

CFOs

Confined Feeding Operations

MRSA and Livestock Production

Paul Ebner and Yingying Hong

Purdue Animal Sciences



Series Publications

1. A Note on Risk
2. What is a Confined Feeding Operation?
3. Manure Rules in Indiana
4. Antibiotics and Livestock Production
5. MRSA and Livestock Production
6. Unabsorbed Antibiotics and the Potential Contribution to Antibiotic Resistance
7. Impact of CFO Odor and Odor Setback Models
8. CFO Emissions and the National Air Emission Monitoring Study
9. Role of the Extension Educator on the Plan Commission
10. CAFOs and Community Conflict: Understanding Community Conflict
11. CFOs and Community Conflict: Understanding Conflict Between Individuals

The connection between Methicillin Resistant *Staphylococcus aureus* (MRSA) and livestock production is among the most debated issues related to CFOs. (Go [here](#) for a definition of CFO.) Unfortunately, it is also one of the least understood. This is largely due to the fact that the connection between MRSA and livestock is still a new field of research. In recent years, however, there has been a substantial amount of progress in understanding, and much more information is known regarding MRSA, animal agriculture, and human health. Below are several of the key updates on the state of science related to MRSA and livestock production. (See [link](#) for further reading.)

Classifications. MRSA infections were first discovered in hospitals and were generally thought of as nosocomial infections, or infections that occurred in the hospital itself. As new infections were seen in individuals with no connection to health care settings, it became clear that MRSA was circulating outside of hospitals as well. Epidemiologists began separating MRSA strains and infections into two groups: hospital-acquired (HA); and community-acquired (CA). While there were some genetic differences between the two types of MRSA, there were also some differences in disease patterns, with HA-MRSA being more associated with pulmonary infections and CA-MRSA being more associated with skin infections.

In the mid-2000s, researchers in Europe found MRSA circulating in swine farms, both in pigs and humans who worked or were in regular contact with pigs. The strain of MRSA in this case was different from other HA-MRSA or CA-MRSA. This type of MRSA was deemed livestock-associated (LA) MRSA. Several labs in the US have identified this strain in US pigs, among other animals.

It is worth noting that bacterial communities do not live in silos. There is a considerable amount of movement of these strains from the hospital, the community, and from animals to humans (and vice versa). So much so that some scientists no longer use groups (e.g., HA, CA, LA) to describe strains, but rather use more specific genetic characterizations.

ST398. The original LA-MRSA was referred to as ST398. This name is based on a DNA fingerprinting technique used to identify different types of bacteria. ST398 distinguished itself from other MRSA based on a few other characteristics; namely it was also resistant to tetracycline, but lacked some (not all) genetic components that were responsible for pathogenesis, or the ability to cause disease. With time, it became clear that ST398 was able to move from pigs to humans, and it was also isolated from other types of livestock. As DNA sequencing techniques improved, different groups have shown that ST398 was likely a human variant of *Staphylococcus aureus* that morphed to infect pigs. Most agree it acquired methicillin resistance in pig populations prior to being re-introduced to human populations.

While ST398 in livestock herds received a great amount of attention, several research groups have since shown that it is not alone, as numerous MRSA strains are able to cross over from livestock to humans and vice versa.

LA-MRSA and Humans. At the onset, one major concern was whether the newly identified LA-MRSA could transmit to human populations and, if so, whether it could cause disease. Research over the past 10 years has shown that different LA-MRSA strains are certainly able to colonize humans, even those with no livestock contact. These strains, however, have also been found in cats, horses, dogs, etc. Humans can “carry” a bacterium without it causing harm or infection. This is true for the majority of *Staphylococcus aureus*, which regularly

colonize our skin or nasal membranes. Thus, one major question remained unanswered: Do LA-MRSA cause human disease on the level of HA-MRSA or CA-MRSA? It is now clear that LA-MRSA, and ST398 in particular, can cause infections in pigs as well as humans. While most of this research has taken place in Europe, there is no reason to think that those results could not be extrapolated to the US. There is, however, still disagreement as to the virulence of LA-MRSA. Some research groups concluded that it is generally lower than HA- or CA-MRSA; others felt that all MRSA should be treated as equals.

MRSA and CFOs. LA-MRSA is not necessarily an issue specific to CFO-size farms. As stated earlier, MRSA strains classified as LA-MRSA have been isolated from a variety of animals, including companion animals. At the same time, the European farms where LA-MRSA was originally isolated would likely **not** be considered CFOs in the US based on their smaller size. While larger volumes of animals could certainly increase the volume of any pathogenic bacteria, the bacteria itself would not discriminate between a farm with 599 pigs (not a CFO) vs. a farm with 600 pigs (CFO).

References

- Bosch T, Schouls LM. 2015. Livestock-associated MRSA: innocent or serious health threat? *Future Microbiology*. 10:445-447.
- Mole B. 2013. Farming up trouble. *Nature*. 499:398-400.
- Smith T. 2015. Livestock-Associated *Staphylococcus aureus*: The United States Experience. *PLoS Pathog* 11(2): e1004564.

Jan. 2017

It is the policy of the Purdue University Cooperative Extension Service that all persons have equal opportunity and access to its educational programs, services, activities, and facilities without regard to race, religion, color, sex, age, national origin or ancestry, marital status, parental status, sexual orientation, disability or status as a veteran.

Purdue University is an Affirmative Action institution. This material may be available in alternative formats.