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VIEWPOINTS

Antimicrobial Prescribing in the Telehealth Setting: Framework for Stewardship During a Period of Rapid Acceleration Within Primary Care

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Antibiotic resistance is a global public health threat. The use of telehealth in primary care presents unique barriers to antimicrobial stewardship, including limited physical examination and changes to the patient-provider relationship. Since the coronavirus disease 2019 (COVID-19) pandemic, there is a need to identify novel antimicrobial stewardship strategies with an explosion in the use of telehealth within primary care. Our review proposes a tailored, sustainable approach to antimicrobial prescribing in the telehealth setting based on the Centers for Disease Control and Prevention's Core Elements of Outpatient Antibiotic Stewardship: commitment, action for policy and practice; tracking and reporting; and education and expertise. The rapid growth of telehealth for all types of primary care visits (not just antibiotic use) is outpacing knowledge associated with strategies for antimicrobial stewardship. Improving antibiotic use within primary care settings is critical as telehealth will remain a priority whether the COVID-19 pandemic recedes, particularly within patient populations with limited access to healthcare.

Keywords. telehealth; antimicrobial stewardship.

Antibiotic resistance is one of the greatest public health threats globally, prompting the Centers for Disease Control and Prevention (CDC) and other healthcare organizations to implement practical solutions [1, 2]. Antibiotic-resistant and *Clostridioides difficile* infections, which occur following antibiotic exposure, lead to morbidity, mortality, longer hospital stays, and increased healthcare costs [3–5]. The CDC estimates that antibiotic-resistant bacteria cause approximately 2.8 million infections and 35 900 deaths in the United States (US) each year [2]. Resistant infections cost the US up to $33 billion annually, which is expected to grow considerably if antibiotic resistance rates continue [6].

Antimicrobial stewardship (AMS) programs aim to improve patient safety by monitoring antibiotic use, antimicrobial resistance, and *C. difficile* rates [7]. The CDC released the Core Elements of Hospital Antibiotic Stewardship Programs in 2014 and the Core Elements of Antibiotic Stewardship for Nursing Homes in 2015. AMS programs have become increasingly common in acute care settings, with 85% implementing all core elements in 2018 compared to 41% in 2014 [7–9]. Yet, the largest antibiotic use and misuse source occurs in the outpatient setting [10, 11]. More than 266 million courses of antibiotics are prescribed annually in outpatient locations around the US [12]. The majority of antibiotic expenditures (>60%) and consumption (80%–90%) occur among outpatients [13]. At least 30%–40% of outpatient antibiotics are deemed unnecessary, often prescribed for viral respiratory infections. Excessive outpatient antibiotic use prompted the CDC to release the Core Elements of Outpatient Antibiotic Stewardship in 2016 [14]. The Joint Commission also instituted requirements for outpatient AMS programs in 2019 [15].

The CDC Core Elements provides a valuable framework for improving antibiotic use; however, little guidance exists for alternative healthcare delivery models such as telehealth [14]. The expansion of telehealth users during the coronavirus disease 2019 (COVID-19) pandemic caused an emergent need to identify AMS approaches specifically for this modality of care [16]. The limited research on telehealth antibiotic use has been variable; some studies have associated telehealth visits with higher antibiotic use than in-person primary care visits [17]. Other studies have shown that antibiotic prescribing is more appropriate in telehealth settings for conditions such as urinary tract infections (UTIs) [18]. Nevertheless, the rise of telehealth and the dearth of relevant research point to a need to characterize antibiotic telehealth prescribing and implement unique, sustainable AMS strategies. This article

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describes the unique barriers that telehealth use presents to safe and appropriate antibiotic prescribing.

Furthermore, it proposes a tailored and sustainable antimicrobial stewardship framework for primary care settings using telehealth based on the CDC's Core Elements of Outpatient Antimicrobial Stewardship. It is important to emphasize that the Core Elements were published by reviewing available studies and expert opinions for face-to-face primary care and did not include telehealth studies. We offer modified approaches that have been successfully utilized in other clinical settings to overcome the specific barriers presented with telehealth-delivered care.

WHAT IS TELEHEALTH, AND HOW IS IT USED TO TREAT COMMON INFECTIONS?

A prerequisite to understanding an approach for AMS for primary care telehealth is knowing how to define telehealth. The US Department of Health and Human Services defines telehealth as "electronic information and telecommunications technologies to support long-distance clinical health care, patient and professional health-related education, public health and health administration" [19]. Telehealth allows for mobility and enhanced access to care through real-time, interactive video visits, in-home and mobile health remote monitoring, and devices that gather and store health data [20]. Telehealth has taken many forms, including synchronous telehealth, which involves real-time interactions between patient and provider, often through telephone calls or virtual audiovisual appointments on a computer or device. Asynchronous telehealth, also known as "store-and-forward," involves consultations reliant on transferring health data and images [21].

Current literature regarding telehealth and AMS pertains to tele-antimicrobial stewardship programs, where infectious diseases and AMS expertise is provided remotely via telehealth consultation to clinical settings without traditional in-person infectious diseases/AMS expertise, especially rural, community, and critical access hospitals [22]. However, AMS is needed during telehealth appointments when antibiotics are considered. A CDC study of 4 large national telehealth providers found that in the first quarter of 2020, the number of telehealth visits increased by 50% compared to the first quarter of 2019 [23]. A retrospective study of an integrated healthcare system that analyzed 231 596 adult primary care and specialist visits demonstrated that 65% of the visits were virtual (31.7% telephone and 33.5% video) in 2020 [16]. Data from 13 community-based outpatient Veterans Health Administration clinics found that primary care visits for acute respiratory infection, UTI, or skin and soft tissue infection conducted using either telephone or video telehealth increased from 10% in 2019 to 67% in 2020 [24]. Although it is clear that more providers utilize telehealth to prescribe antibiotics, more data are needed to fully characterize and compare antibiotic use in traditional primary care and telehealth settings.

BARRIERS TO APPROPRIATE ANTIBIOTIC PRESCRIBING

Primary care telehealth presents unique barriers to AMS (Table 1). Physical assessment and subsequent differential/diagnosis are compromised in the virtual setting and providers may not have access to laboratory services to order microbiology cultures or strep throat testing [25]. Given this lack of diagnostic capacity, prescribers may have a lower threshold to diagnose infection and prescribe antibiotics [26]. In a retrospective cohort study of 2954 outpatient visits for UTIs, physicians were less likely to order a UTI-related test at an e-visit than at an office visit (8% vs 51%, respectively; $P < .01$) [26]. Authors postulated that prescribing antibiotics when urinalysis was unavailable was considered a "conservative approach" [26]. Other studies have demonstrated that telehealth visits were associated with more first-line and guideline-concordant prescribing [17]. In a retrospective study of Teledoc, a direct-to-consumer (DTC) telehealth company, authors related higher rates of antibiotic prescribing for acute bronchitis e-visits to the need for provider education and training in telehealth [27]. A retrospective pediatric study of >12 000 DTC telehealth visits with 560 physicians found that antibiotics were prescribed for 55% of respiratory tract infection (RTI) encounters, often requiring no antibiotics [28]. Antibiotic prescribing rates were high and varied by diagnosis: sinusitis (92.1%), otitis media (96.0%), pharyngitis (76.7%), and bronchitis and/or bronchiolitis (62.0%). Patients were more likely to give their telehealth provider a 5-star rating if antibiotics were prescribed (odds ratio, 3.38 [95% confidence interval, 2.84–4.02]) [28].

This relationship between patient satisfaction and antibiotic prescription has been reported elsewhere in a large cross-sectional study of 28 222 DTC telehealth encounters, in which

Table 1. Barriers to Antimicrobial Stewardship in Primary Care Settings Utilizing Telehealth

Barriers Identified
Paucity of well-validated antimicrobial stewardship strategies specific to primary care settings utilizing telehealth to guide interventions
Inability to complete physical examination
Lack of diagnostic services
Patient expectations, satisfaction ratings, and changed dynamics of patient-provider relationship
Providers may have lack of up-front information without patient records or concerns for integrating the visit afterward with current electronic medical records
Lack of provider training in use of telehealth technology, lack of education to adjust to shorter visit times, and lack of information technology support for providers
Challenges associated with patient access to technological resources, connectivity, and ability to operate e-visit technology

satisfaction varied by a prescription receipt [29]. Concerns for satisfaction measures may alter providers' decision to prescribe [18, 29, 30]. Some DTC telemedicine platforms explicitly advertise their services as a convenient way to get refills or new prescriptions [29]. The relationship between patient satisfaction and antibiotic medication may be less of a concern for traditional medical practices. However, providers may find it easier to prescribe antibiotics than to educate patients on why antibiotics are not needed, mainly if it appears to be what the patient wants [28, 29]. Other research has shown that visits ending with antibiotic prescriptions are shorter, which may motivate inappropriate prescribing [28]. In one study, the average length of a telehealth encounter ending with an antibiotic prescription averaged 6.6 minutes compared to 7.5 minutes in visits where nothing was prescribed [29]. Last, telehealth prescribers may empirically prescribe broad-spectrum antibiotics to avoid the need for in-person appointments [31]. A study of antibiotic prescribing for acute RTI found that among cases in which an antibiotic was specified, the adjusted broad-spectrum antibiotic prescribing rate for all acute respiratory infections visits was 86% for telehealth visits compared to 56% for physician office visits ($P < .01$) [31].

PROPOSED CORE ELEMENTS FOR ANTIMICROBIAL STEWARDSHIP FOR PRIMARY CARE SETTINGS UTILIZING TELEHEALTH

The CDC Core Elements of Outpatient Antibiotic Stewardship may serve as a framework to overcome these barriers and guide safe and appropriate antibiotic prescribing in primary care settings utilizing telehealth (Table 2). These Core Elements recognized several studies that demonstrated benefits of AMS in traditional primary care clinics, but nontraditional healthcare delivery models like telehealth may require unique AMS approaches [14, 32]. While we propose adapting the CDC outpatient Core Elements to telehealth, research is needed to determine successful implementation strategies and sustainable approaches to AMS in primary care settings utilizing telehealth.

Table 2. Framework for Antimicrobial Stewardship for Primary Care Settings Utilizing Telehealth: Utilizing the Centers for Disease Control and Prevention Core Elements for Outpatient Antimicrobial Stewardship

Core Element	Framework
Commitment	Improving antibiotic prescribing in primary care settings utilizing telehealth requires a commitment from all healthcare team members to participate in antimicrobial stewardship and prescribe antibiotics appropriately.
Action for policy and practice	Anticipating barriers and areas for meaningful intervention are necessary to create feasible telehealth antimicrobial stewardship efforts. Action is critical to transform policy and practice into successful telehealth antimicrobial stewardship approaches.
Tracking and reporting	Tracking and reporting specific to telehealth visits are necessary so providers who use telehealth can compare their antibiotic use during telehealth visits to that during in-person visits and to other providers' use both during telehealth and in-person visits.
Education and expertise	Education on proper antibiotic use involves providers, staff, and patients. Effective education for providers includes access to expertise and improves quality of care through appropriate antibiotic use. Involving patients in education improves healthcare literacy and may limit patient pressures to prescribe. Technological education may play a role in effective telehealth antimicrobial stewardship.

Commitment

Improving antibiotic prescribing in primary care settings utilizing telehealth requires a commitment from all healthcare team members to participate in AMS and prescribe antibiotics appropriately.

- *Incorporate unique displays of public commitment to supporting AMS into the telehealth visit.* For in-person visits, displaying posters in examination rooms that demonstrate a commitment to appropriate prescribing is associated with reduced inappropriate antibiotic prescriptions for acute RTI [32]. Since patients will not physically be in the examination room to see the posters during telehealth visits, visual displays of commitment to AMS could be incorporated into the virtual visit platform, or verbal presentations of commitment could replace "hold music" during telephone visits. These displays of commitment to AMS adapted to nontraditional telehealth delivery models may facilitate patient communication about appropriate and safe antibiotic use.
- *Identify a single champion to direct AMS activities focused on telehealth.* A successful outpatient AMS intervention resulted in a significant decrease in overall antibiotic use (14.4% relative reduction; $P < .001$) for RTIs centered on an identified peer champion combined with clinical pathways and patient education materials [33]. Peer champions' role in interventions is to advocate for use of clinical pathways. With increasing virtual visits and unique barriers to telehealth AMS, a focused champion for telehealth AMS may be helpful to overcome these barriers and motivate the whole healthcare team to improve their use of antibiotics during telehealth visits. Virtual infectious disease– or AMS-trained "telestewards" could be key advisors to support peer champion efforts.
- *Include AMS-related duties related explicitly to telehealth in position descriptions or job evaluation criteria.* Telehealth AMS might get overlooked without clear leadership support that dedicates time and resources. A national study of core elements in inpatient settings demonstrated that with leadership support, it was significantly more likely for the other elements to be implemented, a finding also supported by AMS initiatives in the Veterans Affairs (VA) system [34, 35].

- *Communicate with all staff to set patient expectations.* Patients might expect that telehealth visits will lead to antibiotics, as evidenced by the studies linking e-visit patient satisfaction to antibiotic prescription [18, 28, 29]. Patients and staff need to know that the visit may or may not lead to an antibiotic prescription and set those expectations before the encounter, perhaps through the use of guidance documentation provided to patients when they opt for telehealth.

Action for Policy and Practice

Anticipating barriers and areas for meaningful intervention are necessary to create feasible telehealth AMS efforts. Action is critical to transforming policy and practice into successful telehealth AMS approaches.

- *Use evidence-based diagnostic criteria and treatment recommendations.* Barriers to appropriate physical examination and diagnosis can make applying evidence-based diagnostic criteria and treatment recommendations challenging. Providers should adhere to clinical practice guidelines for common infections (eg, American Academy of Pediatrics, Infectious Diseases Society of America, American Thoracic Society). Use of strategies such as guidebooks, drop-down based ordering, and delayed antibiotic prescribing (described below) may help promote adherence to evidence-based guidelines. Furthermore, education to providers about the appropriate diagnosis and treatment of common infections during telehealth visits may also be helpful. This telehealth-tailored education could be developed from CDC efforts such as the "Be Antibiotics Aware" Toolkit.
- *Use virtual treatment pathways to outline evidence-based clinical decisions.* Previous work in VA healthcare settings found that locally developed antibiotic prescribing guidebooks from local antibiotic resistance data and provider-specific education improve antibiotic prescribing [36, 37]. Guidebooks can include pathways with first- and second-line antibiotic choices, making it easier for clinicians to quickly choose the right drug, at the right dose, by the right route, for the right length of therapy and the right reason. Such treatment pathways can be made available virtually within the telehealth visit platform to help clinicians quickly determine when antibiotics are not needed and provide options to recommend for treatment.
- *Drop-down–based ordering may also improve prescribing.* A retrospective study comparing in-person to virtual visits for sinusitis found that guideline-concordant antibiotic selection and duration of therapy occurred significantly more frequently during virtual visits. The study surmised that the improved adherence to antibiotic prescribing guidelines during virtual visits occurred due to the use of drop-down menu recommendations [38]. Drop-down–based ordering can motivate prescribers to select an indication for each antibiotic they order, facilitating appropriate drug choices, drug dosing based on renal status, and appropriate durations of therapy for different indications.
- *Use delayed prescribing practices or watchful waiting, when appropriate.* A formal "watch and wait" approach of delaying antibiotic prescriptions for a preset period may be helpful in preventing unnecessary antibiotic use. A Cochrane review found that delayed antibiotic prescriptions for RTI led to reduced antibiotic use, with no differences in complication rates or patient satisfaction [30]. Encouragingly for telehealth AMS efforts, 2 telehealth studies in this review found no difference in follow-up between in-person and virtual visits [39, 40]. Automated texting applications could be used for routine patient follow-up to help patients track and report their symptoms. This could be especially useful for telehealth clinicians using "watch and wait" approaches to help them monitor patients' symptoms during the "waiting" period. The VA "Annie App" is an example of a service that sends automated texts to Veterans to help them with self-care. Texts based on clinical protocols have been shown to improve the quality of care for Veterans [41]. Outside the VA, a surveillance study using text questionnaires for colorectal surgery follow-up found that no postoperative complications were missed and proposed texting as a safe replacement for in-person follow-ups [42].
- *Provide communications skills training for providers.* A toolkit created during the COVID-19 pandemic created diagnostic and communication strategies for providers to use with a patient with a suspected viral RTI to promote judicious use of antibiotics [25]. The toolkit identified barriers cited above, such as limited ability to do physical examinations, and identified facilitators associated with care during telehealth visits as increased patient-provider communication and patient willingness to receive "viral prescription," particularly in COVID-19. Although it has undergone limited evaluation to date, a viral prescription is a prescription pad outlining the diagnosis, why an antibiotic was not prescribed, symptom management, and evidence-based supportive therapies, as well as a contingency plan should symptoms persist. The CDC Be Antibiotics Aware Toolkit contains prescription pad PDFs, including a "symptom relief for viral illnesses" option. Providers should be specifically trained on how to have difficult conversations virtually or over the phone with patients regarding antibiotic prescription denial when it is not appropriate. Telehealth visits may be recorded and reviewed back for coaching purposes.

Tracking and Reporting

A recent retrospective cohort study found significantly more antibiotic prescribing associated with telehealth visits when compared to urgent care and primary care settings (52% telehealth vs 42% urgent care and 31% primary care; $P < .001$)

and that guideline-concordant antibiotic management was lower (59% telehealth vs 67% urgent care and 78% primary care; $P < .001$) [18]. As such, tracking and reporting specific to telehealth visits are needed, so providers who use telehealth can compare and benchmark their antibiotic use during telehealth visits compared to in-person visits.

- *Enable a dashboard system for peer and self-review.* Dashboard results could be shared with telehealth providers to self-evaluate their antibiotic prescribing practices and participate in quality improvement activities. The data should include both in-person and telehealth visit antibiotic prescribing habits. One previous study found significant reductions in antibiotic prescription rates during telehealth visits for upper respiratory infections (URIs) and bronchitis by combining education and individualized feedback (ie, online dashboard with monthly individual- and facility-level antibiotic prescription rates) compared to education alone [43]. Follow-up meetings should also be set up periodically to provide coaching opportunities or improvement strategies.
- *Develop telehealth-specific quality metrics to ensure appropriate goals and patient safety in the growing telehealth sector.* Considering the rapid expansion of telehealth, the National Committee for Quality Assurance added guidance for telehealth for 40 Healthcare Effectiveness Data and Information Set (HEDIS) measures in the 2020 coronavirus report [44]. In 2022, HEDIS introduced a new measure addressing antibiotic use for respiratory conditions. This new measure, in addition to the 3 existing HEDIS measures that target inappropriate antibiotics for URIs, pharyngitis, and acute bronchitis, could help AMS programs track and monitor antibiotic use [45].

Education and Expertise

Education on proper antibiotic use involves providers, staff, and patients. Effective education includes providers access to expertise and involving patients in education that improves healthcare literacy and may limit patient pressures to prescribe.

- *Provide telehealth-tailored AMS education for patients.* Effective communication strategies to educate patients about when antibiotics are not needed, and the potential harms of antibiotic treatment, may be helpful. Considering the limited telehealth interaction time with a provider (median, 5.5 minutes [interquartile range, 3.9–8.2 minutes]), it is important that patients have access to supplemental educational aids, pamphlets, and links to ensure they understood why antibiotics were not prescribed after the visits [28]. The CDC Be Antibiotics Aware Toolkit includes patient-tailored material that can be easily shared. Previsit education within the virtual "waiting room" might also allow for more nuanced face-to-face education.
- Education to other providers through training. It may be important to have someone accustomed to providing telehealth AMS to educate other less-experienced providers. This education could focus on telehealth AMS and how to promote appropriate and safe antibiotic use. Short social media–style educational videos or posts for clinicians to digest between telepatients and clinical duties may be preferred.
- Ensure timely access to persons with expertise. Access to consulting infectious disease specialists, pharmacists, and information technology support who can help maintain successful telehealth AMS should be made available. Likewise, providers should be aware when more conventional face-to-face visits are required.

CONCLUSIONS

Antimicrobial stewardship programs are recommended across all facets of healthcare, including outpatient settings, to improve antimicrobial use and combat antimicrobial resistance. Effective interventions for primary care settings utilizing telehealth are largely absent. We identified barriers to AMS programs in primary care settings utilizing telehealth and suggest a framework to overcome these barriers using a modified approach to the CDC Core Elements for Outpatient Antibiotic Stewardship. Patients with limited access to healthcare, such as those residing in rural locations and older patients with transportation challenges, will benefit from AMS for telehealth. Likewise, time-constrained individuals with jobs and/or caregiver responsibilities may prefer telehealth. There is a critical need for future well-designed studies to develop tailored, sustainable interventions to improve the care of the patients seeking care through telehealth.

Notes

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