



Review

One size does not fit all: advanced practice provider considerations for the antimicrobial steward

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Abstract

Advanced practice providers are a diverse and established group of antimicrobial prescribers in both ambulatory and inpatient settings. We outline important considerations for antimicrobial stewardship programs and stewards to consider when engaging this important group of providers.

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Introduction

Advanced practice provider (APP) is a term that indicates a group of healthcare providers, generally referring to physician assistants (PAs) and nurse practitioners (NPs), but also includes clinical nurse specialists, certified registered nurse anesthetists (CRNAs), and certified nurse midwives (CNMs).¹ APPs provide evidence-based care throughout the lifespan of patients and across many different disciplines and practice settings, making them an important group to consider for antimicrobial stewardship interventions and utilization as stewards. We want to emphasize and highlight the diversity of the term “Advanced Practice Provider”; however, we have chosen to focus our review on PAs and NPs given almost all infectious diseases (ID), and antimicrobial stewardship-related literature has been published on these two provider groups.

Background and diversity of APPs

In 2022, there were a reported 335,000 NPs and 159,000 PAs in the United States.^{2,3} Both NPs and PAs require graduate-level degrees (Master's degree for PA; Master's or Doctoral degree for NPs) and national board certification prior to obtaining state licensure; however, there are key differences. NP candidates have already obtained registered nurse (RN) licensure, and programs typically offer multiple training tracks, including, but not limited to, Family (FNP), Pediatric (PNP-PC), or Adult-Geriatric (AGNP) tracks, as well as Acute Care (ANP), Women's Health and Psych-Mental Health. Each track focuses on providing tailored education and clinical experience to the population foci in which a NP seeks certification. In contrast, PA training programs tend to have a

singular track modeled on medical school curricula with a broad range of didactics and clinical rotations.³ While curricula regarding ID and antimicrobials vary between APP training programs, one study found 95% of NP programs had lectures on antimicrobials, but most programs had less than 10 hours of total content.⁴

Historically, APPs were utilized as a solution to the primary care physician shortage with a positive impact on patient outcomes and patients' satisfaction in their care. However, in the setting of physician trainee work hour restrictions, there has been evolution of practice scope with increasing inpatient involvement.^{5,6} Currently, almost 10% of NPs have acute care certification with the majority working in hospital-based inpatient settings.⁷ Over 35% of PAs currently report working in hospital-based settings with the highest frequency in surgical and internal medicine sub-specialties.³ A study of Veteran's Health Administration data showed over 50% of inpatient medical services now utilize APPs.⁸ Although it is not a requirement for employment or clinical practice, APP residencies and fellowships are becoming more popular, providing APPs with more hands-on and specialized training in certain disciplines, including emergency medicine, surgical sub-specialties, hospital medicine, and ID.^{9–11}

What we know about APP antimicrobial usage

There are limitations about APP antimicrobial utilization, as most studies have been done in the ambulatory setting with a focus on NPs. Studies have found that APPs now provide over 25% of outpatient antibiotic prescriptions in the United States.^{12,13} Comparison between APP and physician prescribing practices remains limited to the ambulatory setting, where antimicrobial stewardship interventions are not common and have varied results.¹⁴ In these settings, several studies showed a higher rate of antibiotic prescriptions from APPs compared to physicians, while others showed no difference.^{12,15–20} A more recent study in the VA healthcare system showed a decrease in outpatient antibiotic

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prescriptions from APP prescribers over time, even after independent prescribing privileges were granted at the VA.²¹

As noted, limited literature exists about APP prescribing for both non-antimicrobials and antimicrobials in the inpatient setting. One study of a multi-disciplinary orthopedic surgery teams at an academic medical center found that NPs and PAs were responsible for a similar amount of discharge opioid prescriptions as post-graduate years 1–3 residents; however, no studies have been published comparing inpatient antimicrobial prescriptions between APPs and other prescribers.²²

There are differences between APPs practicing in ambulatory settings, where there might be a higher level of autonomy, versus APPs working in inpatient settings. APPs on inpatient care teams may work as the primary hospitalist or as part of care teams that include attendings, fellows, and physician trainees.²³ Inpatient team dynamics likely influence APP antibiotic decision-making. Surveys have found inpatient NPs are more likely to seek attending physician input on antimicrobial decisions compared to NPs practicing in community or outpatient settings.²⁴ In addition, APPs practicing at one academic medical center reported “Attending or Fellow Decision” as the most common barrier to decreasing inappropriate antimicrobial prescriptions.²⁵ Another study found that “fear of offending senior clinician” is a commonly cited factor in antibiotic decision-making among NPs.²⁶

How have ASPs historically engaged with APPs?

APPs have reported high motivation to be antibiotic stewards and have a high perception of the risks of antimicrobial overuse, such as resistance development and adverse effects.^{24,27} Taking these qualities and importance to patient care into account, there have long been calls for increased APP involvement with antimicrobial stewardship programs (ASPs).²⁸ However, ASPs have not traditionally prioritized APP engagement in stewardship education and interventions, instead focusing on physician, physician trainees, pharmacists, and pharmacy trainees.^{29,30} It is not surprising that early studies found APPs did not have favorable perceptions of ASP interactions. One early study of NPs at a tertiary care medical center found a majority (66%) reported they were “not familiar” with the center’s ASP and only 17% reported finding ASP interactions “useful” or “very useful.”²⁷ More recent studies suggest that ASP engagement of APPs is increasing with several more recent studies of APPs finding that the majority of NPs and/or PAs now report ASPs as helpful sources for ID and antimicrobial education were “somewhat useful or useful.”^{24,25}

There have been few studies on ASP interventions that target APPs with the goal of improving antimicrobial prescribing, but those published found success in ambulatory settings. One of our authors’ (GMW) own experience was a study of four pediatric urgent care centers staffed by NPs and found a significant decrease in inappropriate prescribing for NPs that attended disease-specific educational sessions.³¹ An additional study found that the introduction of an acute otitis media bundle, including clinical decision support tools around guideline recommendations and appropriate dosing of antibiotic, to a pediatric hospital-owned retail clinic staffed by NPs and PAs improved appropriate antibiotic prescriptions and selections and, importantly, were sustained over the study follow-up (18 months).³²

Studies on inpatient APP interventions have been limited by small study populations. We conducted a pilot study utilizing an educational intervention to decrease antimicrobial prescribing for asymptomatic bacteriuria among 33 inpatient Neurocritical Care

and Cardiac Surgery NPs and PAs. We found that the educational intervention was well-received and improved knowledge acquisition; however, there was no change between pre- and post-intervention prescribing patterns for asymptomatic bacteriuria.²⁵ Another study on NPs working on cardiothoracic surgery inpatient wards found success in increasing antimicrobial guideline adherence through targeted prescribing feedback coupled with educational outreach; however, the study only involved 11 NPs.³³

Direct engagement of prescriber groups through education is recommended to supplement ASP activities; however, there may be unique barriers for APPs.³⁴ A reported lack of protected time for education as well as perceptions that continuing education curricula were primarily designed for medical students and physician trainees are both factors that could lead to decreased APP engagement in ASP educational activities.^{25,35} We had also previously hypothesized that the culture at medical centers could be contributing to a lack of APP engagement, exemplified through the use of terms such as “nonteaching services,” “resident substitutes,” or “midlevels” that remain prevalent in both clinical and research settings and may perpetuate historical biases towards APPs.^{5,36–39}

Utilization of APPs on antimicrobial stewardship teams

There is a long history of APPs specializing in ID with the earliest reports of multi-disciplinary ambulatory HIV care teams coming from the late 1990s and inpatient ID consult teams from the mid-2000s.^{40,41} APPs in ID continue to grow with a survey of ID physicians and APPs reporting around 71% of ID physicians currently work with APPs in their practice.⁴² The role of ID APPs also continues to evolve with increased non-clinical, research, and leadership opportunities available, and, recently, 22% of ID APPs reported having antimicrobial stewardship roles at their medical center.^{7,42}

We could not find further literature describing specific APPs roles in ASPs. However, we (authors GMW and JCH) have a long-standing history of APP team members on our ASP team. Our ASP APP is integrated into all aspects of our ASP program. For example, our dedicated ASP APP provides a portion of scheduled ASP coverage for our prospective audit with feedback service. This allows for the ASP pharmacists to have dedicated administrative time for other required activities, including formulary management requirements and data management of performance measure along with surveillance. This dedicated time also allows for professional development opportunities for our ASP pharmacists.

This relatively unique situation arose from inclusion of nursing representation in our ASP in the form of a program manager with a nursing background and a pediatric nurse practitioner early on in our program’s evolution. Our ASP APP’s role was initially sponsored and heavily supported by the organization’s Chief Nursing Officer. Capitalizing on the NP background of our ASP APP, we believe a valuable perspective is contributed, one that combines prescriber, nurse, and antimicrobial steward. Having this not only uncovered barriers impacting antimicrobial prescribing specific to APPs but additionally helped us design and implement initiatives that included nursing and APPs. These have included working to empower front-line nursing staff through education and support around obtaining timely cultures, IV to PO conversion, allergy/adverse reaction clarification and documentation, as well as a major undertaking to address antibiotic waste. These efforts have also led to APPs initiating ASP-related quality improvement work in diverse areas of the hospital. Specific

examples of the clear benefits of APP involvement within our ASP are highlighted in Box 1.

Box 1. Examples of Successful Initiatives with APP Involvement

1. *Front-Line RN and Prescriber Engagement to Decrease Antimicrobial Waste:* nursing staff noted antibiotic doses being wasted due to the surgical teams not discontinuing the antibiotic order or extending the duration for a longer time than recommended with subsequent discharge of the patient from the hospital. Many of the antibiotics additionally had supply chain shortages. Our ASP team engaged not only the front-line RNs but surgical APPs, physicians, and our information technology department to standardize post-operative orders. This additionally led to the monitoring of other antimicrobial waste and highlighting the important role of stewardship in conservation and allocation of resources.
2. *Peer APP to APP Antimicrobial Stewardship Education and Outreach:* education is a key component for improving clinical practice among front-line APPs, and our ASP APP has allowed for expansion of educational access. For example, all onboarding APPs receive an ASP overview lecture by our ASP APP member. We feel that it is very beneficial for this group of providers to receive this education from a peer, similar to utilizing physicians and pharmacists for their peer groups. Additionally, when our ASP has undertaken new initiatives coupled with education to prescribers, our ASP APP member ensures these are communicated to APPs across the organization through appropriate channels and venues that are sometimes different than other clinical staff. These educational efforts serve an additional purpose of establishing relationships for future collaborations.

Our thoughts on effective APP engagement by antimicrobial stewardship programs

Box 2. Where to Start? Recommendations for Antimicrobial Stewardship Programs (ASPs) and Stewards in Engaging Advanced Practice Providers (APPs)

- Identify key APP leadership at both division and institutional levels
- Include APP representation on ASP sub-committees and oversight committees, quality improvement projects, and guideline development workgroups
- Avoid “One Size Fits All” approach to stewardship interventions by recognizing APP unique characteristics and barriers to influencing antimicrobial prescribing
- Institute ASP-dedicated roles for both ID APPs and/or non-ID APPs
- Invest in educational resources, such as the Infectious Diseases Society of America Antimicrobial Stewardship Curriculum, for APPs in ID or stewardship roles

First, it is crucial to identify key APP leadership. For the majority of medical centers employing APPs, there is often a Director of Advanced Practice that can be engaged to help guide initiative development or dissemination of resources (guidelines, practice alerts).⁴³ In addition, each division is likely to have an APP lead that oversees both inpatient and outpatient APPs. In our experience, these division leads can be key resources for ASPs. Furthermore, our own institutions have APP Councils that bring together APP leads in a multi-disciplinary forum to discuss practice-related issues, professional development opportunities, APP recognition, and promote overall collaboration and idea exchange among the divisions.

Second, we encourage ASPs to strongly consider APP representation on ASP sub-committees or oversight committees, quality improvement projects, and guideline development

workgroups. For example, at one of our community hospitals, we invited APPs from the Critical Care group to join our ASP sub-committee. We found these Critical Care APPs provided a more longitudinal presence in the ICUs than attending physicians, who tended to rotate on service one week every one or two months. APP sub-committee membership also provided better dissemination of stewardship recommendations, particularly during the COVID-19 pandemic where recommendations evolved quickly. Similarly, inpatient APPs often develop a specialized clinical focus and should also be considered for guideline development workgroups (eg, colorectal surgery APPs and an intra-abdominal infection guideline). APP involvement would provide key group representation and perspective as well as a peer champion to aid with effective guideline dissemination and education.

Third, one of the tenets of antimicrobial stewardship interventions is customization to fit institutional needs and providers, and a similar approach should be taken when considering how to effectively engage APPs, avoiding a “One Size Fits All” approach.³⁴ It is important to recognize the diversity within the term “Advanced Practice Provider.” For example, CRNAs have primary exposure to antimicrobials through surgical prophylaxis, while an NP on an inpatient orthopedic surgery team would be involved with antimicrobials for prosthetic joint infections. Interventions, particularly if involving educational components, should be tailored to fit the provider group’s background, interests, and mechanisms for communication/engagement. ASPs need to be cognizant that APPs may have different and unique barriers to effective interventions as outlined in the prior sections. Potential solutions would include working with APP leadership on local needs assessments and tailoring of educational sessions and materials, such as inclusion of self-directed modules and on-demand virtual components.⁴⁴

Lastly, APPs, particularly those specializing in ID, could be considered for dedicated antimicrobial stewardship roles. We have outlined our authors’ own ASP experience in the prior section, but APPs have successfully been incorporated into inpatient ID consult teams and as sole primary providers in outpatient ID and outpatient antibiotic therapy (OPAT) clinics with benefits including expanding patients’ access to care and providing continuity of care.^{41,45} Depending on the institution’s program, ASP APP responsibilities could take the form of prior authorization of restricted antimicrobials (eg, antimicrobial approval pager coverage), assigned days for prospective audit and feedback, or providing peer education as an ID/ASP expert. An ASP APP could fill critical roles in expanding an ASPs’ reach, particularly in outpatient and emergency department settings that remain areas of need.^{46,47} These practice settings employ APPs at a higher rate than inpatient settings, and APPs could provide a critical perspective on intervention development and implementation.² While there have not been published studies on the financial benefits of ASP utilization of APPs, APPs may help expand the pool of available stewards at a lower FTE rate than physicians or pharmacists, which may benefit smaller ASPs where the financial resources can be limited.

There has also been concern about the ongoing shortage of ID physicians, which would have a downstream effect of impacting ASP participation.⁴⁸ A recent study found that while the presence of on-site ID specialists was associated with lower antimicrobial utilization, almost 15% of VA hospitals did not have on-site ID physicians – a number previously reported as even higher in smaller, community hospitals.^{49–51} Hospitalist APPs have been reported to fill key ASP roles at sites without on-site ID specialists,

and this avenue should be continued to be explored.⁵² It is not clear whether APPs in stewardship roles would fulfill regulatory requirements if ID-trained physicians or pharmacists are not available. The most recent Center for Medicare and Medicaid Services (CMS) standards (482.42b) state that “the hospital must designate an individual or a group of individuals as its antibiotic stewardship program leaders” qualified through education, training, or certification.⁵³ CMS does state that the “ideal” situation is a jointly led program led by a physician and pharmacist, but this may be difficult for smaller and rural community hospitals to achieve. In contrast, The Joint Commission requirement (EP11) does specify that the leader of the ASP is a “physician and/or pharmacist.”⁵⁴

A lack of standardized ID-specific training has been reported as a perceived barrier to increasing APPs in ID, and a similar concern may arise in utilizing both ID and non-ID APPs in formal stewardship roles.⁴² However, the Infectious Diseases Society of America has created both an online Core and Advanced Antimicrobial Stewardship Curriculum. While these courses were initially designed and have already been found to be effective for ID fellows, the IDSA does specifically mention that other “stewards-in-training” groups, including APPs, can utilize and benefit from the curricula.^{55,56} For ID APPs, opportunities for involvement in ASPs might have the benefit of providing not only additional professional fulfillment but also non-clinical salary support to help potentially reduce risk of APP burnout and maintain a robust ID and stewardship workforce.

Conclusion

With APPs taking on a more primary role in patient care in both the ambulatory and acute care settings, APPs are a prime group of healthcare providers that should not only be targeted for ASP interventions but also empowered to be front-line antimicrobial stewards and considered for dedicated ASP-related roles. APP inpatient antimicrobial prescribing practices, APP groups other than NPs and APPs, and outcomes related to APPs on ASPs have not been studied and remain important gaps that need to be further explored. Engaging APPs as well as their inclusion in ASP roles has the potential benefit to influence front-line antimicrobial prescribing as well as expand the scope and reach of stewardship programs.

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