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CON: Environmental microbiological surveillance does not support infection control in veterinary hospitals

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We live in a polymicrobial environment. Every item or surface that contacts a person or animal, or that is even exposed to air, will have some degree of bacterial contamination. We, and our patients, are in a constant state of exposure to myriad microorganisms as part of daily activities, with the vast majority of those exposures being of no clinical consequence. Environmental surface contamination with opportunistic pathogens has the potential to contribute to healthcare-associated infections (HAIs) in both human and animal hospitals.[1–6] However, the incidence and impact of HAIs in veterinary patients are presumably much lower than in humans because of factors such as shorter hospital stays, fewer highly compromised patients and smaller facilities. HAIs are relatively uncommon in veterinary patients and while the environment is a plausible source of exposure, it is likely of lesser concern compared with other sources such as the patient's own microbiota and the hands of veterinary personnel. Yet, while the incidence of environmentally acquired infections is likely low, the environment poses an ever-present risk for pathogen exposure, alongside other potential sources.

Hospital-associated bacteria, in the environmental pool, of clinical significance to humans include MRSA, VRE, *Clostridioides difficile*, carbapenemase-producing Enterobacterales (CPE), *Pseudomonas* spp. and *Acinetobacter* spp.[7,8] These pathogens can survive or persist on inanimate surfaces, some for multiple months and, without effective cleaning/disinfection, represent a continuous source of exposure of susceptible patients.[9] From a veterinary perspective, MRSA and methicillin-resistant *Staphylococcus pseudintermedius* (MRSP), ESBL-producing *Escherichia coli* and MDR *Salmonella* spp., *Acinetobacter* spp. and *Pseudomonas* spp. are currently considered the most important organisms that cause HAIs in companion animals and also pose a zoonotic risk.[10,11] The authors will argue that routine environmental microbiological surveillance offers no value as a measure of cleanliness and, provides no actionable information by determining the presence or absence of pathogens in the hospital environment.

Microbial contamination of hospital environments is expected and any surface that has contact with people, animals or non-sterile objects will have some degree of bacterial contamination. In a systematic review of the veterinary literature, Sebola *et al.*[11] documented eight separate studies that cultured MRSA from samples of the veterinary hospital or equipment, compared with five studies for MRSP, two for *Salmonella* spp. and one each for ESBL-producing *E. coli*, *C. difficile*, *P. aeruginosa* and *A. baumannii*. Identical PFGE MRSA clones have been detected in isolates from dogs, veterinary staff and environmental samples in small animal hospitals in the UK,[12] Germany[13] and Malaysia.[14] Environmental contamination with MRSA was commonly detected (9.6%) in samples collected from a veterinary teaching hospital where MRSA-positive horses were hospitalized.[15] In all these reported cases, the direction of bacterial transmission, environment to patient or vice versa, was not determined.

Opportunistic pathogens, including MDR pathogens, are expected to be present in the environment of all clinics, so results of environmental microbiological surveillance offer limited actionable data to guide infection control

Opportunistic pathogens are also present in a dynamic situation, where there are rapid changes through a continuous cycle of removal (cleaning, disinfection, discarding) and recontamination (e.g. contact with patients or personnel, aerosol contamination). Environmental surveillance offers a means to qualify (and provided a standardized approach is used, potentially quantify) the presence of specific pathogens within a hospital environment at a single point in time from this ever-changing situation. The usefulness of this information, and how it can guide improvements in a veterinary hospital's infection control policy, is questionable. Environmental cultures provide an indication of the bacterial load at a single point in time, typically a few days later, and it may only be a partial indication as some organisms are not

detected using routine culture methods, particularly anaerobes. Furthermore, the sensitivity of environmental cultures is unknown and likely varies greatly based on sampling and culture techniques. Environmental sampling also only typically involves a very small percentage of the environment, providing questionable information for broader interpretations. The contamination status of individual sites also presumably varies throughout the day, based on cleaning and disinfection and subsequent recontamination, so culture results from a single site could change from 'positive' to 'negative' many times over the course of a day. The Royal College of Veterinary Surgeons (RCVS) Practice Standards Scheme (PSS) small-animal module on infection control and biosecurity requires environmental swabbing of all clinical areas to be carried out in accordance with infection rate audits (PSS Small Animal Modules and Awards 2023) but the reasoning and evidence basis behind both the recommendation to test and the frequency of testing are unclear.

Other measures to limit transmission of pathogens offer a greater benefit for lower cost

Infection control strategies including the implementation of rigorous hand hygiene, antimicrobial stewardship policies and regular environmental cleaning reduce HAIs in human hospitals independent of the underlying level of infection.[16–20] Targeted control strategies to address a particular issue, such as following a disease outbreak, offer a broader impact and are more cost effective. These include active surveillance, patient isolation and/or decolonization but this reactive approach should be differentiated from routine environmental surveillance.

Routine environmental culturing has not been recommended by the CDC since the 1970s as surface contamination with bacteria could not be directly associated with HAI rates.[21] While it is now recognized that environmental contamination can serve as a reservoir of infection, risking direct and indirect (via the hands and equipment of healthcare workers) transmission to patients,[1,5] it does not follow that routine environmental surveillance is required or helpful to minimize the infection risk. Using a patient-level analogy, it is well known that patients harbour many different potential pathogens but there is no effort to routinely culture multiple patient sites as an infection control tool, despite the fact that the microbial burden on patients would be many orders of magnitude greater than a hospital surface.

As fully expected, there is evidence that most veterinary hospitals similarly contain surfaces from which potential animal and human pathogens may be isolated.[2,3,12,15] That these microorganisms could contribute to HAIs and even zoonotic diseases is not in question but does environmental screening provide a level of granularity that would meaningfully improve the infection control approach? Does a single point-in-time sample provide a representation of the risk posed by a site over the course of a day? Can we ascribe significance to the environmental component if we have only a limited idea of the relative sizes of the concurrent human and animal reservoirs and how these pools interact?

Detection of incidental, MDR, environmental bacteria could adversely skew antimicrobial prescribing practices

The infectious dose is both pathogen specific and dependent on the host immune response, duration of exposure and any ongoing antimicrobial use. Demonstration of the presence of a particular pathogen in the hospital environment does not signify its infectious potential. There is a risk that antimicrobial selection practices could be inappropriately influenced by antimicrobial susceptibility profiles of environmental contaminants. Environmental screening could identify the presence of MDR organisms within the hospital, skewing clinicians towards increased selection of higher-tier antimicrobials and ultimately exacerbating the spectrum of encountered resistance. For a diagnostic procedure to have clinical utility it should convey reliable information about the state of current events that can translate into meaningful measures to rectify, improve or mitigate any identified issues; knowledge of the resistance profile of historic environmental pathogens risks is misleading.

Counts of cfu from surface swabs have been proposed to offer a surrogate measure of the cleanliness of the veterinary hospital, highlighting gaps in the design or implementation of cleaning protocols.[22,23] In most non-outbreak settings, the costs associated with environmental swabbing would likely outweigh possible benefits. In practice, this is typically an ineffective approach as sampling is not well structured, related to timing of cleaning and disinfection, nor are appropriate laboratory methods used to reduce the impact of residual disinfectants. For example, a site could be pathogen-free, contaminated transiently from contact with a patient or personnel, and then rendered pathogen-free again by cleaning and disinfection. If sampling happens to be performed immediately after disinfection, negative (or low cfu count) results would be expected. However, if a patient is placed on that site, contamination would recur. Even the simple act of clinic personnel placing a hand on that site could reintroduce contaminants. A culture taken after re-exposure, prior to another round of cleaning and disinfection, would identify a contaminated surface and potentially lead to an inaccurate assessment of the cleaning and disinfection practices. Targeted sampling that takes into account disinfection and exposure points, and that focuses on sites that are deemed ready for patient exposure, can be more representative, but such structure is rare.

Funds to support infection control could be better directed elsewhere

Veterinary practices must consider all expenditure carefully. The laboratory fees and additional labour from collecting samples from multiple surfaces on a regular basis represents a significant investment; funds may be better redirected towards proven infection control strategies that will reduce the overall infectious disease burden. Even without environmental surveillance data it is still possible to stratify risks and base decisions on anticipated levels of bacterial contamination or degree of patient contact (e.g. the Spaulding classification).[24] This system ensures adherence to good practice regardless of false confidence from negative screening or absent awareness of environmental contamination. Culture results could lead to a misleading perception of

contamination, as well as cleaning and disinfection practices, leading clinics to perform unnecessary and potentially wasteful additional measures.

There are quicker and less expensive approaches to evaluate environmental burdens. Fluorescent tagging[25] or the use of ATP bioluminescence monitors[22] may also offer similar information as to how clean the hospital is, at a lower cost, and can perhaps be more useful for general assessment and education of cleaning. ATP bioluminescence provides a measure of the organic residue levels within minutes, facilitating rapid assessment of the cleanliness of an area or piece of equipment. However, the technique should not be used to determine sterility[26] and the relevance of results from these methods in terms of HAI risk has not been demonstrated.

What actionable information is obtained?

A general tenet of diagnostic testing is that tests should influence patient care and, in this case, the 'patient includes the hospital as a whole'. Environmental surveillance can be considered analogous to a diagnostic test. For any diagnostic test, there should be a reasonable *a priori* indication of need and a plan to use the result. Failure to provide actionable information, or at least information where logical, evidence-based action would ensue, is a major weakness. Results of routine environmental cultures rarely lead to evidence-based (or often even logic-based) actions, since they indicate the status of a site a few days earlier, with several rounds of disinfection and renewed patient/personnel contact having occurred in the interim. There are no healthcare guidelines in human or veterinary medicine that describe optimal responses to environmental cultures, further highlighting the limited clinical utility.

The limitations of environmental cultures that are described above are in reference to routine testing. There may be value of targeted testing in situations where there is reasonable evidence of an environmental source of infection, based on disease epidemiology and the nature of the pathogen. For example, a cluster of *Serratia* surgical site infections could prompt targeted testing of potential reservoirs (e.g. contaminated biocides). This could identify the source and cause, while routine environmental testing might not detect anything abnormal if testing includes non-involved surfaces and/or testing after disinfection.

In conclusion, the authors find no convincing evidence that routine environmental microbiological surveillance contributes to a reduction in the incidence of HAIs in veterinary hospitals. A more clinically valuable picture of nosocomial risk may be obtained by active surveillance for surgical site infections and HAIs. Monies saved would be better invested in proven infection control measures.

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