

Factors Driving Emerging Diseases Across Species

Most everyone by now has heard of the recent outbreak in China of a novel Corona virus. It has been speculated, based on genetic comparisons of this novel virus, that the origin of the virus lies in animals from a live animal market. Although the Wuhan Novel Corona Virus or 2019 nCoV is the most recent iteration, the reality is that diseases are emerging at an increasing frequency. This is not only true for diseases in humans. Cattle have some emerging disease challenges that are worth noting as well. Whether in humans or animals, there are several factors that are driving disease emergence including:

- Increased travel and international movement of people and products. People spreading diseases during or following travel is only one way this occurs. Another example is the spread of West Nile Virus to the United States. Although it cannot be proven conclusively, it is hypothesized that West Nile Virus was brought to North America by a mosquito or an infected bird that was transported (either advertently or inadvertently) to the New York City area.
- Increasing global populations mean that there is more and more competition for living space with wild animal habitats. With more human animal interactions occurring, there is more contact, especially in developing nations, with wild animals. Contact and proximity are key contributions to the ability for a disease to become zoonotic or pass between animals and humans.
- Climate changes have led to numerous other changes in both humans and animals. For humans, climate change is altering some food production systems and access to resources. For animals, climate changes are leading to animals changing their traditional habitats and migratory patterns. Again, this has a tendency to bring wild animals into closer contact and proximity with human populations, especially where there is competition for resources such as food and water.
- In some cases, there have been changes to the susceptibility of the population and what we call the pathogenicity of the disease itself. Examples of a change in susceptibility in a population would be what has been seen recently with measles. The anti-vaccination movement has led to a group of individuals that have no resistance, to a disease and thus represent what would be called a “naïve” (no pun intended) population. An example of change in pathogenicity, would be development of traits such as antibiotic resistance. Essentially this is where an existing disease evolves a new set of traits that allows it to be more infectious or severe.

Emerging Diseases in Cattle

There are a few disease processes in cattle that have at least one of the above factors we discussed that can classify them as emerging. They include:

- Bovine Tuberculosis- Tuberculosis or TB is a major concern for several reasons. Firstly, TB is considered to be extremely zoonotic, meaning that it can easily be spread from cows to humans. It's also important to remember that street goes both ways, and so there is significant concerns that TB is transmissible from people back to cattle. Secondly, TB has a major impact on the ability to transport cattle across state and national borders, and thus the TB free status impacts access to markets and over economics of the cattle industry. Finally, the same bacteria that causes TB in cattle and people also causes TB in wildlife. Several states, like Michigan, have experience first-hand that TB in the wildlife populations can be very problematic to not only

other wildlife, but also to humans and livestock. In all these cases, there is no longer Federal resources to depopulate infected herds, as was done in the past, and so producers whose livestock become TB infected face a long, arduous and expensive process to escape from the grips of TB infected status.

- Bovine Leukosis Virus- Bovine Leukosis Virus or BLV is a virus that pre-disposes the infected animal to a higher risk of developing cancer, in a similar way to cervical cancer in humans. BLV is by no means a new virus. The virus was isolated 50+ years ago. What qualifies this disease as potentially emerging, is what we have learned over time about the sheer scope of the infection and the stunning economic impact it potentially has. It has recently been shown that as high as 89% of US dairies have animals that test positive for BLV virus, and it is estimated that as high as 44% of US dairy cattle are likely positive for BLV virus. Although less than 5% of infected cattle go on to develop leukemia (tumors), nearly 1/3 will experience a dramatic increase in a specific white blood cell (lymphocytosis). It is likely that there are far more physiological impacts on the cow that have yet to be classified. All of this contributes to a projected net loss to the dairy industry of \$285 million annually, most of which is attributed to lost milk production and premature culling or cattle death.
- Anaplasmosis- Shifting climatic trends are altering the ranges of many species, and insects are no exception to this rule. Tick borne diseases are increasing in many species as the ranges of ticks species and their populations expand. This expansion increases the tick pressure on both wildlife and livestock populations. Anaplasmosis is a bacterial infection of red blood cells, or erythrocytes, that is spread by ticks. The result is a lack of red blood cells known as anemia. While anaplasmosis has in the past been considered a more tropical disease, the disease is now being seen in more temperate climates. The veterinary community is also realizing that there are likely more infected animals in the populations than we may have previously thought. Surprisingly, Anaplasma is not just found in pastured cattle, but can on occasion even be found in confinement raised cattle as well.
- Vesicular Stomatitis- Like Anaplasmosis, Vesicular stomatitis (VS) is spread by biting insects, but in this case the vector is flies and biting midges. VS causes significant lesions and disease in cattle that include ulcerations and erosions of mucosal surfaces such as the mouth and nose. While the disease itself is significant, VS is considered a reportable disease not solely because of the effects of VS, but also because the lesions it creates are very similar to those produced from Foot and Mouth Disease (FMD) Virus. FMD is a foreign animal disease whose presence in the US would drastically and negatively impact our cattle production and meat export markets.

It is likely that the forces making novel disease emergence increasingly common will continue and perhaps even grow in the foreseeable future. We must remember that diseases are opportunistic, and so diseases confined to one species or geographical region are not guaranteed to maintain that confinement. Globally, programs that seek to isolate with borders and quarantines will be challenged to contain diseases that can be spread by a single mosquito in a fruit crate or a few morsels of unpasteurized cheese that a person forget to declare at customs. This is of course to say nothing of those people that may choose to bring diseases to our shores deliberately to cause harm. As health professionals and producers our role will be to utilize strong biosecurity practices and maintain our hyper vigilance for signs of disease. Corona has certainly taught us the value of prompt response!