Humans carry more antibiotic-resistant bacteria than animals they work with

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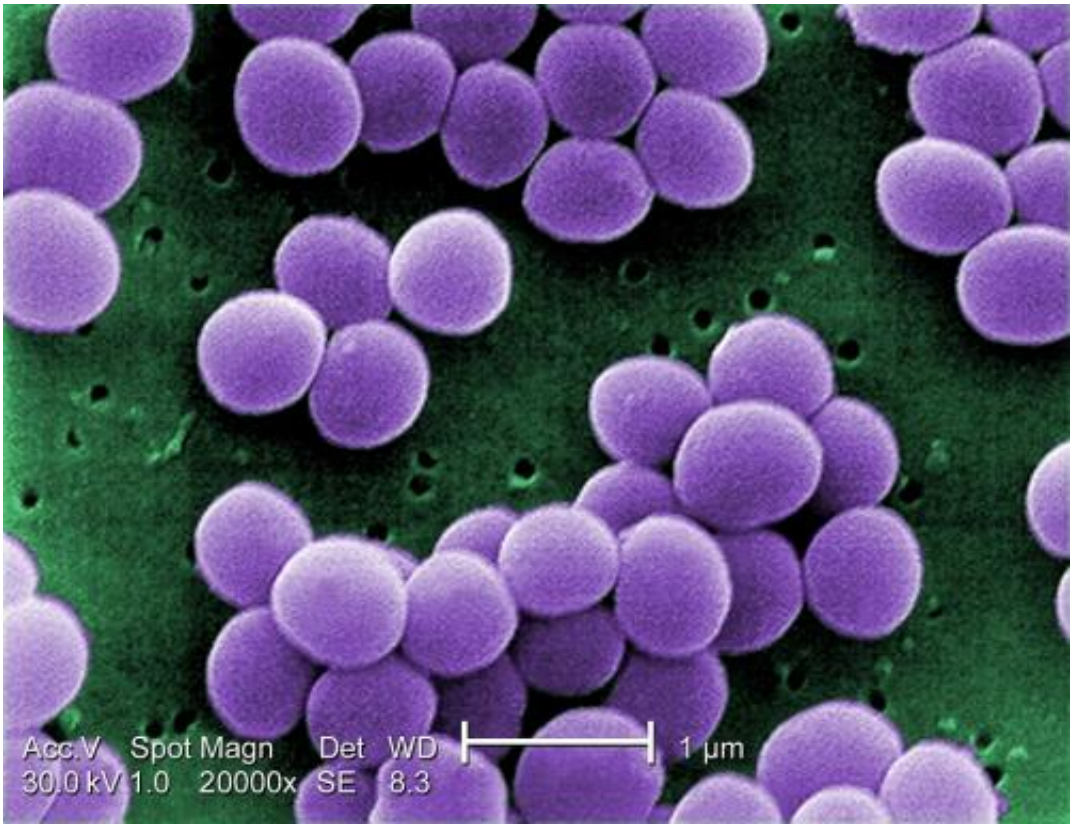

Scanning electron micrograph of S. aureus; false color added. Credit: CDC

Antibiotic-resistant bacteria are a concern for the health and well-being of both humans and farm animals. One of the most common and costly diseases faced by the dairy industry is bovine mastitis, a potentially fatal bacterial inflammation of the mammary gland (IMI). Widespread use of

antibiotics to treat the disease is often blamed for generating antibiotic-resistant bacteria. However, researchers investigating staphylococcal populations responsible for causing mastitis in dairy cows in South Africa found that humans carried more antibiotic-resistant staphylococci than the farm animals with which they worked. The research is published in the *Journal of Dairy Science*.

Animal agriculture is often blamed for generating antibiotic-resistant bacteria through the "widespread" use of antibiotics. "South Africa has one of the highest HIV/AIDS and tuberculosis rates in the world and the human health risk to immune-compromised individuals is therefore that much greater," explained lead investigator Tracy Schmidt, a PhD candidate at the Department of Medical Microbiology, University of Pretoria, and a veterinary researcher at the KwaZulu-Natal (KZN) provincial Department of Agriculture and Rural Development in South Africa. "The rise of livestock-associated methicillin-resistant *Staphylococcus aureus* (LA-MRSA) and reported cases of bacterial transmission between dairy cows and humans has raised concerns from both the agriculture/veterinary sector and public health officials. The lack of data about the occurrence of LA-MRSA in South Africa and the need to investigate possible reservoirs were part of the motivation for this work."

Staphylococcus aureus is a contagious udder pathogen that readily spreads between cows at milking. The main source is milk from infected quarters, with milking machine teat liners playing a significant role in the transmission of the bacteria among cows and mammary quarters. Infected cows need to be promptly identified and appropriate control measures need to be taken to curb bacterial transmission among cows. Other *Staphylococcus* species, collectively referred to as coagulase-negative staphylococci (CNS), have traditionally been regarded as opportunistic pathogens of minor importance as mastitis caused by these bacteria is usually mild and remains subclinical However, the

significance of CNS is being reassessed because, in many countries including South Africa, CNS have become the most common bacteria isolated from bovine IMI. Also of great importance is the fact that CNS often exhibit extensive resistance to antimicrobials and may serve as a reservoir of resistance genes that can transfer and supplement the genome of more pathogenic bacteria like *Staphylococcus aureus*.

This research in the KwaZulu-Natal province of South Africa investigated the diversity of *Staphylococcus* populations responsible for IMI in dairy cows and assessed the susceptibility of different species to antimicrobials commonly used in the veterinary field as well as human medicine. At the same time, individuals working in close contact with the animals were sampled and the diversity and susceptibility profiles of staphylococcal isolates determined and compared with isolates of animal origin.

With respect to staphylococcal diversity the results showed the clear predominance of *Staphylococcus* chromogenes among the CNS causing IMI, while *Staphylococcus* epidermidis was the isolate most commonly recovered from the human specimens.

The study found a relatively low occurrence of antimicrobial resistance among the bovine staphylococci. "This is encouraging as it indicates the responsible usage of antimicrobials within local dairies and provides our veterinary practitioners and animal owners valuable information going forward with respect to the treatment of infected animals," commented Schmidt. None of the staphylococcal isolates of bovine origin were found to be resistant to methicillin. Furthermore, all isolates tested negative for the presence of vancomycin-encoding genes - vancomycin being one of the front-line antimicrobials used for the treatment of methicillin-resistant staphylococcal infections in humans. The results indicate the low potential health risk posed to close contact workers and milk consumers through exposure to antibiotic-resistant staphylococci

originating from milk.

"Of greatest interest was the extensive antimicrobial resistance noted among the coagulase-negative staphylococci of human origin. Multidrug resistance was common among isolates, and due to the propensity for staphylococci to acquire antimicrobial resistance through genetic exchange, human staphylococci can be regarded as a potential reservoir of resistance genes," added Schmidt.

"As an industry we are making great strides to reduce the use of blanket treatment of farm animals with antibiotics and the notion that antibiotic-resistant bacteria are moving from farm animals to humans has been debunked many times," observed Matt Lucy, PhD, Professor of Animal Science at the University of Missouri and Editor-in-Chief of the *Journal of Dairy Science*. "What the authors found is that the humans working with farm animals carry far more antibiotic-resistant staphylococci that the farm animals they work with. The risk, therefore, is the transfer from humans to farm animals and not from farm animals to humans as is often suggested."

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