

Published in final edited form as:

*J Infect Prev.* 2011 January ; 12(1): 6–10. doi:10.1177/1757177410389627.

## Covering more Territory to Fight Resistance: Considering Nurses' Role in Antimicrobial Stewardship

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### Abstract

The potential contribution nurses can make to the management of antimicrobials within an in-patient setting could impact on the development of antimicrobial resistance (AMR) and healthcare associated infections (HCAIs). Current initiatives promoting prudent antimicrobial prescribing and management have generally failed to include nurses, which subsequently limits the extent to which these strategies can improve patient outcomes. For antimicrobial stewardship (AS) programmes to be successful, a sustained and seamless level of monitoring and decision making in relation to antimicrobial therapy is needed. As nurses have the most consistent presence as patient carer, they are in the ideal position to provide this level of service. However, for nurses to truly impact on AMR and HCAIs through increasing their profile in AS, barriers and facilitators to adopting this enhanced role must be contextualised in the implementation of any initiative.

### Keywords

Antimicrobial drug resistance; nurse; healthcare associated infection; *Clostridium difficile*

### Introduction

Over the past decade, there has been an increase in prevalence of micro-organisms that are resistant to antimicrobial treatment. Antimicrobial resistance (AMR) is an increasing problem that limits and complicates treatment of infections – particularly in hospitals (MacDougall & Polk, 2005). Initiatives have been implemented within acute care settings to promote prudent antibiotic prescribing that have primarily targeted the practices of pharmacists and doctors within this context. Very little consideration has been afforded to the contribution nurses can make to the management of antimicrobials and how this may impact the development of AMR and healthcare associated infections (HCAIs). Herein we further discuss the problem and explore the extent to which nurses could contribute to the management of antimicrobials within an in-patient setting, whilst considering the difficulties inherent in introducing a new realm of responsibility to a workforce already challenged in time and resources.

## The Impact of Antimicrobial Therapy on Acute Healthcare

Excessive and indiscriminate use of antimicrobials in acute care settings contributes to the emergence and dissemination of antimicrobial resistant organisms, such as Meticillin-resistant *Staphylococcus aureus* (MRSA) and Vancomycin-resistant *enterococci* (VRE) (Dancer, 2008; Taconelli et al, 2008). The spread of New Delhi metallo- $\beta$ -lactamase (NDM) from the Asian subcontinent to Europe is just one recent reminder of the continuing evolution of AMR. This highlights potential for the spread of resistant organisms globally, promulgated by the connectivity of the world through air travel, and particularly through emerging trends in treatment options in the form of 'medical tourism' (Kumarasamy et al, 2010). Thus the UK is not only vulnerable to AMR emerging as a result of local suboptimal practice, but also to the ramifications of poor antimicrobial management internationally.

Inappropriate antimicrobial use also results in an increased prevalence of HCAs, such as *Clostridium difficile* Infection (CDI) (Barbut & Petit, 2001; Bartlet, 2008). More than 90% of CDI occurs following or during treatment with antibiotics, with CDI disproportionately affecting elderly patients (Barbut & Petit, 2001; Weston, 2008). Significant problems relating to antimicrobial therapy emerge in hospitals as many patients receive antimicrobials and are often highly susceptible to infections due to complex, severe illness and compromised immunity. When infections present in a single patient they can be transmitted to other patients and ultimately become endemic in hospital settings (Weston, 2008). Further, HCAs caused by resistant organisms are associated with increased morbidity and mortality, and a longer hospital stay compared to infections caused by more sensitive organisms (Cosgrove, 2006; Owens et al, 2008). The impact of HCAs such as MRSA and CDI on patient's experience of healthcare has been profound, with infection rates being one of the primary concerns of individuals being admitted to hospital (Department of Health, 2004).

Increased monitoring of antimicrobials combined with optimisation of antibiotic prescribing and infection prevention and control strategies, have shown to reduce HCAs (Dubberke et al, 2008). Further, judicious selection of antimicrobials and appropriate duration of therapy slows or prevents the emergence of resistant organisms (Davey et al, 2005). Antimicrobial prescribing and management choices involve a multidimensional decision making process based on a fundamental understanding of the key principles of microbiology and the ramifications of inappropriate antibiotic use (Charani et al, 2010). However it is estimated that between 25% - 68% of antibiotic use in hospitals is inappropriate (Dunagan et al, 1989; House of Lords, 1998; Behar et al, 2000; Willemsen, 2007), with many aspects of antimicrobial management having an impact on the emergence of AMR, HCAs and patient outcomes. In addition to this, the highest incidence of medication errors occur during the administration of antibiotics (Lewis et al, 2009). Considering the link between the inappropriate use of antibiotics and the development of drug-resistant organisms and CDI, it is imperative that systems are implemented to optimise antimicrobial use in hospitals to decrease HCAs and increase patient safety.

## Nurses' Role in Antimicrobial Stewardship

Preventing further emergence of AMR depends on optimising use of antimicrobials through such activities as ensuring the agents used to treat infection are as specific as possible; courses of antibiotics are stopped at the earliest opportunity; oral rather than intravenous route of administration is used whenever appropriate; and that some antibiotics be avoided in hospital settings (Knox et al, 2002; MacDougall & Polk, 2005). Antimicrobial stewardship (AS) has been described as a multidisciplinary approach to minimising the development of AMR through selection of appropriate antimicrobials, optimising dose and

duration, and minimizing toxicity and side effects (Knox et al, 2002; MacDougall & Polk, 2005). Antimicrobial stewardship programmes (ASP) have been implemented throughout many UK hospitals, and although described as multidisciplinary in approach, nurse involvement in AS has been limited. AS teams have primarily included Infectious Disease Physicians, Clinical or Infectious Disease Pharmacists, Clinical Microbiologists and Epidemiologists (Lesprit & Brun-Buisson, 2008), and there is currently a lack of recognition of how nurses can contribute to the reduction of HCAs and AMR through participation in ASPs. It has been suggested that AS teams collaborate with infection control teams, including infection control nurses, however this is primarily for multidisciplinary data exchange (MacDougall & Polk, 2005), and the potential contribution nurses can make to the management of antimicrobials on the ward remains under-explored.

Currently, elements of AS such as monitoring duration and indication for antimicrobial treatment, instigating prompt de-escalation from intravenous to oral therapy, monitoring for drug allergies and side effects, monitoring therapeutic levels, ensuring timely administration of antimicrobials and following up on missed doses have primarily fallen into the work remit of physicians and pharmacists. However, due to time constraints, workload and high staff rotation, it may be difficult for these activities to be performed consistently. Nurses work at multiple levels within the clinical setting, playing a key role in patient safety and have the most consistent presence as patient carer. With review of medication charts being part of routine professional practice and as the primary healthcare worker within the hospital setting to administer medications, nurses are in a key position to collaborate with AS teams and contribute to the multidisciplinary management of antimicrobials throughout acute care settings.

Table 1 highlights some of the areas of antimicrobial management that nurses could impact upon, thus potentially making a valuable contribution to ASPs. Yet omission of nurses from decision making processes regarding antimicrobial therapy has limited the extent to which nurses may influence outcomes. In particular, antibiotic decision making on general ward rounds, or rounds targeted specifically at reviewing antimicrobial therapy are opportunities for nurses to make a contribution. Ward rounds can result in cooperative decision making between nurses and other healthcare colleagues (Beuscart-Zephir et al, 2005), and although generally not directly involved in prescribing, nurses can influence the decision making of medical and other prescribers through, for example, encouraging medication compliance, monitoring prescription decisions and reducing prescribing errors (Castledine, 2006; Jutel & Menkes, 2010). Nurse involvement in antibiotic ward rounds could provide nurses, physicians and pharmacists with a venue for prompt dialogue to discuss antimicrobial treatment, indication, and duration, thus further enhancing the multidisciplinary management of AS to reinforce best practice. Ward nurses are also in a key position to facilitate patient referrals for outpatient antibiotic therapy (OPAT) in instances where patient admission to hospital is for extended antibiotic therapy only. This proactive approach to patient care could reduce patients' length of stay, thus decreasing their risk of HCAs and associated costs, and enabling the patient to continue treatment in their own environment.

## A Collaborative Approach to Antimicrobial Management

Nurses have already demonstrated positive impacts on patient outcomes in other specialty areas such as pain management, which in the past has been heavily based on medication use. Nurse introduction of non-pharmacological and patient education approaches to reduce pain has subsequently decreased patients' reliance on medications (Wells-Federman et al, 2002). It is possible that initiatives focused on increasing nurses' participation in antimicrobial management activities can yield similar success. Although in the past there has been a focus on expanding the prescribing authority of nurses, which has become emblematic of

professional autonomy, it may be more appropriate to look at the influence nurses may have in the management of medications (Jutel & Menkes, 2010), and how this can be channelled to enhance AS.

Participation in the multidisciplinary management of antimicrobials would provide an avenue through which nurses could be more effective patient advocates. As specified in the UK Code of Conduct for Nurses (Nursing & Midwifery Council, 2007), nurses have an obligation to be patient advocates, ensuring that those in their care have access to relevant healthcare, information and support. As part of this function, the appropriate management and administration of antimicrobials is enshrined in nursing practice, and as such, nurses have a responsibility to ensure that antimicrobials are used appropriately, that administration of antimicrobials occur in accordance with the treatment plan, and that any variations are acted on promptly to ensure optimal therapy. However, nurse's exclusion from ASPs has created an environment in which antimicrobial management is considered outside the remit of nursing responsibilities and expertise, which essentially has disempowered healthcare institutions from taking a true multidisciplinary approach to preventing AMR.

Although the value in bringing together the expertise and experience of a variety of healthcare professionals may seem apparent, inter-professional collaboration is increasingly becoming a complex concept often marred by unclear working methods and a lack of understanding of how to translate knowledge into practice (Martin-Rodriguez, 2005). However, it is understood that a hospital's success and patient outcomes are strongly dependent on how effectively the members work together as a team (Rafferty et al, 2001; Leonard et al, 2004). Therefore, it is likely that effective monitoring and direct communication between healthcare professionals, including nurses, regarding antimicrobial use would promote best practice, improve patient care and reduce nurses' workload. Specifically, these activities are likely to contribute to reducing the risk of CDI and HCAs associated with antimicrobial use, thus decreasing patient morbidity and mortality, reducing length of stay and improving patient experience of healthcare.

Although it is recognised that expertise is required to manage antimicrobial treatment, in reality the decision making process is often performed by junior doctors working outside their area of expertise with varying levels of senior support (Charani et al, 2010). The high rotation of junior doctors throughout wards means that a repository for local knowledge regarding the management of antimicrobials for specific patient groups is lost. Prescribing and management of antimicrobials occurs across all areas of healthcare and does not sit within a particular specialty, and as such the memory of the healthcare organisation suffers. Organisational memory refers to the retrievable information contained within an organisation in formats such as spreadsheets and guidelines as well as in the minds of the organisation members (Paoli & Prencipe, 2003). As one of the less transient professional populations within the hospital, nurses are in an ideal position to contribute to organisational memory regarding antimicrobial management. In collaboration with physicians and pharmacists, nurses' local knowledge could assist in informing decision choices in relation to antimicrobial therapy, and enhance the multidisciplinary approach to antimicrobial management.

For ASPs to continue to be successful, a sustained and seamless level of monitoring and decision making in relation to antimicrobial therapy is needed, and as the most consistent provider of care at the bedside, nurses are in the ideal position to provide this level of service. However, all nurses may not have the required training or profile among peers and other medical staff to actively contribute to antimicrobial management. Additionally, nursing shortages may impose time constraints that prohibit any additional duties into nurses' work regimes. It is therefore important to first assess the feasibility of increasing

nurse's participation in ASPs. It is necessary to identify what role nurses currently have in relation to the management of antimicrobials, and where this could be developed in the future.

## Contextual Challenges in the Multidisciplinary Management of Antimicrobials

Assumptions that healthcare professionals have the time, resources, knowledge, motivation and skills to change clinical practice in line with evidence-based recommendations are counterproductive. Historically, interventions focused on changing the behaviours of healthcare professionals have had limited success (Cooke et al, 2000; Pittet, 2004; Ferlie et al, 2005), especially if not implemented with an understanding of the cultural, contextual and environmental influences on professional practice. In order to more successfully engage healthcare workers in initiatives and produce more successful outcomes, the obstacles and facilitators to changing or adopting new practice must be considered in the development and implementation of any programme (Hulscher et al, 2010). Therefore, for nurses to truly have an impact on AMR and HCAs through increasing their profile in AS, barriers and facilitators to adopting this enhanced role must be contextualised. Further, a clear understanding of nurses' roles, and clarity amongst healthcare professionals of where responsibilities lie, will assist with cohesiveness amongst multidisciplinary teams.

It would be remiss not to acknowledge the professional challenges that may be presented when attempting to enhance nurses' role in antimicrobial management. Nurse's ability to discuss or even challenge antimicrobial management choices is heavily connected to the construct of power and knowledge, particularly within the acute care context. Nurses may not feel they are in a position to participate in ASPs due to lack of knowledge, closely linked to positions of power, particularly within healthcare environments (Hindess, 1996). The challenges associated with influencing antimicrobial management decisions are further complicated through prescribing etiquette, which refers to prescribers reluctance to change colleagues decisions (Lewis & Tully, 2009). Indeed, one could argue that moving away from the persistent use of the term 'antimicrobial prescribing' to antimicrobial management would facilitate a more inclusive approach. The term 'prescribing' relates to a specific area of expertise associated primarily with the practice of doctors and pharmacists, eliminating nursing from the decision making process. Acknowledging that it is the management of antimicrobials that leads to the emergence of AMR and HCAs could facilitate a more holistic approach to ensuring antimicrobials are used appropriately and could facilitate nurses' involvement in ASPs.

## Conclusion

Given the increasing social and economic burden of AMR and HCAs, it is critical that healthcare professionals increase their efforts to work together across disciplines for the protection and safety of their patients. The implementation of ASPs within the UK has been effective in promoting prudent antimicrobial prescribing, however the extent to which nurses can contribute to such initiatives is poorly understood. As the most consistent providers of care at the bedside, and medication chart review being part of routine professional practice, nurses are in an ideal position to enhance antimicrobial management through multidisciplinary collaboration. Increasing nurses' awareness of antimicrobial use and impact of antibiotic therapy on infection outcomes is likely to enhance the optimisation of antimicrobial treatment, monitoring and administration. Nurse involvement in AS could therefore be a time and cost efficient use of resources whilst improving patient safety and quality of care. As pharmacological options for the treatment of infection decrease, and development of new antimicrobials is slow, it is imperative that initiatives to reduce AMR



are implemented. For these initiatives to positively and sustainably impact on outcomes, it is necessary to gain a contextual understanding of the barriers and facilitators to nurses contributing to AS, and how this aspect of the nursing role may be developed in the future.

## Acknowledgments

The authors acknowledge the support from the National Institute for Health Research (NIHR) Biomedical Research Centre Funding Scheme at Imperial College and the support from the National Centre for Infection Prevention and Management (CIPM) funded by the UK Clinical Research Collaboration.

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**Table 1**

Aspects of Antimicrobial Management associated with antimicrobial resistance (AMR) and other patient outcomes in which nurse involvement could impact.

Aspect of Management	Associated Risk	Potential Nurse Contribution
Treatment Specificity	Use of broad spectrum antibiotics is a major contributory factor to developing CDI and AMR. Broad spectrum antibiotics should be avoided when possible (Lespirit & Brun-Buisson, 2008).	Additional support and training of nurses could ensure treatment is in line with microbiology results, and use of broad spectrum antimicrobials is limited where possible.
Duration of treatment	Prolonged duration of antimicrobial treatment is a risk factor for development of CDI, and may increase AMR(Knox et al, 2002; MacDougall & Polk, 2005; Lespirit & Brun-Buisson, 2008)	In collaboration with doctors and pharmacists, nurses can ensure antimicrobials are prescribed for appropriate duration.
Route of antimicrobial administration	Early switching from intravenous antimicrobial therapy to oral treatment decreases length of hospital stay, reduces risk of AMR and decreases workload on nurses (Oosterheert et al, 2006; Mertz et al, 2009)	Nurses can monitor IV antimicrobial prescriptions and engage physicians and pharmacists in discussion regarding de-escalation to oral therapy.
Surgical prophylaxis	Timing of administration and duration of surgical prophylaxis often occurs outside best-practice guidelines (Bratzler et al, 2005) which decreases impact on post- surgical infections and increases AMR (Harbarth et al, 2000)	Through collaboration with doctors and pharmacists, nurses can ensure antimicrobials are prescribed for appropriate duration.
Timing of antimicrobial administration	Prompt and timely administration of antimicrobials may be associated with increased survival to hospital discharge. (Kumar et al, 2006).	Through increasing nurse's awareness and training in AS programmes, it is likely that they will improve antimicrobial administration practices
Therapeutic drug monitoring	Sub-optimal antibiotic concentrations contribute to the development of antimicrobial resistance (Thomas et al, 1998). Therapeutic drug monitoring should occur for antibiotics that perform optimally within a specific 'therapeutic level', and prescriptions titrated accordingly.	Nurses could contribute through monitoring of blood results and working with physicians to ensure doses are in-line with recommended guidance
Outpatient Antibiotic Therapy (OPAT)	OPAT decreases patient's length of stay in hospital, reduce risks for transmission of HCAs and decreases associated costs (Gilchrist et al, 2008; Hitchcock et al, 2009).	Engaging nurses in decision making regarding a patient's suitability for OPAT may result in more proactive and efficient use of this service and improve associated outcomes.