Newest Defense Against the Avian Flu Indoors

QUESTIONS & ANSWERS ABOUT THE AVIAN INFLUENZA VIRUS

- How do we stop the avian influenza outbreak?
- How we protect poultry from various diseases and viral pandemics?
- How do we improve our biosecurity measures that have failed to stop the increasing mortality?
- How do we prevent a potential serious public threat from developing?

It is already the end of March 2023 and major outbreaks of HPAI (highly pathogenic avian influenza) are occurring in many northern states in the US. Canada is already reporting 7.2 million total cases with a 500,000 poultry outbreak in Saskatchewan occurring March 1. Poultry mortality could make the 58 million culled birds in the US in 2022 just the early beginning of a major pandemic threating the domestic food chain[1] in areas of many countries.

Since February, the USDA United States 30 day plot[2] on March 7 of 'Birds Affected' compared to 'All Flocks' (poultry) are identical. Six states [MN, ND, SD, PA, UT, WI] total losses are about 9 million turkeys and 17 million chickens. Backyard flock infections are highest in WA and MN but also significant in OR, ID, PA. HPAI is present in all the US northern states. Commercial flocks have the highest infection in MN and SD.

However, the USDA does not recognize that the HPAI is most likely being transmitted by air circulation in the current 'Prevent Avian Influenza at Your Farm'[3] flyer that is featured on their website but dated July 2015. Yet, their large buffer zones[4] indicate that air circulation is a major vector for this disease. The current 'Avian Influenza in Birds' page on the CDC site still does not recognize airborne transmission as a vector for disease by their statement;

> 'Infected birds can shed avian influenza A viruses in their saliva, nasal secretions, and feces. Susceptible birds become infected when they have contact with the virus as it is shed by infected birds. They also can become infected through contact with surfaces that are contaminated with virus from infected birds.'

Unfortunately, both the CDC and the USDA and other US Government bodies do not read or pay attention to the scientific community research and the many research papers published each year. It took the CDC more than one year, after the COVID19 pandemic hit the US, before they recognized that this SARS virus was predominantly transmitted by air currents. But the CDC paper, published in Emerging Infectious Diseases in **November 2006** by microbiologist Raymond Tellier, stated in his first paragraph;

> 'Published evidence indicates that *aerosol transmission of influenza can be an important mode of transmission*, which has obvious implications for pandemic influenza planning and in particular for recommendations about the use of N95 respirators as part of personal protective equipment.'[5]

He specifically discussed the H5N1 virus because of its potential for a pandemic. He showed documented evidence that aerosol exposure occurred with mice, squirrel monkeys, and human volunteers.

> 'These experiments and observations strongly support the view that many, possibly most, natural influenza infections occur by the aerosol route and that the lower respiratory tract may be the preferred site of initiation of the infection.'

Critical to bird-flu transmission is his statement;

> '…transmission of influenza A (H5N1) *by aerosols from geese to quails* has been demonstrated in the laboratory (33). Thus, even in the current incarnation of A (H5N1), infection by the virus can generate aerosols that are infectious for highly susceptible hosts.'

HPAI IS AERSOLIZED AND SPREAD BY THE AIR

Until recently, it has been difficult to detect viral particles in the air. The technology has improved to where researchers have recorded that a single human exhale can contain up to 10,000 viral particles[6]. This fact along with the observation that HPAI spreads so quickly strongly suggests that this avian influenza is transmitted by the aerosol pathway. A similar hypothesis caused researchers in MN to capture the swine PRRS virus 9 km down wind of an infected barn. It is the airborne pathway that is so infective. The bird-to-human infections occur only when infected birds are slaughtered, and the aerosolized virus enters the airway and lung of the soon to be infected person[7]. This confirms Tellier's statement in 2006;

> 'Thus, in the respiratory system the current strains of A (H5N1) appear to infect mostly (perhaps exclusively) the lower respiratory tract. If that is indeed the case, it in turn suggests that human cases of avian influenza were acquired by exposure to an aerosol, since large droplets would not have delivered the virus to the lower respiratory tract.'

If the CDC and USDA had paid attention to Tellier's 2006 paper, many lives lost and the current devastating HPAI could have been prevented. Since Tellier's 2006 paper, there have been over a dozen studies showing virus and bacteria shedding via exhales of the sick reaching concentrations of 37 million per hour in a 2012 Yale study.

Current biosecurity methods are not designed nor capable of treating the source of transmission which turns out to be air. Fortunately, there is a new technology that has already proven to destroy viruses in the air and on surfaces by a unique 222nm Far-UV photon-emitting lamp. This 222nm wavelength targets and destroys the biomolecular surfaces of these microorganisms unlike other UV wavelengths. The difference between 2006 and 2023 is that Far-UV light is much more effective for disinfection of air, as well as surfaces and is safe for human and animal exposure. The poultry industry needs to begin adopting this technology to protect the commercial as well as family-owned flocks from HPAI. This technology also provides additional benefits of keeping poultry healthy from common bacteria and other viruses in the least intrusive manner.

NEW TECHNOLOGY IS REQUIRED AND AVAILABLE

In 1999, Neister started working to develop and patent a new UV lamp that would be a superior disinfectant, compared to available mercury-based lamps and safe for human exposure. This lamp targeted proteins that form the outer membrane of bacteria as well as the capsid and lipid layer surrounding viruses. It also targeted the DNA/RNA nitrogenous bases of microorganisms with photon energy that can break chemical bonds of biomolecules. Other UV wavelengths make chemical changes but cannot destroy them. As a result, the Far-UV wavelength at 222 nm (nanometer) has become the weapon of choice for disinfecting microbes. It has proven to be safe for human skin and eyes and critical tissue of all animals[8]. It is lethal to all microorganisms such as viruses, bacteria, fungus, and molds. Its existence became important when the COVID19 pandemic hit the world.

The use of 222 nm far-UV lamps to prevent the spread of avian flu and salmonella in chicken barns has gained interest among researchers in recent years. One study conducted by a team of researchers from

The Animal Health and Veterinary Laboratories Agency in the UK[9] tested UVB on HPAI virus because it is principally the environmental effective virucidal radiation from the sun on the earth's surface. They found that UVB reduced by one log H7N1 and H5N1 highly pathogenic avian influenza viruses and a virulent isolate of Newcastle disease virus (NDV) with exposures ranging from 69 (NDV) to 158 (H7N1) to 167 (H5N1) minutes.

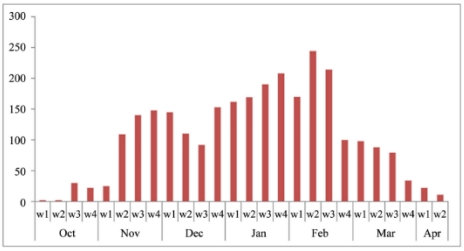

Figure 8. Epidemic curve showing the weekly incidence of outbreaks of HPAI since October 2016 (World Organisation for Animal Health, 2017).

A 2018 study at the University of Suwon, South Korea[10] added more data that UV light would deactivate HPAI by studying solar UV radiation effects on the earth and proposing satellite parameters could be used to predict HPAI outbreaks. They tied outbreaks to atmospheric ozone concentrations which absorb UVB and to daily sunspot area as a function of latitude and time. They concluded that UVB radiation 'may suppress the activity of AIV for blockage of its outbreak during the period of September to April, when migratory birds move from Poles to the Continental poultry. **It is therefore proposed that having artificial UV radiation with poultry farmhouses is a simple solution to suppress AIV outbreaks**. There were close relations between rice production, HPAI H5N1 outbreak under low water temperature, poultry, and migratory birds [18].' They claim that AIV is detected and can remain viable for long times in drinking water, suggesting that it should be replaced/sterilized often.

UVB is virucidal solar radiation that causes dimer formation and requires long exposure times. Far-UV 222 nm light is safe for human and animal exposure and is quick in destroying bacteria, virus and microorganisms. There is less difference in reduction in viral strains for Far-UV because it targets the fundamental protein makeup compared to UVB as shown in the S. Korea study. This was confirmed by a study using UVC 254 nm light[11]. They showed that relative humidity (RH) played a key role in viral survival. The lower %RH produced greater log reduction which is supported by other studies of RH.

Many studies have used uvc light to test inactivation of Salmonella. In a 2012 study by the Department of Food Technology at University of Zaragoza, Spain, they found that pH and water temperature affected the dose required for a log reduction[12]. Tests with Far-UV light are not expected to be dependent on water temperature since the targeted chromophore is different and not dimer formation dependent. Salmonella is a gram negative bacterium which is highly susceptible to Far-UV 222 nm destruction. Legionella and Pseudomonas are two others.

FAR-UV STERILRAY PRODUCTS FOR THE POULTRY INDUSTRY

It took many years to develop an effective and efficient long-life lamp that represents the best value for high level disinfection for surfaces, liquids, and air. These specialized products are now being introduced by the Sterilray Inc. for poultry disinfection.

Far-UV Sterilray 222 nm photo-disinfection is proven safe for human skin and eye exposure, will not hurt chicken feathers, eyes or feet and will reduce urea and ammonia odor in the coop. It will significantly reduce any infiltrating virus from causing a flu outbreak or a bacterial infection by fast line-of-sight impact. Some diseases that are particularly susceptible are Erisypelas, Salpingitis, Aspergillosis, and Marek's Disease. For normal day-to-day operation, the lamp will reduce salmonella on the birds, the poop, and the surfaces that are exposed to the lamp light field. Additionally, its use will save on expenses associated with general disinfection and drugs when the flock gets an infection and becomes sick. Most importantly, it will provide the best protection from airborne HPAI.

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Sterilray 222 nm Far-UV lamps are coaxial, have been designated 'organic' and do not produce hazardous by-products. The UV light from the lamp is the disinfectant, so simple soap and water can be used to clean surfaces. Visually, the lamp produces a faint blue glow. The lamps are patented, made in the USA in New Hampshire and are generally in stock. Their life exceeds 30,000 hours or 3 years and can be run 24/7 at either full rated power or half power when sickness or flu viruses are not present.

Sterilray Inc. has done many tests to prove their patented Far-UV lamp quickly kills bird flu, salmonella, other flu viruses and airborne bacteria that affect the health of chickens and turkeys. Sterilray Inc. is introducing some new products (www.sterilray/products.com) to help commercial businesses, as well as back yard coops, protect their flocks and keep them healthy. These include ceiling-mounted Luminaires, wall-mounted eSconces in 3 sizes, HVAC units for different size units, and a Germ-Buster Sabre that can use battery power to go anywhere to disinfect the air and surfaces. For more information or to discuss your specific needs to get the product that is the best fit and the best value for your use, go to the website and navigate to the Products section and click on 'contact us'.

REFERENCES:

The sections in this article are listed with detailed descriptions at www.sterilray.com/products/poultry.

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