



HHS Public Access

Author manuscript

Infect Dis Clin North Am. Author manuscript; available in PMC 2024 August 13.

Published in final edited form as:

Infect Dis Clin North Am. 2023 December ; 37(4): 659–667. doi:10.1016/j.idc.2023.06.003.

Antibiotic Stewardship:

A Decade of Progress

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Keywords

Antibiotic stewardship; Antimicrobial resistance; Outpatient stewardship; Hospital stewardship; Nursing home stewardship

Antibiotic stewardship has seen transformative change over the past decade. Antibiotic stewardship infrastructure has grown significantly across the spectrum of health care in hospitals, nursing homes, and ambulatory settings, and issues related to improving antibiotic use have become central to high-level policy discussions, regulations, and legislation. This edition of *ID Clinics of North America* highlights the current state-of-the-art of stewardship as well as future needs. Its publication provides an opportunity to reflect on important stewardship developments over the past several years.

Important initiatives at the federal and state level have been pivotal in the recognition of the importance of antibiotic stewardship and its expansion, including a significant boost in 2014 and 2015 when the Obama administration announced a specific focus on addressing approaches to fight antibiotic resistance, beginning with a report from the President's Council of Advisors on Science and Technology. This was followed by the first National Action Plan for Combating Antibiotic Resistance (updated every 5 years), the establishment of the Presidential Advisory Council for Combating Antibiotic Resistance to provide recommendations to the federal government on mitigation of antibiotic resistance, and a White House Forum on Antibiotic Stewardship. All of these identified antibiotic stewardship across the spectrum of human and animal health as a critical component to reduce the threat of antibiotic resistance. In addition, funding from the Centers for Disease Control and Prevention's (CDC) Antimicrobial Resistance Solutions Initiative beginning in 2016 has allowed state health departments to engage in stewardship activities including analysis of antibiotic use data from hospitals, nursing homes, and outpatient clinics; the initiation of state-wide collaborative projects in partnership with local health systems to advance stewardship interventions; and provision of feedback letters to high prescribers offering stewardship resources and education.^{1,2} These federal and state actions have catalyzed

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efforts from many partners in supporting approaches that improve antibiotic stewardship across the United States.

HOSPITAL ANTIBIOTIC STEWARDSHIP

Nowhere has the growth and change in antibiotic stewardship been more dramatic than in hospitals. Although some hospitals had started antibiotic stewardship programs (ASPs) in the 2000s, and before, they tended to be at academic centers, in part due to resource limitations and lack of information on stewardship approaches in the nonacademic environment. Three important types of initiatives have led to the expansion of both the quality and quantity of hospital stewardship: development of guidance regarding antibiotic stewardship infrastructure and implementation “best practices”; introduction of requirements for ASPs; and establishment of a method and platform to collect and benchmark antibiotic use and resistance data.

Infrastructure and Implementation

In 2014, the CDC released the “Core Elements of Hospital Antibiotic Stewardship Programs,” a set of seven structural and procedural components associated with strong stewardship programs based on both data and expert opinion that were developed with the goal of defining components of an ASP.³ The Hospital Core Elements were announced with a press conference during which Tom Frieden, the then-Director of the CDC, in conjunction with the American Hospital Association, promoted the Core Elements and the importance of hospital ASPs to combat antibiotic resistance and promote patient safety.⁴ The Core Elements were updated in 2019 to incorporate new data and experiences. In 2016, the Society for Healthcare Epidemiology of America (SHEA) and the Infectious Diseases Society of America (IDSA) released evidence-based guidelines that address several critical areas to consider in implementing hospital stewardship programs, with the goal of providing more specific and granular recommendations to assist hospitals.⁵ Also in 2016, the Agency for Healthcare Research and Quality (AHRQ) funded and, in collaboration with Johns Hopkins and NORC at the University of Chicago, developed and implemented the Safety Program for Improving Antibiotic Use.⁶ This program provides a toolkit and implementation strategy to assist teams in developing stewardship activities in hospitals, nursing homes, and ambulatory practices with a particular emphasis on training front-line providers to perform stewardship regularly for all patients at key points in care using the Four Moments of Antibiotic Decision Making framework.⁷ The implementation of the Safety Program in over 400 hospitals across the United States was associated with reductions in antibiotic use and hospital-onset *Clostridioides difficile* infection.⁸

Requirements and Regulations

For many years, establishing a hospital ASP was voluntary and depended on the ability of dedicated stewards to convince administrators that such programs would improve patient safety and reduce antibiotic costs. In contrast, infection prevention programs were more prevalent and received more funding because they are required by the Centers for Medicare and Medicaid Services (CMS) as a Condition of Participation as well as by accrediting organizations, the largest of which is The Joint Commission (TJC). The

Conditions of Participation are requirements that health care organizations must meet to begin and continue participating in CMS programs and are considered “health and safety standards [that] are the foundation for improving quality and protecting the health and safety of beneficiaries.”⁸ Similarly, TJC develops standards and evaluates compliance with them at triannual hospital accreditation visits; these standards have great impact on driving practice changes. Recognizing the potential impact of these requirements on uptake of stewardship programs, the CDC collaborated with TJC and external stewardship stakeholders to determine potential components of a stewardship standard. In 2017, TJC added a requirement for hospital ASPs to its Medication Management accreditation standards. CMS followed in 2019 with a Condition of Participation requiring antibiotic stewardship. TJC requirements have been updated recently to provide additional granularity around expectations of stewardship programs.⁹

Measurement

What gets measured gets done is a popular aphorism and has long been a critical challenge in antibiotic stewardship efforts. Historically, national data on outpatient prescribing were available from publicly available and proprietary data sources, but there was no comparable data for hospitals or nursing homes. In hospitals, stewardship leaders have long called for benchmarking data to facilitate comparisons of antibiotic use. In 2012, CDC launched the antibiotic use (AU) Option in the National Healthcare Safety Network (NHSN). This option allows hospitals to electronically submit antibiotic use data and has at its center a risk-adjusted measure of various categories of antibiotic use, the Standardized Antimicrobial Administration Ratio (SAAR).¹⁰ With the SAAR, hospitals have access to a near real-time metric for benchmarking antibiotic use, along with the ability to also track the use of individual agents throughout the hospital. Uptake of the NHSN AU option started slowly, but has grown significantly in the past few years, with more than 2700 hospitals having voluntarily submitted data by March of 2023. Noting both the importance of these data and the considerable voluntary uptake, in August of 2022, CMS finalized a new Antibiotic Use and Resistance (AUR) Surveillance measure under the Medicare Promoting Interoperability Program’s Public Health and Clinical Data Exchange Objective.¹¹ Beginning with the CY 2024 electronic health record (EHR) reporting period, eligible hospitals and CAHs must attest to reporting both antibiotic use and antibiotic resistance (AR) Option data to NHSN or else claim an applicable exclusion to receive credit under the measure.¹¹ Future work will include the development of approaches to more precisely risk-adjusted antibiotic use to facilitate more accurate benchmarking among hospitals, including patient level factors. Access to electronic patient-level data is already a reality for NHSN with the growth in electronic health data resources such as Fast Healthcare Interoperability Resource (FHIR).¹²

The impact of these three broad initiatives on hospital stewardship infrastructure and practice has been impressive. To assess the uptake of the Core Elements, CDC began collecting data on Core Element implementation through the annual facility survey of the NHSN, which is completed by nearly all hospitals in the country. In 2014, 41% of hospitals indicated that they had all seven of the Core Elements in place.¹³ By 2021, the most recent year for which data exist, that had risen to 95%.¹⁴ Not only has the implementation of

core elements increased but also has the implementation of highly recommended practices. For example, professional organizations recommend that hospital stewardship programs should be co-led by a physician and a pharmacist. In 2015, only 23% of hospitals had co-led programs and that had increased to 63% in 2021 (CDC, 2021, unpublished data). Having data on stewardship programs has also informed targeted support. In 2014, 20% of critical access hospitals reported having all of the Core Elements in place, less than half the rate of larger hospitals. This finding prompted discussions with the critical access community and identified not just some of the key barriers to implementing core elements in small hospitals but also some important solutions. In 2017, CDC, together with the Pew Charitable Trusts, the American Hospital Association, the Health Resources and Services Administrations' Federal Office of Rural Health Policy, and critical access hospital experts developed an implementation guide specific to these facilities. Following the development of this guidance, The Federal Office of Rural Health Policy made stewardship programs in critical access hospitals a required component of their Medicare Beneficiaries Quality Improvement Program. In the 2021 survey, critical access hospitals had almost entirely closed the gap with larger facilities with 89% of them reporting all core elements in place (CDC unpublished data).

NURSING HOME ANTIBIOTIC STEWARDSHIP

Although the pace of adoption of stewardship in nursing homes has been slower than in hospitals, advances in implementation, regulation, and measurement have also occurred in nursing homes. The positive reactions to the Hospital Core Elements prompted CDC to develop Core Elements for Nursing Home Antibiotic Stewardship Programs in 2015. The seven elements were the same as those for hospitals, but this document translated implementation of the elements to the nursing home sector. The AHRQ Safety Program for Improving Antibiotic Use was also developed for and implemented in the long-term care setting, again with an emphasis on engaging front-line providers, including the nurses and medical technicians who provide the majority of care of nursing home residents.⁶ Implementation of the Safety Program in over 400 US long-term care facilities was associated with reductions in antibiotic starts and urine cultures.¹⁵ CMS Quality Improvement Organizations and some state health departments have worked collaboratively with CDC and other partners to support implementation of stewardship programs in nursing homes.¹⁶

An update to the nursing home Conditions of Participation in 2016 gave CMS the opportunity to add a requirement for stewardship programs to the existing requirements for infection prevention and control. CDC added questions about implementation of stewardship programs to the NHSN facility survey for nursing homes in 2016, which were completed by roughly 3000 nursing homes that were voluntarily participating in NHSN before the COVID-19 pandemic. In 2016, 43% of reporting nursing homes indicated they had all seven core elements in place and this had raised to 71% by 2018, the last year for which data are available.¹⁷ Implementation of each of the individual elements was above 90% in 2018, with the lone exception being education at 80%.¹⁷ However, this represents only about 11% of nursing homes nationally and may overestimate overall nursing home engagement in stewardship activities, which remains challenging due to the lack of infectious disease

(ID) resources as well as disruptions in staffing that were exacerbated by the COVID-19 pandemic. The ability to measure antibiotic use in nursing homes depends on resources available. Some nursing homes have access to antibiotic use data via electronic pharmacy or health record systems, although many nursing homes have to manually collect data on antibiotic use. CDC and others have begun partnerships with a variety of groups, including pharmacy vendors and EHR companies, to collate and analyze nursing home antibiotic use data to inform stewardship actions.

OUTPATIENT ANTIBIOTIC STEWARDSHIP

Stewardship implementation, regulation, and measurement in the outpatient arena differ in several ways from the hospital and nursing home. National data on both overall and condition-specific antibiotic prescribing in ambulatory settings have been available for many years and show important progress. From 2011 to 2019, total outpatient antibiotic prescriptions, as measured by the IQVIA XPONENT database, decreased from 877 prescriptions per 1000 population to 765, a 13% reduction nationally.¹⁸ Total outpatient prescriptions were down even further in 2021 to 636 per 1000 population, although this may be related to reductions in outpatient visits due to the COVID-19 pandemic.¹⁹

In addition to overall reductions in antibiotic use, there have been improvements in the appropriateness of prescribing in outpatient settings. Overall, the proportion of antibiotic prescriptions that were deemed unnecessary in US physician offices and emergency departments dropped from 30% in 2010–2011 to 28% in 2014–2015, with an even greater decrease in children: 32% in 2010–2011 to 19% in 2014–2015.²⁰ Likewise, in an analysis of antibiotic prescribing for acute respiratory infections from 2011 to 2018, the investigators noted a 32% drop in visits for an acute respiratory infection that resulted in an antibiotic prescription.²¹ To support and accelerate national progress towards optimizing outpatient prescribing, CDC and The Pew Charitable Trusts collaborated in 2016 to establish national targets for appropriate prescribing for several common conditions.²²

Improving prescribing in the outpatient setting is more challenging than in any other setting given the sheer number and huge variability in these practices. Although decreases in prescribing are encouraging, the implementation strategies associated with these decreases are less clear, although several implementation resources have been developed. CDC efforts have targeted both outpatient providers and the public through the “Be Antibiotics Aware” (formerly “Get Smart”) campaign, with a particular focus in the past on pediatric practices. The CDC developed a Core Elements framework for outpatient settings in 2016 which condensed the original seven elements into four Core Elements (commitment, action for policy and practice, tracking and reporting, and education and expertise).²³ The AHRQ Safety Program for Improving Antibiotic Use was developed for the ambulatory setting and emphasizes how practices can work together to develop standardized approaches for when and which antibiotics to prescribe as well as for selection of symptomatic treatment when antibiotics are not indicated.⁶ Implementation of the Safety Program in over 350 US ambulatory practice and urgent care clinics was associated with reductions in overall antibiotic use and in antibiotic use for viral respiratory tract infections.²⁴ Implementation of the MITIGATE toolkit, developed to improve antibiotic use in emergency departments

and urgent care centers, resulted in significant reductions in antibiotic prescribing for acute respiratory tract visits.^{25,26} The CDC offers a training program in outpatient stewardship, and the approaches to improve communication about antibiotic prescribing, a critical skillset for outpatient providers, have been developed.^{27–29}

There are limited regulatory mechanisms to advance ASPs in the outpatient arena because most outpatient practices do not undergo any sort of accreditation review. TJC has developed accreditation standards for outpatient stewardship programs in both its outpatient and hospital accreditation programs, and the Urgent Care Association also has stewardship programs as part of its accreditation process, although the reach of these accreditation standards is not as universal as in hospitals and nursing homes.

In outpatient settings, payment programs are likely to have more impact on engaging providers in efforts to improve antibiotic use than accreditation standards, and the last decade has seen steady growth in this area. Under the CMS Quality Payment Program, providers who participate in the Merit-Based Incentive Payment System (MIPS) track receive payment adjustment for Medicare Part B-covered professional services based on their performance across different performance categories.³⁰ These categories include (but are not limited to) measures of care quality and patient safety—some of which are related to antibiotic prescribing and participation in quality improvement activities, such as CDC's training program on antibiotic stewardship.³¹ The Medicaid program also includes antibiotic use measures in its Adult and Child Core Measure sets.³² Likewise, the National Quality Forum and Health Effectiveness Data and Information Set (HEDIS) both have quality measures for antibiotic prescribing.³³ None of these outpatient measures are required for all providers; for example, the MIPS antibiotic prescribing measures are among many measures that providers and practices can choose from. However, several health plans and payers are using the HEDIS measures in various quality improvement and provider payment programs.

FUTURE ACTIVITIES AND NEEDS

In less than 10 years, stewardship programs have become almost universal in hospitals and widely prevalent in nursing homes, and antibiotic use has improved in outpatient settings. By 2024, nearly every hospital in the country will be electronically reporting AUR data to CDC. Moreover, antibiotic stewardship has become a central focus of efforts to combat antibiotic resistance and is specifically called out in national legislation like the Pioneering Antimicrobial Subscriptions to End Upsurging Resistance (PASTEUR) Act.

Although we celebrate that progress, more work is needed. Building and supporting the stewardship workforce to successfully perform stewardship interventions must be a top priority. Although many hospitals and nursing homes report high levels of compliance with the Core Elements, this reporting may overestimate the true extent of active stewardship interventions. Stewardship leads are commonly underfunded and understaffed to perform stewardship activities, and the majority of hospitals and nursing homes in the United States do not have access to physicians and pharmacists trained in ID. IDSA statistics indicate that 80% of counties in the United States do not have access to an ID physician³⁴ and there are fewer than 2000 ID-trained pharmacists in the country, not all of whom work in antibiotic

stewardship.³⁵ The COVID pandemic underscored these challenges. Hospital ASPs were central to the COVID response, often taking the lead in writing treatment protocols and overseeing the use of COVID therapeutics.³⁶ However, the lean staffing of most programs meant this came at the expense of efforts to improve antibiotic use. Although direct causality cannot be demonstrated, it seems likely that the increases in antibiotic resistance seen during 2020 were at least partly due to increases in antibiotic use that stewardship programs might have been able to address if they had adequate resources.³⁷ To ensure that active and impactful stewardship interventions continue to occur, training more ID physicians and pharmacists in stewardship is essential, as is improving training in stewardship principles and practices for all providers involved in antibiotic prescribing to increase the frequency of self-stewardship.

Now that standards and requirements exist for stewardship programs, we must ensure that surveyors are well-versed in all components of effective antibiotic stewardship so that they are able to identify high- and low-performing programs. Recognizing the impact that regulations can have on promoting stewardship activities, novel approaches to identifying and assessing potential regulatory and payment targets are needed in settings where they do not universally exist, such as ambulatory practices and telemedicine.

Measures that inform stewardship must be continued and advanced across the spectrum of care. The Promoting Interoperability Program's new AUR surveillance measure is an important first step; however, data must be available in ways that help prescribers and other stakeholders translate information into action. For example, electronic measures should be developed to support real-time assessment of the quality, not just the quantity of antibiotics use. Likewise, measuring the harms of antibiotic use, electronically and in real time, is important both to help providers understand the importance of reducing unnecessary use and to identify improvement opportunities for stewardship programs. Continued discussions on potential noncommercial approaches to measure antibiotic use in nursing homes and outpatient clinics with the goal of benchmarking and feedback to prescribers is essential.

The articles in this edition of *Infectious Disease Clinics of North America* provide an excellent overview of the current state of the art of antibiotic stewardship in the United States. Much more importantly, they will help provide a road map of where we can go from here. If the past 10 years are any indication, the future of stewardship is indeed bright.

REFERENCES

1. Staub MB, Ouedraogo Y, Evans CD, et al. Analysis of a high-prescribing state's 2016 outpatient antibiotic prescriptions: Implications for outpatient antimicrobial stewardship interventions. *Infect Control Hosp Epidemiol* 2020;41(2):135–42. [PubMed: 31755401]
2. U.S. Department of Health and Human Services Center for Disease Control and Prevention. 2020 Update: Antibiotic Use in The United States, Progress and Opportunities Available at: <https://www.cdc.gov/antibiotic-use/pdfs/stewardship-report-2020-H.pdf>. Accessed May 11, 2023.
3. Core Elements of Hospital Antibiotic Stewardship Programs | Antibiotic Use | CDC. Published November 15, 2022. Available at: <https://www.cdc.gov/antibiotic-use/core-elements/hospital.html>. Accessed May 11, 2023.

4. CDC VitalSigns - Making Health Care Safer. Centers for Disease Control and Prevention. Published March 12, 2014. Available at: <https://www.cdc.gov/vitalsigns/antibiotic-prescribing-practices/index.html>. Accessed May 11, 2023.
5. Barlam TF, Cosgrove SE, Abbo LM, et al. Implementing an antibiotic stewardship program: guidelines by the infectious diseases society of america and the society for healthcare epidemiology of America. *Clin Infect Dis* 2016;62(10):e51–77. [PubMed: 27080992]
6. Antibiotic Stewardship Toolkits | Agency for Healthcare Research and Quality. Available at: <https://www.ahrq.gov/antibiotic-use/index.html>. Accessed May 11, 2023.
7. Tamma PD, Miller MA, Cosgrove SE. Rethinking how antibiotics are prescribed: incorporating the 4 moments of antibiotic decision making into clinical practice. *JAMA* 2019;321(2):139–40. [PubMed: 30589917]
8. Conditions for Coverage (CfCs) & Conditions of Participation (CoPs) | CMS. Available at: <https://www.cms.gov/Regulations-and-Guidance/Legislation/CfCsAndCoPs>. Accessed May 11, 2023.
9. R3 report issue 35: new and revised requirements for antibiotic stewardship, 2022, The Joint Commission, 1–4. Available at: https://www.jointcommission.org/-/media/tjc/documents/standards/r3-reports/r3_antibioticstewardship_july2022_final.pdf. Accessed May 11, 2023.
10. van Santen KL, Edwards JR, Webb AK, et al. The standardized antimicrobial administration ratio: a new metric for measuring and comparing antibiotic use. *Clin Infect Dis* 2018;67(2):179–85. [PubMed: 29409000]
11. Federal Register :: Medicare Program; Hospital Inpatient Prospective Payment Systems for Acute Care Hospitals and the Long-Term Care Hospital Prospective Payment System and Policy Changes and Fiscal Year 2023 Rates; Quality Programs and Medicare Promoting Interoperability Program Requirements for Eligible Hospitals and Critical Access Hospitals; Costs Incurred for Qualified and Non-Qualified Deferred Compensation Plans; and Changes to Hospital and Critical Access Hospital Conditions of Participation. Available at: <https://www.federalregister.gov/documents/2022/08/10/2022-16472/medicare-program-hospital-inpatient-prospective-payment-systems-for-acute-care-hospitals-and-the#h-623>. Accessed May 11, 2023.
12. Ayaz M, Pasha MF, Alzahrani MY, et al. The fast health interoperability resources (FHIR) standard: systematic literature review of implementations, applications, challenges and opportunities. *JMIR Med Inform* 2021;9(7):e21929. [PubMed: 34328424]
13. Pollack LA, van Santen KL, Weiner LM, et al. Antibiotic stewardship programs in U.S. Acute care hospitals: findings from the 2014 national healthcare safety network annual hospital survey. *Clin Infect Dis* 2016;63(4):443–9. [PubMed: 27199462]
14. Hospital Antibiotic Stewardship | A.R. & Patient Safety Portal. Available at: <https://arpsp.cdc.gov/profile/stewardship>. Accessed May 11, 2023.
15. Katz MJ, Tamma PD, Cosgrove SE, et al. Implementation of an antibiotic stewardship program in long-term care facilities across the US. *JAMA Netw Open* 2022;5(2):e220181. [PubMed: 35226084]
16. Who We Help - Nursing Homes | qioprogram.org. Available at: <https://qioprogram.org/nursing-homes>. Accessed June 1, 2023.
17. Long-term Care Stewardship | A.R. & Patient Safety Portal. Available at: <https://arpsp.cdc.gov/profile/ltc/united-states-United%20States>. Accessed May 12, 2023.
18. Measuring Outpatient Antibiotic Prescribing. Available at: https://www.cdc.gov/antibiotic-use/data/outpatient-prescribing/index.html?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fantibiotic-use%2Fcommunity%2Fprograms-measurement%2Fmeasuring-antibiotic-prescribing.html. Accessed June 1, 2023.
19. Antibiotic Use & Stewardship | A.R. & Patient Safety Portal. Available at: <https://arpsp.cdc.gov/profile/antibiotic-use?tab5antibiotic-use>. Accessed May 12, 2023.
20. Hersh AL, King LM, Shapiro DJ, et al. Unnecessary antibiotic prescribing in US ambulatory care settings, 2010–2015. *Clin Infect Dis* 2021;72(1):133–7. [PubMed: 32484505]
21. King LM, Bartoces M, Fleming-Dutra KE, et al. Changes in US outpatient antibiotic prescriptions from 2011–2016. *Clin Infect Dis* 2020;70(3):370–7. [PubMed: 30882145]

22. Antibiotic Use in Outpatient Settings. Published May 3, 2016. Available at: <http://pew.org/1N89p4C>. Accessed May 12, 2023.
23. Core Elements of Outpatient Antibiotic Stewardship | Antibiotic Use | CDC. Centers for Disease Control and Prevention. Published September 9, 2021. Available at: <https://www.cdc.gov/antibiotic-use/core-elements/outpatient.html>. Accessed November 28, 2022.
24. Keller SC, Caballero TM, Tamma PD, et al. Assessment of Changes in Visits and Antibiotic Prescribing During the Agency for Healthcare Research and Quality Safety Program for Improving Antibiotic Use and the COVID-19 Pandemic. *JAMA Netw Open* 2022;5(7):e2220512. [PubMed: 35793084]
25. May L, Yadav K, Gaona SD, et al. MITIGATE Antimicrobial Stewardship Toolkit. Published online April 13, 2018. Available at: https://www.saem.org/docs/default-source/saem-documents/mitigate-toolkit_final_4-13-18.pdf. Accessed May 11, 2023.
26. Yadav K, Meeker D, Mistry RD, et al. A Multifaceted intervention improves prescribing for acute respiratory infection for adults and children in emergency department and urgent care settings. *Acad Emerg Med* 2019;26(7):719–31. [PubMed: 31215721]
27. Dialogue Around Respiratory Illness Treatment (DART) – iMTR. Available at: <https://www.uwimtr.org/dart/>. Accessed May 12, 2023.
28. CDC’s Antibiotic Stewardship Course - CDC TRAIN - an affiliate of the TRAIN Learning Network powered by the Public Health Foundation. Available at: https://www.train.org/cdctrain/training_plan/3697. Accessed May 12, 2023.
29. Kronman MP, Gerber JS, Grundmeier RW, et al. Reducing Antibiotic Prescribing in Primary Care for Respiratory Illness. *Pediatrics* 2020;146(3):e20200038. [PubMed: 32747473]
30. The Quality Payment Program. Available at: <https://qpp.cms.gov/>. Accessed June 1, 2023.
31. Participation Options Overview. Available at: <https://qpp.cms.gov/mips/overview>. Accessed May 12, 2023.
32. Adult and Child Health Care Quality Measures | Medicaid. Available at: <https://www.medicaid.gov/medicaid/quality-of-care/performance-measurement/adult-and-child-health-care-quality-measures/index.html>. Accessed June 1, 2023.
33. The National Committee for Quality Assurance (NCQA), HEDIS MY 2023 Measure Description, 2022, NCQA, 1–15. Available at: <https://www.ncqa.org/wp-content/uploads/2022/07/HEDIS-MY-2023-Measure-Description.pdf>. Accessed May 11, 2023.
34. Counties With Greatest COVID-19 Caseloads Have Few or No Infectious Diseases Physicians. Published June 3, 2020. Available at: <https://www.idsociety.org/news-publications-new/articles/2020/counties-with-greatest-covid-19-caseloads-have-few-or-no-infectious-diseases-physicians/>. Accessed May 12, 2023.
35. Infectious Diseases Pharmacy. Available at: <https://www.bpsweb.org/bps-specialties/infectious-diseases-pharmacy/>. Accessed May 12, 2023.
36. Duties, resources, and burnout of antibiotic stewards during the coronavirus disease 2019 (COVID-19) pandemic - PubMed. Available at: <https://pubmed.ncbi.nlm.nih.gov/36168448/>. Accessed June 1, 2023.
37. COVID-19: U.S. Impact on Antimicrobial Resistance, Special Report 2022. National Center for Emerging and Zoonotic Infectious Diseases 2022. 10.15620/cdc:117915.