The Infusion Nurse's Role in Antibiotic Stewardship

Sharon A. Morgan, MSN, RN, NP-C

ABSTRACT

Since the introduction of the first antibiotic, the quick development of resistance has threatened the efficacy of such medications. Improving antibiotic use is, above all, a patient safety issue. As frontline health care providers, nurses can become more engaged and take a leadership role to enhance antibiotic stewardship programs. The unrecognized role of nurses in antibiotic stewardship efforts is just beginning to be explored. From hospital to home settings, the breadth of infusion nurse practice positions them to take principal roles in antibiotic stewardship program development across the continuum of care.

Key words: allergies, antibiotic stewardship, antibiotics, hospital, infusion nurse, long-term care, outpatient, priming, pump

The 20th century discovery and introduction of antibiotics changed the landscape of health care. Infectious bacterial diseases that were once deadly became treatable, substantially reducing deaths compared to the preantibiotic era.[1] Unfortunately, bacterial resistance to these medications have kept pace, setting the stage for potentially multi-drug resistant superbugs that simply cannot be treated. Resistance is a global phenomenon, occurring not only along human pathways, but through agricultural pathways as well.[2] In order to address these concerns, international and national government organizations and stakeholders have issued action plans to mitigate antimicrobial resistance and develop antibiotic stewardship programs (ASPs).[3-9] Unfortunately, the nurse's role historically has not been clearly articulated and often goes unrecognized.[10] All nurses, no matter what skill level or area of practice, can play a critical role in antibiotic stewardship. Due to the breadth of practice locations and specialties, infusion nurses are particularly well situated to be leaders in stewardship efforts.

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WHY STEWARDSHIP MATTERS

A Wake-up Call

The World Health Organization (WHO) considers antibiotic resistance to be one of the largest threats to global health and development and cautions that an increasing number of infections are getting harder to treat as antibiotics over time are becoming less effective.[11] According to the Centers for Disease Control and Prevention (CDC), more than 2 million illnesses occur annually because of antimicrobial resistance, resulting in approximately 23 000 deaths. In addition, patients who have been hospitalized and receive antibiotics are more vulnerable for developing potentially lethal infections such as *Clostridium difficile*. The populations most at risk are those whose chronic conditions leave them immunocompromised or who are at risk for surgical site infections.[2]

In November 2015, mcr-1, a newly discovered gene that makes bacteria resistant to the antibiotic colistin, was first reported among livestock in China. In the spring of 2016, US government agencies reported that the mcr-1 gene had been detected in both human and pig subjects. This raised alarms globally, as colistin, a much older antibiotic, is considered a drug of last resort, but is being used more frequently in multi-drug-resistant infections.[12] Figure 1 shows the interrelationship between antibiotic use in agriculture and humans, and how resistance can occur both in and between pathways.

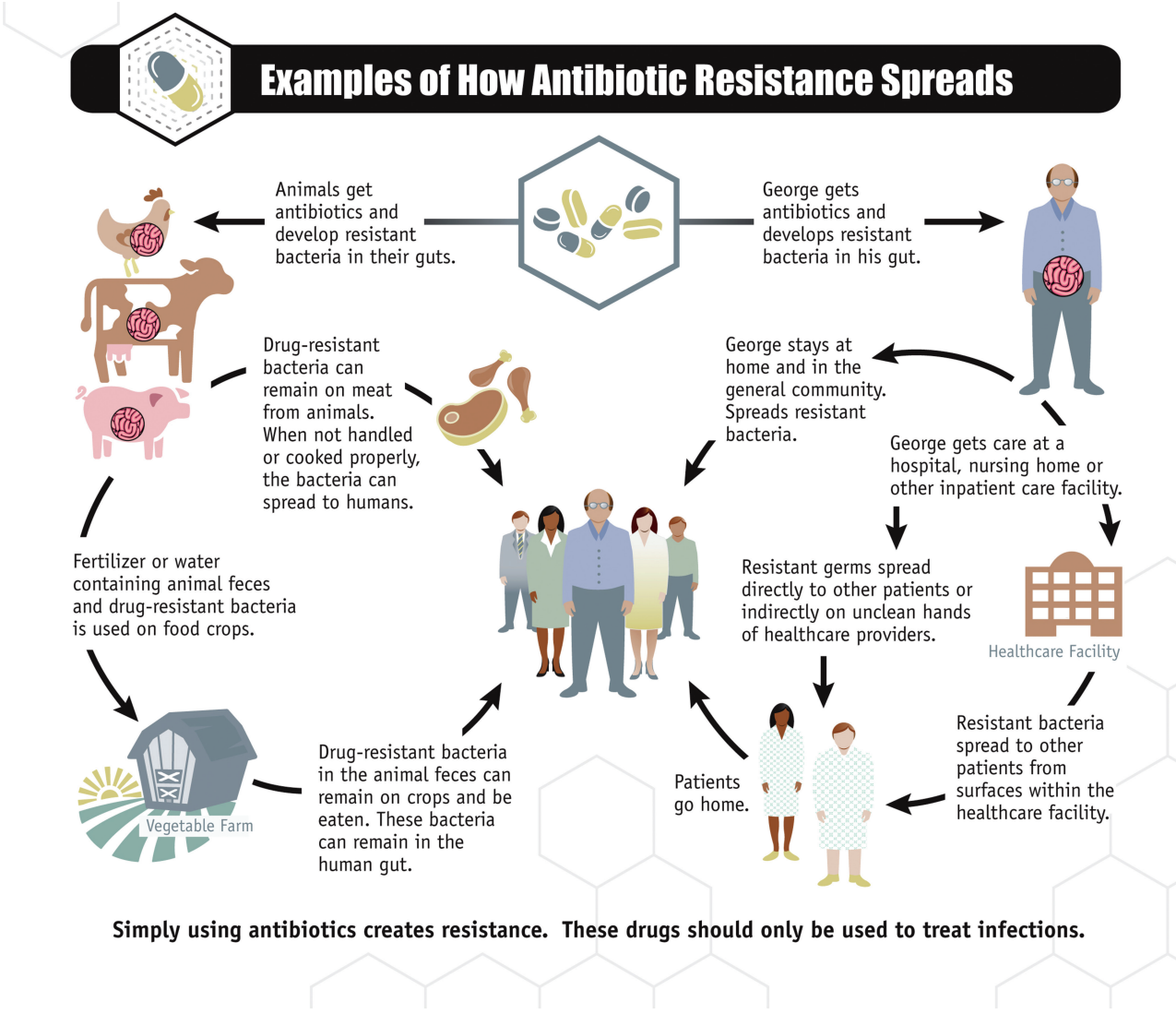

Figure 1 Examples of how antibiotic resistance spreads. Reprinted from The Centers for Disease Control and Prevention.[13]

Following the CDC's 2013 seminal work on antibiotic resistance in the United States, the Obama Administration issued Executive Order 13676[4]: a national action plan that outlines steps for implementing the National Strategy for Combating Antibiotic-Resistant Bacteria. Since then, the CDC, The Joint Commission (TJC), and the National Quality Forum have outlined core elements for combating resistance through ASPs.[5] In 2014 and 2015, the CDC released the *Core Elements of Hospital Antibiotic Stewardship Programs* and the *Core Elements of Antibiotic Stewardship for Nursing Homes*, respectively.[6-8] These core elements did not include the outpatient setting. While some hospital or nursing home ASPs may have been able to take on outpatient stewardship, it was not feasible in all outpatient settings—especially for those not associated with larger, more urban health care systems that have inpatient stewardship programs. The CDC subsequently issued the *Core Elements of Outpatient Antibiotic Stewardship*, which was published in the *Morbidity and Mortality Weekly Report Recommendations and Reports* on November 11, 2016.[9] These core elements provide a framework for improving antibiotic prescribing by outpatient clinicians and within facilities that routinely provide antibiotic treatment.

Internationally, the WHO's Global Antimicrobial Resistance Surveillance System (GLASS) provides a standardized approach to the collecting, analyzing, and sharing of antimicrobial resistance data among participating countries at a global level.[3] Launched in October 2015, GLASS initially is focused on 8 priority bacterial pathogens in humans, considered the greatest threats globally. These are *Escherichia coli*, *Klebsiella pneumoniae*, *Acinetobacter baumannii*, *Staphylococcus aureus*, *Streptococcus pneumoniae*, *Salmonella species (spp)*, *Shigella spp*, *and Neisseria gonorrhoeae*.[14] GLASS is also collecting information on participating countries' progress in establishing national antimicrobial resistance surveillance systems. WHO hopes to expand the system to include other types of resistance-related surveillance,

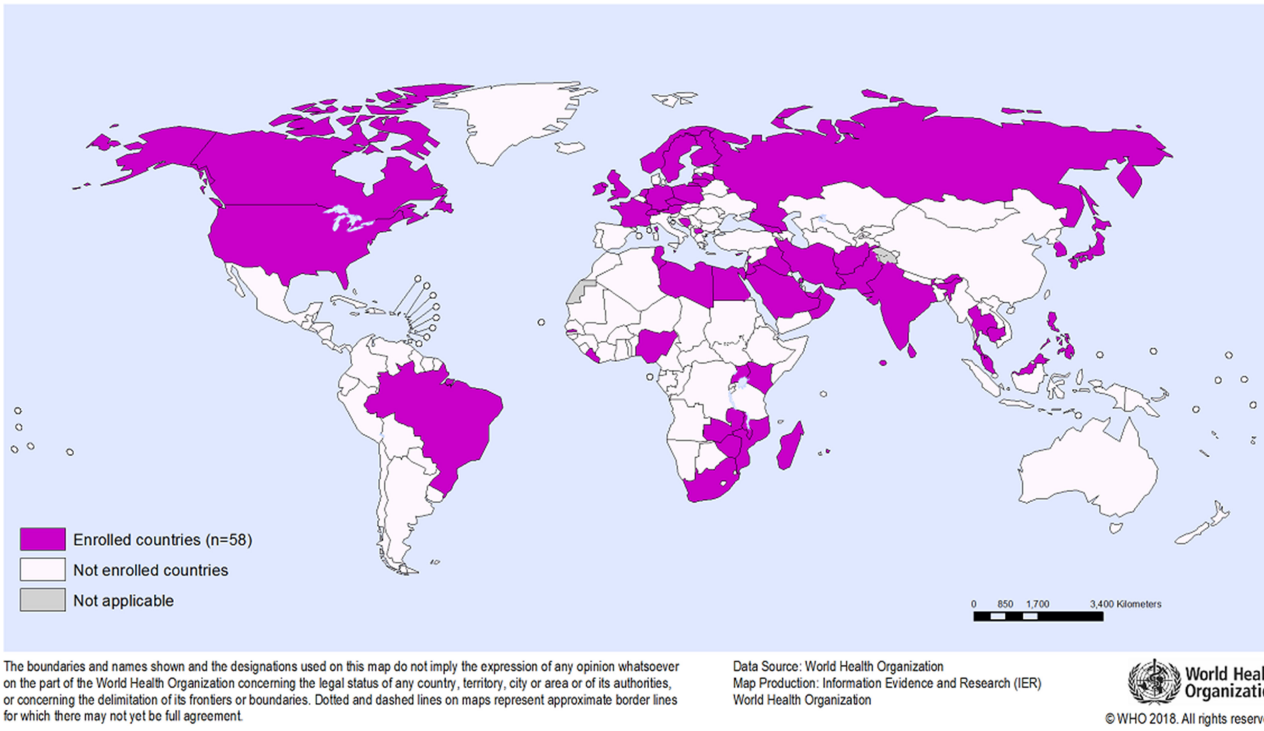

Figure 2 GLASS country participation. Reprinted from The World Health Organization.[15] *Abbreviation: GLASS, Global Antimicrobial Resistance Surveillance System.*

such as in the food chain and in the environment.[14] Figure 2 illustrates countries currently participating in GLASS as of May 2018.

Definitions

The terms *antibiotic* and *antimicrobial* may appear to be used interchangeably, but there is a difference. Microbes encompass not only bacteria but also other organisms such as viruses, fungi, and parasites.[2] Antibiotics are those medicines that fight or destroy bacteria and are a subset of antimicrobial drugs, or those medicines that fight not only bacteria (antibiotics) but the other types of microbes. Antibiotic or antimicrobial resistance is the ability of certain pathogens to resist the targeted drugs meant to kill them or disrupt their growth. All microbes have the ability to become drug resistant, which, in reality, is only their desire to survive.

Stewardship activities focus primarily on antibiotic prescribing and use. Antibiotic medications are prescribed frequently; however, depending on the scenario and the infection being treated, up to 70% of the time these antibiotics are prescribed inappropriately. Studies have shown that stewardship interventions reduce resistance, improve individual patient outcomes, and save health care dollars.[16]

DEFINING THE NURSE'S ROLE IN ANTIBIOTIC STEWARDSHIP

In a consensus statement from the Infectious Diseases Society of America, the Society for Healthcare Epidemiology of America, and the Pediatric Infectious Diseases Society, antibiotic stewardship was defined as "coordinated interventions designed to improve and measure the appropriate use of [antibiotic] agents by promoting the selection of the optimal [antibiotic] drug regimen, including dosing, duration of therapy, and route of administration."[17(p323)] To help institutions implement ASPs, the CDC developed the core elements of antibiotic stewardship and related documents,[6-9] which call for a multidisciplinary approach to improving antibiotic use. As of January 2017, TJC is also requiring hospital ASPs to demonstrate interprofessional engagement to address core performance elements and expand antibiotic stewardship reach.[18] Both the CDC and TJC specifically highlight the need to engage nurses as part of the multidisciplinary effort, but beyond that, few details are offered.

Recognizing the central role that nurses play in patient care and quality improvement, the CDC (with a grant from the CDC Foundation) partnered with the American Nurses Association (ANA) to bring together a group of registered nurses to explore the nurse's role in acute care hospital ASPs and to identify practical areas for nurse engagement.[19] In late 2015, ANA sent out a call to members soliciting interest in working with CDC and ANA to better define and extrapolate the role of bedside nurses in antibiotic stewardship efforts in acute care hospitals. From these applications, staff at CDC and ANA selected 30 members to serve on an expert advisory committee. Members were chosen to represent a diverse range of geographic locations, expertise, and acute care hospital experience. The work group held a series of virtual meetings, culminating in a 1-day live seminar in July 2016 at ANA headquarters in Silver Spring, Maryland. As a result of

these meetings, the work group published the joint ANA/CDC white paper "*Redefining the Antibiotic Stewardship Team: Recommendations From the American Nurses Association/ Centers for Disease Control and Prevention Workgroup on the Role of Registered Nurses in Hospital Antibiotic Stewardship Practices*"[19] in the summer of 2017.

The white paper reflected the first time national-level organizations specifically outlined the critical and lead role nurses could and should play in antibiotic stewardship. While the initiative focused on the hospital setting, work group members believed that the alignment of core elements with current nurse practices and activities can be templated to most health care situations. For example, the nurse is most likely to be triaging or taking the history of an individual seeking care and is, therefore, in the best position to verify the accuracy of reported allergies. One study suggests that up to 90% of reported drug allergies for antibiotics are, in fact, in error and would preclude a patient from receiving the first-line medication.[20] An accurate allergy history ensures appropriate first-line treatments and minimizes unneeded length of stay or additional considerations that may accompany a less therapeutic line of antibiotics.

THE INFUSION NURSE'S ROLE

Engaging Nurses

The ANA leadership believe that all registered nurses can be a powerful, unifying force in engaging consumers and transforming health and health care. To that end, ANA aligns with nurse specialty organizations who are organizational affiliates (OAs) with ANA. The Infusion Nurses Society (INS) is one such affiliate.[21] OAs maintain their autonomy but are voting members in ANA's annual Membership Assembly, the governing and official voting body of ANA.[22]

One of the avenues ANA uses to engage its members and nurses at large is through social media. In January 2017, ANA staff hosted a Twitter chat on whether nurses thought patients were receiving their complete dose of intravenous piggyback (IVPB) medications, including antibiotics. One of the questions asked during the Twitter chat was whether nurses were aware of institutional protocols that address the delivery of IVPB medications. Responses during the Twitter chat revealed a wide variety of practice, some of which are captured in Figure 3.

Following the chat session, INS provided ANA members with an informal briefing to discuss the appropriate procedure for priming pumps for medication delivery. During the presentation it was noted that when administering intravenous (IV) solutions, knowing the volumes needed to completely deliver a prescribed medication is crucial. The *priming volume* is the amount of fluid required to fill the entire length of the IV administration set, eliminating the air in line. After priming the administration set, the *drug volume* is the volume left in the medication bag. The *residual volume* is the amount of fluid or medication left in the IV administration set after the medication container is empty or the prescribed drug volume is infused. Some call this "dead volume." Problems can arise if the residual volume is not flushed through the administration set. For example, a patient's medication is ordered to be administered in 50 mL of solution, and approximately 25 mL of solution remains in the administration set upon completion

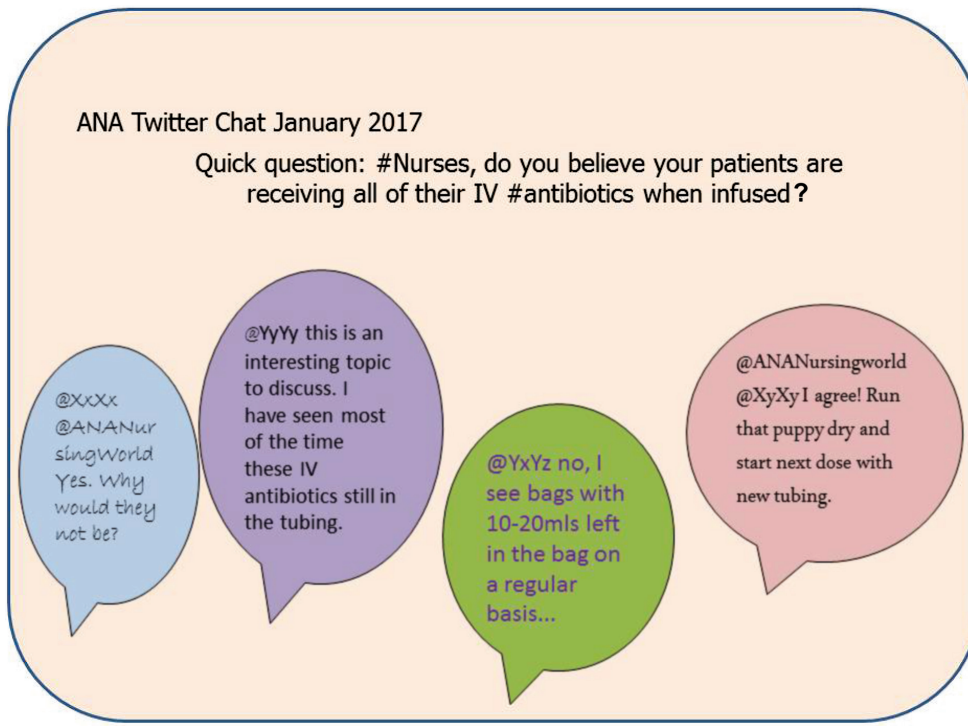

Figure 3 American Nurses Association-sponsored Twitter chat on infusion medication pump priming. From Strootman G.[23] Used with permission.

of the dose. At the point where the bag "runs dry," if the administration set is discarded, about 50% of the medication could be lost. As infusion nurses, being sensitive to these variations can minimize medication loss and ineffective antibiotic administration.[24]

Practice Settings

Infusion nurses practice in a variety of settings, each of which provides opportunities to engage in antibiotic stewardship activities. Over 70% of health care occurs in small community hospitals with a mean bed size of 160.[22] Understanding antibiotic use in these facilities is extremely limited, with most data coming from larger academic medical centers. According to the 2014 National Healthcare and Safety Network annual survey, the more hospital beds a facility has, the more likely that hospital meets all of the CDC's core elements of antibiotic stewardship.[25] In addition, technological and safety improvements, as well as cost-saving measures, have prompted completion of IV therapy to occur outside the hospital setting over the years, such as in ambulatory infusion suites.[26] Therefore, the role of the infusion nurse in taking a lead role in ASP development could be crucial in community settings.

Increased vigilance is warranted in long-term care and skilled nursing facilities, where the lack of in-house medical and pharmacy staff makes the nurse's role in antibiotic stewardship even more critical. According to the CDC, up to 70% of nursing home residents will receive at least 1 or more courses of systemic antibiotics over a year, 40% to 70% of which will probably not be needed.[8] Residents are older, frailer, have more complex histories, and are more likely to suffer an adverse event. Because these facilities are far less likely to have in-resident medical or pharmacy support, responsibility will fall on nurses to take the lead in developing a cohesive ASP.

Of all places where infusion nurses may practice, the home setting can provide exceptional autonomy but also extreme isolation in dealing with antibiotic stewardship issues. In developing antibiotic stewardship principles, the Association for Professionals in Infection Control and Epidemiology/Healthcare Infection Control Practices Advisory Committee Surveillance Definitions for Home Health Care and Home Hospice Infections provides a ready resource to help identify potential infections and determine antibiotic needs.[27] The document lists 5 steps to take when considering an antibiotic for a patient who is exhibiting signs and symptoms of an infection:

1. Assess: accurately identify signs/symptoms of potential infection
2. Use: a concise reporting guide when communicating with prescribing practitioners, such as the situation, background, assessment, recommendation (SBAR) format, to facilitate prompt and effective dialogue
3. Refrain: from asking for an antibiotic
4. Obtain: a culture before an antibiotic is started
5. Monitor: for adverse reactions or *C difficile*

CONCLUSION

A thorough medication history may also illuminate recent, current, or incomplete antibiotic regimens and highlight potential conflicts in further treatments.

ASPs provide the best and clearest platform to address antimicrobial resistance, and infusion nurses have ample expertise and opportunity to take a lead role in ASP development. All nurses are at the center of patient care and are in a prime location across all health care settings to take a lead role in antibiotic stewardship, education, and advocacy. The nursing profession is 4 million strong and can be the unifying voice to move the dial on proper practices to minimize antibiotic resistance.

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