Risk assessment of acquiring Avian Influenza from Poultry Products: Risk characterisation

This risk assessment was produced using a multidimensional model of risk which includes the probability of an adverse effect occurring alongside the detriment (harm or damage) associated with the severity of the microbiological hazard. The uncertainties associated with these categories and additional uncertainties are also considered (see Appendix 2; ACMSF, 2020).

As included in the risk question, the risk characterisations below are considered on a UK population basis. For some products or activities (like consuming game birds or processing game birds), the UK subpopulation of people engaging in that activity are considered as opposed to the entire UK population. This is based on the evidence that a small percentage of the UK population engages in these activities.

5.1 Frequency of occurrence of AI from commercial poultry products

Data presented in section 4.1 indicates that HPAI-infected commercial flocks of chicken and turkeys would likely be identified before being slaughtered and that LPAI-infected flocks would not likely have the virus present in the muscle tissue or organs. This means that contaminated meat is unlikely to reach the consumer. The situation may be different for commercially reared duck and geese, as they are less likely to exhibit clinical signs of infection.

While the consumption data indicates that chicken and turkey are the most commonly consumed poultry products in the UK, they are also very unlikely to be eaten pink. However, duck and geese are more likely to be eaten less than thoroughly cooked. Research demonstrates that AI viruses are heat-labile, so thorough cooking would inactivate any virus present. Additionally, proper hygienic handling of raw product would reduce the amount of any virus encountered by consumers from cross-contamination. Finally, there is the species-barrier present for infection given the receptors located in the upper human GI tract are not conducive to infection with AI viruses.

Given the above differences, the commercial poultry group was split to consider chicken and turkeys separately from duck and geese. The frequency of occurrence for the UK population of acquiring AI from the handling and consuming of commercial chicken and turkey is **negligible (so rare that it does not merit to be considered)**. This is supported by the lack of evidence of any previous foodborne transmission of this virus from cooked poultry products. The level of uncertainty related to this is **low**, as there are several research studies demonstrating the inactivation of AI from cooking and disinfection.

The frequency of occurrence for the UK population of acquiring AI from the handling and consuming of commercial duck and geese is **very low (very rare but cannot be excluded)** with **medium uncertainty**. This uncertainty is because less research has focused on ducks and geese compared to other poultry.

5.2 Frequency of occurrence of AI from game birds

Since UK AI surveillance in wild birds relies on testing of identified dead birds, it is difficult to understand the infection dynamics in the game bird population. Additionally, game birds can have very different clinical signs, with species like pheasants likely to be ill enough to not be available for shooting while species like ducks might not show any signs of infection. Fewer people in the UK consume game birds, but the meat is much more likely to be eaten pink compared to chicken or turkey. Since backyard poultry would experience conditions more similar to game birds than commercial poultry, the risk from handling and consuming meat from backyard poultry is considered similar to that presented here for handling and consuming game birds. Any virus present in either game bird meat or meat from backyard poultry would be as susceptible to disinfection and cooking as was discussed for commercial poultry.

The population considered for these products is UK consumers of game birds or backyard poultry as opposed to the UK population in general. The frequency of occurrence of acquiring avian influenza virus for this population of consumers from handling or consuming these products is **very low (very rare but cannot be excluded)**. The level of uncertainty related to this is **medium** as the game bird industry is less well understood compared to commercial poultry. A lack of government knowledge on the structure and integration of the game bird industry, including the behaviour of game birds in the wild has been highlighted in previous reports (Defra, 2017b). Closer liaison with the industry and individual businesses has been recommended to gain a better understanding of this sector. Furthermore, the variety of birds that may be included in “game birds” make it difficult to generalise how infections with AI viruses will progress across all the different species.

5.2.1 Frequency of occurrence of AI from home processing of birds

This risk assessment also considered the risk of acquiring AI from home processing of birds, which might include infection via inhalation during the steps of defeathering, butchering, etc. The home processing of backyard poultry is also included here. Some game birds, such as ducks and geese, that are natural reservoirs for AI may have virus present in various tissues without clear clinical signs in the bird, possibly leading to infected birds being processed for consumption. In this situation, infection could occur either by the respiratory route from inhaling droplets aerosolised during processing or by the oral route from cross-contamination.

Given the difference in systemic infection in birds between HPAI and LPAI, these were considered separately. The population under consideration here is individuals in the UK that process birds at home. Since HPAI can be present in the feathers and blood of infected birds, the frequency of occurrence of acquiring avian influenza from processing birds at home is low (rare but does occur). This takes into account the low number of AI human infections reported worldwide during outbreaks despite the huge number of birds infected. During LPAI infections, the virus is not distributed in as many tissues throughout the bird, meaning the frequency of occurrence of acquiring AI from processing birds at home is very low (very rare but cannot be excluded). The uncertainty associated with both these risk levels is medium as data exists for the distribution of the HPAI and LPAI viruses in bird tissues but research on exposure levels to AI from home processing is limited.

5.3 Frequency of occurrence of AI from hen eggs

Evidence from both natural outbreaks and experimental infections demonstrate that AI viruses can be present in the internal contents of eggs. It can also be present on the shell. Eggs are consumed by a large portion of the UK population and, compared to the other poultry products considered in this risk assessment, are the product most likely to be consumed either raw or

undercooked. AI present in or on eggs would experience the same inactivation from disinfectant or cooking as described previously. Eggs produced by backyard poultry flocks can be considered alongside those from commercial laying flocks in this risk characterisation.

Given the evidence, the frequency of occurrence to the UK population of acquiring avian influenza virus from handling and consuming hen table eggs is very low (very rare but cannot be excluded). The uncertainty associated with this is low, as there was adequate data on AI in eggs, consumption of LTTC eggs in the UK and viral inactivation from heating of egg products.

5.4 Severity of detriment for avian influenza infections in humans

As discussed in Section 3, humans can exhibit a range of symptoms when infected with AI, ranging from asymptomatic infections or mild conjunctivitis to severe respiratory illness. Considering recorded AI infections worldwide, there is a high case fatality rate of up to 50%, depending on the strain. Given this, the severity of detriment from infection of AI in humans is high (severe illness: causing life-threatening or substantial sequelae or illness of long duration) with medium uncertainty. This uncertainty is due to the lack of surveillance for AI infections in people, meaning many asymptomatic infections may go undetected. This would artificially inflate the case mortality of reported infections compared to true infection numbers.

5.5 Key uncertainties

Several factors contributed to the uncertainties associated with the different risk levels identified in this risk assessment. Key uncertainties associated with different steps of the risk pathway are outlined below.

5.5.1 Uncertainties related to frequency of occurrence of AI in poultry products

The uncertainties in each section are listed in order of priority – for example, which uncertainty would make the biggest impact to the risk assessment if they were able to be resolved.

5.5.1.1 Uncertainties related to commercial poultry

- uncertainty over the prevalence of LPAI infections in commercial poultry
- uncertainty about the potential presence of LPAI in meat/muscle tissue of commercial poultry since evidence is only from experimental studies and not natural outbreaks
- uncertainty about cross-contamination of carcasses with LPAI during slaughter

5.5.1.1.1 Uncertainties related to backyard poultry

- uncertainty of the size of the smallholder community flocks and backyard poultry population
- uncertainty over the amount of backyard poultry products produced that are consumed; including eggs and meat
- uncertainty over understanding and/or compliance of owners of backyard poultry for introducing biosecurity measures when in protected zones or their ability to recognise clinical signs of AI in their backyard flock

5.5.1.2 Uncertainties related to game birds

- uncertainty over the number of game birds shot each year and consumed through unregulated routes.
- uncertainty over potential for cross-contamination, including from faeces, from home processing of birds.
- uncertainty over the likelihood of transmission from the defeathering process, particularly if carried out in a domestic setting without appropriate PPE or ventilation.
- prevalence of AI in game birds
- variability of clinical signs caused by different strains in wild aquatic birds, such as ducks and geese.

5.5.1.3 Uncertainties related to eggs

- uncertainty around the chance HPAI-contaminated eggs would be sent for processing in the time between flock infection and detection
- uncertainty around the ability to detect LPAI infection in laying flock
- uncertainty over the presence of LPAI on eggshell or inside egg

5.5.1.4 Uncertainties related to consumer behaviour

- uncertainty around cross-contamination when preparing poultry in domestic settings.
- uncertainty around different strains and temperature inactivation during cooking

5.5.2 Uncertainties related to severity of detriment of AI infection in humans

- uncertainty about the true number of human infections given asymptomatic or mild cases due to limited surveillance in humans
- uncertainty about the severity of illness associated with AI since different strains may have different pathogenic potential in humans and the variability in response to infection due to human genetic factors.

5.5.3 Additional Uncertainties

While the uncertainties related to the frequency of occurrence of AI in humans and the severity of detriment are due to either a lack of data or variability in the population, there are some additional uncertainties around the ability of AI to cause infection from food through the oral route. This is due to the lack of epidemiological evidence associated with AI cases from food, the potential infectious dose required for infections via the oral route and the ability of the AI virus to infect tissue from receptors available along the human gastrointestinal tract. Another additional uncertainty is around the effect mutations may have on the ability of the virus to transmit between species or cause infections in humans from consumption of contaminated food.

5.6 Recommendations for future research

Additional research into some of the data gaps highlighted in Section 5.5 could help reduce the uncertainty associated with the risk characterisation of this assessment. Some suggestions are below.

5.6.1 Research related to commercial poultry

- surveillance studies to better estimate LPAI prevalence in commercial flocks
- characterisation of LPAI distribution within tissues from naturally infected birds
- quantitation of levels of infectious virus in the meat and eggs of infected birds

5.6.2 Research related to game birds

Survey of game birds to determine numbers and species of birds hunted each season, including how many are for personal use or for sale through an AGHE.

Sampling study looking at prevalence of AI in game bird populations (either in the wild or during rearing).