A pilot study to determine the prevalence of methicillin-resistant *Staphylococcus aureus* in showers at pork production facilities, gymnasiums, and private residences in Indiana

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Summary

Swab samples of the floor and water-control handles of showers at 10 pork production facilities, 10 public gymnasiums, and 10 private residences were culture-negative for methicillin-resistant *Staphylococcus aureus*. This organism appears not to be a human health risk for those utilizing showers at these 10 Indiana pork production facilities.

Keywords: swine, shower, communal shower, methicillin-resistant *Staphylococcus aureus*

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Resumen – Un estudio piloto para determinar la prevalencia del *Staphylococcus aureus* resistente a la meticilina en las regaderas de las granjas porcinas, gimnasios y residencias en Indiana

Los hispopos que se tomaron del piso y llaves de control de agua de las regaderas de 10 granjas porcinas, 10 gimnasios públicos y 10 residencias fueron negativos al cultivo de *Staphylococcus aureus* resistente a la meticilina. Este organismo parece no ser un riesgo para la salud de quienes que utilizan las regaderas en estas 10 granjas porcinas en Indiana.

Resumé – Une étude pilote pour déterminer la prévalence du *Staphylocoque aureus* résistant á la méthicilline dans les douches aux installations des fermes porcines, les gymnases, et les résidences dans Indiana

Écouvillons du sol et des poignées de control de l'eau de douches des 10 fermes porcines, 10 gymnases publics, et 10 résidences ont été négatifs à la culture du *Staphylocoque aureus* résistant à la méthicilline. Cet organisme paraît ne pas être un risque pour la santé humaine pour ceux qui utilisent des douches à ces 10 fermes porcines dans Indiana.

Many pork production facilities require employees and visitors (including veterinarians) to shower prior to entry. These communal showers are maintained with various levels of hygiene, and some facilities do little to maintain the cleanliness of their shower facilities. Poor hygiene in these facilities might lead to communicable health issues among people utilizing the mandatory showers. For example, showers in a human hospital contaminated with *Legionella pneumophila*, the causative agent of Legionnaire's disease, were implicated as the source of infection for two transplant patients.[1] Another study reported that microbial biofilms on vinyl shower curtains contained genetic material of opportunistic human pathogens.[2] The prevalence of human pathogens and the risk of contracting a disease by using communal showers in a swine facility have not been documented. Since members of the American Association of Swine Veterinarians expressed concerns regarding this subject, a pilot study was designed to evaluate the health risk when showering in pork production facilities.

Recent news reports have warned that infection with methicillin-resistant *Staphylococcus aureus* (MRSA) poses a health challenge to athletes using communal equipment.[3,4] Only one scientific study reports the risk of *S aureus* infection from communal showers. In that study, an outbreak of mupirocin-resistant *S aureus* was traced to a communal shower and communal equipment in the dermatology ward of a hospital.[5]

The present study compared the prevalence of MRSA in swine facility showers, communal showers of gymnasiums, and showers in private, single-family residences to establish whether or not there was an increased risk of infection from showers in swine facilities compared to other public or private showers.

Materials and methods

Swab samples from the floor and water-control handles of a single shower at each of 10 pork production facilities, 10 public gymnasiums, and 10 private residences within a 160-km radius of West Lafayette, Indiana, were collected and cultured for MRSA. The men's showers were sampled at each location unless there were no gender-specific showers. In such cases, the unisex shower was sampled. Samples were collected in 2004 on the 7th, 8th, 12th, and 14th of October. Additionally, two positive and two negative control samples were submitted on the 21st of October. Visits to potential sampling sites were unannounced. Permission to sample sites was given at arrival. The shower was not sampled if the owner volunteered that the shower had been disinfected prior to the investigators' arrival at the site on the day of sampling.

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Investigators donned dust masks and nitrile gloves during sample collection to prevent iatrogenic contamination of samples. A single sterile culture swab (BBL CultureSwab Collection and Transport System; Becton, Dickinson, and Company, Sparks, Maryland) was used to aseptically sample an approximately 6.2-cm^2 area of the floor and then a 6.2-cm^2 area of the water-control handle of each shower. A sterile metal washer was used to control sampling area; however, the irregular surface of some water-control handles prevented exact measurements. Swab samples were refrigerated and transported to the microbiology laboratory at the local human hospital (Greater Lafayette Health Services, Inc, Lafayette, Indiana) within 7 hours of collection. Positive controls were duplicate swabs of quality control cultures of *Staphylococcus aureus* provided by Dr Ron Gillespie of the Indiana Animal Disease Diagnostic Laboratory. Negative controls were two swabs exposed to room air. Samples, including positive and negative controls, were coded such that laboratory personnel were blinded to the sample origin.

Samples were cultured according to hospital standard operating procedures for isolation of *S aureus*. Briefly, swabs were plated onto mannitol salt agar and aerobically incubated with 5% to 10% CO_2 at 35 ± 2°C for 48 hours. Plates were examined daily. A coagulase test was performed on mannitol-positive colonies that resembled *Staphylococcus* spp. Antimicrobial sensitivity testing was performed on all coagulase-positive colonies.

Results

Staphylococcus aureus was isolated from both positive control samples. The two negative control samples and all other samples were culture-negative for *S aureus*.

Discussion

Although, the primary means of contracting MRSA is by direct contact with a colonized person, recent evidence suggests that environmental reservoirs of MRSA may pose a human health concern.[5] Under the conditions of this study, MRSA was not detected in samples collected from floors and water-control handles of showers in pork production facilities, public gymnasiums, or private residences. Thus, MRSA was not found to be a risk for those utilizing shower facilities at the pork production units sampled. However, the study had several limitations, including small sample size, geographical area, season, and limited scope of bacterial species.

First, sample sizes were limited by the number of public gymnasiums in the geographical area sampled. A sample size of 10 would only allow us to detect MRSA in one sample with 95% confidence, assuming a 30% prevalence of MRSA in our shower population. Thus, the experimental design provided limited capability of isolating MRSA at prevalences of less than 30%. Second, all samples were collected in a limited geographical area. Our results might have been different had sampling occurred in an expanded geographical area incorporating multiple states and diverse climates. Third, sampling occurred during the fall of the year. Sampling during other seasons might have been more conducive to maintenance of environmental bacterial reservoirs. Lastly, the focus of this study was on MRSA alone, which is only one of several potential pathogens of concern in communal showers.

Future studies in the area of human health concerns pertaining to the use of communal showers should address these study limitations and should be expanded to include other infectious agents, including fungi.

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