



## Antibiotic Stewardship and Prevention of Multidrug Resistant Bacterial Transmission from Pets to Their Owners

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### Short Communication

Multi-drug resistance (MDR) in bacteria is a growing issue within healthcare with bacteria becoming resistant to overused antibiotics due to selective pressure [1]. As a result, antimicrobial stewardship programs (ASP) are one of the most important advances in human healthcare. Many studies have shown that implementation of ASP have resulted in a decrease in the amount of broad-spectrum antibiotic prescribing in human hospitals; which in turn, has slowed down the development of antibiotic-resistant bacteria [2,3]. Despite the legal, zoonotic, and morbidity issues associated with bacterial resistance, veterinary medicine has been slow to adopt infection control principles. However, due to the increasing concern about the rapid emergence and spread of multidrug resistant bacteria among household pets particularly in households where there is contact with immunosuppressed persons, new interest in antibiotic stewardship programs have emerged. In general, there is a lack of data on resistant bacteria and its prevalence in pets and the incidence of human infections attributed to pets. In order to improve knowledge and minimize risk of human infections, some authors have recommend 1) coordination of surveillance of zoonotic pathogens and antimicrobial resistance in household pets, 2) estimation of the burden of human disease attributed to pets and identification of risk factors contributing to transmission and 3) education of healthcare workers and those having close contact with animals about the potential zoonotic risks involved [4]. Pet therapy animals and service animals have contributed greatly to human mental and physical rehabilitation, but may also serve as reservoirs for multidrug resistant organisms. Among individuals infected with human immunodeficiency virus (HIV) studies suggest that companion animals serve as a great source of affection and protection against loneliness [5]. However, at least 70 human pathogens are likely pet associated and these may not be apparent to immune suppressed owners if the animal is a non-symptomatic carrier [6]. Aside from multidrug resistant zoonotic bacterial transmission, multiple other zoonotic bacteria (*Pasteurella multocida*, *Capnocytophaga* spp., *Bartonella* spp., *Leptospira*, *Salmonella* spp.) have been reported to be transmissible from companion animals to their owners [5,6]. Various genetic similarities have been observed in multidrug resistant (MDR) isolates from human infections and household pets [7]. *Staphylococcus aureus* is a major cause of wound infections, endocarditic, osteomyelitis, device-associated infections and other serious infections in humans and animals. Methicillin-resistant *S. aureus* (MRSA) frequently colonize healthy humans and animals, and may reside in then are acting as a reservoir for continuous cross-infection [8]. The transmission of antibiotic-resistant bacteria can occur in two distinct avenues: direct transmission of bacteria from contact with animals or contaminated surfaces or through the transmission of bacterial genes encoding antibiotic-resistance [9]. Resistant bacteria in pets are selected by antimicrobial use in pets. In turn, they reach a human host and are able to exchange their genes with resident bacteria on or in the human host. Molecular typing of strains has been able to prove transmission of bacteria, and genotyping has shown that the resistance genes for certain antibiotics are shared amongst bacteria from both human and pets, which suggests that transmission is a valid concern [10]. The most common MRSA clones identified in pets (ST22) occurred in humans prior to animals suggesting its origin was from pet owners with pets acting as reservoirs of infection or colonization [9]. In contrast, *S. pseudintermedius* originated from canine patients and is not commensally in people. However, up to 8% of dog owners with infected dogs carry methicillin resistant *S. pseudintermedius* suggesting evidence of zoonotic transmission [10,11]. This frequent transmission cautions against the use of unnecessary antimicrobial use in animals. Multidrug resistant gram negative organisms have also been identified

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in dogs and cats that most likely originated from their owners. Carbapenemase-producing *E. coli*, MDR *Klebsiella pneumoniae* and *Acinetobacter baumannii* [12,13]. Hospitalization and antimicrobial treatment with cephalosprins and fluoroquinolones have been documented as risk factors associated with carriage and infection of MDR bacteria in animals [14]. Considering that hospitalization and the use of broad spectrum antibiotics are the main risk factors associated with colonization and infection with MDR in animals, it is essential that veterinarians use extreme prudence in prescribing broad spectrum antibiotics and that antibiotic stewardship programs (ASP) be implemented. Because of the possibility of zoonotic bacterial transmission to immunosuppressed patients and others at risk (diabetic, pregnant, elderly, neonates), clinicians should inquire about household pet exposure and include information in the medical record. Health-care providers should advise immunocompromised persons of the potential risk posed by pet ownership. However, they should be sensitive to the psychological benefits of pet ownership. The CDC recommendations for immunosuppressed individuals includes: avoidance of young animals, particularly those with diarrhea or respiratory infections, proper hygiene when handling pets and their bedding, feces or litter box, avoidance of exotic or stray animals, a commercial pet diet that avoids raw or undercooked food, availability of clean water and regular veterinary exams of all pets [15,16]. Culture and sensitivity should be performed on all suspicious or recurrent infections and speciation should be performed on humans with *Staphylococcus sp.* infections. The frequency of methicillin resistant *S. pseudintermedius* in humans may be an underestimation due to diagnostic problems regarding identification of *S. pseudintermedius* in human laboratories [4]. With increasing bacterial resistance, ASP continue to play a major role. Fortunately, ASP significantly decreases the amount of broad-spectrum prescribing occurring in human institutions [2,3]. This trend would likely be applicable in the veterinary setting. The current off-label use of broad spectrum human antibiotics in animals must be reduced to an absolute minimum. Broad spectrum antibiotics licensed for veterinary use (cephalosporins and fluoroquinolones) have recently been regulated in food animals but should be further controlled in companion animals by implementation of antimicrobial stewardship programs [17,18]. Veterinarians should be familiar with current guidelines for empiric therapies [19,20]. As culture results return, de-escalation to appropriate targeted therapy should be implemented. By encouraging use of narrow-spectrum agents as much as possible, development of resistance to the broad-spectrum agents can be significantly delayed. In a world where MDR is a growing concern, preventing the spread of resistant organisms whether in humans or animals would be a public health benefit. Development of narrow-spectrum, veterinary specific antimicrobials may be useful as well as the development of biological agents such as phage and bacteriocins.

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