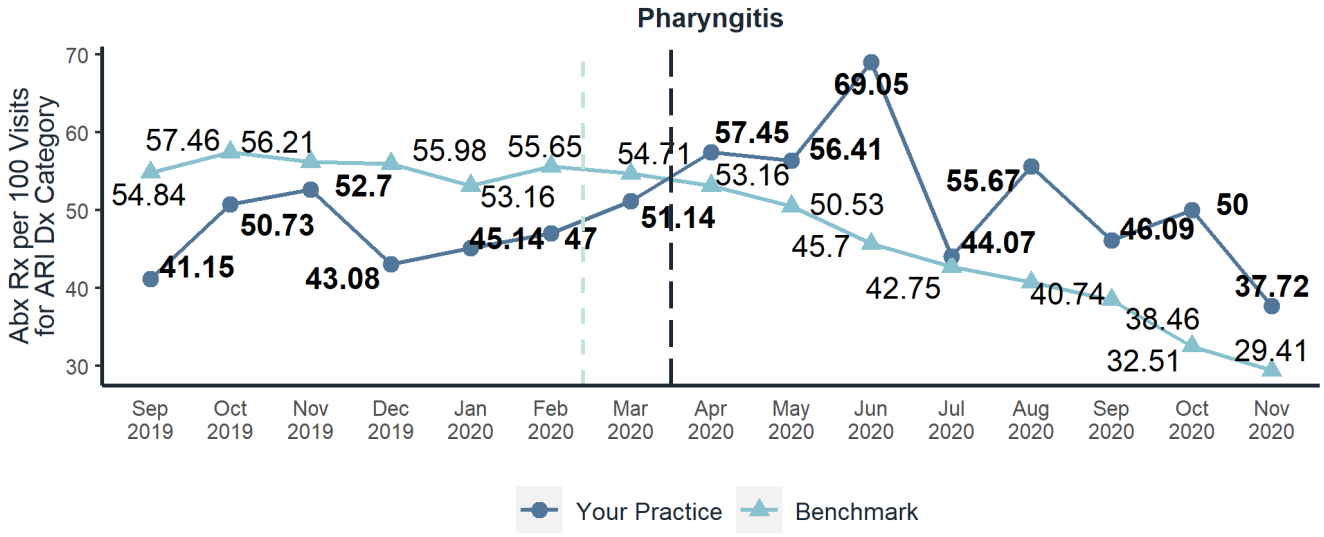
Your practice's antibiotic data may not be presented or may not be included in the benchmark in this section for several reasons. Below, we summarize relevant reasons for your practice by month.

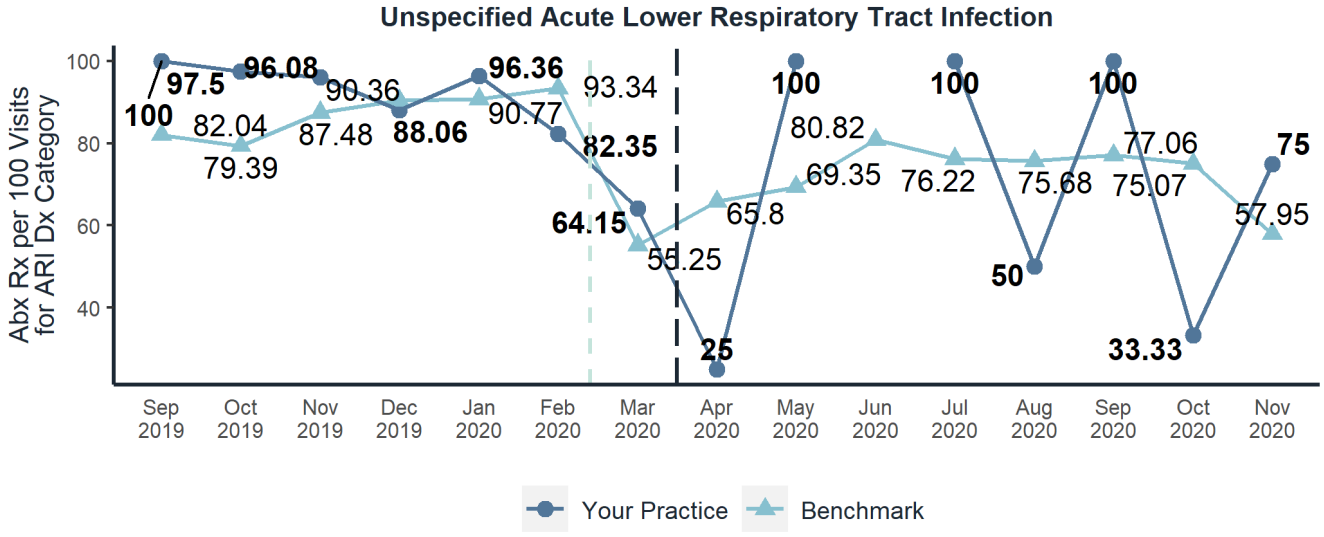
- Benchmark not available for the selected template for Mar 2020

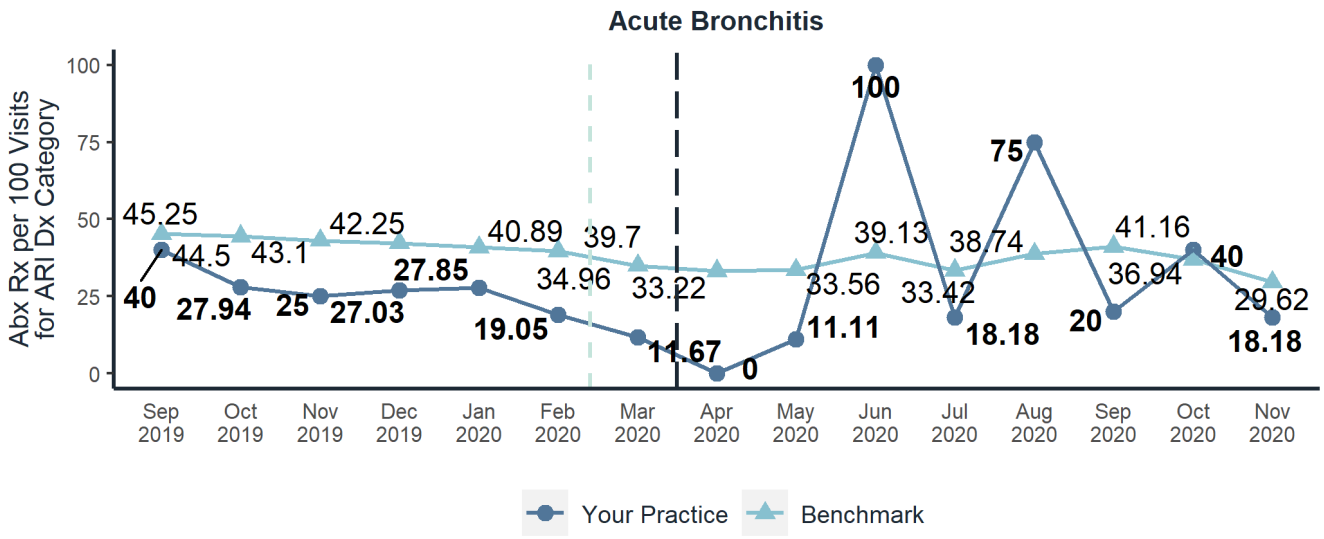
Figure 6. Antibiotic Prescriptions per 100 Visits with ARI Diagnosis, by ARI Diagnosis Category

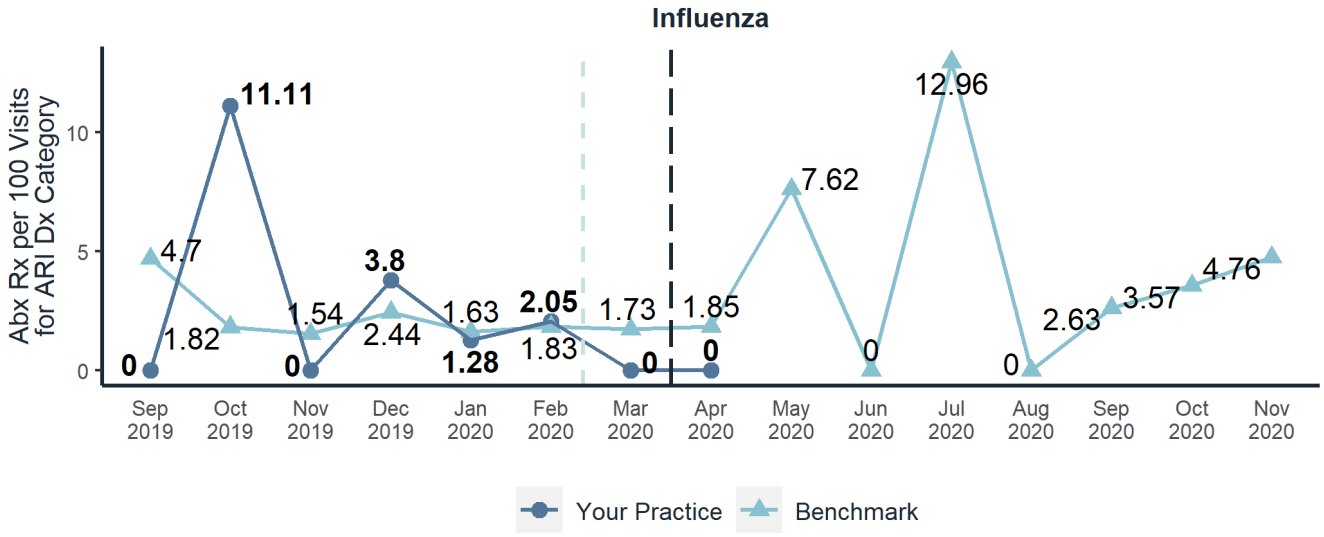


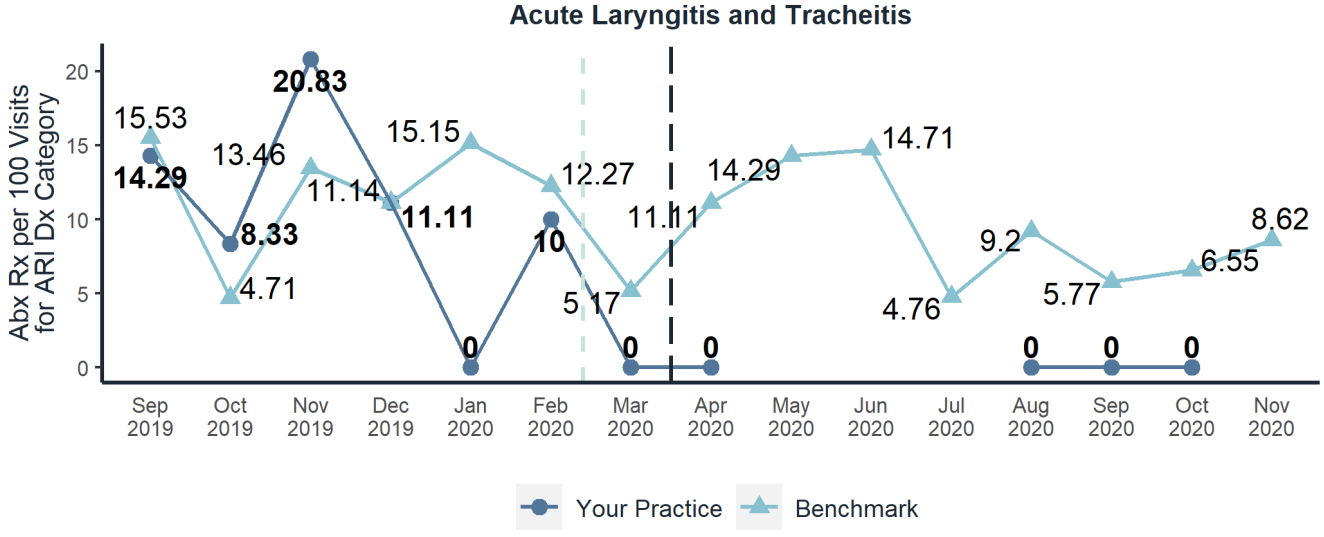

Acute Sinusitis
Abx Rx per 100 Visits for ARI Dx Category
100
90
80
70
95.77
95.58
93.55
92.86
88.19
91.79
95.83
100
100
93.33
100
89.74
89.74
86.67
84.02
84.09
87.15
85.41
87.09
85.22
76.95
78.2
80.86
73.62
72.01
72.32
70.19
66.58
66.39
63.64
Sep 2019
Oct 2019
Nov 2019
Dec 2019
Jan 2020
Feb 2020
Mar 2020
Apr 2020
May 2020
Jun 2020
Jul 2020
Aug 2020
Sep 2020
Oct 2020
Nov 2020
Your Practice
Benchmark

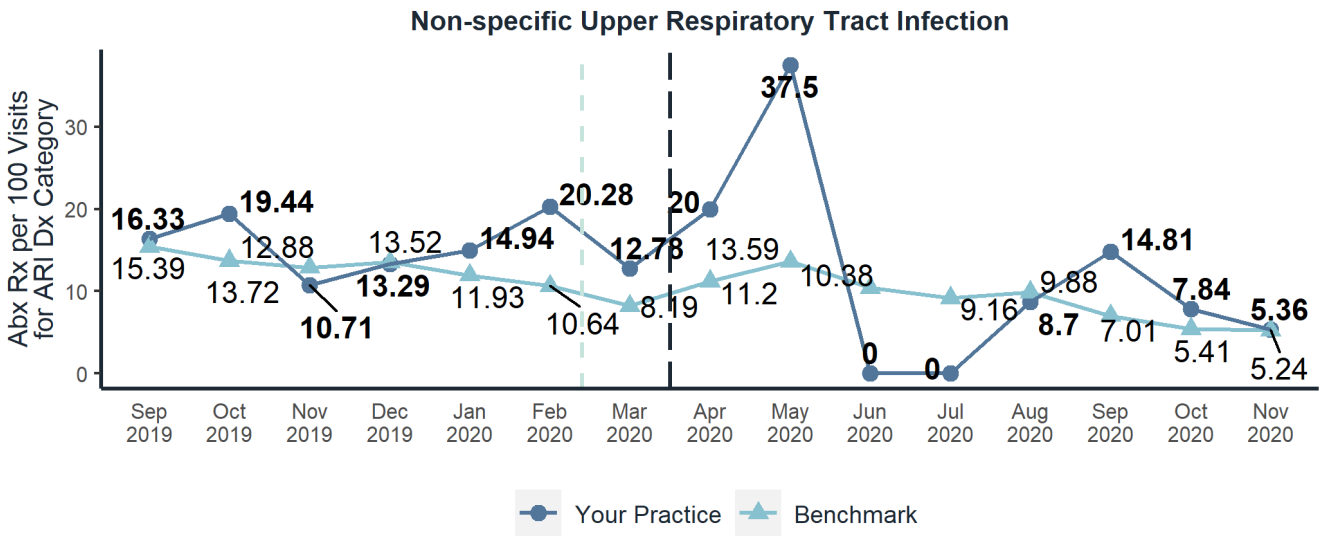

Pharyngitis
Abx Rx per 100 Visits for ARI Dx Category
70
60
50
40
30
57.46
56.21
55.98
55.65
54.71
57.45
56.41
69.05
54.84
52.7
53.16
53.16
50.53
55.67
50
50.73
51.14
45.7
44.07
46.09
41.15
45.14
47
42.75
40.74
37.72
43.08
38.46
32.51
29.41
Sep 2019
Oct 2019
Nov 2019
Dec 2019
Jan 2020
Feb 2020
Mar 2020
Apr 2020
May 2020
Jun 2020
Jul 2020
Aug 2020
Sep 2020
Oct 2020
Nov 2020
Your Practice
Benchmark

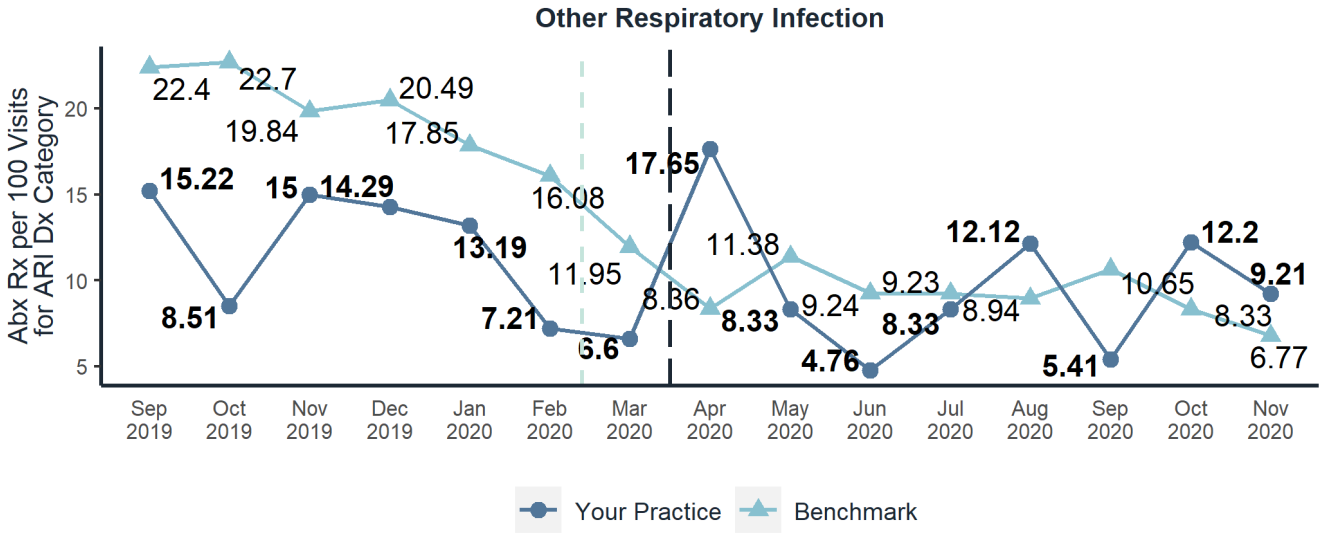

Unspecified Acute Lower Respiratory Tract Infection
Abx Rx per 100 Visits for ARI Dx Category
100
80
60
40
97.5
96.08
96.36
93.34
100
100
100
100
82.04
90.36
87.48
88.06
90.77
82.35
80.82
77.06
75
79.39
69.35
76.22
75.68
75.07
64.15
65.8
57.95
55.25
50
25
33.33
Sep 2019
Oct 2019
Nov 2019
Dec 2019
Jan 2020
Feb 2020
Mar 2020
Apr 2020
May 2020
Jun 2020
Jul 2020
Aug 2020
Sep 2020
Oct 2020
Nov 2020
Your Practice
Benchmark


Acute Bronchitis
Abx Rx per 100 Visits for ARI Dx Category
100
75
50
25
0
45.25
44.5
43.1
42.25
40.89
39.7
39.13
38.74
41.16
40
27.94
25
27.03
27.85
34.96
33.22
33.56
33.42
36.94
40
29.62
40
19.05
11.67
0
11.11
100
18.18
75
20
18.18
Sep 2019
Oct 2019
Nov 2019
Dec 2019
Jan 2020
Feb 2020
Mar 2020
Apr 2020
May 2020
Jun 2020
Jul 2020
Aug 2020
Sep 2020
Oct 2020
Nov 2020
Your Practice
Benchmark


Influenza
Abx Rx per 100 Visits for ARI Dx Category
10
5
0
4.7
1.82
1.54
2.44
1.63
1.83
1.73
1.85
7.62
0
12.96
0
2.63
3.57
4.76
0
11.11
0
3.8
1.28
2.05
0
0
Sep 2019
Oct 2019
Nov 2019
Dec 2019
Jan 2020
Feb 2020
Mar 2020
Apr 2020
May 2020
Jun 2020
Jul 2020
Aug 2020
Sep 2020
Oct 2020
Nov 2020
Your Practice
Benchmark


Acute Laryngitis and Tracheitis
Abx Rx per 100 Visits for ARI Dx Category
20
15
10
5
0
15.53
14.29
13.46
8.33
4.71
20.83
11.14
15.15
11.11
0
12.27
5.17
10
0
11.11
14.29
0
14.71
4.76
9.2
5.77
6.55
8.62
0
0
0
Sep 2019
Oct 2019
Nov 2019
Dec 2019
Jan 2020
Feb 2020
Mar 2020
Apr 2020
May 2020
Jun 2020
Jul 2020
Aug 2020
Sep 2020
Oct 2020
Nov 2020
Your Practice
Benchmark


Non-specific Upper Respiratory Tract Infection
Abx Rx per 100 Visits for ARI Dx Category
0
10
20
30
16.33
19.44
10.71
13.29
14.94
20.28
12.78
20
37.5
0
0
14.81
7.84
5.36
15.39
12.88
13.72
13.52
11.93
10.64
8.19
13.59
11.2
10.38
9.16
9.88
8.7
7.01
5.41
5.24
Sep 2019
Oct 2019
Nov 2019
Dec 2019
Jan 2020
Feb 2020
Mar 2020
Apr 2020
May 2020
Jun 2020
Jul 2020
Aug 2020
Sep 2020
Oct 2020
Nov 2020
Your Practice
Benchmark


Other Respiratory Infection
Abx Rx per 100 Visits for ARI Dx Category
5
10
15
20
15.22
8.51
15
14.29
13.19
7.21
6.6
17.65
8.33
4.76
8.33
12.12
5.41
12.2
9.21
22.4
22.7
19.84
20.49
17.85
16.08
11.95
8.86
11.38
9.24
9.23
8.94
10.65
8.33
6.77
Sep 2019
Oct 2019
Nov 2019
Dec 2019
Jan 2020
Feb 2020
Mar 2020
Apr 2020
May 2020
Jun 2020
Jul 2020
Aug 2020
Sep 2020
Oct 2020
Nov 2020
Your Practice
Benchmark

3.1 Benchmarking Reports and Summarized Data

As part of your participation in the AHRQ Safety Program for Improving Antibiotic Use, your practice will receive four benchmarking reports to compare your practice's progress to those of similar practices:

- Report 1 contained retrospective data (Sep 2019 - Nov 2019) and baseline data (Dec 2019 - Feb 2020), baseline SA and baseline MOSOPS data
- Report 2 contains previously reported data and data from Mar 2020 - May 2020
- Report 3 will contain previously reported data and data from June 2020 - Aug 2020
- Report 4 will contain previously reported data and data from Sep 2020 - Nov 2020, endline SA and endline MOSOPS data

Usable data submitted by 01/31/2021 are incorporated in Report 4. Please see the individual results above for more detail. Note that results from individual practices will not be shared with other participating practices; the report only includes aggregate benchmark data from other practices. We welcome your feedback on the report. If you have any questions about the report or the individual results for your practice, please contact your implementation adviser.

3.2 Benchmarking Groups

The report also includes aggregate data results from similar participating practices (benchmark practices). Your practice may be benchmarked into one of the following categories:

- Pediatric Practices that treat only the pediatric population such as pediatric clinics, pediatric urgent care centers, pediatric sites of FQHCs, and pediatric specialty care
- Urgent Care Practices except those treating only the pediatric population
- Federally Qualified Health Centers (FQHCs) except those treating only the pediatric population
- Primary Care Practices such as internal medicine, family medicine, and other primary care practices that do not provide specialty care
- Other Practices such as student health and practices providing specialty or multi-specialty care.

3.3 COVID-19 and Benchmarking

The COVID-19 pandemic and resulting public health challenges have had a significant impact on healthcare delivery. The AHRQ Safety Program for Improving Antibiotic Use recognizes that many ambulatory care practices participating in the Safety Program have shifted away from in-person visits to non-in-person synchronous visits for care that would normally be provided face-to-face. Non-in-person synchronous visits refer to billable telehealth visits, virtual check-in, and e-visits that are facilitated via telecommunication systems/devices/patient portals using video and/or phone communication. Given this significant shift, the Safety Program has updated the monthly data collection template and submission process to collect data on all visits (i.e., in-person and non-in-person synchronous visits), instead of in-person visits only which were collected before the pandemic. The word 'visits' reported in Reports 2, 3 and 4 may reference in-person visits or all visits for the months of September 2019 - February 2020 and will refer to all visits only for data from March 2020 and onwards.

3.4 Measures and Formulas for their Calculations

Number of visits - The total number of in-person and non-in-person synchronous visits made by any patient to the practice in the reporting month. If a patient visited the practice twice within the given month, then it is counted as two visits. If a patient visited the practice twice in one day, then those visits are counted as one and the antibiotic prescriptions during those visits are summed up.

Number of visits with ARI diagnosis - The total number of in-person and non-in-person synchronous visits with an ICD-10 CM diagnosis code for the respective ARI in an antibiotic appropriateness order (i.e., if the visit has ICD-10-CM code for Pneumonia and Otitis Media the visit is counted as Pneumonia). The antibiotic appropriateness order is described in Appendix 2A of the data collection template Version 4.

Antibiotic prescriptions during visits - Antibiotic prescription administered during in-person and non-in-person synchronous visits for any illness/condition in a given month.

Antibiotic therapy prescriptions during visits for patients diagnosed with ARI - Antibiotic prescriptions administered during in-person and non-in-person synchronous visits with ARI diagnosis in an antibiotic appropriateness order (i.e., if the visit has ICD-10-CM code for Pneumonia and Otitis Media then the antibiotic prescriptions are counted for Pneumonia as it is more antibiotic appropriate). The antibiotic appropriateness order is described in Appendix 2A of the data collection template Version 4.

Antibiotic Prescriptions per 100 Visits, Total (for section 1):

$$\frac{(Sum\ of\ abx\ for\ in-person\ visits)*100}{Sum\ of\ in-person\ visits}\ or\ \frac{(Sum\ of\ abx\ in\ all\ visits)*100}{Sum\ of\ all\ visits}$$

Antibiotic Prescriptions Per 100 Visits with ARI Diagnosis, Total (for section 2):

$$\frac{(Sum\ of\ Abx\ in\ in-person\ visits\ with\ ARI\ dx)*100}{Sum\ of\ in-person\ visits\ with\ ARI\ dx}\ or\ \frac{(Sum\ of\ Abx\ in\ all\ visits\ with\ ARI\ dx)*100}{Sum\ of\ all\ visits\ with\ ARI\ dx}$$

Antibiotic Prescriptions per 100 Visits, by Antibiotic Therapeutic Class (for section 1.1):

$$\frac{(Type\ of\ abx\ prescribed\ in\ in-person\ visits)*100}{Total\ of\ in-person\ visits}\ or\ \frac{(Type\ of\ abx\ prescribed\ in\ all\ visits)*100}{Total\ of\ all\ visits}$$

Antibiotic Prescriptions per 100 Visits with ARI Diagnosis, by Antibiotic Therapeutic Class that are found to be frequently prescribed in visits with ARI diagnosis (for section 2.1):

$$\frac{(Type\ of\ abx\ for\ in-person\ visits\ with\ ARI\ dx)*100}{Sum\ of\ in-person\ visits\ with\ ARI\ dx}\ or\ \frac{(Type\ of\ abx\ for\ all\ visits\ with\ ARI\ dx)*100}{Sum\ of\ all\ visits\ with\ ARI\ dx}$$

Antibiotic Prescriptions per 100 Visits with ARI Diagnosis, by ARI Diagnosis Category (for section 2.2):

$$\frac{(Abx\ per\ ARI\ for\ in-person\ visits\ with\ ARI\ dx)*100}{In-person\ visits\ for\ ARI\ dx\ category}\ or\ \frac{(Abx\ per\ ARI\ for\ all\ visits\ with\ ARI\ dx)*100}{All\ visits\ for\ ARI\ dx\ category}$$

3.5 Results Interpretation

These benchmarks are the average of results from all practices in your benchmark group whose data are available at the time of production of this report. The benchmark rates represent an average across all participating practices in your benchmarking category. Rates below the benchmark line indicate your practice's antibiotic prescriptions are lower than the benchmark. Rates above the benchmark line indicate your practice's antibiotic prescriptions are higher than the benchmark.

All practices will see a 'light blue long dashed line' between February and March, which denotes the difference between the benchmark calculations. Benchmark calculations before the 'light blue long dashed line' are calculated based on in-person visits only, and the benchmark calculations after the 'light blue long dashed line' are calculated based on all visits. This difference is due to the update made to the data collection template in March 2020 from V3 (which collects data from in person visits) to V4 (which collects data from all visits).

For practices that have submitted data in both V3 and V4 of the template, the antibiotic prescription rates before the 'black short dashed line' reflect prescriptions from in-person visits only, and the antibiotic prescription rates after the dotted line reflect prescriptions from all visits. Practices that submitted all of their data in V4, will not see a 'black short dashed line', and their antibiotic prescription rates reflect prescriptions from all visits in the figures.

Practices that did not follow a sequential order between switching from V3 to V4 between September and March will see a 'black short dashed line' based on the number of V3 or V4 submissions made during those months. If the number of V3 submissions are equal to or more than V4 submissions, then the 'black short dashed line' will denote the most recent V3-V4 switch. For example, if a practice submitted data in the following order: Sept Oct V3 - Nov Dec V4 - Jan Feb V3 - Mar after V4, then the practice will see a line after the most recent V3-V4 switch, in this example between February and March. If the number of V4 submissions are more than the number of V3 submissions, there will be no 'black short dashed line' shown. For example, if a practice submitted the data in the following order Sept Oct V3 - Nov Dec Jan V4 - Feb V3 - Mar and after V4, then the practice will see the 'black short dashed line' between October and November as February submission will be considered in the wrong template.

In addition to directly comparing your practice's results with the average in your benchmark group, we also provide you an indicator for whether your practice's performance was among the top within your benchmark or not (i.e., if your practice was among the top performers who had the lowest antibiotic prescriptions for a given month then your practice will receive a 'Yes' for that month, but if your practice was not among the top of practices with the lowest antibiotic prescriptions or not included in the benchmark calculations then your practice will get a 'No'). If your practice submitted incomplete data (e.g., missing data), or reported using an incorrect version of the data collection template, your data will be excluded from the benchmark calculation for that month as they are not directly comparable to benchmark data.

3.6 Glossary Tables

Glossary Table 1. Antibiotic Drug Classes

Therapeutic Class	Drug Name
Penicillins	Amoxicillin (Amoxil), Amoxicillin/Clavulanate (Augmentin), Ampicillin Po, Dixlocacillin, Penicillin V
Macrolides	Azithromycin (Zithromax), Clarithromycin, Erythromycin
Tetracyclines	Doxycycline (Vibramycin), Minocycline, Omadacycline (Nuzyra), Tetracycline
Cephalosporins	1st Generation: Cefadroxil (Duricef), Cephalexin (Keflex); 2nd Generation: Cefaclor, Cefprozil, Cefuroxime (Ceftin); 3rd Generation: Cefdinir (Omnicef), Cefditoren, Cefixime (Suprax), Cefpodoxime (Vantin), Cleftibuten
Fluoroquinolones	Ciprofloxacin (Cipro), Delafloxacin, Levofloxacin (Levaquin), Moxifloxacin (Avelox), Ofloxacin
Trimethoprim/Sulfamethoxazole	Sulfadiazine, Sulfamethoxazole/Trimethoprim (Bactrim, Septra), Trimethoprim
Clindamycin and related antibiotics (Lincosamides)	Clindamycin (Cleocin), Lincomycin
Nitrofurantonin	Nitrofurantoin (Macrobid)
Metronidazole	Metronidazole (Flagyl)
Rifampin (graphs not shown)	Rifampin
Oral Vancomycin (graphs not shown)	Vancomycin Po
Linezolid and related antibiotics (Oxazolidinones)	Linezolid (Zyvox), Tedizolid
Fosfomycin	Fosfomycin (Monurol)

Glossary Table 2. ICD-10 Codes

ARI Diagnosis (ICD Code)
Pneumonia (J12.xx, J13, J14, J15.xxx, J16.x, J17, J18.x, J09.x1, J10.0x, J11.0x)
Otitis media (H65.0x, H65.1xx, H65.9x, H66.0xx, H66.4x, H66.9x, H67.x, J10.83, J11.83)
Acute sinusitis (J01.xx)
Pharyngitis (J02.x, J03.xx)
Unspecified acute lower respiratory infection (J22)
Acute bronchitis (J20.x, J21.x, J40)
Influenza (J09.x, J10.x, J11.xx) – excluding (J09.x1, 10.0x, J10.83, J11.0x, J11.83)
Acute laryngitis and tracheitis (J04.xx, J05.xx)
Non-specific upper respiratory tract infection (J00, J06.x)
Other respiratory diagnosis:
Viral infection or unspecified site (B34.x)
Other viral agents as the cause of disease classified elsewhere (B97.89)
Unspecified disorder of tympanic membrane (H73.9x)
Other specified disorders of middle ear and mastoid (H74.8)
Unspecified disorder of middle ear and mastoid (H74.9)
Other disorders of middle ear and mastoid in diseases classified elsewhere (H75.xx)
Other specified disorders of nose and nasal sinuses (rhinorrhea) (J34.89)
Other specified diseases of the upper respiratory tract (J39.8)
Disease of the upper respiratory tract, unspecified (J39.9)
Respiratory disorders in diseases classified elsewhere (J99)
Cough (R05)

Appendix A-6. Structural Assessment

STRUCTURAL ASSESSMENT

Form Approved
OMB No. 0935-0238
Exp. Date 8/31/2022

1. How many clinicians work in your practice (including MDs, DOs, MBBSs, NPs, & PAs)?
    - M.D.s, D.O.s, and/or M.B.B.s: __
    - N.P.s: __
    - P.A.s: __

2. Does your practice have regular meetings? Y/N

    2a. If yes, who attends these meetings? SELECT ALL THAT APPLY
    - ☐ Clinicians
    - ☐ Nurses
    - ☐ Medical assistants
    - ☐ Front desk staff
    - ☐ Others

    2b. If yes, how often do you meet?
    - ☐ More than once a week
    - ☐ Once a week
    - ☐ 2-3 times a month
    - ☐ Once a month
    - ☐ Less than once a month

    2c. If yes, what time of the day do you meet?
    - ☐ Before clinic
    - ☐ During morning clinic hours
    - ☐ During lunch
    - ☐ During afternoon clinic hours
    - ☐ After clinic
    - ☐ Other (please specify)

3. Has your practice used a team-based approach (such as the comprehensive unit-based safety program (CUSP)) for quality improvement initiatives in the past? Y/N

    3a. If yes, please describe previous initiatives that have used a team-based approach.

    [Enter response here]

4. Have clinicians in your practice developed local guidelines for conditions for which antibiotics are commonly prescribed? Y/N

    4a. If yes, please describe.

    [Enter response here]

5. Have clinicians in your practice developed a list of conditions for which antibiotic prescriptions are discouraged? Y/N

5a. If yes, please describe.

[Enter response here]

6. Does your practice formally track antibiotic prescriptions? Y/N

6a. If yes, please describe how tracking occurs and what the data are used for.

[Enter response here]

7. Do patient satisfaction scores impact provider compensation in your practice? Y/N

7a. If so, are all clinic visits eligible for patient satisfaction scores? Y/N

8. Does your practice report any quality measures or quality indicators to either payers or to organizations that monitor health care quality? Y/N

Public reporting burden for this collection of information is estimated to average 12 minutes per response, the estimated time required to complete the survey. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to: AHRQ Reports Clearance Officer Attention: PRA, Paperwork Reduction Project (0935-0238) AHRQ, 540 Gaither Road, Room # 5036, Rockville, MD 20850.

The confidentiality of your responses are protected by Sections 944(c) and 308(d) of the Public Health Service Act [42 U.S.C. 299c-3(c) and 42 U.S.C. 242m(d)]. Information that could identify you will not be disclosed unless you have consented to that disclosure.

Appendix A-7.1. Monthly Data Collection Template Original Version

Form Approved
OMB No. 0935-0238
Exp. Date 08/31/2022

Using this Form	Submission Instructions
● Please DO NOT modify the structure of the spreadsheet such as adding, deleting, or altering rows or columns ● Please fill in all non-colored cells on "Data Entry page 1 &2" tabs ● All numbers are expected to be whole numbers. ● Please use the practice name that you used during website registration when entering submission inforatmion in Section 1.	● Each ambulatory care practice participating in the AHRQ Safety Program for Improving Antibiotic Use should use this spreadsheet to submit monthly data ● Separate spreadsheets (data collection forms) should be submitted for each reporting month by each practice ● Please speak with your Implementation Adviser regarding the timeline for the monthly data submissions or if you anticipate any difficulties collecting antibiotic usage data

Page number	Section	Overview of Sections
Data Entry page 1	Section 1: Submission Information	Collects information about your practice and reporting month.
Data Entry page 1	Section 2: Number of In-Person Visits	Collects total-in-person visits
Data Entry page 1	Section 3: In-Person Visits by ARI Diagnosis & Antibiotic Therapy Prescriptions	Collects in-person visits by acute respiratory infection (ARI) and antibiotic prescriptions during those in-person visits with ARI diagnosis
Data Entry page 2	Section 4: Antibiotic Therapy Prescriptions by Antibiotic(Total/In-Person Visits/ARI)	Collects antibiotic prescriptions for selected antibiotics, antibiotic prescriptions for selected antibiotics for in-person visits only, as well as those related to an ARI.

Category	Definitions
Number of patient visits (in-person visits)	The total number of visits made by any patient to the practice in the reporting month. If a patient visited the practice twice within the given month and it should be counted as two visits.
Column 3.1 **Number of in-person visits for patients diagnosed with acute respiratory infection (ARI)**	The total number of visits where patients received a ICD-10 code for the respective ARI. Please **count the ARI using the decreasing antibiotic appropriateness order as indicated in Appendix 2A**. Moreover, the priority of the diagnosis does not matter for selecting the priority of the specific acute respiratory infection diagnosis. For example, if a patient was diagnosed with both pneumonia (7th diagnosis) and acute bronchitis (1st diagnosis) in the same visit, then that visit should only be counted in "pneumonia" category (B13) since bronchitis is less antibiotic appropriate than pneumonia. Please **exclude patients** with any ICD-10 codes as directed in **Appendix 2B**. For simplicity, we are only looking within single visit encounter codes (i.e., we're not examining the patient's problem list or looking back at prior encounter diagnoses). Furthermore, if there is any exclusion in any position, then the visit is excluded as an acute respiratory tract infection visit. For example, if the patient has diabetes and pneumonia listed on the same visit. Let's further assume an antibiotic was prescribed. Because there was an exclusion diagnosis, they are NOT counted in columns 3.1 or 3.2. However, the antibiotic gets counted as prescribed in column 4.1, the visit is a face-to-face visit, so the visit gets counted in the in-person visit in column 4.2, the patient is excluded from having an ARI because of the diagnosis of diabetes, so they are NOT counted in column 4.3. A detailed list of ICD-10 codes is available in **Appendix 3** and for the **list with all sub codes** please see 'ICD10 CM Codes With Subcodes' **on the program website** resources page under "Data Collection Information"
Column 3.2 **Total antibiotic therapy prescription for in-person visits for patients diagnosed with each ARI**	An antibiotic therapy prescription is defined as any amount of an antibiotic administered to a patient. Each drug is counted independently. If a patient was prescribed two antibiotics from your practice within the given month, it should be counted as two. **Count the sum of selected antibiotics prescribed during in-person visits for each ARI**, in the decreasing antibiotic appropriateness order (see Appendix 2A). If a patient was prescribed antibiotics during a visit with more than one ARI diagnosed, count the antibiotic only for the most appropriate ARI for that visit. For example, if a patient was diagnosed with both pneumonia and acute bronchitis in the same visit and antibiotics were prescribed, count that antibiotic only for "pneumonia" (E13) since that visit was also counted for "pneumonia" (B13). **Exclude patients with any excluded ICD-10 codes (see Appendix 2B).** Please only include antibiotics listed in rows 6-44 in data entry page 2, and refer to the national drug codes (NDC) list for those antibiotics in Appendix 1. which has Product National Drug Codes (NDC) up to 10 digits, for included antibiotics. For package NDC codes and 11 digits codes please see 'Package_and_Product_NDC_Codes_List' on the program website resources page under "Data Collection Information" Note: All the codes in the appendix and lists corresponds to antibiotics administered through oral route only

Category	Definitions
Column 4.1 **Antibiotic therapy prescriptions for selected antibiotics**	An antibiotic therapy prescription is defined by any amount of an antibiotic administered to a patient. Each drug is counted independently. If a patient was prescribed two antibiotics from your office within the given month, then it should be counted once for each antibiotic separately. * Please note that antibiotic brand names are listed only as examples. Not all brand names are listed. Please also **count antibiotic prescriptions outside of in-person visits** (e.g., prescribed during a telephone, refill, on-line or other type ofencounter). Please note, **do not include antibiotics prescribed from other physician offices or health care settings**. Appendix 1 lists 'product' NDC codes (up to 10 digits) for included antibiotics. For package NDC codes and 11 digits codes please see 'Package and Product NDC Codes' on the program website resources page under "Data Collection Information" Note: All the codes in the appendix and lists corresponds to antibiotics administered through oral route only
Column 4.2 **Antibiotic therapy prescriptions during in-person visits for selected antibiotics**	Antibiotic prescription administered during in-person visits only within the given month for each selected antibiotics.
Column 4.3 **Antibiotic therapy prescriptions during in-person visits for patients diagnosed with ARI**	Antibiotic prescription administered during in-person visits and for patients diagnosed with an ARI. Please see the ICD-10 code list in Appendix 2A or Appendix 3 for ARI diagnosis code and refer to the antibiotic list in Appendix 1. Enter the total number of antibiotics prescribed for **patients with ICD-10 codes for any ARI during an in-person visit** in the given month. The number should only reflect patients who had a visit to the ambulatory care practice. Please **exclude patients with any same-visit ICD-10 codes as directed in Appendix 2B**. A detailed list of ICD-10 codes is available in Appendix 3 and for the list with all sub codes please see 'ICD10 CM Codes With Subcodes' on the program website resources page under "Data Collection Information"

Submission Instructions: ● Upload completed form to the program website portal (safetyprogram4antibioticstewardship.org) using your log-in credentials. ● When you are uploading the completed form to be sure to save it with file name: [practice name_Reportingmonth], e.g. ABC practice_Jan 2020 (please use the practice name that you used during website registration)	Form Approved OMB No. 0935-0238 Exp. Date 08/31/2022

Section 1: Submission Information

Request	*Response*	*Request*	*Response*
Practice NPI	[enter practice NPI here]	**Practice Name**	[enter practice name here]
Reporting Month	[select reporting month from drop-do	**Contact Person's Name**	[enter contact person's name here]
Contact Email Address	[enter email here]	**Contact Telephone Number**	[enter telephone number here]

Section 2: Number of In-Person Visits

Number of In-Person Visits: [enter number of in-person visits here]

Section 3: In-Person Visits by ARI Diagnosis & Antibiotic Therapy Prescriptions

Definitions

Number of In-Person Visits for Patients Diagnosed with Acute Respiratory Infection (ARI) (Column 3.1): enter sum # of in-person visits for patients diagnosed with acute respiratory infection (ARI) in the reporting month. Please count the visits following the decreasing antibiotic appropriateness order as indicated in Appendix 2. If no visits associated with the respective ARI in the reporting month, enter "0" for that row

Total Antibiotic Therapy Prescriptions for In-Person Visits for Patients Diagnosed with each ARI Condition (Column 3.2): enter sum # of prescriptions forall antibiotics administered to patients with each ARI condition in the reporting month. Only visits counted in the left cell should be considered. If no prescriptions were administered for a particular ARI, enter "0" for that row

Condition and Corresponding ICD-10 Code(s)	Section 3.1 Number of In-Person Visits for Patients Diagnosed with Acute Respiratory Infection (ARI)	Section 3.2 Total Antibiotic Therapy Prescriptions for In-Person Visits for Patients Diagnosed with each ARI Condition
Pneumonia (J12.xx, J13, J14, J15.xxx, J16.x, J17, J18.x)	[enter number of in-person visits here]	[enter number of in-person visits here]
Otitis media (H65.0x, H65.1xx, H65.9x, H66.0xx, H66.4x, H66.9x, H67.x)	[enter number of in-person visits here]	[enter number of in-person visits here]
Acute sinusitis (J01.xx)	[enter number of in-person visits here]	[enter number of in-person visits here]
Pharyngitis (J02.x, J03.xx)	[enter number of in-person visits here]	[enter number of in-person visits here]
Unspecified acute lower respiratory infection (J22)	[enter number of in-person visits here]	[enter number of in-person visits here]
Acute bronchitis (J20.x, J21.x, J40)	[enter number of in-person visits here]	[enter number of in-person visits here]
Influenza (J09.xx, J10.xx, J11.xx)	[enter number of in-person visits here]	[enter number of in-person visits here]
Acute laryngitis and tracheitis (J04.xx, J05.xx)	[enter number of in-person visits here]	[enter number of in-person visits here]
Non-specific upper respiratory tract infection (J00, J06.x)	[enter number of in-person visits here]	[enter number of in-person visits here]
Other respiratory diagnosis: Viral infection or unspecified site (B34.x) Other viral agents as the cause of disease classified elsewhere (B97.89) Unspecified disorder of tympanic membrane (H73.9x) Other specified disorders of middle ear and mastoid (H74.8) Unspecified disorder of middle ear and mastoid (H74.9) Other disorders of middle ear and mastoid in diseases classified elsewhere (H75.xx) Other specified disorders of nose and nasal sinuses (rhinorrhea) (J34.89) Other specified diseases of the upper respiratory tract (J39.8) Disease of the upper respiratory tract, unspecified (J39.9) Other respiratory disorders (J98.xx) Respiratory disorders in diseases classified elsewhere (J99) Cough (R05)	[enter number of in-person visits here]	[enter number of in-person visits here]

Submission Instructions: ● Upload completed form (excel file) to the program website portal (safetyprogram4antibioticstewardship.org) using your log-in credentials. ● When you are uploading the completed form to be sure to save it with file name: [practice name_Reporting month], e.g. ABC practice_Jan 2020 (please use the practice name that you used during website registration)	Form Approved OMB No. 0935-0238 Exp. Date 08/31/2022

Section 4: Antibiotic Therapy Prescriptions by Antibiotic (Total/In-Person Visits/ARI)

Definitions

Antibiotic Therapy Prescriptions (Column 4.1): enter sum # of prescriptions of each antibiotic below administered to patients in the reporting month. Please count antibiotic prescription administered during in-person visits and outside of in-person visits. If no prescriptions were administered for a particular antibiotic, enter "0" for that row

Antibiotic Therapy Prescriptions for In-Person Visits (Column 4.2): enter sum # of prescriptions of each antibiotic below administered at in-person visits only in the reporting month. If no prescriptions were administered during in-person visits for a particular antibiotic, enter "0" for that row

Antibiotic Therapy Prescriptions for In-Person Visits for Patients Diagnosed with Acute Respiratory Infection (ARI) (Column 4.3): enter sum # of prescriptions of each antibiotic below administered at in-person visits for patients diagnosed with acute respiratory infection (ARI) in the reporting month. If no prescriptions were administered during in-person visits for patients with ARI for a particular antibiotic, enter "0" for that row

Antibiotic	Section 4.1 Antibiotic Therapy Prescriptions	Section 4.2 Antibiotic Therapy Prescriptions for In-Person Visits	Section 4.3 Antibiotic Therapy Prescriptions for In- Person Visits for Patients Diagnosed with Acute Respiratory Infection (ARI)
AMOXICILLIN (Amoxil)	[enter prescription here]	[enter prescription here]	[enter prescription here]
AMOXICILLIN/CLAVULANATE (Augmentin)	[enter prescription here]	[enter prescription here]	[enter prescription here]
AMPICILLIN PO	[enter prescription here]	[enter prescription here]	[enter prescription here]
AZITHROMYCIN (Zithromax)	[enter prescription here]	[enter prescription here]	[enter prescription here]
CEFACLOR	[enter prescription here]	[enter prescription here]	[enter prescription here]
CEFADROXIL (Duricef)	[enter prescription here]	[enter prescription here]	[enter prescription here]
CEFDINIR (Omnicef)	[enter prescription here]	[enter prescription here]	[enter prescription here]
CEFDITOREN	[enter prescription here]	[enter prescription here]	[enter prescription here]
CEFIXIME (Suprax)	[enter prescription here]	[enter prescription here]	[enter prescription here]
CEFPODOXIME (Vantin)	[enter prescription here]	[enter prescription here]	[enter prescription here]
CEFPROZIL	[enter prescription here]	[enter prescription here]	[enter prescription here]
CEFTIBUTEN	[enter prescription here]	[enter prescription here]	[enter prescription here]
CEFUROXIME (Ceftin)	[enter prescription here]	[enter prescription here]	[enter prescription here]
CEPHALEXIN (Keflex)	[enter prescription here]	[enter prescription here]	[enter prescription here]
CIPROFLOXACIN (Cipro)	[enter prescription here]	[enter prescription here]	[enter prescription here]
CLARITHROMYCIN	[enter prescription here]	[enter prescription here]	[enter prescription here]
CLINDAMYCIN (Cleocin)	[enter prescription here]	[enter prescription here]	[enter prescription here]
DELAFLOXACIN	[enter prescription here]	[enter prescription here]	[enter prescription here]
DICLOXACILLIN	[enter prescription here]	[enter prescription here]	[enter prescription here]
DOXYCYCLINE (Vibramycin)	[enter prescription here]	[enter prescription here]	[enter prescription here]
ERYTHROMYCIN	[enter prescription here]	[enter prescription here]	[enter prescription here]
FOSFOMYCIN (Monurol)	[enter prescription here]	[enter prescription here]	[enter prescription here]
LEVOFLOXACIN (Levaquin)	[enter prescription here]	[enter prescription here]	[enter prescription here]
LINCOMYCIN	[enter prescription here]	[enter prescription here]	[enter prescription here]
LINEZOLID (Zyvox)	[enter prescription here]	[enter prescription here]	[enter prescription here]
METRONIDAZOLE (Flagyl)	[enter prescription here]	[enter prescription here]	[enter prescription here]
MINOCYCLINE	[enter prescription here]	[enter prescription here]	[enter prescription here]
MOXIFLOXACIN (Avelox)	[enter prescription here]	[enter prescription here]	[enter prescription here]
NITROFURANTOIN (Macrobid)	[enter prescription here]	[enter prescription here]	[enter prescription here]
OFLOXACIN	[enter prescription here]	[enter prescription here]	[enter prescription here]
OMADACYCLINE (Nuzyra)	[enter prescription here]	[enter prescription here]	[enter prescription here]
PENICILLIN V	[enter prescription here]	[enter prescription here]	[enter prescription here]
RIFAMPIN	[enter prescription here]	[enter prescription here]	[enter prescription here]
SULFADIAZINE	[enter prescription here]	[enter prescription here]	[enter prescription here]
SULFAMETHOXAZOLE/TRIMETHOPRIM (Bactrim, Septra)	[enter prescription here]	[enter prescription here]	[enter prescription here]
TEDIZOLID	[enter prescription here]	[enter prescription here]	[enter prescription here]
TETRACYCLINE	[enter prescription here]	[enter prescription here]	[enter prescription here]
TRIMETHOPRIM	[enter prescription here]	[enter prescription here]	[enter prescription here]
VANCOMYCIN PO	[enter prescription here]	[enter prescription here]	[enter prescription here]

Appendix A-7.2. Monthly Data Collection Template Modified Version

Version 4 - New Monthly Data Collection Template **Submission Instructions:** ● Upload completed form to the program website portal (safetyprogram4antibioticstewardship.org) using your log-in credentials. ● When you are uploading the completed form to be sure to save it with file name: [practice name_Reporting month], e.g. ABC practice_Jan 2020 (please use the practice name that you used during website registration)	Form Approved OMB No. 0935-0238 Exp. Date 08/31/2022

Section 1: Submission Information

Request	*Response*	*Request*	*Response*
Practice NPI	[enter practice NPI here]	**Practice Name**	[enter practice name here]
Reporting Month	[select reporting month from drop-down list]	**Contact Person's Name**	[enter contact person's name here]
Contact Email Address	[enter email here]	**Contact Telephone Number**	[enter telephone number here]

Section 2: Number of all Visits

Number of Visits (in-person and non-in-person synchronous): [enter number of visits here]

Section 3: All Visits (in-person and non-in-person synchronous) & Antibiotic Therapy Prescriptions by ARI Diagnosis

Definitions

Number of All Visits (in-person visits and non-in-person synchronous) for Patients Diagnosed with Acute Respiratory Infection (ARI) (Column 3.1): enter sum # of in-person and non-in-person synchronous visits for patients diagnosed with acute respiratory infection (ARI) in the reporting month. Please count the visits following the decreasing antibiotic appropriateness order as indicated in Appendix 2. If no visits associated with the respective ARI in the reporting month, enter "0" for that row

Total Antibiotic Therapy Prescriptions for all visits (in-person and non-in-person synchronous) for Patients Diagnosed with each ARI Condition (Column 3.2): enter sum # of prescriptions for all antibiotics administered to patients with each ARI condition in the reporting month. Only visits counted in the left cell should be considered. If no prescriptions were administered for a particular ARI, enter "0" for that row

Condition and Corresponding ICD-10 Code(s)	Section 3.1 Number of all Visits (in-person and non-in-person synchronous) for Patients Diagnosed with Acute Respiratory Infection (ARI)	Section 3.2 Total Antibiotic Therapy Prescriptions in all Visits (in-person and non-in-person synchronous) for Patients Diagnosed with ARI Conditions
Pneumonia (J12.xx, J13, J14, J15.xxx, J16.x, J17, J18.x)	[enter number of visits here]	[enter total of prescriptions here]
Otitis media (H65.0x, H65.1xx, H65.9x, H66.0xx, H66.4x, H66.9x, H67.x)	[enter number of visits here]	[enter total of prescriptions here]
Acute sinusitis (J01.xx)	[enter number of visits here]	[enter total of prescriptions here]
Pharyngitis (J02.x, J03.xx)	[enter number of visits here]	[enter total of prescriptions here]
Unspecified acute lower respiratory infection (J22)	[enter number of visits here]	[enter total of prescriptions here]
Acute bronchitis (J20.x, J21.x, J40)	[enter number of visits here]	[enter total of prescriptions here]
Influenza (J09.x, J10.x, J11.xx) – excluding (J10.0x)	[enter number of visits here]	[enter total of prescriptions here]
Acute laryngitis and tracheitis (J04.xx, J05.xx)	[enter number of visits here]	[enter total of prescriptions here]
Non-specific upper respiratory tract infection (J00, J06.x)	[enter number of visits here]	[enter total of prescriptions here]
Other respiratory diagnosis: Viral infection or unspecified site (B34.x) Other viral agents as the cause of disease classified elsewhere (B97.89) Unspecified disorder of tympanic membrane (H73.9x) Other specified disorders of middle ear and mastoid (H74.8) Unspecified disorder of middle ear and mastoid (H74.9) Other disorders of middle ear and mastoid in diseases classified elsewhere (H75.xx) Other specified disorders of nose and nasal sinuses (rhinorrhea) (J34.89) Other specified diseases of the upper respiratory tract (J39.8) Disease of the upper respiratory tract, unspecified (J39.9) Other respiratory disorders (J98.xx) Respiratory disorders in diseases classified elsewhere (J99) Cough (R05)	[enter number of visits here]	[enter total of prescriptions here]

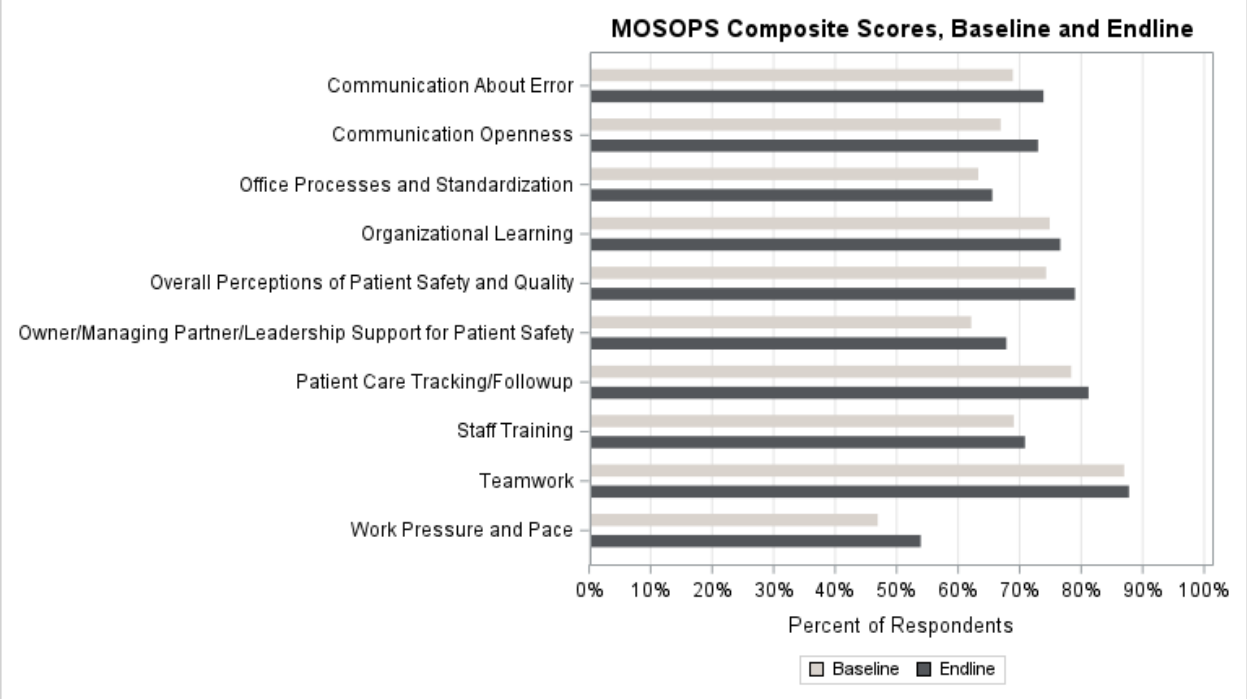
Public reporting burden for this collection of information is estimated to average 60 minutes per response, the estimated time required to complete the survey. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to: AHRQ Reports Clearance Officer Attention: PRA, Paper Reduction Project (0935-0238) AHRQ, 5600 Fishers Lane, #07W41A, Rockville, MD 20857.

The confidentiality of your responses are protected by Sections 944(c) and 308(d) of the Public Health Service Act [42 U.S.C. 299c-3(c) and 42 U.S.C. 242m(d)]. Information that could identify you will not be disclosed unless you have consented to that disclosure.

Appendix B-1. Sensitivity Analysis for MOSOPS

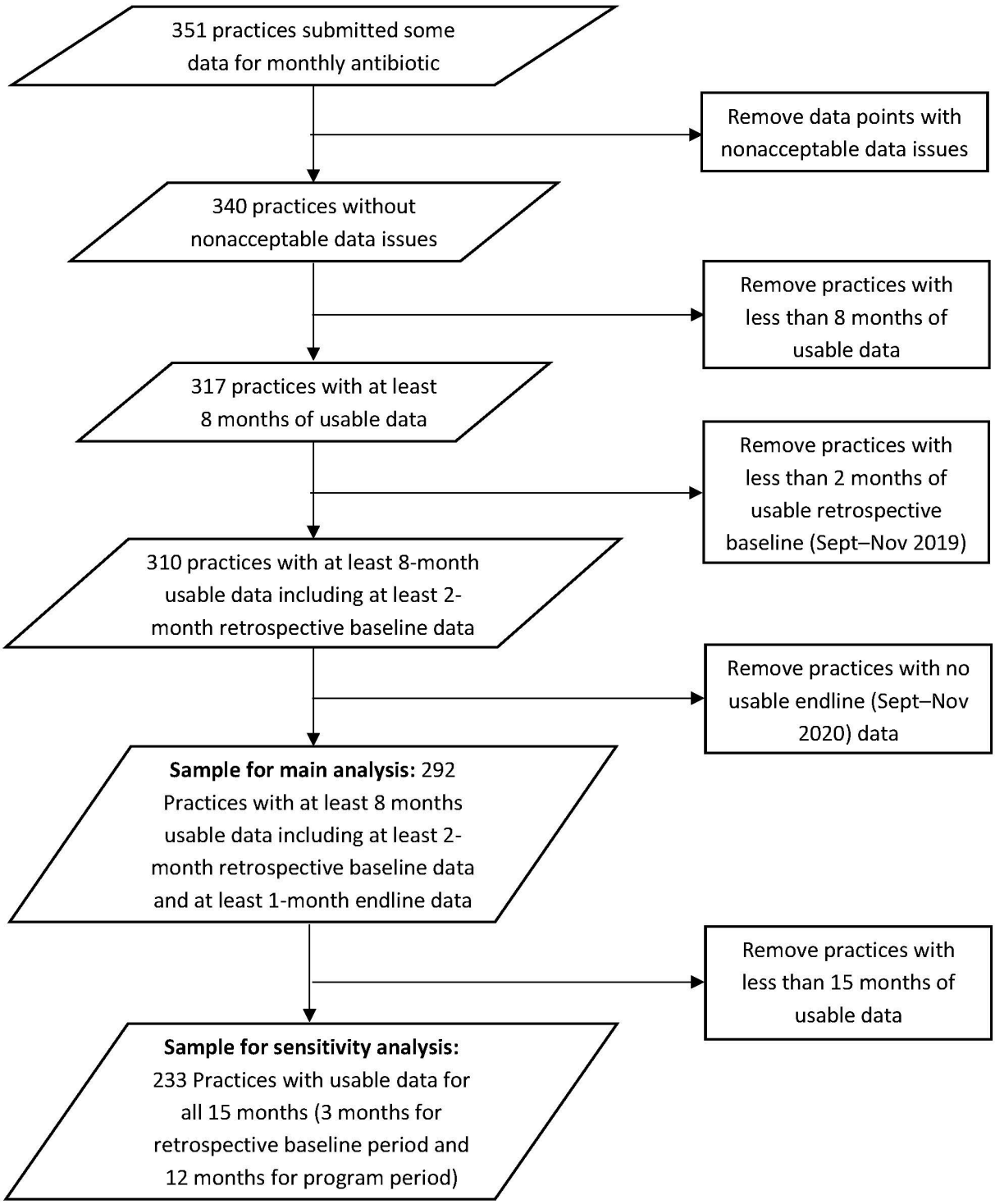
Sensitivity analysis for MOSOPS included 58 practices that submitted usable data for both baseline and endline survey.

APPENDIX EXHIBIT B-1: MOSOPS COMPOSITE SCORES FOR PARTICIPATING PRACTICES BEFORE AND AFTER THE PROGRAM



Appendix B-2. Sensitivity Analysis for Antibiotic Prescription

APPENDIX EXHIBIT B-2.1: CRITERIA FOR EXCLUDING PRACTICES ANTIBIOTIC PRESCRIPTION ANALYSIS



Appendix Exhibit B-2.2: Change in Antibiotic Prescription per 100 Total Visits From Baseline (Sept–Nov 2019)

Practice type	N	Dec 2019–Feb 2020	Mar–May 2020	June–Aug 2020	Sept–Nov 2020
Entire cohort	233	1.0 (0.60, 1.4) ‡	-1.9 (-2.8, -1.1) ‡	-7.6 (-8.7, -6.5) ‡	-9.3 (-10.6, -8.1) ‡
Primary care practice	79	0.80 (0.40, 1.2) ‡	-0.17 (-1.2, 0.82)	-2.7 (-3.7, -1.7) ‡	-3.0 (-3.9, -2.0) ‡
General	59	0.41 (0.031, 0.78) *	0.46 (-0.69, 1.6)	-1.9 (-2.9, -0.92) ‡	-2.1 (-3.0, -1.2) ‡
Pediatric	20	1.8 (0.85, 2.8) ‡	-2.0 (-3.7, -0.20) *	-4.8 (-7.3, -2.3) ‡	-5.2 (-7.6, -2.7) ‡
Federally supported practice	17	1.3 (0.62, 2.0) ‡	1.7 (-0.25, 3.7)	-0.71 (-2.1, 0.64)	-0.47 (-1.8, 0.87)
Urgent care center	127	0.98 (0.26, 1.7) †	-4.4 (-5.5, -3.3) ‡	-12.6 (-14.0, -11.2) ‡	-15.8 (-17.4, -14.2) ‡
General	91	0.30 (-0.65, 1.3)	-5.0 (-6.5, -3.5) ‡	-12.4 (-14.4, -10.4) ‡	-15.4 (-17.6, -13.2) ‡
Pediatric	36	2.2 (1.4, 3.1) ‡	-2.8 (-3.7, -1.9) ‡	-12.3 (-13.5, -11.1) ‡	-15.7 (-17.1, -14.3) ‡
Other type	10	-0.39 (-1.7, 0.91)	2.9 (-5.0, 10.8)	2.0 (-7.8, 11.7)	1.7 (-7.6, 10.9)

Note: 233 practices with 3,495 practice-months contributed to this analysis. A negative binomial mixed model with random intercept of practice was used to generate the estimate. The entire cohort model includes quarter as the independent variable; the model by practice type includes quarter, practice type, and their interaction terms as the independent variables. Pediatric practices and pediatric urgent care centers provide care only to pediatric population (infants, children, and adolescents); and the rest of practices providing primary care and urgent care are in the "general" category. Federally supported practices include Federally Qualified Health Centers (FQHCs), Indian Health Service (IHS) practices, and Department of Defense (DoD) practices. Other type includes student health, and specialty or multi-specialty care.
* denotes p-value<0.05; † denotes p-value<0.01; ‡ denotes p-value<0.001.

Appendix Exhibit B-2.3: Change in Antibiotic Prescription per 100 Total Visits by Antibiotic Class

Antibiotic Class	Dec 2019–Feb 2020	Mar–May 2020	June–Aug 2020	Sept–Nov 2020
Penicillins	1.25 (1, 1.5) ‡	-1.72 (-2.11, -1.33) ‡	-4.49 (-5.09, -3.89) ‡	-4.55 (-5.2, -3.91) ‡
Macrolides	0.12 (0.0079, 0.23) *	-0.43 (-0.66, -0.21) ‡	-1.19 (-1.42, -0.97) ‡	-0.97 (-1.2, -0.75) ‡
Cephalosporins	-0.27 (-0.4, -0.15) ‡	0.12 (-0.037, 0.28)	-0.23 (-0.42, -0.041) *	-0.98 (-1.2, -0.76) ‡
Fluoroquinolones	-0.073 (-0.12, -0.027) †	0.079 (-0.014, 0.17)	-0.052 (-0.15, 0.042)	-0.12 (-0.2, -0.029) †

Note: 233 practices with 3,495 practice-months contributed to the antibiotic class analysis. Linear mixed model with random intercept of practice was used to generate the estimate; quarter was the independent variable.
* denotes p-value<0.05; † denotes p-value<0.01; ‡ denotes p-value<0.001.

Appendix Exhibit B-2.4: Change in Antibiotic Prescription per 100 ARI Visits, Change From Baseline (Sept–Nov 2019)

Practice Type	N	Dec 2019–Feb 2020	Mar–May 2020	June–Aug 2020	Sept–Nov 2020
Entire cohort	233	-3.9 (-4.9, -2.9) ‡	-0.64 (-2.2, 0.87)	-5.7 (-7.5, -3.9) ‡	-12.9 (-14.8, -11.1) ‡
Primary care practice	79	-2.4 (-3.9, -0.95) †	-3.5 (-5.6, -1.4) †	-6.4 (-9.3, -3.5) ‡	-8.6 (-11.6, -5.7) ‡
General	59	-3.1 (-4.8, -1.3) ‡	-6.3 (-8.3, -4.4) ‡	-9.0 (-11.9, -6.0) ‡	-9.9 (-13.1, -6.7) ‡
Pediatric	20	-0.59 (-3.3, 2.1)	4.9 (0.86, 9.0) *	1.2 (-5.2, 7.5)	-4.9 (-11.2, 1.5)
Federally supported practice	17	3.3 (-1.7, 8.4)	1.1 (-6.3, 8.5)	-0.37 (-8.6, 7.8)	-0.32 (-8.7, 8.1)
Urgent care center	127	-5.9 (-7.1, -4.7) ‡	1.2 (-0.97, 3.3)	-5.7 (-8.2, -3.3) ‡	-17.6 (-19.8, -15.4) ‡
General	91	-7.7 (-9.2, -6.2) ‡	-3.0 (-5.3, -0.69) *	-6.1 (-9.5, -2.8) ‡	-17.9 (-21.0, -14.9) ‡
Pediatric	36	-1.3 (-2.3, -0.33) †	11.7 (9.3, 14) ‡	-4.7 (-6.6, -2.8) ‡	-16.8 (-18.8, -14.8) ‡
Other type	10	-2.3 (-5.1, 0.54)	-4.0 (-9.8, 1.7)	-9.9 (-16.5, -3.3) †	-8.8 (-18.2, 0.59)

Note: 233 practices with 3,488 practice-months contributed to this analysis. A mixed model with random intercept of practice was used to generate the estimate. The entire cohort model includes quarter as the independent variable; the model by practice type includes quarter, practice type, and their interaction terms as the independent variables. Pediatric practices and pediatric urgent care centers provide care only to pediatric population (infants, children, and adolescents); and the rest of practices providing primary care and urgent care are in the "general" category. Federally supported practices include Federally Qualified Health Centers (FQHCs), Indian Health Service (IHS) practices, and Department of Defense (DoD) practices. Other type includes student health, and specialty or multi-specialty care.
*Denotes p-value<0.05; † denotes p-value<0.01; ‡ denotes p-value<0.001.

APPENDIX EXHIBIT B-2.5: CHANGE IN ANTIBIOTIC PRESCRIPTION PER 100 ARI VISITS BY ANTIBIOTIC CLASS

Antibiotic Class	Dec 2019–Feb 2020	Mar–May 2020	June–Aug 2020	Sept–Nov 2020
Penicillins	-2.25 (-2.91, -1.58) ‡	1.21 (0.12, 2.3) *	-1.2 (-2.42, 0.029)	-6.33 (-7.61, -5.04) ‡
Macrolides	-1.3 (-1.73, -0.88) ‡	-1.38 (-1.92, -0.85) ‡	-2.54 (-3.15, -1.92) ‡	-2.52 (-3.13, -1.91) ‡
Cephalosporins	-0.36 (-0.64, -0.092) †	0.31 (-0.10, 0.73)	-0.34 (-0.70, 0.014)	-1.35 (-1.67, -1.03) ‡
Fluoroquinolones	-0.090 (-0.19, 0.010)	-0.022 (-0.16, 0.12)	-0.074 (-0.26, 0.12)	-0.23 (-0.41, -0.041) *

Note: 233 practices with 3,488 practice-months contributed to the antibiotic class analysis. Linear mixed model with random intercept of practice was used to generate the estimate; quarter indicator was the independent variable.
*Denotes p-value<0.05; † denotes p-value<0.01; ‡ denotes p-value<0.001.

APPENDIX EXHIBIT B-2.6: CHANGE IN ANTIBIOTIC PRESCRIPTION PER 100 ARI VISITS BY ARI DIAGNOSIS

ARI Diagnosis	Dec 2019–Feb 2020	Mar–May 2020	June–Aug 2020	Sept–Nov 2020
Pneumonia	3.15 (0.21, 6.1) *	-4.64 (-8.08, -1.2) †	-7.6 (-12.67, -2.52) †	-9.3 (-13.5, -5.11) ‡
Otitis media	3.07 (1.48, 4.67) ‡	2.38 (-0.24, 5.01)	0.2 (-2.5, 2.9)	-0.06 (-2.91, 2.8)
Acute sinusitis	2.1 (-0.15, 4.35)	-0.15 (-2.58, 2.29)	-4.31 (-7.29, -1.34) †	-7.98 (-10.8, -5.13) ‡
Pharyngitis	1.02 (-0.44, 2.48)	5.58 (3.24, 7.91) ‡	-6.98 (-9.08, -4.87) ‡	-11.9 (-14.1, -9.67) ‡
Unspecified acute lower respiratory infection	7.21 (-0.13, 14.5)	-6.73 (-15.4, 1.97)	2.99 (-8.6, 14.57)	-4.83 (-14.9, 5.28)
Acute bronchitis	-2.84 (-4.78, -0.89) †	-2.57 (-5.45, 0.31)	-3.56 (-7.4, 0.28)	-4.66 (-7.66, -1.66) †
Influenza	-0.53 (-1.93, 0.86)	-0.09 (-1.9, 1.72)	-0.27 (-3.89, 3.36)	0.64 (-1.74, 3.03)
Acute laryngitis and tracheitis	1.17 (-1.3, 3.64)	3.26 (-0.78, 7.3)	-0.15 (-3.45, 3.14)	-0.25 (-3.03, 2.54)

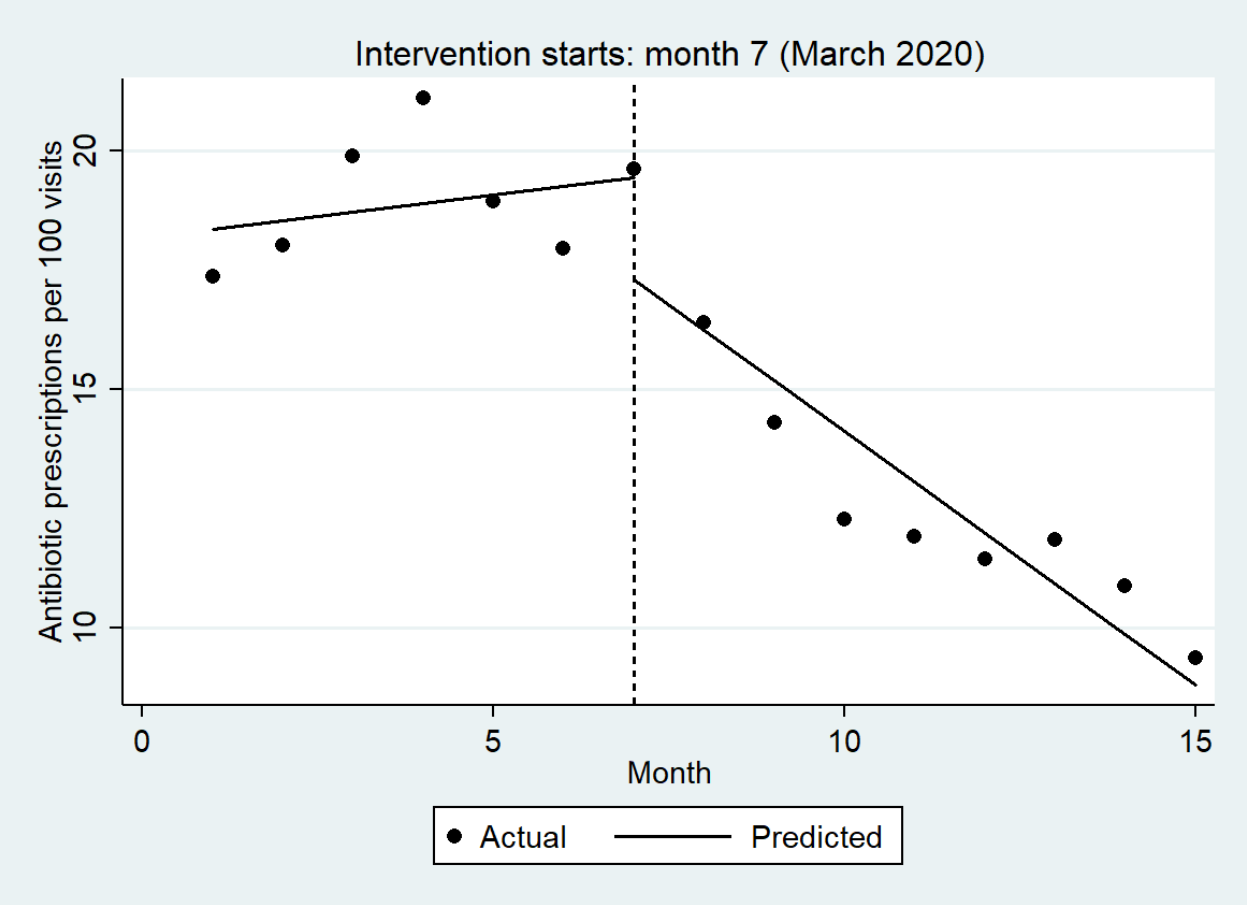
Note: number of practices and practice-months contributing to the analysis varied by ARI diagnosis due to zero visits for some diagnosis. Linear mixed model with random intercept of practice was used to generate the estimate; quarter indicator was the independent variable.
*Denotes p-value<0.05; † denotes p-value<0.01; ‡ denotes p-value<0.001.

Appendix B-3. ITS Analysis for Antibiotic Prescription

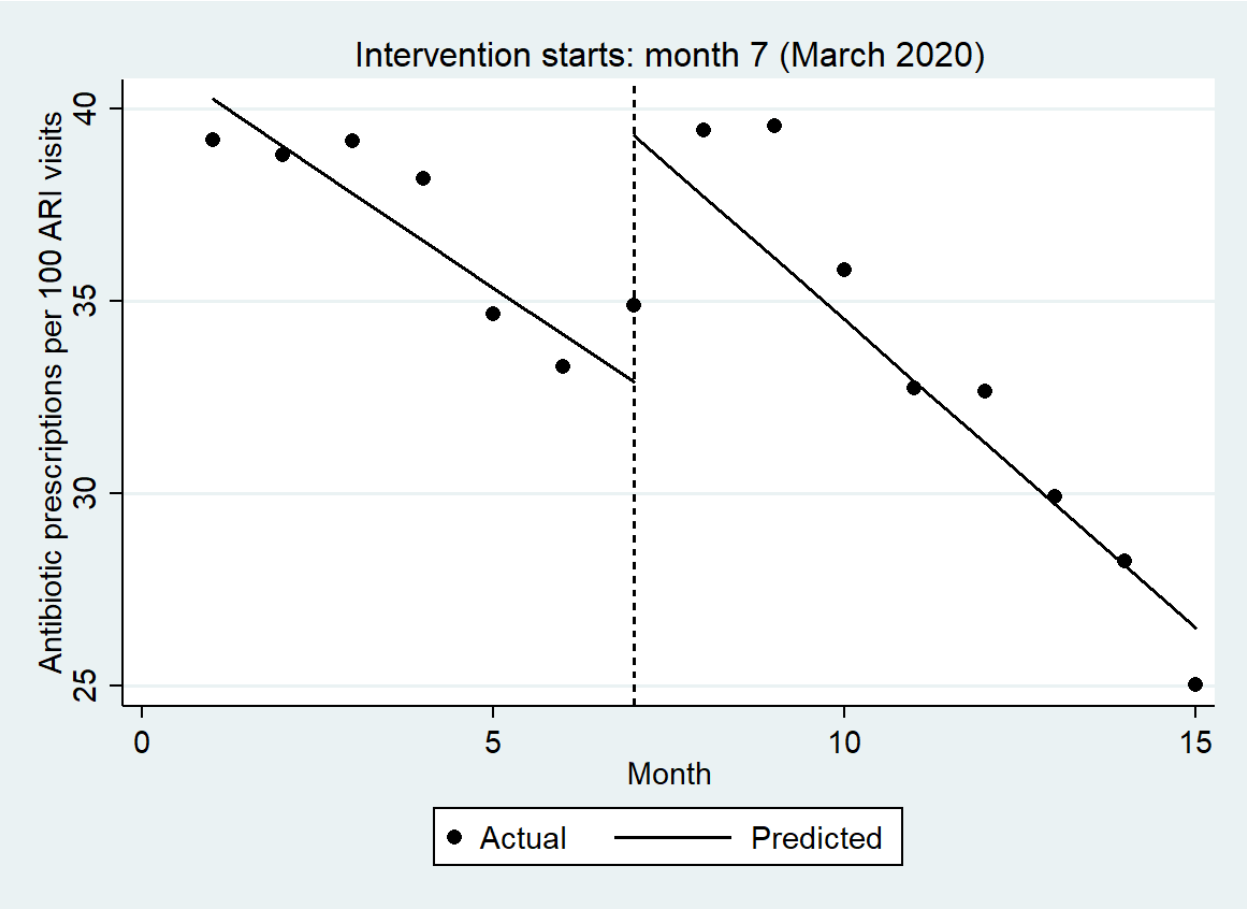
For total antibiotic prescription per 100 visits, there was an increasing trend prior to the intervention (0.18, 95% CI: 0.064 to 0.30, p=0.002), but an immediate decrease when the intervention started (-2.14, 95% CI: -2.94 to -1.34, p<0.001), and a continuous reduction over time during post-intervention period (-1.06, 95% CI: -1.18 to -0.95, p<0.001). The treatment effect for the trend difference between pre-intervention and post-intervention was -1.25 (95% CI: -1.41 to -1.08, p<0.001).

For total antibiotic prescription per 100 ARI visits, there was a decreasing trend prior to the intervention (-1.22, 95% CI: -1.52 to -0.93, p<0.001), but an immediate increase when the intervention started (6.40, 95% CI: 4.70 to 8.10) – note that the COVID-19 pandemic started at the same month (i.e., March 2020). The post-intervention trend was -1.60 (95% CI: -1.88 to -1.32, p<0.001). The treatment effect for the trend difference between pre-intervention and post-intervention was -0.37 (95% CI: -0.76 to 0.013, p=0.058).

APPENDIX EXHIBIT B-3.1: ITS CHART FOR ANTIBIOTIC PRESCRIPTION PER 100 TOTAL VISITS



APPENDIX EXHIBIT B-3.2: ITS CHART FOR ANTIBIOTIC PRESCRIPTION PER 100 ARI VISITS



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