

Updated Outbreak Assessment #2

Influenza A (H5N1) of Avian origin in domestic livestock in the United States of America

15 August 2024

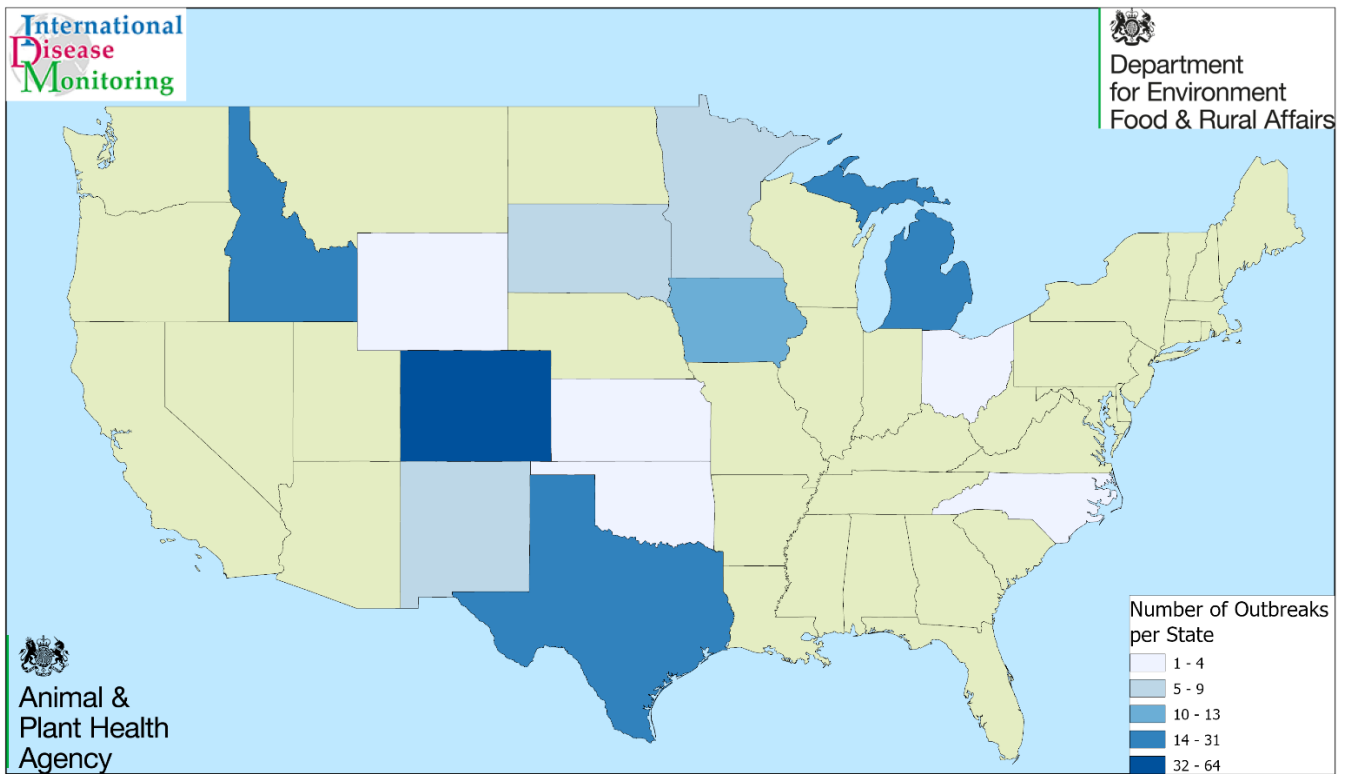
Disease report

On 26 March 2024, the United States of America (USA) made an immediate notification to the World Organisation for Animal Health (WOAH) of an outbreak of influenza A of avian origin (H5N1) affecting dairy cattle in Texas. The outbreak strain, a high pathogenicity avian influenza (HPAI) strain, belongs to clade 2.3.4.4b, genotype B3.13 ([Nguyen et al., 2024](#)). This genotype has never been detected outside of the Americas ([UKHSA, 2024](#)).

In our previous report, dated 25 April 2024 ([Influenza A \(H5N1\) of avian origin in domestic livestock in the USA](#)), there had been 32 reports of HPAI virus in dairy cattle in the USA across 8 states (Defra, 2024). As of 15 August 2024, this has risen to 192 reports in livestock (191 in dairy cattle and 1 in alpacas, present on a poultry farm with the same strain) across 13 states (Map 1) (US Department of Agriculture ([USDA, 2024a](#))). As of 15 August 2024, 156 of these reports are available on [WOAH \(2024a\)](#). According to the USDA's National Epidemiological Brief, on average, less than 10% of affected dairy cattle have displayed clinical signs. Where clinical disease has been seen, it has included a reduction in feed consumption and production of thickened or clotted milk, with average mortality and culling estimated at 2% or less. However, no deaths in dairy cattle have been directly attributed to HPAI ([USDA, 2024b](#)).

In and around affected dairy herds, deaths have been described in wild birds (great-tailed grackles), domestic birds (chickens), peri-domestic birds (pigeons), wild mammals (raccoons), domestic (cats) and peri-domestic mammals (mice). The exact number infected with HPAI is undefined. However, over 50% of affected dairy farms with cats present have observed sick or dead cats and nearly all affected farms with poultry have observed sick or dead poultry (USDA, 2024b). As of 15 August 2024, four dairy workers from farms where cattle have tested positive for H5N1 virus have been identified with influenza A (H5) infection. All of those affected showed symptoms of conjunctivitis and were treated with oseltamivir, prior to making a full recovery ([CDC, 2024](#)).

The risk to **Great Britain** of this particular genotype of H5N1 being introduced to livestock is considered **very low**.



Map Prepared by IDM

Date: 22/08/2024

Absolute Scale: 1:24,000,000

HPAI in Livestock
March to August 2024
(USDA Data)

0 205 410 820 1,230 1,640
Kilometers

Map 1. US states where livestock infected with HPAI have been detected as of 15 August 2024. The legend shows the number of confirmed reports of HPAI per state (data from USDA, 2024a).

Situation assessment

The USDA first confirmed HPAI H5N1 virus in a commercial poultry flock in February 2022 ([WOAH, 2024b](#)). Since February 2022, the USA has reported and responded to over 1,100 detections on poultry farms (USDA, 2024c). Since late March 2024 the USDA, Food and Drug Administration (FDA), Centres for Disease Control and Prevention (CDCP), state veterinary and public health officials, and the National Animal Health Laboratory Network (NAHLN) have been working together to investigate the emergence of influenza A(H5N1) of avian origin in dairy cows in a rapidly evolving environment with many knowledge gaps (USDA, 2024a).

Following the first report of HPAI H5N1 in cattle in Texas, HPAI infection has also been reported in dairy cattle in Kansas, New Mexico, North Carolina, Idaho, South Dakota, Ohio, Colorado, Iowa, Michigan, Minnesota, Oklahoma and Wyoming (and one backyard Alpaca premises in Idaho) (USDA, 2024a).

The genotype of the virus found in all the positive dairy cattle in other states is genetically almost identical to the genotype initially confirmed in cattle in Texas and Kansas (H5N1, Eurasian lineage goose/Guangdong clade 2.3.4.4b strain B3.13). Genetic analyses suggest that H5N1 had already been circulating in US dairy cattle for several months before it was detected in March 2024 and that it entered US dairy cattle following an introduction event from wild birds in the Texas Panhandle (Caserta et al., 2024, Nguyen et al., 2024).

Currently, the exact mechanism which led to the introduction of HPAI H5N1 into dairy cattle is unknown (Neumann and Kawaoka, 2024). However, laboratory studies in dairy calves and lactating cattle have shown that direct inoculation of the teats and udders with H5N1 virus produces the same clinical signs as those seen in naturally infected cattle on dairy farms (Baker et al., 2024, Halwe et al., 2024). This suggests that the initial incursion into dairy cattle may have occurred through the intramammary route, though this has not been confirmed.

On 16 April 2024, the USDA confirmed that cow-to-cow transmission is a risk factor for spread of HPAI H5N1 (USDA, 2024d). Within affected farms, spread is suspected to have occurred through indirect cattle-to-cattle transmission. This could be through contaminated milking equipment, due to the high levels of H5N1 virus detected in milk (Le Sage et al., 2024). Of the various samples tested, the highest viral loads have been detected in milk (Caserta et al., 2024), while viral markers were highest in mammary glands in post-mortem tissue samples (Kristensen et al., 2024). Furthermore, laboratory studies have shown that intramammary, but not respiratory inoculation, has been able to reproduce the clinical signs of H5N1 in dairy cattle, suggesting that milk and milking procedures are the primary routes of H5N1 transmission between cattle (Baker et al., 2024, Halwe et al., 2024).

According to the USDA's National Epidemiological Brief, the spread of H5N1 between states is linked to cattle movements, as opposed to independent wild bird introductions. However, spread from wild birds to cattle cannot be ruled-out. Spread of H5N1 between dairy cattle farms is likely due to a combination of direct and indirect transmission routes, such as movement of people, animals, equipment or vehicles (USDA, 2024b). There is no evidence of cattle-to-cattle transmission of HPAI H5N1 in germplasm products. However, transmission in semen is currently being investigated (EFSA, ECDC and EURL, 2024).

HPAI is notifiable in mammals in the USA and the interstate movement of HPAI-infected animals is prohibited under federal law. On 24 April 2024, the USDA announced a [Federal Order](#) highlighting that the detection of this distinct H5N1 virus genotype in cattle poses a new animal disease risk to cattle, as well as an increased risk to poultry. The Order introduced new control measures to monitor the current situation and mitigate against further disease spread, effective from 29 April 2024. This included mandatory testing for interstate movement of dairy cattle at an approved National Animal Health Laboratory Network (NAHLN) site. The USDA's Animal and Plant Health Inspection Service (APHIS) is providing reimbursement for testing at NAHLN-approved laboratories, including samples

submitted from dairy cattle with clinical suspicion of disease, pre-movement testing, producers who have an interest in the disease status of their asymptomatic animals and samples identified as part of tracing activities. The Federal Order also introduced mandatory reporting from laboratories and state veterinarians of positive influenza A nucleic acid detection and positive influenza A serological results in livestock to APHIS (USDA, 2024e). A [case definition](#) has been provided to assist with reporting (USDA, 2024f).

In a further effort to maximise understanding in a rapidly evolving situation, APHIS continue to publish whole genome sequence data, with data from 239 US H5N1 clade 2.3.4.4b virus samples [publicly available](#), and are urging farmers to share epidemiological information from affected farms (USDA, 2024g).

On 28 May 2024, the USDA's APHIS reported that viral particles (RNA) had been detected in a diaphragm sample from a cull dairy cow with signs of systemic disease. The sample was one of 109 muscle samples from cull dairy cattle tested for H5N1 virus as part of a survey of US slaughterhouses, undertaken in collaboration with the USDA's Food Safety Inspection Service (FSIS) and Agricultural Research Service (ARS). The affected cow was prevented from entering the food chain. In a separate study, posted on 1 May 2024, APHIS also failed to detect viral particles in ground beef samples (number not specified) collected from retail outlets in states where dairy cattle had tested positive for H5N1 virus (USDA, 2024h).

The USDA maintains that the country's meat supply is safe, with multiple safeguards in place to protect consumers, such as veterinary inspection of each animal before and after slaughter. Nevertheless, it continues to recommend safe handling and cooking of raw meat to a safe internal temperature. In a study posted on 16 May 2024, the ARS found that FSIS-recommended cooking temperatures are effective in inactivating H5N1 virus in ground beef patties inoculated with high concentrations of the virus (USDA, 2024h). To help assure the safety of the US meat supply, the USDA's FSIS will also start testing dairy cattle sent to slaughter for H5N1 virus from 16 September 2024. The USDA will work with industry to prevent any carcasses which test positive from entering the food supply (USDA, 2024i).

The FDA and USDA have indicated that the US commercial milk supply is also safe due to diversion or destruction of milk from sick cows and the pasteurisation process (FDA, 2024). Most studies available have shown that pasteurisation temperatures are capable of inactivating HPAI viruses in cow's milk, although some viral fragments may remain, which are not considered to pose a risk to human or animal health (FDA, 2024, GovCan, 2024, Schafers et al., 2024). Two recent studies have reported the presence of viable HPAI virus in cow's milk after heat treatment at 72° C for 15 seconds under laboratory conditions (Guan et al., 2024, Kaiser et al., 2024). However, these conditions are not considered comparable to industrial-scale pasteurisation processes (EFSA, ECDC and EURL, 2024, 2024). The safety of the US commercial milk supply is supported by the results of two FDA

surveys of retail pasteurised milk and dairy products, which did not detect any infectious HPAI H5N1 virus in over 400 samples collected from various states (FDA, 2024).

Implications for Great Britain

Since the start of the current global avian influenza outbreak in 2021, in Great Britain and across the world, HPAI H5N1 has been detected in multiple wild mammals and some domestic mammal species ([WOAH, 2024a, 2024b](#)).

The emergence of a strain of H5N1 capable of infecting the mammary gland of a domestic mammal is a new characteristic of this virus. However, given the global epizootic which has been occurring over the last 3 transmission seasons, this is considered a rare or undetectable event, which is made even less likely by implementing biosecurity practices and disease control measures. The full genome of the virus affecting cattle has been made publicly available (USDA, 2024g). The virus is different from H5N1 which has been circulating in Great Britain and Europe.

Other H5N1 viruses circulating in poultry and in wild birds in North America are a mixture of Eurasian strains and reassortant strains with North American low pathogenicity avian influenza (LPAI) viruses, which have been evolving independently from European viruses since 2022 (EFSA, ECDC and EURL, 2024).

While a similar event could be possible with a virus in Great Britain adapting to more mammalian livestock species, this would still be very rare and would likely require a high initial introductory dose, as well as close proximity between mammalian livestock and poultry or wild birds. Whole Genome Sequencing (WGS) of H5N1 viruses detected on poultry farms in Great Britain has taken place throughout the HPAI H5 epizootic. All pigs present on the same premises as infected poultry have been tested for avian influenza (with negative results). The avian influenza surveillance carried out to date in Great Britain and the EU gives a very high level of confidence that this strain has not been detected in Great Britain.

The most likely routes of entry of this American H5N1 virus into Great Britain are through trade in bovine products from affected farms in the USA, or by migratory wild birds. There is no trade in live cattle. There is also no evidence that HPAI H5N1 has been introduced into Great Britain by migratory birds, based on genomic analysis of outbreaks in Great Britain (UKHSA, 2024). However, there are a small number of wild bird species which migrate annually every autumn into north-western Europe from North America, typically from the north-east tundra of Canada, through Greenland, Iceland and the Faroes. These include whole populations of light-bellied brent geese which breed in north-west Greenland where they may interact with other geese species which have wintered in the mid USA, and some populations of northern wheatear, together with a small proportion of pectoral sandpipers and buff-breasted sandpipers, although the latter are rare in Europe. For these birds to bring the cattle-adapted strain of HPAI H5N1 into Great Britain it would require the HPAI virus to have entered northern Canada where these birds breed during the summer.

There is no evidence that this has occurred. Therefore, the risk of those bird species which breed in the far north of Canada being exposed is very low.

Annual bird migration from the USA itself east-west across the Atlantic Ocean into northern Europe does not occur, with most migrations in the Americas being between North and South America through Central America and the Caribbean. This is partly because of the distances involved in crossing the Atlantic but more because birds want to move from high northerly latitudes where they breed in the Arctic summer to more southerly latitudes where the day lengths are longer and it is warmer in the winter. Generally, bird species do not enter north-west Europe directly from the USA across the Atlantic. However, during the annual migration of wild birds from North America south through the Caribbean in August, September and even October, the autumn hurricanes in the Caribbean, together with a strong jet stream, could blow birds migrating south down the Eastern seaboard of the USA in a north-west direction and across the Atlantic into Ireland and even the western parts of Great Britain. Most of the birds blown off course end up in the Atlantic Ocean. However, a small proportion make it to the more westerly points of Great Britain, including the Isles of Scilly, the Western Isles and west Wales, albeit in very small numbers and in a completely unpredictable manner. However, this is considered rare and considering the low likelihood that individual birds from the USA are infected, the likelihood of their bringing HPAI into north-western Europe directly from the USA is very low.

HPAI has been translocated to North America from Europe on at least 2 occasions over the last 2 years by infected migratory wild birds from Europe mixing with migratory birds from North America in Greenland (Caliendo et al., 2022). HPAI H5N1 has also entered Canada by the Pacific flyway (Alkie et al., 2022), although this is of less relevance to Europe. Analysis of wild bird migration suggests HPAI H5N1 could have been carried across the Atlantic to eastern Canada through Iceland, Greenland and Arctic or pelagic routes (Caliendo et al., 2022). It is plausible that great skuas in autumn 2021 could have carried HPAI H5N1 from their breeding sites on the Faroes to the eastern tip of Newfoundland in Canada where they winter. However, the return route in the spring from eastern Canada is not such a plausible route of reintroduction of H5N1 from North America to the Faroes in northern Europe because the returning seabirds in spring have been dispersed over the winter, unlike when on their breeding sites in the summer. Those seabirds that breed in Great Britain (including Shetlands and Western Isles) typically winter off the coast of west Africa or the Biscay and not the east coast of Canada or the USA. Additionally, detections of HPAI H5N1 in poultry in the USA and Canada have slowed, with approximately 8 commercial poultry outbreaks per month from May to July 2024, with none so far in August 2024 (to 20 August 2024), and approximately 5 backyard poultry outbreaks per month in the same period, with 1 so far in August 2024 (to 20 August 2024) (USDA 2024a). The key point is that not only is the prevalence of HPAI in poultry in the USA currently (August 2024) relatively low and greatly reduced since the November 2023 peaks (USDA 2024a), suggesting an overall reduction in the wild bird infection

pressure, but also there is no direct route from the USA to northern Europe across the Atlantic. Therefore, it is considered that the likelihood of introduction of this genotype to Great Britain through wild birds is **very low**.

The USA is approved for the export to Great Britain of raw milk and raw milk products for human consumption, as they are listed in Column A of the Third Country list (Gov.uk, 2024a). The H5N1 virus affecting dairy herds in the USA has been shown to be shed in milk in high concentrations, where it may remain infectious unless the milk is pasteurised (EFSA, ECDC and EURL, 2024). Therefore, the virus could enter Great Britain through importation of unpasteurised dairy products from affected farms in the USA. However, according to IPAFFs data, most dairy products from the USA are pasteurised, such as cheese and whey, along with smaller amounts of yogurt, condensed milk and dairy spreads (UK Office for SPS Trade Assurance, personal communication, 2024). In accordance with the relevant import health certificate requirements (GBHC583), milk and milk products not for human consumption must be subject to at least high temperature short time (HTST) pasteurisation, which has been shown to inactivate the virus (FDA, 2024, GovCan, 2024, Gov.uk, 2024b, Schafers et al., 2024).

Since our previous report on 25 April 2024, there has been no increase in the trade of commodities likely to pose the greatest risk in terms of HPAI H5N1 virus introduction from any of the 13 affected US states, including raw milk, raw dairy products, colostrum and colostrum-based products, according to IPAFFs data. Between 1 April and 9 July 2024, 2 consignments of raw milk (totalling 8 kg) were imported from the USA and 11 consignments of colostrum (totalling 17,578 kg). However, neither of the raw milk consignments and only 1 of the colostrum consignments (266 kg from Texas) were imported from states which have reported HPAI H5N1 in dairy cattle as of 15 August 2024. The use of milk powder as a semen extender for artificial breeding is being investigated.

Although it may be common practice in many parts of the world (including the USA) to use poultry litter as feed, this is not the case in Great Britain. Therefore, this does not represent a likely route of exposure of dairy cattle to HPAI H5N1 virus. Under Great Britain's Animal By-Product (ABP) Regulations, manure is not permitted to be used as bedding, unless it can be shown not to pose an unacceptable risk to public or animal health (Assimilated Regulation 1069/2009). The import of unprocessed manure is also prohibited under the ABP Regulations, while processed manure imports would need to comply fully with the health certificate requirements contained in [GBHC550 \(Gov.uk, 2024c\)](#).

HPAI H5N1 may be transmitted through fomites, such as contaminated equipment, vehicles and clothing (USDA, 2024b). However, assuming that proper biosecurity practices are followed, it is considered highly unlikely that any contaminated equipment, such as milking equipment, is entering and being utilised on farms in Great Britain. Evidence of viral persistence for several hours on milking equipment under experimental conditions suggests it is a viable route for indirect transmission (Le Sage et al., 2024). However,

given the travel times between the US and Great Britain, it is unlikely that any virus would persist on used milking equipment being imported.

To date, no import restrictions on animal products or ABPs from the USA to Great Britain have been implemented in response to the outbreaks of HPAI H5N1 virus in dairy cattle. However, the situation is being monitored by the UK Office for SPS Trade Assurance and restrictions will be implemented if necessary.

The movement of people between dairy farms was highlighted as a potential risk factor in the US outbreaks (USDA, 2024b). While most tourists would be unlikely to visit dairy farms either in the US or Great Britain, there may be visits undertaken by professionals or veterinary students on extra-mural studies, who may return to Great Britain. Guidance is being provided to avoid any contact with the dairy sector.

Conclusion

Available trade data shows that only a small proportion of consignments of dairy products could contain H5N1 virus. Given the low prevalence of disease in dairy cattle in the USA so far, it is very unlikely that these would come from infected farms. Additionally, the mitigation measures that are currently in place in the USA, along with the mandatory testing and reporting which have been implemented will reduce this likelihood further. Migratory birds could be a potential indirect route of introduction of this H5N1 virus into Great Britain, although the likelihood of this is considered very low. Therefore, the overall likelihood of entry of H5N1 virus capable of infecting domestic livestock is **very low**.

There are always concerns around infected products entering Great Britain in passenger luggage and the subsequent waste being discarded in areas where livestock or wildlife could access them. We would like to highlight to all cattle keepers, dairy producers, smallholders and members of the public that it is illegal to feed cattle catering waste, kitchen scraps or dairy products, and to adhere to the swill feeding ban. All dairy keepers should remain vigilant and ensure that any visitors to their premises have not had any recent contact with dairy cattle or cattle premises in the affected regions in USA. People who have been working on farms or with animals returning from any affected areas should avoid any contact with domestic cattle or domestic poultry in commercial holdings and smallholdings. All clothing, footwear or equipment should be cleansed and disinfected before entering dairy cattle or other livestock areas.

Any suspect cases must be reported promptly. Clinical signs may include a decrease in feed consumption, with a decrease in rumination and rumen motility and subsequent acute drop in milk production. Severely affected cattle may have thicker, concentrated, colostrum-like milk or produce no milk at all. Others may include abnormal tacky or loose faeces, lethargy, dehydration, fever, and respiratory signs, such as nasal discharge. Other non-avian species may exhibit respiratory or neurological signs (Caserta et al., 2024, USDA, 2024f).

If you suspect a notifiable disease in your animals, you must report it immediately by calling the Defra Rural Services Helpline on 03000 200 301. In Wales, call 0300 303 8268. In Scotland, contact your local Field Services Office. Failure to do so is an offence. We will continue to monitor the situation.

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