

Environmental Cleaning and Disinfection

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KEYWORDS

- Small animal • Veterinary clinic • Environmental contamination • Infection prevention
- Surveillance

KEY POINTS

- As in human medicine, hospital-associated infections (HAIs) exist in veterinary medicine and must be subject to control measures.
- Environmental contamination with pathogens of concern is widespread in veterinary hospitals and should be an important target of proactive measures to prevent (limit) HAI.
- For environmental cleaning and disinfection (C/D) to be effective, all stakeholders should be educated as to the need for appropriate C/D and the participation of all (at any level) should be encouraged to accomplish this goal.
- Veterinary practices should seriously consider identifying personnel responsible for establishing infection control practices, establishing monitoring/audit procedures, and determining whether their practice situation warrants proactive environmental surveillance.
- More research is required to identify the precise relationship between environmental contamination and HAI and to establish control and surveillance/monitoring procedures of direct relevance to veterinary medicine.

BACKGROUND

The concept of infection control and prevention in veterinary medicine outside the surgical suite or epidemic disease control/eradication in livestock populations was more or less unheard of until the last 1 or 2 decades. During that time, there has been a paradigm shift, such that veterinary infection control is a growing discipline that is becoming part of the customary way in which veterinarians practice medicine. This shift is seen primarily in large academic teaching hospitals associated with specific veterinary schools and in specialty clinics dedicated to advanced diagnostics and care for animals. However, the nature of medicine and mission of veterinary hospitals

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are such that animals clinically affected by the agents that have the potential to spread among the hospital population, as well as subclinical carriers that may go unrecognized, are always likely to be present in veterinary medical facilities, regardless of size or specialty. The standard of care at every veterinary hospital should include a high level of hygiene, awareness of the dangers of transfer of infectious agents between both animals and people, and procedures to reduce infection risk wherever possible. Such infection control procedures are intended to prevent (limit) introduction and spread of infectious diseases within a group of patients and their human caregivers, thereby, protecting human, animal, and environmental health against biological threats. This article provides an overview of environmental considerations in infection control rather than an exhaustive review. There are numerous excellent resources that cover various aspects in greater detail, many of which are referenced in the following sections.

HEALTH CARE-ASSOCIATED INFECTIONS IN HUMAN MEDICINE

Nosocomial infection, otherwise known as hospital-acquired or more recently health care-associated infections (HAIs), are the subject of high-profile press coverage and government or internal regulation in human medicine. The latest published figures from human medicine in the United States suggest that in 2011, 722,000 patients contracted HAI in acute-care hospitals, more than half of which were acquired outside the intensive care unit (ICU).¹ These infections resulted in 75,000 deaths and constitute the seventh leading cause of death in the United States.² Although they may be artificial constructs, when these numbers are averaged out over time, they indicate that on any given day in the United States, 1 in 25 patients has at least 1 HAI, and every day of the year, 205 people die from HAIs. As shocking as these figures are, stringent control efforts instituted over the last 2 to 3 decades in human medicine, which were formalized in 2008,^{3,4} seem responsible for an apparent decline in rates of HAI compared with the 1970s to 1990s, during which approximately 2 million HAIs were estimated to occur each year and were, in turn, associated with 100,000 annual deaths.²⁻⁴ In 2011, the most common HAIs included central line-associated bloodstream infections (54,500), catheter-associated urinary tract infections (30,100), surgical site infections (53,700), and *Clostridium difficile* infections (107,700).^{1,2} The pathogens principally associated with these infections include methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant enterococci (VRE), *Clostridium difficile*, *Acinetobacter*, norovirus, and most recently, carbapenemase producing enterobacteriaceae.² HAIs are estimated to account for \$40 billion in excess health care costs each year.⁵

ENVIRONMENTAL CONTAMINATION IN HUMAN HOSPITALS

In the early 1990s, initial estimates of the sources of HAI among adult ICU patients suggested that endogenous microbiota accounted for 40% to 60% of infections, cross-infection from the hands of health care personnel for 20% to 40%, changes in the microbiota driven by antimicrobial drug use for 20% to 25%, and other factors, such as environmental contamination, for 20%.⁶ In the interim, much compelling evidence has accumulated to confirm an important role for the environment in pathogen transmission.⁷ Surfaces in the room of a patient colonized/infected with a hospital pathogen are frequently contaminated, pathogens can remain viable on hospital surfaces and equipment for extended periods, the hands, gloves, and other apparel of health care personnel are readily contaminated after being in contact with a contaminated environment, a person admitted to a room previously occupied by a patient

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