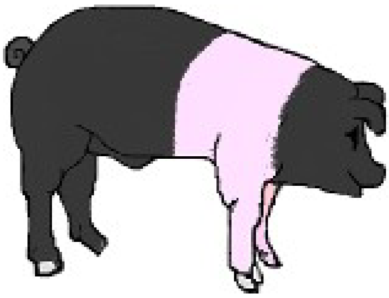
Animal & Plant Health Agency



SRUC

Great Britain pig quarterly report: disease surveillance and emerging threats

Volume 26: Quarter 3 of 2022 (July to September)

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Introduction and overview

This quarterly report reviews disease trends and disease threats for the third quarter of 2022, July to September. It contains analyses carried out on disease data gathered from APHA, Scotland's Rural College (SRUC) Veterinary Services and partner post-mortem providers and intelligence gathered through the Pig Expert Group networks.

In addition, links to other sources of information including reports from other parts of theAPHA and Defra agencies are included. A full explanation of how data is analysed is provided in the annexe available on GOV.UK.

Pig disease surveillance dashboard outputs

Diagnoses made in the third quarter of 2022 compared to the same quarter in 2021 through the Great Britain (England, Wales and Scotland) scanning surveillance networkare illustrated in table 1. These can be interrogated further using the interactive pig disease surveillance dashboard which was launched in October 2017.

Table 1: Great Britain scanning surveillance 15 most frequent diagnoses in quarter 3 of 2022 and quarter 3 of 2021

15 most frequent diagnoses quarter 3 of 2022 (total 242)	15 most frequent diagnoses quarter 3 of 2021 (total 329)
1. *Lawsonia sp*. associated disease	1. Salmonellosis – *S*. Typhimurium
2. Salmonellosis – *S*. Typhimurium	2. Colibacillosis - enteric
3. Colibacillosis - enteric	3. PRRS - pneumonia
4. Brachyspira pilosicoli	4. Rotavirus
5. Porcine reproductive and respiratory syndrome (PRRS) - pneumonia	5. Brachyspira pilosicoli
6. PRRS - systemic	6. Streptococcus suis disease
7. Streptococcal meningitis	7. *Lawsonia* sp. associated disease
8. M. hyopneumoniae pneumonia	8. PRRS - systemic
9. Rotavirus	9. Colibacillosis – oedema disease
10. Streptococcus suis disease	10. Salmonellosis – other serotype
11. Intestinal torsion	11. Erysipelas
12. *B. hyodysenteriae* – swine dysentery	12. Intestinal torsion
13. Glaesserella parasuis disease	13. Pasteurella multocida pneumonia
14. Pasteurella multocida pneumonia	14. Actinobacillus pleuropneumoniae pneumonia
15. Salmonellosis – other serotype	15. Swine influenza

Note: that further diagnoses may be added for records for submissions made in quarter 3of 2022 which are finalised at a later date.

Figures 1a to 1d: summary data for 392 submission records in quarter 3 of 2022 (477 in quarter 3 of 2021)

Figure 1a: pig age

Age Category	
Adult	63
Mixed	3
Neonatal	17
Postwean	206
Prewean	31
Unknown/other	72

Figure 1b: disease syndrome

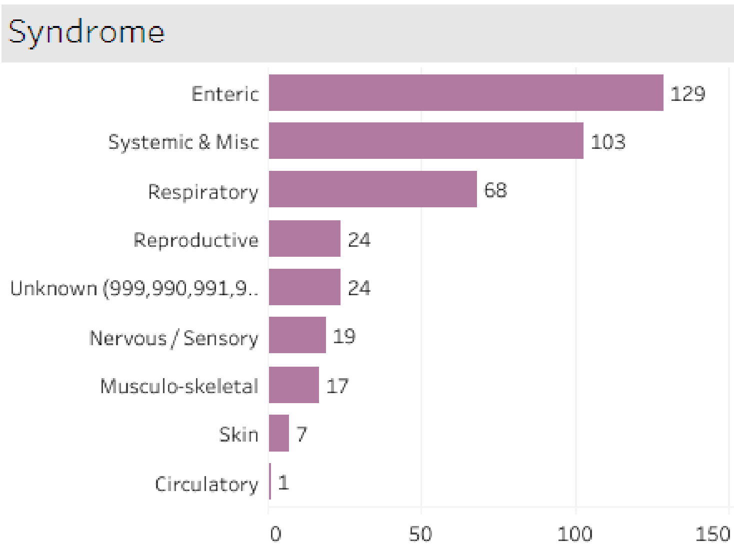


Figure 1c: submission type

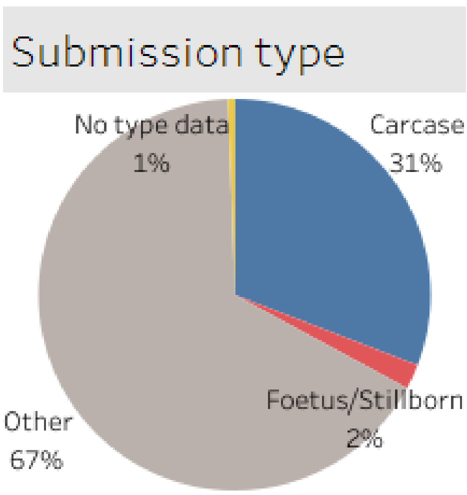
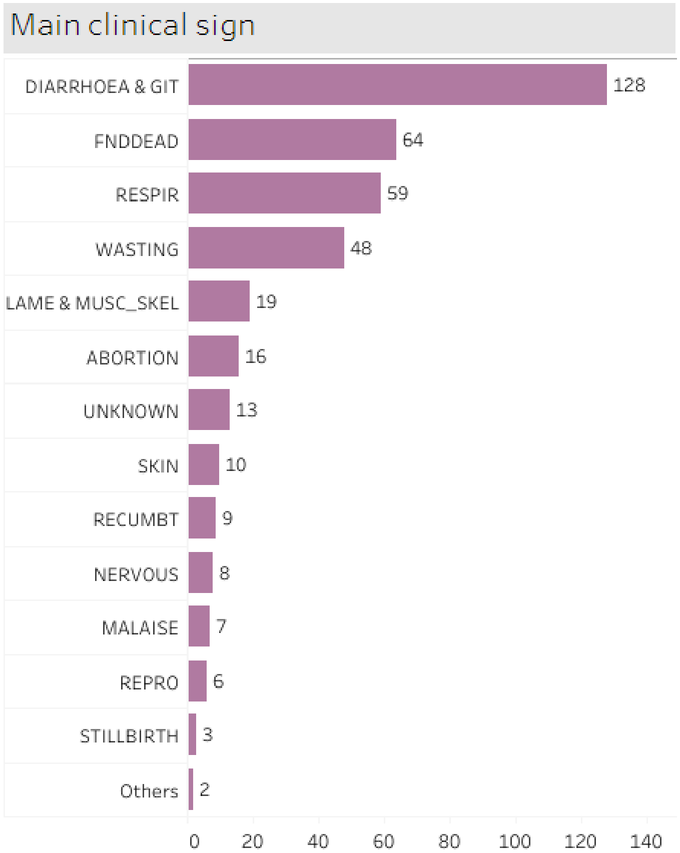


Figure 1d: main clinical sign reported



These diagnostic submissions are voluntary and subject to several sources of bias. The profile of submissions for the third quarter of 2022 was similar to that of the same quarter of 2021 in that the most frequent main clinical sign was diarrhoea and gastro-intestinal, and the most frequent syndrome in quarters 3 of 2021 and 2022 was enteric.

However, total Great Britain diagnostic submission records for quarter 3 of 2022 were lower than the total for the same quarter in 2021, with lower numbers of carcase submissions to both APHA and SRUC. The balance of submission types also changed from being 42% carcases in quarter 3 of 2021 to 29% carcases in quarter 3 of 2022. These changes in balance and numbers affect the number of diagnoses achieved as carcases enable full diagnostic investigation. They can also affect the diagnoses made as submission of non-carcase samples is a more reasonable means of investigating enteric disease than non-carcase samples for investigation of some other disease syndromes. Enteric diagnoses represent four of the top five most frequent diagnoses made in quarter 3 of 2022. Four of the five most frequent diagnoses in quarter 3 of 2022 were also in the top five diagnoses in quarter 3 of 2021, albeit in different order of frequency (table 1), namely salmonellosis due to *Salmonella* Typhimurium, enteric colibacillosis, *Brachyspira pilosicoli* and pneumonia due to porcine reproductive and respiratory syndrome (PRRS).

The reduced carcase submissions continue the trend noted in the previous quarter 2 of 2022 (APHA, 2022a). Discussion with pig veterinary and industry representatives suggest that the continued reduction of submissions, at least in part, reflects the financial and resource pressures that pig producers are facing. Factors mentioned include that pig prices have not met the cost of production for a prolonged period, higher pig feed and fuel prices, retained older sows for breeding due to poor cull sow prices, the challenges of recent hot weather and increased demand for feed ingredients from other livestock sectors. The reduction in the national breeding sow population in recent months is also resulting in a fall in the growing pig population and postweaned pigs from which most diagnostic submissions derive.

New and re-emerging diseases and threats

African swine fever summary

Updated assessments continue to be published on African swine fever (ASF) on GOV.UK.

The latest updates on the ASF situation in Europe was issued in July 2022. Figures 2 and 3 show cases reported to World Organisation for Animal Health (WOAH) from May to 7 November 2022 in domestic pigs and wild boar respectively.

ASF continues to be seen in domestic pigs in ASF-affected countries across Europe however there have not been further major geographical jumps into previously unaffected areas since two domestic pig farms were affected in Germany close to the borders of the Netherlands and France in July and May 2022 respectively. Those outbreaks have resolved and no wild boar cases were detected through surveillance around these two premises. Human-mediated spread was strongly suspected. A total of seven outbreaks have been detected in domestic pigs in Germany since 2020. Mainland Italy has not reported further domestic pig outbreaks.

The wild boar ASF cases reported from Europe to WOAH in August to 7 November 2022 are listed in Table 2. Generally lower numbers of cases were reported in Eastern Europe than in recent years.

Table 2: Wild boar ASF cases reported to WOAH from Europe August to 7 November 2022

Country	Aug	Sept	Oct	Nov	Total
Germany	25	2	15		42
Hungary	27	13	15		55
Italy	10	2	3	2	17
Latvia	92	88	72	26	278
Moldova	1				1
Poland	64	102	115	41	322
Republic of North Macedonia			1		1
Romania	9	17	20	6	52
Russia	12	5	6	1	24
Totals	240	229	247	76	792

Figure 2: ASF reports for domestic pigs in Europe for May to 7 November 2022 WOAH data only (mapped 7 November 2022)

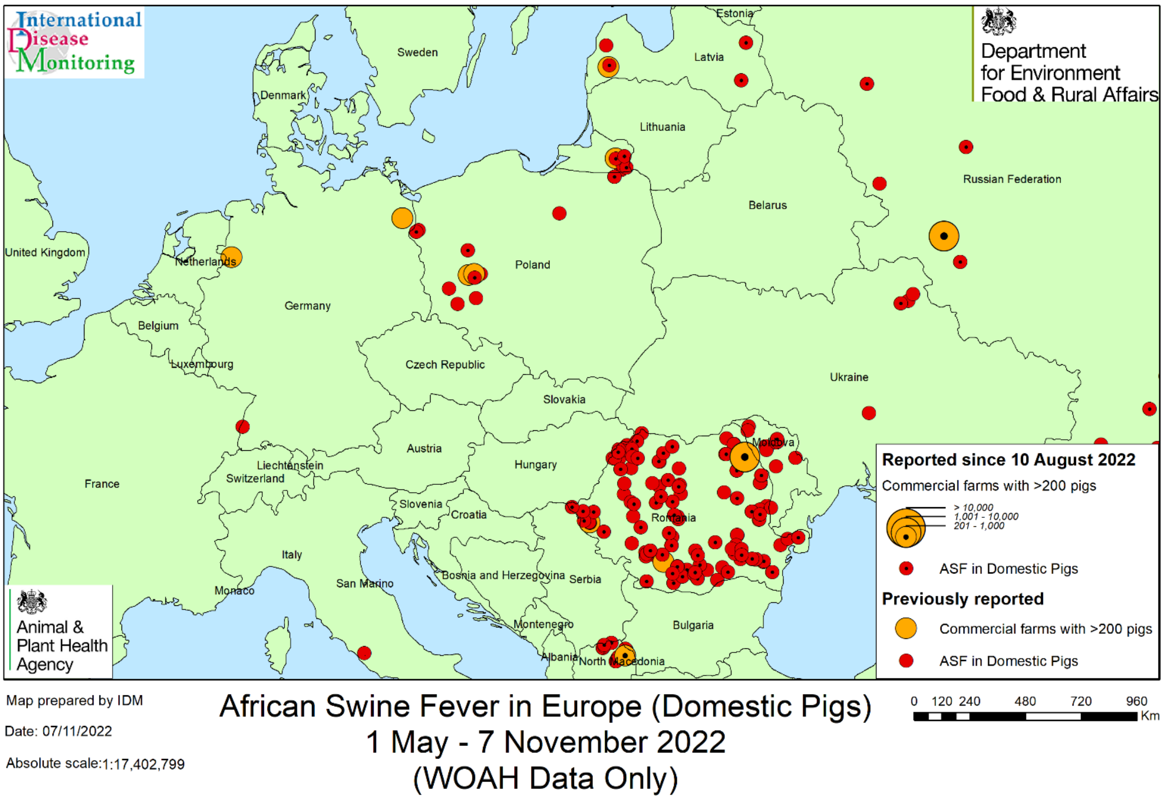
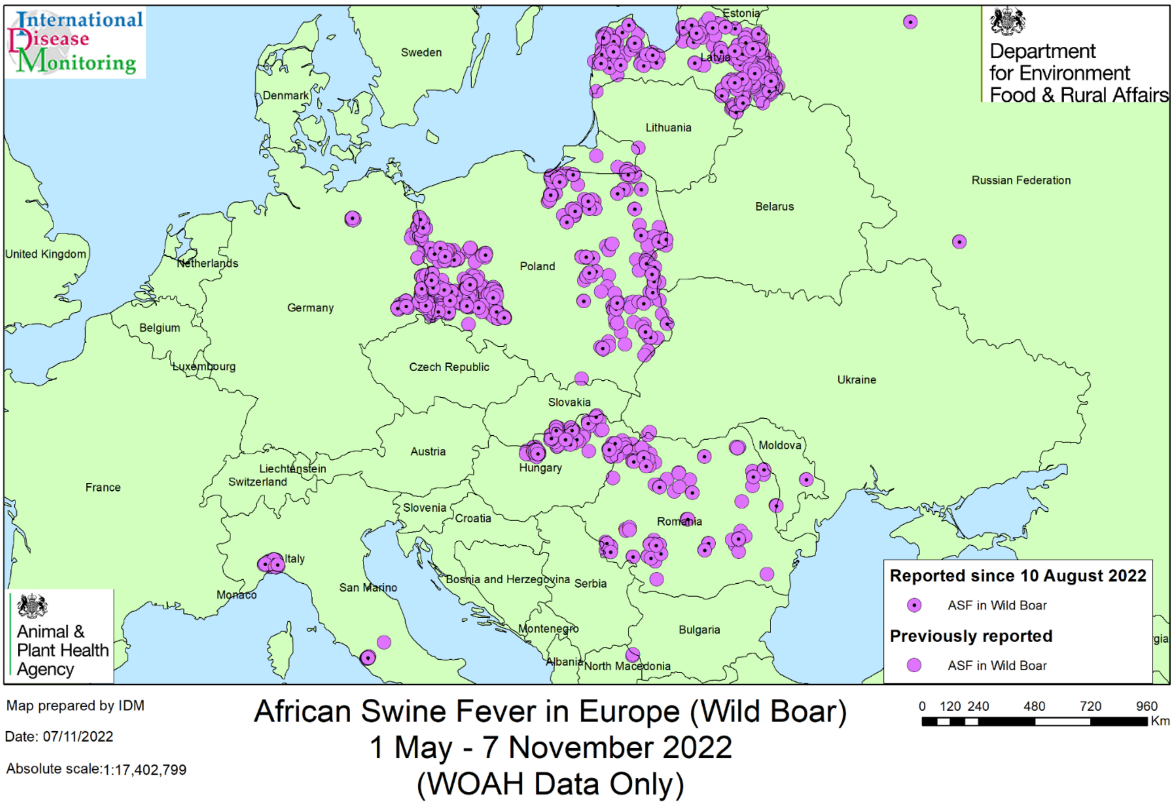


Figure 3: ASF reports for wild boar in Europe for May to 7 November 2022 – WOAH data only (mapped 7 November 2022)



Maps showing information on the European Union (EU) ASF restriction zones are available.

No new updates on the ASF situation in the Caribbean were issued by IDM since the previous IDM report in September 2021. The Dominican Republic (DR) and Haiti continue to report ASF cases in domestic pigs. The United States Department of Agriculture's (USDA) Animal and Plant Health Inspection Service (APHIS) has increased its input into raising local ASF disease awareness, and ASF surveillance and is assisting with feral pig control in the region.

Concerns about whether ASF or Classical swine fever were involved in pigs dying with respiratory disease in Ecuador were allayed by a Promed post (2022a) indicating that testing for the swine fever viruses had ruled both out.

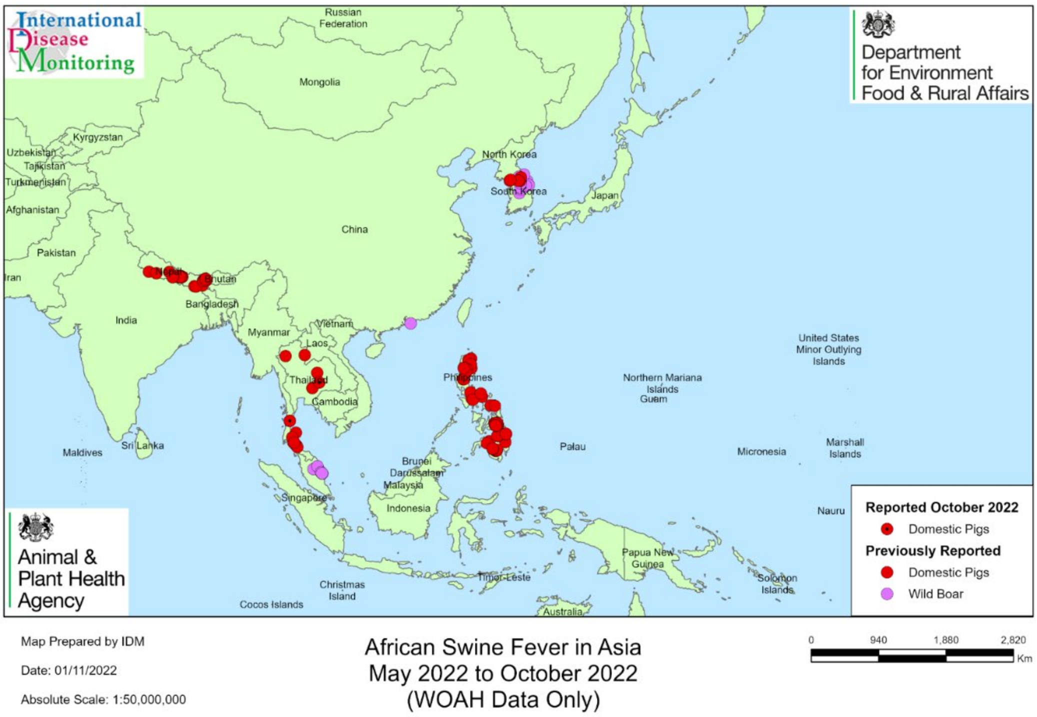
No further updates on the ASF situation in Asia have been issued by IDM since January 2022.

Monthly IDM summaries are also included in the disease surveillance items in the Veterinary Record https://www.gov.uk/government/publications/apha-disease-surveillance-monthly-reports/monthly-apha-animal-disease-surveillance-reports

The Swine Health Information Centre (SHIC) global reports include a round-up of ASF each month and the November report provided country by country updates for Asia. The September report referred to a halt to the deployment of the first commercial ASF vaccine which was approved for use in Vietnam. This was prompted by the death of apparently healthy pigs after vaccination. According to an industry media report, an official investigation into the pig deaths has indicated that they were the result of uncontrolled vaccination procedures which were not compliant with Ministry guidelines, at incorrect pig ages and dosages. Ministry officials intend to expand ASF vaccination under supervision to evaluate effectiveness of the vaccine.

ASF continues to cause domestic pig outbreaks in the region as illustrated in Figure 4, showing cases reported to WOAH from May to 1 November 2022.

Figure 4: ASF cases reported in Asia from May to October 2022 – WOAH data only (mapped 1 November 2022)



Of note are informal reports of spread of ASF within India from north to south with infection detected in both domestic and wild pigs. Thailand has reported two outbreaks in domestic pigs to WOAH following a period of four months with no outbreaks reported. Nepal has also reported outbreaks. In October 2022, ASF cases were reported in the Philippines with the west region now also experiencing outbreaks.

Amongst recent publications on ASF is a publication from China on ASF transmission, prevention and control (Liu and others, 2022) which details strategies for dealing with ASF epidemics. The various sources of infection and transmission routes for ASF are reviewed.

A paper from the United States (US) by Pepin and others (2022) informs how to optimise the response to ASF introduction in wild pigs. This is a concern in the US where feral pigs are numerous and found in different ecological situations across the country. A disease transmission model contrasting wild pig movement and contact ecology was developed based on two ecosystems in Southeastern US. This determined that response areas usually need to be of large radius of 14km but early detection of introduction or high culling rates could allow this to be reduced. The model predicted elimination of ASF under most conditions within a year, or less in some situations.

Malladi and others (2022) described application of a transmission model to assist in understanding ASF virus transmission dynamics within a herd. Their results suggest that it may take two weeks or more to detect ASF in a finisher pig herd based on clinical signs or increased mortality above baseline levels occurring as part of the herd's usual pig production. This aligns with the work of Guinat and others (2018) which suggested that ASFV could be circulating in a herd for several weeks before a substantial increase in mortality occurred in a herd, based on data from outbreaks in Russia. Such information is vital when raising awareness amongst pig producers and veterinarians, as well as for disease preparedness and targeting of surveillance.

A feed industry publication raised awareness of research on pig feed and feed ingredients as a risk pathway for ASF and other notifiable or exotic viruses to new countries and summarised some of the mitigations that can be applied to reduce the risk (Ioannis Mavromichalis, 2022).

On 1 September 2021, new controls were introduced restricting the movement of pork and pork products into Great Britain from the EU and European Free Trade Association States. It is no longer legal to personally import pork or pork products weighing over two kilograms, unless they are produced to the EU's commercial standards. Information about an operation at Dover port was reported in Pig World. Around 2.5 tonnes of non-compliant pork were seized in this operation at the start of October. Illegal pork products greater than 2kg were found in 21 vehicles from Romania, Moldova, Poland and Ukraine, all of which are countries affected by ASF. Much of it was in carrier bags or other unsuitable packaging, and often leaking. Raw pork was mixed with other ready-to-eat food products. These types of imports pose a risk to both public and animal health and this operation has raised awareness of the extent of such attempted imports and the new controls.

The mission of Global ASF Research Alliance (GARA) is to establish and sustain global research partnerships that will generate scientific knowledge and tools to contribute to the successful prevention, control and, where feasible, eradication of ASF. Their news and activities are accessible on the GARA website.

Information on ASF is disseminated to veterinary practices and Pig Veterinary Society members. The assistance of veterinary practitioners in raising awareness about ASF amongst their pig-keeping clients in the UK is vital, together with advising them on resolving biosecurity weaknesses to reduce the risk of introduction.

The biggest risk for ASF virus entering the UK's pig population continues to be pigs or wildboar eating pork or pork products derived from infected animals. ASFV can survive for months in smoked, dried and cured meats, and for years in frozen meat.

Meat and meat products brought into the UK from affected countries as personal imports and illegal imports represent the most significant risk of introduction of exotic notifiable diseases including ASF, Classical swine fever and foot and mouth disease (FMD), the commercial trade of such products is not permitted from ASF-affected areas. The Government announced new restrictions on the movement of pork and pork products into Great Britain to help safeguard pigs from the threat of ASF. These came into force from 1 September 2022 and mean it is no longer legal to bring non-commercial pork or pork products weighing over two kilograms in from EU member states and European Free Trade Association states unless they are produced to the EU's commercial standards. This does not apply to commercial imports. It remains illegal to trade in pork or wild boar meat from ASF-affected areas or to bring in meat products from Asia or Africa.

AHDB Pork and the British Pig Association teamed up this summer to deliver information about alternatives to compound feed for pig keepers with non-commercial pigs to assist in trying to reduce feed costs while ensuring the health of their pigs is maintained and they do not breach any legislation. The webinar is available here: AHDB Feed Seminar.

Pig keepers are reminded that it is illegal to feed pigs catering, kitchen or domestic waste, or meat or meat products. Providing dedicated clothing and boots for staff and visitors, limiting visitors to a minimum, and preventing outside vehicles or equipment which may be contaminated from coming on to the farm, are also all valuable procedures to reinforce. Images of the clinical signs and pathology of ASF are available. Suspect cases must be reported promptly to APHA and this is followed by an official veterinary investigation.

Porcine epidemic diarrhoea surveillance

Porcine Epidemic Diarrhoea (PED) due to any PED virus strain remains notifiable in England and Scotland and suspicion of disease, or confirmation of infection, must be reported (Defra, 2015 and Scottish Government, 2016). The last diagnosis of PED recorded in the Great Britain diagnostic database (VIDA) was in 2002 on a farm in England. No more suspect incidents of PED have been reported since the case in May 2022 on a small pig premises in England in which PED was ruled out and iron deficiency anaemia was diagnosed.

Enhanced surveillance for PED continues and diagnostic submissions from cases of diarrhoea in pigs (non-suspect) submitted to APHA are routinely tested by PCR for PED virus (PEDV) and transmissible gastroenteritis virus (TGEV) on a weekly basis. None have been positive for PED in over 1,400 diagnostic submissions tested under Agriculture and Horticulture Development Board (AHDB) Pork funding from June 2013 to September 2022. This routine diagnostic PCR testing is to be extended to include porcine deltacoronavirus under the same funding, veterinary practitioners will be informed of the added testing when it is implemented.

Detection of Seneca Valley Virus in pigs in England

Vesicular disease due to Seneca Valley virus has been confirmed on five commercial breeding pig premises in one geographical area of England between June and September 2022.

Disease was first reported to the Animal and Plant Health Agency (APHA) as suspect notifiable vesicular disease and official investigations with testing at The Pirbright Institute ruled out notifiable diseases, namely foot-and-mouth disease (FMD), swine vesicular disease and vesicular stomatitis.

The Pirbright Institute is the National Reference Laboratory for vesicular diseases and also acts as the World Reference Laboratory for foot-and-mouth disease. Samples from vesicular lesions collected from affected pigs for the official notifiable disease investigations tested positive by RT-PCR for Seneca Valley virus (SVV) confirming the presence of this virus for the first time in pigs in England.

Clinical cases of SVV infection were characterised by lameness with associated vesicular lesions (Figures 5a and 5b) of short duration in adult pigs, particularly sows which were recently weaned and served. Evidence of SVV infection has also been found in breeding and growing pigs without clinical signs. Epidemic neonatal transient mortality associated with SVV infection in neonatal piglets which has been described in the US has not been a feature in affected herds.

Figures 5a and 1b: recently ruptured coronary band vesicles due to SVV

5a

5b

Full genome sequencing used to characterise the SVVs in these herds shows that they form two distinct clusters, sharing a common ancestor with an SVV strain from the United States identified as SVV/USA/TN/NADC6/2020 (Genbank: MZ733975).

Pig producers and vets are aware of the need to promptly report signs of vesicular disease in pigs to APHA for official investigation and to maintain high biosecurity standards to minimise the risk of disease introduction.

The detection of these SVV cases reinforces the value of passive surveillance for notifiable vesicular disease with pig keepers or vets detecting and reporting suspect lesions promptly. This surveillance operates on pig-keeping premises, in transport and at the abattoir and detection of vesicular disease at any stage is reported as suspect notifiable disease for official investigation. Guidance on reporting notifiable vesicular disease is provided here: https://www.gov.uk/guidance/foot-and-mouth-disease.

SVV is not notifiable or reportable in the UK and is not a disease listed by the World Organisation of Animal Health (WOAH). It is not known to readily affect other livestock species. The virus is generally accepted to be incapable of causing disease in humans and there is no record of SVV causing human disease. Risk assessment by the Food Standards Agency concludes that the risk to humans through the consumption of infected meat or product is negligible. The main concern relating to SVV is that it resembles notifiable vesicular diseases, in particular FMD.

SVV has not been detected by RT-PCR in feed and soya bean meal samples available from feed batches fed to sows prior to clinical signs developing. Boars supplying semen to affected herds have also been tested for SVV infection with negative results and affected herds had not imported pigs. The timing and means by which SVV was introduced into the UK has not yet been determined and investigations continue.

It is of note that a publication by US authors reported an unidentified country (not the UK) having its first outbreaks of SVV in July 2022 and confirming association with detection of SVV in soya bean meal imported from a country (not identified) with endemic SVV that was fed to affected pigs (Dee and others, 2022). Chile also recently reported vesicular disease due to SVV occurring in April 2022 for the first time (Bennett, and others, 2022).

A letter to the Veterinary Record and publication on the detection of SVV in pigs in England are in preparation. A presentation on vesicular diseases of pigs was given at the Pig Veterinary Society 2022 autumn conference in November as a refresher for veterinarians.

More facts about SVV are provided below and in references reviewing information on this virus (Houston and others, 2020; Buckley and others, 2022).

Key Facts about Seneca Valley Virus

Seneca Valley virus (SVV), also known as Senecavirus A is a picornavirus of pigs which was initially isolated from pigs in the United States (US) in 1988 and was later identified as a cell culture contaminant in the US.

SVV was identified in US pigs with vesicular lesions sporadically prior to 2015. In 2014 and 15, outbreaks of vesicular disease due to SVV emerged in pig herds across Brazil and, from July 2015, outbreaks occurred in pigs in the US also. The virus was later found to have been circulating silently in US pigs since at least 1988.

Vesicular disease in pigs due to SVV has been described in the US, Canada, Brazil, Colombia, China, Thailand, Vietnam, Chile and the United Kingdom. There are no vaccines available for SVV.

Human disease has not been associated with SVV infection, and naturally occurring infection of humans is not thought to occur.

SVV is not a notifiable disease and is not listed by World Organisation for Animal Health (WOAH formerly the OIE). It is not known to readily affect other livestock species. Current information suggests that there is limited production loss in affected herds; disease is relatively mild and of short duration. Piglet mortality may occur but, in other countries, has been transient.

The main concern around SVV is its clinical resemblance to vesicular notifiable diseases such as foot-and-mouth disease (FMD), swine vesicular disease and vesicular stomatitis. Lameness and vesicular (blister) lesions which rapidly rupture are seen, similar to those in foot-and-mouth disease. The lameness may affect one or all four feet. Foot lesions are more obvious than those on the snout or lips and involve the coronary bands of the hooves and accessory digits, and/or interdigital spaces. Ruptured lesions can form erosions and deep ulcerations that heal within about two weeks. Deep nail bed haemorrhages visible on the hooves may also be present.

A key message to pig keepers and vets is that they must report any clinical signs of vesicular disease promptly for official investigation which enables notifiable vesicular diseases to be ruled out by testing.

It remains unclear how the virus enters the pig population in new countries and naïve herds. Therefore, stringent application of well-established biosecurity practices is recommended and will also help reduce the risk of introduction of other exotic diseases, such as African swine fever, and of endemic diseases, such as porcine reproductive and respiratory syndrome.

Facts are limited on SVV epidemiology and transmission, but direct routes (infected pig to another pig) and indirect routes (through secretions or faeces of infected pigs, and anything contaminated with them) are likely. The role of contaminated feed ingredients, infected semen, meat from infected pigs, or other methods of transmission play in the source and spread of disease is poorly documented. Therefore, although some transmission routes have not yet been proven for SVV, a range of potential transmission pathways should be considered likely to exist. Infection of mice and houseflies with SVV has been reported in the literature. SVV has also been detected in environmental samples suggesting that persistence in the environment could occur.

The efficacy of most disinfectants against SVV is not known. Disinfectants at General Orders rate are recommended. FAM30 at the General Orders rate is likely to be suitable. There is information in this US factsheet: https://www.cfsph.iastate.edu/pdf/shic-factsheet-senecavirus-a

A diagnostic PCR test is available at the UK National Reference Laboratory at The Pirbright Institute and a serological test for antibodies has been established.

Advice to pig farmers

Pig keepers should inspect their pigs at least once a day and be vigilant for lameness

and foot or snout/mouth lesions. Pigs should be observed moving to be able to detect lameness as they may appear otherwise healthy. Inspection of lame pigs may require the feet to be washed to inspect the coronary band properly especially in wet conditions or where wallows are present. Snout lesions are more transient and may be harder to see in an outdoor setting.

Where several pigs develop lameness over a short period of time with coronary band foot lesions, these should be reported to APHA as suspect FMD/vesicular disease even if the vesicular stage is not seen, and no snout or mouth lesions are visible.

It is vital that any vesicular disease in pigs is reported immediately to APHA for official investigation to rule out notifiable disease.

How to report: **https://www.gov.uk/guidance/foot-and-mouth-disease**

Pig keepers are advised to:

- Urgently review their biosecurity measures and address any weaknesses, minimising movements of vehicles, people or equipment onto pig units
- Control rodents, flies and as far as possible, wild birds:https://ahdb.org.uk/knowledge-library/biosecurity-on-pig-farms
- Isolate incoming pigs away from the resident herd for at least one month
- Source their pig food or ingredients from reputable pig feed companies and never feed kitchen or catering waste or meat to pigs
- Follow the National Pig Association import protocol if importing live pigs:http://www.npa-uk.org.uk/hres/NPA%20imports%20protocol%20Feb%202019

This advice applies to all pig keepers, no matter how many pigs they own. Pig keepers and the public are also reminded that it is illegal to feed pigs meat or meat products, and kitchen or catering waste. Doing so endangers the health of the pigs and risks introducing exotic diseases, such as foot-and-mouth disease or African swine fever, into the country.

Unusual diagnoses or presentations

Ocular lesions due to multicentric lymphoma

Unusual bilateral marked conjunctival swelling (Figure 6) and unilateral microphthalmia were found affecting one of three twelve-week-old commercial pigs submitted to the Bury St Edmunds Veterinary Investigation Centre (VIC). Both of this pig’s kidneys had numerous raised pale pink nodules in the cortex measuring 0.5 to 1cm and showing a homogenous pale pink appearance on the cut surface; the bladder mucosa was diffusely thickened. The renal lesions raised the possibility of neoplasia. Histopathology revealed changes throughout the organ systems consistent with a multicentric lymphoma with symmetrical involvement of the eyes leading to phthisis bulbi in one. Lymphoma is considered to be the most common neoplasm in pigs. They are commonly B-cell lymphomas and half of cases with a multicentric presentation occur in animals between three and six months of age. Ocular metastasis as seen in this pig, has been described previously in other species, most frequently in dogs, followed by cats and cattle. Additional changes to the eyes (ulcerative keratitis) were also detected likely secondary to the entropion in the shrunken eye, and neoplasia in the other. Immunohistochemistry indicated the lymphoma to be primary a B-cell tumour which correlates with what is described in the bibliography for systemic lymphomas in pigs.

Figure 6: Conjunctival bulging and tear staining due to lymphoma

Figure 7: ***Chimonanthus praecox*** **("wintersweet") – cause of a plant toxicity incident in pigs**

Nervous disease due to plant poisoning

The APHA partner post-mortem provider service at University of Bristol diagnosed an unusual case of plant poisoning in pigs due to a non-native garden plant, *Chimonanthus praecox* ("wintersweet") illustrated in Figure 7. Three pigs in a small pig herd developed nervous signs: two were found in lateral recumbency in the morning, with subnormal temperatures, sunken eyes, dilated pupils, hyperaesthesia and tonic seizures with vocalisation. One died and was submitted for post-mortem examination, the other recovered with supportive veterinary treatment and provision of water and feed by hand. The third to be affected was a sow which died after showing a short period of clinical signs starting as ataxia and progressing to hyperaesthesia, panting, pyrexia (41.5°C), inability to drink although motivated to go to water and seizures when stressed. Initial concerns were of water deprivation as the water container had been emptied overnight, although nervous signs in water deprivation tend to be depressive and the clinical signs in this case were more excitatory in nature. The attending veterinary surgeon reported that the pigs had accessed the leaves and fruits of a garden plant the previous day. The plant's identity was confirmed by Greg Redwood, Head of Glasshouse Collections at the Royal Botanic Gardens, Kew and has anticholinergic toxic effects consistent with the clinical signs that occurred. Toxicity due to this plant was confirmed after laboratory testing, including histopathology which ruled out water deprivation and did not detect an alternative cause. Leaves confirmed as being consistent with *Chimonanthus* species were found in the pig's stomach. Toxin is particularly found in the leaves and fruits. A case report of toxicity in goats due to this plant describes signs very similar to those reported in the pigs (Numan et al 2016).

Payne and Murphy published a review on plant poisoning in farm animals (2014) and included several that have been identified in pigs, the most common being bracken which causes acute heart failure with lung oedema and body cavity effusions, more information is provided here: http://apha.defra.gov.uk/documents/surveillance/diseases/bracken-poisoning-pigs.pdf

Both these unusual diagnoses were described in the APHA October surveillance report in the Veterinary Record (APHA, 2022b).

Changes in disease patterns and risk factors

Swine influenza strain H1huN1pdm detected in pigs in England

A reassortant swine influenza A virus strain derived from strains endemic to UK pigs was detected in pigs in England during work by APHA in a research project (PIGIE) and through a PhD undertaking retrospective whole genome sequencing (WGS) of strains obtained through the swine influenza surveillance project. It is not predicted that this swine influenza strain will have a greater virulence or zoonotic potential than existing strains endemic in pigs in the UK and similar strains have been detected in pigs elsewhere in Europe (France, Italy, Spain, Belgium and the Netherlands) at various times over the last 14 years.

The research project PIGIE (Understanding the dynamics and evolution of swine influenza viruses in Europe) is an ICRAD-EU and National co-funded project involving six European partner countries including the UK and is aligned with the Defra-funded swine influenza research and surveillance programmes. The PIGIE project is investigating the dynamics and epidemiology of swine influenza in commercial farm settings and has monitored swine influenza

A virus circulation in two cohorts of growing pigs on each of two farms in England during 2022. On one of these farms, the swine influenza A virus strain detected in grower pigs was found to be human-like H1 (H1hu) clade 1B coupled with N1 from the pandemic H1N1 2009 lineage 1A.3.3.2 (H1huN1pdm). The internal genes are also of pandemic H1N1 2009 origin. H1hu has previously only been reported in UK pigs when coupled with N2 as H1huN2. The H1hu clade 1B has been present in UK pigs for approximately 30 years. Preliminary indication from ongoing retrospective WGS analysis is that similar reassortant strains were present in pigs in England in 2015 and 2019. The H1huN1pdm strain most likely resulted from reassortment events between H1N1 pandemic (1A.3.3.2) and H1huN2 (1B.1.1) which are the two most abundant viruses detected in pigs in the UK. These sporadic detections suggest a lack of persistence possibly because these strains do not out-compete the previously established lineages. The farm on which this strain was detected in 2022 observed cyclical disease issues due to swine influenza and the two licensed swine influenza vaccines (pandemic and trivalent) were used in the sow herd.

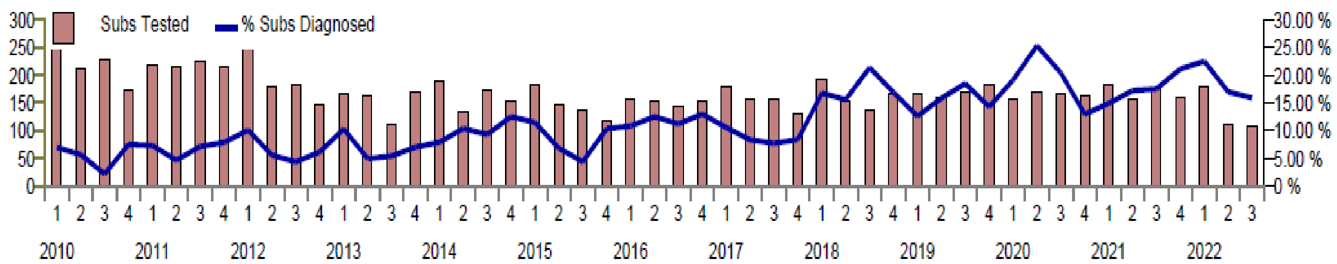
It is thought likely that vaccination against H1huN2 (in the commercial trivalent vaccine licensed for pigs) should still provide some immunity against this strain, and analysis is being undertaken to compare the antigenic relatedness of the HA antigens from this strain and the vaccine viruses to investigate this.

Testing for swine influenza A virus by PCR is offered at APHA at no charge to vets attending UK pigs. Details about accessing this testing are provided in this swine influenza information note.

Porcine reproductive and respiratory syndrome diagnoses

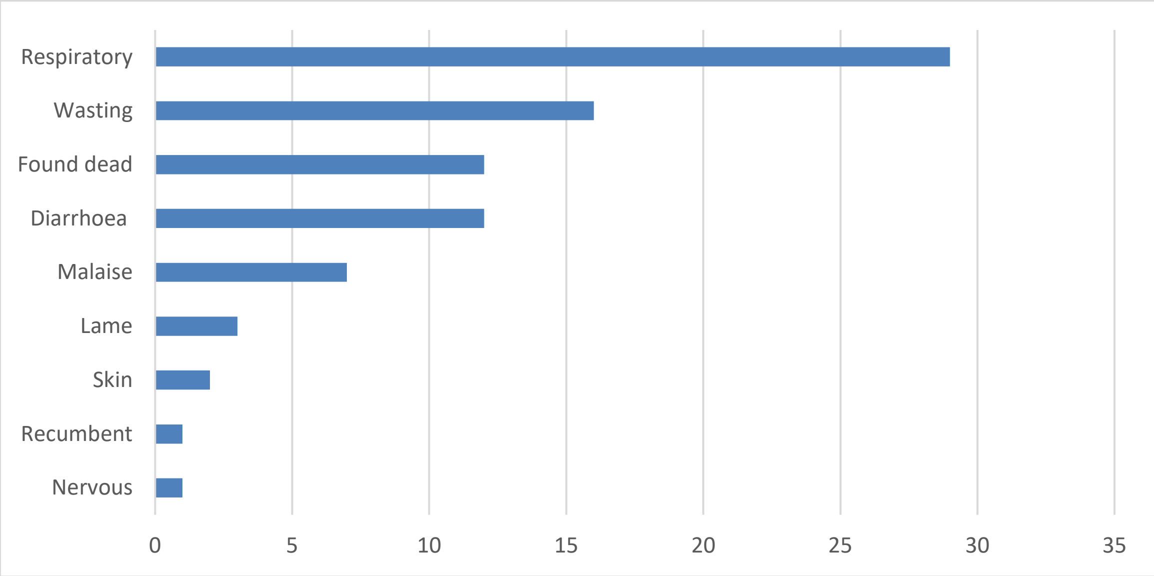
In the first nine months of 2022, 88 diagnoses of PRRS have been recorded in VIDA so far from the Great Britain scanning surveillance network, four of which were reproductive disease (abortion, stillbirths, weak neonates) and the remainder were systemic disease or pneumonia, with most of those diagnoses (58) made in postweaned pigs. This is a similar number of diagnoses as were made in the first nine months of 2021 (85). As shown in Figure 8, the diagnostic rate most recently peaked in Q1 2022 and was higher in in the first quarter of 2022 than in the second and third quarters of this year.

Figure 8: Seasonality of PRRS diagnoses as a percentage of diagnosable submissions to the Great Britain scanning surveillance network



The frequency of the main clinical sign reported in pigs diagnosed with systemic disease or pneumonia due to PRRS in the first nine months of 2022 is illustrated in Figure 9 with respiratory and wasting being the first and second most common main clinical signs respectively.

Figure 9: Frequency of main clinical sign described for non-reproductive PRRS diagnoses in the first nine months of 2022



A severe outbreak of neonatal mortality due to PRRS, also associated with stillbirths in the herd, was described in the September 2022 APHA surveillance report in the Veterinary Record (APHA, 2022c). Piglets were affected with lethargy and wasting starting from two days of age, some showing diarrhoea. Disease had resulted in at least a four-fold increase in preweaning mortality in one farrowing batch. Increased stillbirths and some abortions were also described, while sows remained healthy and pigs that reached weaning age were growing well. PRRSV-1 was detected by PCR in the spleens of all the submitted piglets and in lung and lymph node by immunohistochemistry, providing convincing evidence of active PRRSV infection in the piglets and supporting the diagnosis of PRRS. The ORF5 sequence of the virus detected confirmed it was a field strain. It was closely related (homology 99.3%) to two other PRRSV strains detected by APHA in the same region in 2022. This herd had been vaccinating sows for PRRS for several years without experiencing disease issues suspicious of PRRS until this outbreak. Disease in piglets was severe for two farrowing batches and then significantly reduced. Recent disruption to pig management and flows for other reasons and high ambient temperatures which may have affected the provision of colostrum and milk to piglets were thought to have contributed to destabilisation of PRRSV infection in the herd.

Currently, the PCR-positive sample with the lowest Ct value in each PRRSV positive diagnostic submission to APHA from pigs in England or Wales is being sequenced under pig disease surveillance funding to maintain awareness of the diversity in British PRRSV detected and detect different strains. Any that appear vaccine-like based on the ORF5 sequence are analysed further by sequencing the nonstructural protein 2 (nsp2) to determine if any are potential recombinants. All of the 25 vaccine-like PRRSV from 2022 detected and examined so far have had nsp2 and ORF5 sequences that are consistent and do not suggest that they are potential recombinants.

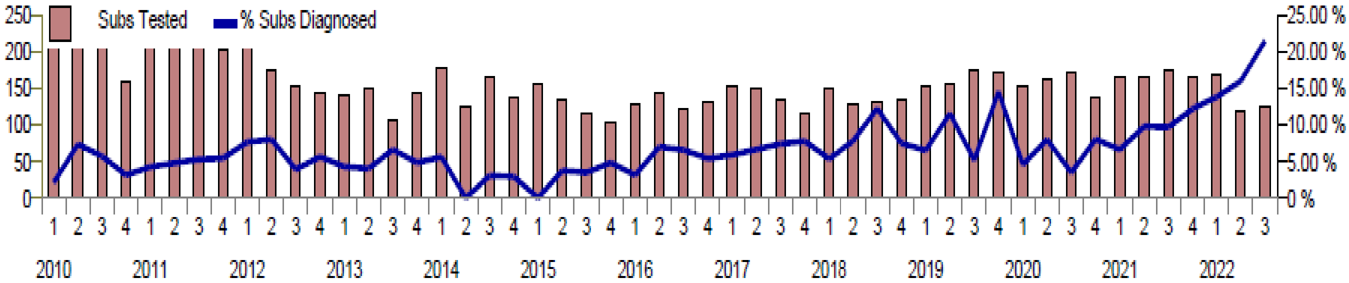
PRRS remains a significant endemic viral pathogen in British pigs and is the priority for disease control in the [pig component of the Animal Health and Welfare pathway] alongside a focus on biosecurity improvement to control endemic pig diseases and help prevent the introduction of exotic disease threats.

An interesting item in Pig Progress summarised Hungary's approach to PRRS eradication which was achieved over an eight-year period (Szabó, 2022). A key element of this was the decision to only allow PRRSV-free pigs to be used for fattening; the introduction of PRRSV-infected pigs for fattening was banned.

Enteric disease surveillance: trends in Quarter 3 of 2022

The diagnostic rate for disease due to *Lawsonia intracellularis* continued its upward trend first noted in 2021 (Figure 10) and described in previous quarterly reports. The diagnostic rates for *Escherichia coli* disease and salmonellosis incidents (Figures 11 and 12) have not continued to rise.

Figure 10: Seasonality of *Lawsonia*-associated disease incidents to quarter 3 of 2022 as a percentage of diagnosable submissions to the Great Britain scanning surveillance network



Although the back logs on pig farms have largely been alleviated, superimposed on the issues those created, pig producers now face increased feed and fuel costs due to the conflict in Ukraine and persistent issues with the cost of pig production exceeding the price paid at slaughter for some producers. There may be other aspects affecting enteric disease trends, for example variation in feed ingredients and dietary changes, and the retention of older sows in breeding herds due to low cull sow prices and these diagnostic rates will be kept under review.

Figure 11: Seasonality of E. coli disease incidents in pigs to quarter 3 of 2022 as a percentage of diagnosable submissions to the Great Britain scanning surveillance network

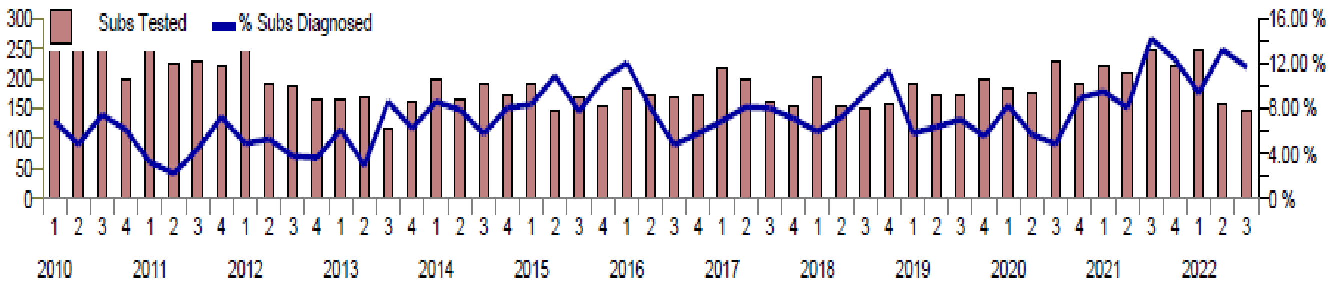
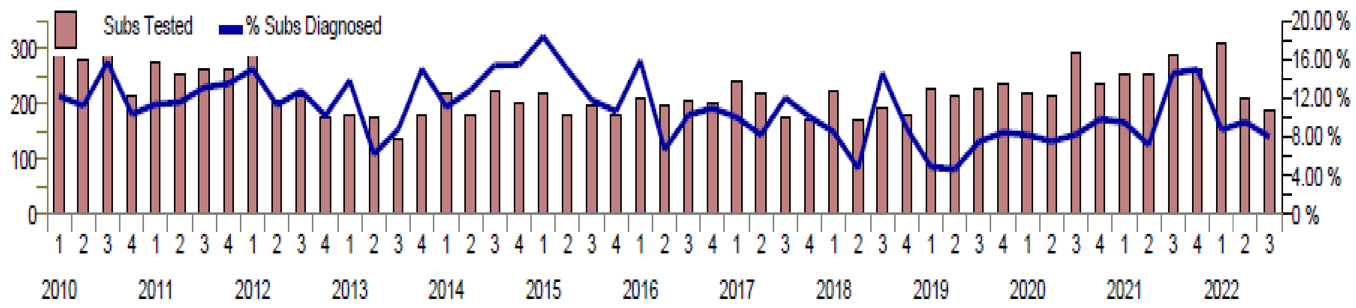


Figure 12: Seasonality of salmonellosis incidents (any serotype) in pigs to quarter 3 of 2022 as a percentage of diagnosable submissions to the Great Britain scanning surveillance network



Enteric colibacillosis in neonatal piglets investigated by whole genome sequencing

Two neonatal piglet submissions were received from a large indoor breeder-finisher unit investigating an ongoing problem with diarrhoea in the first week of life with morbidity and mortality of 10-20% and 4-7% respectively per batch. Litters from gilts and parity two sows were predominantly affected. Untreated piglets from gilt litters were submitted. The consistent findings were of diarrhoeic, non-pyrexic piglets in poor body condition, some also showing evidence of dehydration. Small and large intestinal contents were excessively liquid to varying degrees, some with flocculent contents. *Escherichia coli* isolates from the intestine were serologically untypeable and the *E. coli* virulence gene PCR detected only the *sta1* gene in some of the isolates which encodes the enterotoxin STaP (heat stable toxin type 1, porcine strain). No other neonatal enteropathogens were detected and there was no evidence of hypogammaglobulinaemia. However, histopathology revealed multifocal, segmental, mild to severe acute, neutrophilic enteritis, with bacterial colonisation of the brush border by coccobacillary bacteria (shown to be Gram-negative in stained sections) which raised strong suspicion of involvement of enterotoxigenic *E. coli*.

Whole genome sequencing (WGS) was undertaken on three isolates and identified toxin-associated genes, *astA* and *hlyE* in all three. The *astA* gene encodes the EAST-1 toxin (Zajacova and others, 2013). The *hlyE* gene encodes the cytotoxic α-haemolysin (Ludwig and others, 2004). One isolate also had the toxin-associated genes *sta1*, *stb* and *vat*. Based on the sequence data and knowledge in the literature, these *E. coli* strains were considered to have the potential to induce the pathology seen in these piglets. As litters from young sows were mainly affected, improving the quality and quantity of colostral antibody through gilt acclimatisation and exposure to resident pathogens and also through nutritional and other strategies are part of disease control.

This investigation shows the value of whole genome sequencing as an additional tool for cases where the usual diagnostic testing does not confirm the suspected diagnosis, in this case of enteric colibacillosis. In addition to the virulence factors, WGS can also provide information about sequence type, antimicrobial resistance (AMR) genes, and metal and biocide resistance. The *E. coli* isolates involved in this incident were sequence type (ST)1141 and ST410. There were no AMR genes detected in the ST1141. The ST410 had AMR genes associated with resistance to streptomycin, betalactams, sulphonamides and tetracycline (strA and B, blaTEM-

1b, sul2 and tet(AB)). The ST1141 isolates showed *in vitro* sensitivity to all antimicrobials tested. The ST410 showed *in vitro* resistance to ampicillin and tetracycline (*in vitro* susceptibility to streptomycin was not determined; sulphonamides were tested in combination with trimethoprim).

Swine dysentery diagnoses in quarter 3 of 2022

There were 14 diagnoses of swine dysentery confirmed in the first nine months of 2022 compared to 11 during the whole of 2021, reflecting an increase in the diagnostic rate in early 2022 which has slowed in the subsequent two quarters. However, diagnoses are still being made and several alerts raising awareness about swine dysentery outbreaks were issued by the pig industry's Significant Diseases Charter.

Diagnoses in 2022 have been in pigs in Cornwall, Lincolnshire, Norfolk, Cheshire, Cleveland & Darlington, East Riding and North Lincolnshire and North Yorkshire.

Brachyspira hyodysenteriae isolates obtained undergo whole genome sequencing (WGS) and antimicrobial sensitivity minimum inhibitory concentration testing, under APHA's pig disease and antimicrobial resistance surveillance projects respectively.

Clinical resistance to tiamulin has been identified in one 2022 *B. hyodysenteriae* isolate by antimicrobial sensitivity testing so far. This isolate was sequence type, ST 251, which is the same ST as isolates from one premises found to be tiamulin-resistant in 2020-21 (APHA, 2021). Further analysis of the WGS will help determine how closely related the 2022 isolate is to those detected in 2020-21. The MIC values for the 2022 isolate were also at or above clinical breakpoint for other licensed antimicrobials tested. Multi-drug resistance of this nature is an uncommon finding and severely limits treatment options. The development of resistance in *B. hyodysenteriae* to antimicrobials commonly used in the control of swine dysentery is a recognised risk, particularly in situations where medication is used longer-term. Control of swine dysentery using alternative interventions (all-in, all-out management systems; cleaning and disinfection; and partial and total depopulation leading to eradication) is vital to prevent the development of wider antimicrobial resistance.

Table 3 indicates the multi-locus sequence type (MLST) of 2022 isolates which have been sequenced so far. The B. hyodysenteriae MLST dashboard provides more information about sequence types detected over time and in different counties, with their antimicrobial resistance gene profiles.

Table 3: MLST of *B. hyodysenteriae* isolates in 2022

MLST	Number isolates
52	1
242	6
251	3
297	1
New	2

The importance of practicing excellent vehicle biosecurity in preventing introduction and spread of exotic and endemic diseases, including swine dysentery, has been emphasised in communications highlighting the #MuckFreeTruck campaign from the National Pig Association and AHDB with support from the British Meat Processors Association, the Pig Veterinary Society, the British Pig Association and Red Tractor. The campaign is also endorsed by the UK Chief Veterinary Officer.

Advice on swine dysentery and its control can be found on these links together with information about the pig industry's Significant Diseases Charter:

- ADHB guidance on swine dysentery
- ADHB significant diseases charter
- APHA information note on swine dysentery (PDF)
- NADIS guidance on swine dysentery

Update on *Klebsiella pneumoniae* septicaemia diagnoses in 2022

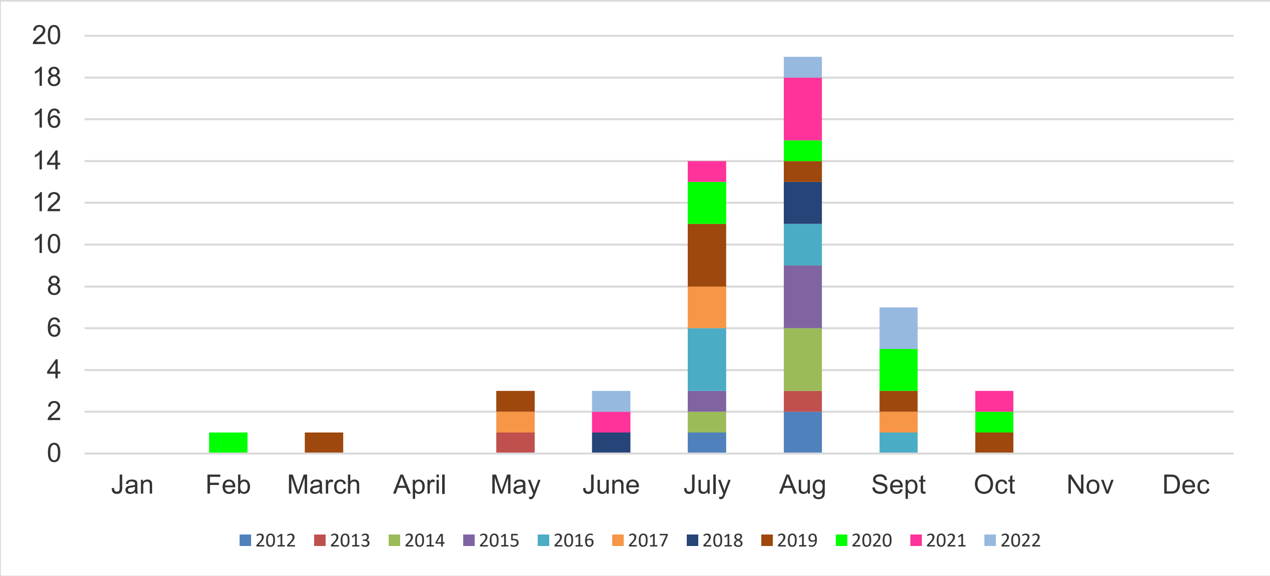
Three further outbreaks of *Klebsiella pneumoniae* subsp. *pneumoniae* (Kpp) septicaemia in piglets were confirmed in quarter 3 of 2022; one in August and two in September, bringing the total number of incidents in the summer of 2022 to four. All were typical and caused sudden or rapid death in preweaned piglets on outdoor breeding farms. The Kpp isolates from the four incidents were sensitive to all antimicrobials tested, apart from ampicillin, however resistance to ampicillin is innate not acquired in Kpp.

Since their emergence in 2011, Kpp outbreaks have shown a marked seasonal pattern, with almost all occurring between May and October each year (Figure 13). There have been a total of 58 outbreaks on 46 farms in England, 41 of which are outdoor breeder units. Disease appears to be self-limiting but has recurred in some herds in successive years; eight farms have had outbreaks in more than one year and three of these have had outbreaks in three separate years. Use of autogenous vaccination is reported to have been used with apparent good effect.

The Kpp isolates from these outbreaks have all been sequence type (ST) ST25 apart from one. The one exception was ST558 which was isolated once in 2017 on a farm which had an outbreak of Kpp due to ST25 in a previous year. All outbreak Kpp isolates carry a small 4kb plasmid.

The clinical signs of sudden death are non-specific and further investigation, including post-mortem examination and culture, is essential to confirm a diagnosis. The case definition for an outbreak of Kpp septicaemia is "'Pigs found dead with lesions consistent with septicaemia and pure/predominant growths of *Klebsiella pneumoniae* subsp. *pneumoniae* isolated from internal sites in multiple pigs". Further information can be found in a paper about updates on the Klebsiella pneumoniae septicaemia outbreaks.

Figure 13: Outbreaks of Kpp septicaemia in piglets by month of diagnosis 2011 to end of September 2022



Horizon scanning

Porcine astrovirus 4 detected in tracheitis cases – United States

A valuable webinar held by SHIC and the American Association of Swine Veterinarians explored the value of extended diagnostic investigation of respiratory disease incidents where no diagnosis was achieved through testing for likely pathogens, and histopathology supported an infectious aetiology. It was agreed that resources for such investigations are limited, however, several cases investigated further by next generation sequencing resulted in detection of porcine astrovirus 4 (PAstV4) and porcine hemagglutinating encephalomyelitis virus. It was considered that these could be brought into the scope of diagnostics when investigating undiagnosed significant respiratory disease.

Porcine astroviruses are widely distributed in pigs worldwide, existing as at least five distinct lineages (PAstV1 to PAstV5) within the genus *Mamastrovirus*. The potential association of PAstV4 with the respiratory tract was not previously known. One US diagnostic laboratory found that RT-PCR Ct values for PAstV4 positive samples were significantly lower (higher levels of PAstV4 genetic material) in nasal swabs compared to faeces indicating higher viral loads in nasal swabs and raising the possibility of a respiratory tropism.

Two presentations described cases where no diagnosis had been established in which PAstV4 was detected in association with lesions of necrosis, and lymphocytic to lymphoplasmacytic inflammation in the trachea and primary bronchi, similar to those caused by swine influenza but testing negative. PAstV4 was detected by next generation sequencing and, in some, in the trachea with RNAscope in situ hybridisation. Further studies have been limited as the virus has not yet been isolated in culture. These cases involved pre and postweaned coughing pigs, mostly under six weeks of age.

More information is provided in the SHIC November 2022 newsletter SHIC November 2022 newsletter and the webinar can be accessed from the SHIC website.

This emphasises the value of comprehensive diagnostic investigation and follow-up of significant cases that remain undiagnosed. Submission of pigs and fresh plucks from outbreaks for post-mortem investigation enable this. Where that is not possible, there is advice on samples and tests for respiratory disease investigation in the APHA diagnostic guide APHA diagnostic guide and in the July disease surveillance report in the Veterinary Record (APHA, 2022d).

Japanese encephalitis virus update - Australia

A Promed item reported that the Australian 2022 Japanese encephalitis virus (JEV) outbreak was at least six times larger than had been thought (Promed, 2022b). This was based on results from a survey (917 people) conducted in New South Wales that found 80 (1 in 11) people were seropositive; the population was believed to have been naive before the outbreak. The survey excluded vaccinated people and those born in, or spent more than one month in, a country outside Australia where the virus is commonly found. Infection with JEV can cause serious disease, however only around one percent of infected people show signs. Thirteen human JEV cases with two deaths were confirmed in January and February 2022. The virus is part of the flavivirus family, closely related to West Nile, Zika, Murray Valley encephalitis, dengue and yellow fever. Apart from pigs and humans, the virus can also affect horses, and is maintained in a cycle between mosquitoes and water birds. Many pig farms in the state's south and west were found to be infected with JEV. In pigs, it can lead to sudden death, fever, abortions and boar infertility, among other clinical signs including piglet deformity. Another wet summer is predicted. Free JEV vaccination is being offered more widely, however the global vaccine supply is reported to be very limited. Avoiding mosquito bites is also advised. A symposium on JEV was held in October 2022 in the US and the presentations have been made available: https://www.ceid.uga.edu/jev2022/archive/.

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Any enquiries regarding this report should be sent to APHA's Surveillance Intelligence Unitby emailing SIU@apha.gov.uk.

More information about scanning surveillance reports is available on APHA's Vet Gatewayat http://apha.defra.gov.uk/vet-gateway/surveillance/index.htm.

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