

The Prevalence of Antibiotic-Resistant *Staphylococcus aureus* Nasal Carriage among Industrial Hog Operation Workers, Community Residents, and Children Living in Their Households: North Carolina, USA

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ABSTRACT

Background:

In industrial hog operations (IHOs), it is common to distribute low doses of antibiotics in hogs' food and water to prevent disease and stimulate growth. The long-term use of antibiotics as a growth promoter rather than to treat disease can cause some bacteria to become immune to the effects of antibiotics over time—a state called antibiotic resistance. In IHOs specifically, the overuse of antibiotics can cause the emergence of antibiotic-resistant pathogen (ABR) *Staphylococcus aureus* (*S. aureus*) in hogs, including methicillin-resistant *S. aureus* (MRSA) and multidrug-resistant *S. aureus* (MDRSA). The latter is resistant to at least three classes of antibiotics. *S. aureus* can be spread to humans who work with pigs in IHOs.

S. aureus has long been recognized as one of the most important bacteria that cause disease in humans. Common threats include skin and soft tissue infections, such as cellulitis and pimple-like boils. Bloodstream infections, bone and joint infections, and even pneumonia are among the more dangerous risks [1]. However, the degree of ABR *S. aureus* exposure in IHO workers and children living in their households remains unclear. It is crucial to find this information for young children especially, since they are susceptible to touch and put objects in their mouths that are likely to carry infection. This, combined with the fact that their immune systems are still developing, puts them at a greater risk for sickness when in contact with *S. aureus*.

Objective:

This research study investigated and compared the ABR *S. aureus* nasal carriage prevalence among adults in and out of IHO occupational exposure, along with children living in their households.

Methods:

The study population involved 198 IHO worker-child household pairs and 202 community referent (CR) adult-child household pairs. The children were all younger than 7 years of age. All participants completed a questionnaire and provided a nasal swab, which was examined for *S. aureus*, methicillin-resistant *S. aureus* (MRSA), multidrug-resistant *S. aureus* (MDRSA), absence of *scn* (putative marker of livestock association), and *spa* type (*S. aureus*-specific gene).

Results:

In adults, *S. aureus* was more prevalent in IHO workers (53%) than those in the CR group (31%). MRSA nasal carriage prevalence was uncommon in both adult groups (2-3%), while MDRSA prevalence was similar (12% in IHO workers vs. 8% in CR adults).

Regarding children, the results were more varied. Like the adults, children in IHO households were found to have more traces of *S. aureus* intranasally than CR children (49% compared to 31%). However, the MRSA prevalence was more than twice the amount in IHO children than CR children (14% vs. 6%), and the MDRSA prevalence was more than 3 times the amount in the IHO group (23% vs. 8%).

Conclusion:

The findings suggest that children younger than 7 years old living in households with IHO workers are more likely to carry ABR *S. aureus* intranasally than children living in CR households. These findings highlight the importance of further research on the exposure to ABR *S. aureus* among children living with IHO workers.

POLICY IMPLICATIONS

The U.S. Food and Drug Administration (FDA) is the primary body responsible for regulating not only human food, but animal feed as well. Officials at the FDA emphasize the importance of antibiotics in animal feed to prevent diseases in the animals.

Nonetheless, the FDA is responsible for ensuring that drugs used in medicated feed do not cause antimicrobial resistance to important, life-saving drugs for humans – which is exactly what has happened with *S. aureus*. This FDA regulation pertains to human exposure to resistant microbes through the consumption of animals, but not necessarily to human exposure through the workplace such as at IHOs [2]. The FDA last updated their regulations in December 2013, which asked animal pharmaceutical companies to phase out the production and use of antimicrobial products [3]. They had three months to voluntarily express their intent to make the changes within three years; however, this was not an enforceable mandate. In lieu of enforceable policies and regulations, FDA might consider working with the food industry to push the pharmaceutical companies towards phase out as well. Education and safety measures against ABR pathogens should be provided for workers in IHOs.

An overwhelming majority of participants in this study (94%) depended on Medicaid insurance, indicating a low-income background. As such, this is an issue of environmental justice that needs to be addressed by all responsible parties.

REFERENCES

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