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Citation for final published version:

Courtenay, Molly and McEwen, Jo 2020. Applying an antimicrobial stewardship competency framework in nurse education and practice. *Nursing Standard* 35 (3) , e11488. 10.7748/ns.2020.e11488

Publishers page: <http://dx.doi.org/10.7748/ns.2020.e11488>

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A competency framework for antimicrobial stewardship in undergraduate nurse education

Abstract

Antimicrobial resistant infections cause approximately 700,000 deaths globally each year. The development of resistance is influenced by the frequency of antibiotic use. This article describes an international antimicrobial stewardship competency framework for international undergraduate nurse education and how this framework can be mapped into nurse education programmes. A case study is used to demonstrate how the competencies apply to nursing practice.

Key points

- Antimicrobial resistant infections cause approximately 700,000 deaths globally each year and the development of resistance is influenced by the frequency of antibiotic use.
- Antimicrobial stewardship (AMS), i.e. the safe and effective use of antibiotics, should result in the best clinical outcome for the treatment or prevention of infection, with minimal toxicity to the patient and minimal impact on subsequent resistance
- Nurses are directly involved in stewardship activities, are increasingly prescribers of antibiotics, and their role in AMS is reinforced in national and international policy, however, few have heard of the term AMS.
- A competency framework, comprising 63 individual competency descriptors essential for AMS in nursing practice, that supports current and future standards of proficiency for registered nurses, has been developed and endorsed by scientific and professional bodies including The National Institute for Health and Care Excellence (NICE), providing a baseline with regards to the minimum standard required of nurses.

Antimicrobial resistance and antimicrobial stewardship

Antimicrobial resistance (AMR) occurs when microorganisms (e.g. bacteria, viruses, fungi and parasites) change in ways that render the medications used to treat the infections they cause, ineffective (World Health Organisation (WHO) 2017). AMR infections cause approximately 700,000 deaths globally each year (O'Neil, 2016). The development of resistance is influenced by the frequency of antibiotic use (Holmes et al. 2015). Antimicrobial stewardship (AMS), is described as 'a collection of co-ordinated interprofessional focused strategies to optimise antibiotic use by ensuring that every patient receives an antibiotic only when it is clinically indicated and then receives the appropriate antibiotic, at the right dose, duration and route of administration' (Manning et al 2015). Good AMS programmes should results in the best clinical outcome for the treatment or prevention of infection, with minimal toxicity to the patient and minimal impact on subsequent resistance (Gerding 2001).

Nurses and antimicrobial stewardship

Nurses are critical to the success of AMS programmes. They are increasingly prescribers of antibiotics (Courtenay et al 2017, American Association of Nurses (AANs 2017), and they are also directly involved in patient and medicine related stewardship activities (such as timely antibiotic administration, specimen collection, monitoring treatment and adverse events (WHO 2019). Nurses are also facilitators of interprofessional collaborative practice which is necessary for optimal AMS practice (Courtenay et al 2018). General practice nurses for example, have an important role with regards to communicating AMR messages to the general public. School nurses are in a good position to educate young people about AMR, as are health visitors to educate families (Royal College of Nursing (RCN) 2014, European Union (EU) guidelines 2017, Reilly et al 2017). The important role nurses play in AMS is reinforced in national (National Health Services (NHS) Scotland 2018, RCN 2018)and international (Centre for Disease Control and Prevention (CDC) 2014, EU guidelines 2017, ANNS 2017, European Federation of Nurses Association (EFN) 2017) policy.

Nurse education and antimicrobial stewardship

Although undergraduate nurse education is recognised as important if AMR is to be contained (WHO 2016), only two thirds of nursing programmes incorporate any AMS teaching with recommended AMS principles covered in only 12% of programmes (Castro-Sánchez et al 2016). Furthermore, both student nurses (McEwen, Burnett 2019) and qualified nurses (McGregor et al

2015) report that their knowledge of antibiotics is not good, and only a few have heard of the term AMS (McEwen, Burnett 2019, McGregor et al 2015).

An antimicrobial stewardship competency framework for nurses

An AMS competency framework has been developed for undergraduate healthcare professional education (Courtenay et al 2018). This framework, which supports current standards of proficiency for registered nurses in the UK [NMC 2018] and possibly elsewhere, provides students and professionals with knowledge to help prevent and control AMR. It has been endorsed by scientific and professional societies including The National Institute for Health and Care Excellence (NICE), (<https://www.cardiff.ac.uk/healthcare-sciences/research/publications/being-antibiotic-aware>) and has also been identified as an educational resource to support the delivery of the UK's five-year national action plan (Her Majesty's (HM) 2019) to tackle this growing problem.

It comprises 6 overarching competency domains, which represent the knowledge, skills, attitudes, and values that shape the judgements essential for AMS, and 55 competency descriptors, reflecting learners experience and type of practice setting. Each of the descriptors can be integrated throughout undergraduate education programmes facilitating students to build on their AMS knowledge and skills incrementally. Although aimed at undergraduate professionals, the framework can additionally be utilized to support learning and skills development in qualified professionals who have not had exposure to AMS/AMR education.

In Spring 2019, an international panel of nurses across eight countries, experienced in AMS with advanced and specialist knowledge, and working in clinical, managerial, education and research roles, were invited to evaluate the AMS competency framework, with regards to its application to nursing practice. By use of a Delphi technique, a further 9 competency descriptors were identified as specific to nursing practice in order to achieve AMS competencies consistent with the roles of nurses (Courtenay et al 2019). The additional competency descriptors reflected the variety of roles, responsibilities, and expectations of nurses. For example, some focused upon patient care activities (e.g. specimen collection, treatment monitoring, interpreting laboratory results) and their utilisation (e.g. recognising the importance of adequate specimen collection during antimicrobial use, recognising the response to antimicrobial treatment, interpreting culture and sensitivity results that demand prompt attention). Others centred upon the central

role of nurses as communicators and patient educators about AMR e.g. enabling selfcare for patients and promoting family engagement in infection prevention and control activities, or recognising those patients and families in need of support to complete a course of antibiotics. Competency statements (sub divided into 6 domains), and the 63 individual descriptors essential for AMS in nursing professional practice are shown in Table 1.

Table 1: Competency domains and descriptors (adapted from Courtenay & Castro-Sanchez 2019)

Domains	Competency descriptors
<p>Domain one: Infection prevention and control</p> <p>Competency statement: All qualified health care professionals must understand the core knowledge underpinning infection prevention and control, and use this knowledge appropriately to prevent the spread of infection.</p>	<p>To support antimicrobial stewardship learners must demonstrate infection prevention and control by:</p> <ol style="list-style-type: none"> 1. Describing what a micro-organism is 2. Describing the different types of organisms that may cause infections 3. Explaining what an antimicrobial resistant organism is 4. Explaining the ‘Chain of Infection’. 5. Defining the components required for infection transmission (i.e. presence of an organism, route of transmission of the organism from one person to another, a host who is susceptible to infection). 6. Describing the routes of transmission of infectious organisms i.e., contact, droplet, airborne routes. 7. Present and recognize the characteristics of a susceptible host. 8. Demonstrate an understanding of the importance of surveillance. 9. Describe how vaccines can prevent infections in susceptible persons. 10. Demonstrate the application of standard precautions in healthcare environments. 11. Apply appropriate policies/procedures and guidelines when collecting and handling specimens. 12. Apply policies, procedures and guidelines relevant to infection control when presented with infection prevention and control cases and situations. 13. Implement work practices that reduce the risk of infection (such as taking appropriate immunization or not coming to work when sick to ensure patient and other healthcare worker protection)^[1] 14. Appreciate that healthcare workers have the accountability and obligation to follow infection

	<p>prevention and control protocols as part of their contract of employment.^[1]_[SEP]</p> <p>15. Act as a role model to healthcare workers and members of the public by adhering to infection prevention and control principles.^[1]_[SEP]</p> <p>16. Demonstrating knowledge and awareness of international/national strategies on infection prevention and control and antimicrobial resistance such as Global Action Plan for AMR and national recommendations, guidelines, and legal requirements- or equivalent</p> <p>17. Understanding the role of the environment in optimal infection prevention and control practices including hand hygiene and environmental cleaning</p> <p>18. Enabling infection prevention and control self-care for patients and family'</p>
<p>Domain 2: Antimicrobials and antimicrobial resistance</p> <p>Competency statement: All qualified health care professionals need to understand the core knowledge underpinning the concept of antimicrobial resistance and use this knowledge to help prevent antimicrobial resistance.</p>	<p>To support antimicrobial stewardship learners must be able to:</p> <ol style="list-style-type: none"> 1. Recognise the signs and symptoms of infection 2. Discuss how inappropriate antimicrobial use (including non-adherence to treatment regime) may lead to antimicrobial resistance 3. Identify approaches to support optimal prescribing of antimicrobials 4. Recognise the importance of adequate specimen collection during relevant stages of antimicrobial use (i.e. prior/during antibiotic treatment) 5. Describe how to recognize the appropriate response to antimicrobial treatment and the main signs that demonstrate antimicrobial failures
<p>Domain 3: The diagnosis of infection and the use of antimicrobials</p> <p>Competency statement: All qualified health care professionals need to demonstrate knowledge in how infections are diagnosed and the appropriate use of antimicrobials, and use this knowledge appropriately to support the accurate diagnosis of infection and the appropriate use of antimicrobials.</p>	<p>To support antimicrobial stewardship, learners must be able to:</p> <ol style="list-style-type: none"> 1. Explain how microbiology samples may aid diagnosis of infection 2. Describe how and demonstrate (following local procedures) the appropriate taking of samples 3. Interpret microbiology results/reports from the laboratory at a basic level 4. Explain why self-limiting bacterial or viral infections are unlikely to benefit from antimicrobials 5. Describe and demonstrate the self-management strategies required to treat self-limiting infections (i.e.

	<p>analgesia /rest /fluids)</p> <ol style="list-style-type: none"> 6. Understand the importance of following local antimicrobial policies (i.e. their development is based on local resistance patterns) and follow these policies in practice 7. Explain the importance of documenting the indications for an antimicrobial (i.e. the route by which it is administered, its duration, dose, dose interval, and review date), in clinical notes and demonstrate this in practice 8. Demonstrate an understanding of the factors that need to be considered when choosing an antimicrobial (including site of infection and type of bacteria likely to cause an infection at a particular site) 9. Describe broad spectrum and narrow spectrum antimicrobials and the contribution of broad spectrum antimicrobials to AMR 10. Present and be able to recognise the common side effects associated with commonly administered antimicrobials 11. Demonstrate an understanding of why documenting a patient allergy to an antimicrobial is important 12. Explain why it is important to consider certain physiological conditions (such as renal function) in patients who receive an antimicrobial 13. Describe what is meant by delayed prescribing 14. Explain why it is essential that an accurate diagnosis of an allergy to an antimicrobial is based on history and laboratory tests. 15. Demonstrate an understanding of the role of the nurse regarding quality and safety of antibiotic prescriptions 16. Demonstrate an awareness of laboratory results (i.e. culture and sensitivity) that demand prompt intervention) 17. Recognize antimicrobials that should be preserved for treatment of specific infections e.g. carbapenemase-producing Enterobacteriaceae (CPE) or colistin –resistance or colistin resistant pathogens
<p>Domain 4: Antimicrobial prescribing practice</p> <p>Competency statement: All qualified health care professionals need to be aware of how antimicrobials are used in practice in terms of</p>	<p>To support antimicrobial stewardship, learners must be able to:</p> <ol style="list-style-type: none"> 1. Explain how you would recognise and manage sepsis 2. Describe why it is important to use local guidelines to initiate prompt effective antimicrobial treatment in patients with life threatening infections

<p>their dose, timing, duration and appropriate route of administration, and apply this knowledge as part of their routine practice.</p>	<ol style="list-style-type: none"> 3. Describe why it is important to switch from intravenous antimicrobials to oral therapy 4. Describe how to switch from IV antimicrobials to oral therapy 5. Understand the appropriateness of antimicrobial administration models such as outpatient parenteral antimicrobial therapy (OPAT) 6. Demonstrate an understanding of the rationale and use of perioperative prophylactic antimicrobials to prevent surgical site infection 7. Discuss factors that can influence antimicrobial prescribing and the implications for antimicrobial stewardship programmes 8. Describe the national guidance on completion of a course of antimicrobials 9. Explain how you would identify the medicines with which antimicrobials can interact and why this is important 10. Describe the difference between empiric, targeted and prophylactic antimicrobial therapy
<p>Domain 5: Person centred care</p> <p>Competency statement: All qualified health care professionals must seek out, integrate and value the input and engagement of the patient /carer as a partner in designing and implementing care</p>	<p>To support antimicrobial stewardship that is patient centred, learners need to:</p> <ol style="list-style-type: none"> 1. Support participation of patients/carers, as integral partners when planning/delivering their care. 2. Share information with patients/carers in a respectful manner and in such a way that is understandable, encourages discussion, and enhances participation in decision-making. 3. Ensure that appropriate education and support is provided by learners to patients/carers, and others involved with their care or service; ^[11]_[SEP] 4. Listen respectfully to the expressed needs of all parties in shaping and delivering care or services. 5. Discuss patient/carer expectations or demands of antimicrobials and the need to use antimicrobials appropriately. 6. Recognize patient social-economic restrictions (or other conditions of vulnerability) that may limit the appropriate course of antimicrobials, and support patients and their families for social protection achievement 7. Recognize patients and families who require support to complete a course of antimicrobial therapy.

<p>Domain 6: Interprofessional collaborative practice</p> <p>Competency statement: All qualified health care professionals need to understand how different professions collaborate in relation to how they contribute to AS.</p>	<p>To support AMS, learners are able to:</p> <ol style="list-style-type: none"> 1. Demonstrate an understanding of the roles, responsibilities, and competencies of other health professionals involved in antimicrobial treatment policy decisions 2. Explain why it is important that healthcare professionals, involved in the delivery of antimicrobial therapy (including the prescription, delivery and supply), have a common understanding of antimicrobial treatment policy decisions, the quantity of antimicrobial use, and effective patient/client outcomes 3. Establish collaborative communication principles and actively listen to other professionals and patients/carer involved in the delivery of antimicrobial therapy 4. Communicate effectively to ensure common understanding of care decisions 5. Develop trusting relationships with patients /carer and other health/social care professionals 6. Effectively use information and communication technology to improve interprofessional patient - centred care
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Strengthening AMS in nurse education

There is an array of AMS activities in which nurses are involved that are critical to the success of AMS programmes. This international competency framework provides evidence of AMS in nurse education programmes and learners’ practice. They provide a baseline with regards to the minimum standard required of nurses. They provide guidance for those working in Nursing Associates roles. Furthermore, antibiotics are frequently prescribed by nurses [Courtenay et al 2017] and, in the UK, newly qualified nurses of the future will graduate “equipped to progress to the completion of a prescribing qualification” (NMC 2018). The competency framework will strengthen AMS in undergraduate programmes, in preparation for this role.

Mapping competencies to nurse education programmes

Those involved in the development of undergraduate curricula for nurses, are encouraged to map the competencies to module content to determine any gaps in content taught. Furthermore, healthcare organisations are also encouraged to review the mandatory training they provide for staff on AMS and adapt resources to ensure the competency descriptors are met. An example of how to map these competencies within undergraduate healthcare professional programmes can be found at <https://www.nice.org.uk/sharedlearning/consensus-based-national-antimicrobial-stewardship-competencies-for-uk-undergraduate-healthcare-professional-education>

Once mapped, the AMS competencies not covered in AMS nurse programmes can be incorporated within learning opportunities integrated throughout these programmes and so help to refine existing resources, address shortfalls, and enabling AMS components to be clearly described and assessed.

Application of AMS competencies to nursing practice

The Case study below demonstrates how the competencies are applied to nursing practice to achieve optimal AMS goals and outcomes.

Christine (a 76-year-old woman) is clinically assessed by the practice nurse. Christine's blood pressure is 102/51mmHg, pulse 73 beats per minute, respiratory rate 16 breathes per minute, temperature 37.2°C. After applying appropriate personal protective equipment (PPE), a urinalysis was undertaken. This showed::

- Leucocytes– positive,
- Glucose, nitrite, protein blood & ketones – negative.

Christine has no other urinary symptoms and the only medication she was taking was paracetamol for hip pain.

The result of the urinalysis influences the diagnosis of a urinary tract infection (UTI) and a subsequent prescription of antibiotics.

AMS competencies in clinical practice

Christine does not have any signs or symptoms that are indicative of a urinary tract infection (domain 2.1).

Using appropriate PPE when handling blood and bodily fluids is essential in preventing the transmission of infection (domain 1. 4, 5, 6,10, 11, 15)

Many older adults have bacteria living in their bladder causing no harm (domain 1.2, 2.2) – this is known as “asymptomatic bacteriuria”

When bacteria break down they produce Nitrites. The presence of bacteria promotes an increase in white cells (leucocytes) – therefore urinalysis is not indicated in the diagnosis of UTI in older adults. Diagnosis should be made on presenting signs and symptoms making this a more patient focussed assessment (domain 5.1, 2, 3,4).

Christine was prescribed a course of antibiotics that she did not need. This is patient harm. Patients who are treated with a single course of antibiotics for UTI are 2.5 times more likely to develop a resistant organism. This has the potential to complicate treatment if they do develop a UTI in the future (domain 2.2,3,4; 3.1,3, 4, 10, 15; 4,2; 5.2).

Older adults, particularly women, are more susceptible to UTIs. Promoting life style measures is a strategy which could be used to prevent UTI, such as:

- Adequate hydration
- Avoid constipation
- Good toilet hygiene (front to back for ladies)
- Adequate bladder voiding
- Continence management
- Catheters only if absolutely necessary
- Standard infection control precautions (SICPs)

(domain 1.4, 5, 6, 7, 18; 5.1, 2, 3, 5)

The above case study is adapted from Courtenay M & Castro-Sánchez E (2019). Antimicrobial Stewardship for Nursing Practice. CABI: Oxfordshire (in press)

Conclusion

Our competency framework supports current standards of proficiency for registered nurses and so can be used by regulators and professional bodies to inform proficiency standards and guidance. We encourage those involved in undergraduate nurse education to map this

competency framework to existing curricula. It should also be used to direct the AMS practices of qualified nurses, nursing associates and students. This will help to optimise AMS goals and outcomes.

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