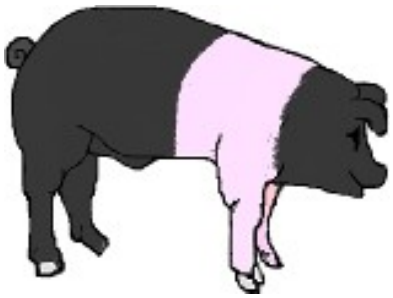
Animal & Plant Health Agency



SRUC

Great Britain pig quarterly report: disease surveillance and emerging threats

Volume 25: Quarter 2 – April to June 2021

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Introduction and overview

This quarterly report reviews disease trends and disease threats for the second quarter of 2021, April to June. 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 the APHA 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 second quarter of 2021 compared to the same quarter in 2020 through the Great Britain (England, Wales and Scotland) scanning surveillance network are illustrated in Tables 1a and 1b. These can be interrogated further using the interactive pig disease surveillance dashboard which was launched in October 2017.

Table 1a and 1b: Great Britain scanning surveillance 15 most frequent diagnoses in Quarter 2 of 2021 and Quarter 2 of 2020

Table 1a: Fifteen most frequent diagnoses Quarter 2 of 2021 (total 265)	Table 1b: Fifteen most frequent diagnoses Quarter 2 of 2020 (total 249)
Streptococcus suis	PRRS - pneumonia
Swine influenza	*Streptococcus suis*
Rotavirus	*Lawsonia* sp. associated disease
Lawsonia sp. associated disease	PRRS - systemic
PRRS - systemic	*Brachyspira pilosicoli*
Colibacillosis - enteric	*Pasteurella multocida* pneumonia
Pasteurella multocida pneumonia	Salmonellosis - Typhimurium
Brachyspira pilosicoli	Swine influenza
Actinobacillus pleuropneumoniae	Streptococcal meningitis
Salmonellosis - other	*Actinobacillus pleuropneumoniae*
Haemophilus parasuis disease	Rotavirus
Diagnosis not listed – digestive disease	Pneumonia – other cause
PRRS - pneumonia	Colibacillosis - enteric
Exudative epidermitis – greasy pig disease	*Haemophilus parasuis* disease
Mycoplasma hyopneumoniae pneumonia	Colibacillosis – oedema disease

Note: that further diagnoses are likely to be added for records for submissions made in quarter 2 of 2021 which are finalised at a later date.

Figures 1a to 1d: summary data for 404 submission records in Quarter 2 of 2021(372 in Quarter 2 of 2021)

Figure 1a: pig age

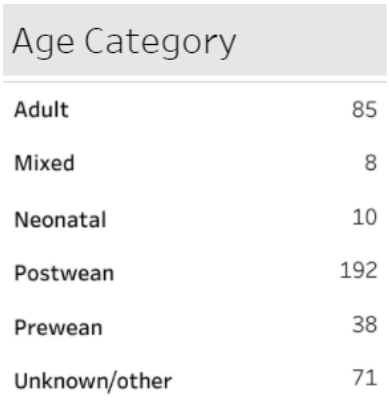


Figure 1b: submission type

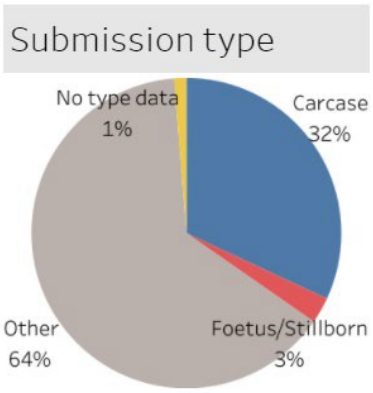


Figure 1c: disease syndrome

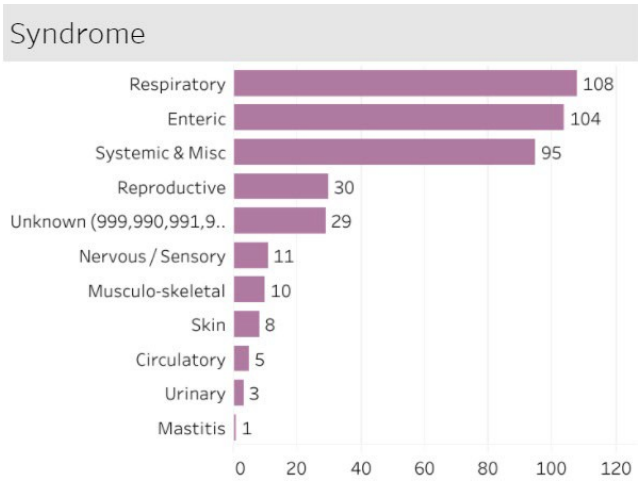
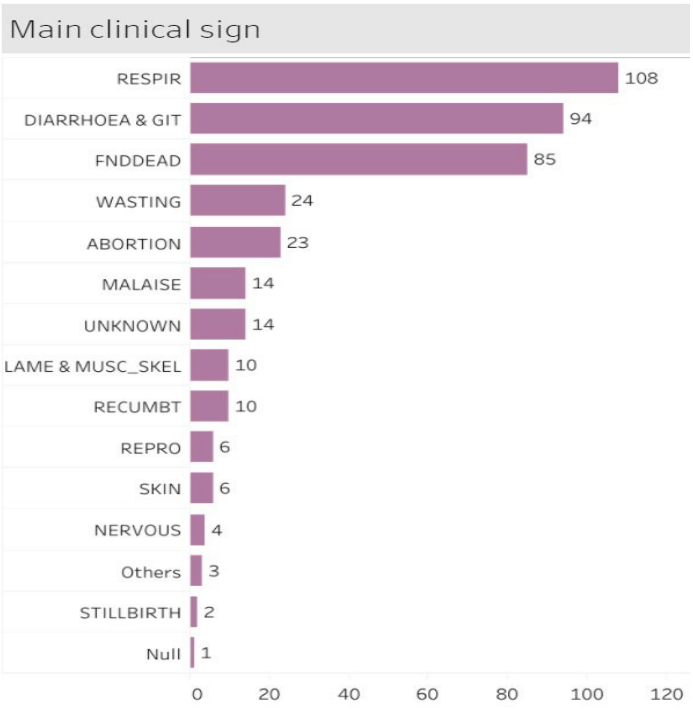


Figure 1d: main clinical sign reported



These diagnostic submissions are voluntary and subject to several sources of bias. The profile of submissions for the second quarter of this year differs from that of quarter 2 of 2020 in that respiratory signs and respiratory disease syndrome are more frequent in quarter 2 of 2021(see Figure 1) rather than diarrhoea and gastro-intestinal signs and enteric disease syndrome in quarter 2 of 2020.

Total Great Britain diagnostic submissions for the quarter (363) were higher than totals for the same quarter in 2017 to 2020 (range from 259 to 323) mainly reflecting higher non-

carcase submissions to APHA and SRUC this quarter compared to the same period in previous years.

This has meant that carcases represent a lower proportion of total submissions in quarter 2 of 2021 (32%) than in quarter 2 of 2020 (49%), but without a reduction in the number of diagnoses made in quarter 2 of 2021. Three of the five most common diagnoses in quarter 2 of 2021 were also in the top five diagnoses in quarter 2 of 2020, namely disease due to *Streptococcus suis*, porcine reproductive and respiratory syndrome virus (PRRSV) and *Lawsonia intracellularis*.

Swine influenza diagnoses are discussed later in this report and, unusually, swine influenza was the one of the most frequent diagnoses in quarter 2 of 2021, which may have influenced the predominance of respiratory disease this quarter.

During the first quarter of 2021, three additional post-mortem examination (PME) providers joined the scanning surveillance network in England and Wales. These are the Universities of Cambridge, Liverpool and Nottingham.

This broadens the expertise of, and contributors to, livestock disease surveillance in England and Wales and also brings livestock premises in the areas they cover closer to a post-mortem provider.

The new PME providers join the five current PME providers: Royal Veterinary College, Universities of Surrey and Bristol, the Wales Veterinary Science Centre, and SRUC Veterinary Services St Boswells, that work together with the six APHA Veterinary Investigation Centres, all of which will continue their valued contribution to scanning surveillance.

New and re-emerging diseases and threats

Refer to the annexe on GOV.UK for more information on the data and analysis.

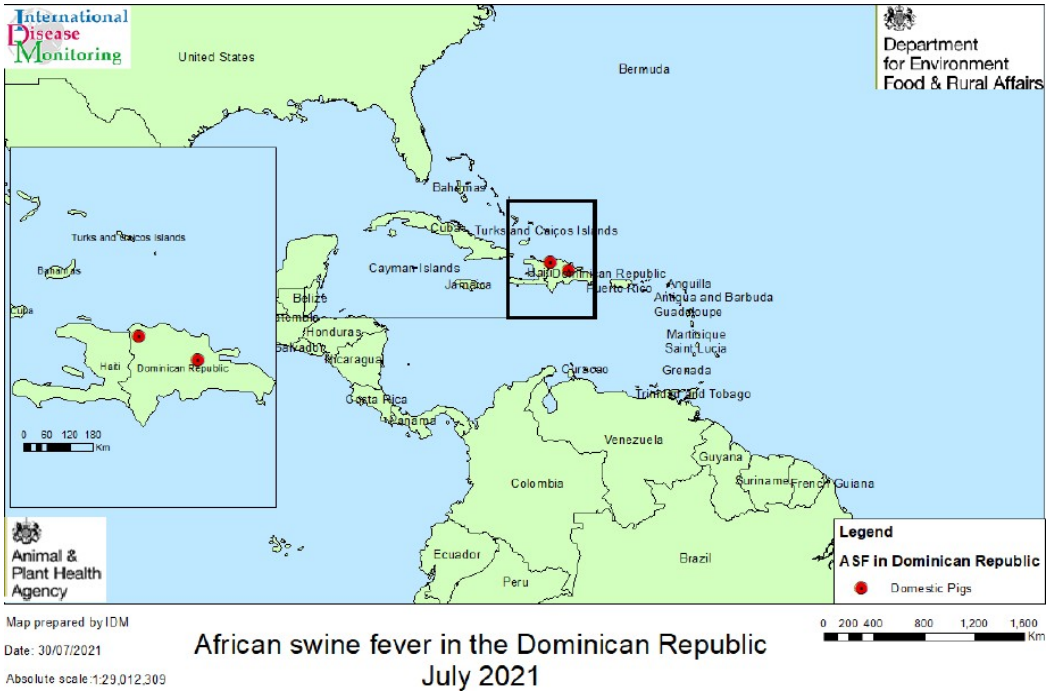
African swine fever summary

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

The most significant global development was the confirmation of ASF by United States Department of Agriculture (USDA) in two domestic pig herds in the Dominican Republic for the first time in 40 years in samples collected through an existing surveillance collaborative programme (see figure 2).

This represents a large geographical jump to the Americas: the Georgia 2007 wild-type strain, genotype 2, was detected through sequencing which differs from the genotype present in the 1980s.

Figure 2: first ASF cases in domestic pigs in the Dominican Republic in July 2021



The detection was reported to the OIE on 29 July and by 8 August, the Dominican Republic had reported a total of 25 outbreaks to the OIE with smaller backyard-type herds mainly affected. Restrictions on Dominican Republic pigs were already in place to prevent entry of Classical Swine Fever from the Dominican Republic into the USA, and increased checks are in place at US airports.

The means by which ASF virus (ASFV) entered the country has not been reported, although human mediated means is highly likely. The APHA International Disease Monitoring (IDM) team issued a preliminary outbreak assessment.

Updates on the ASF situation in Europe were issued in May and July 2021. Full details are in the reports on GOV.UK.

One of the most significant new findings was the detection of ASF in domestic pigs in Germany for the first time, in mid-July (see figure 3). Two outbreaks were confirmed on premises in Brandenburg, close to the border with Poland, but 188 km apart.

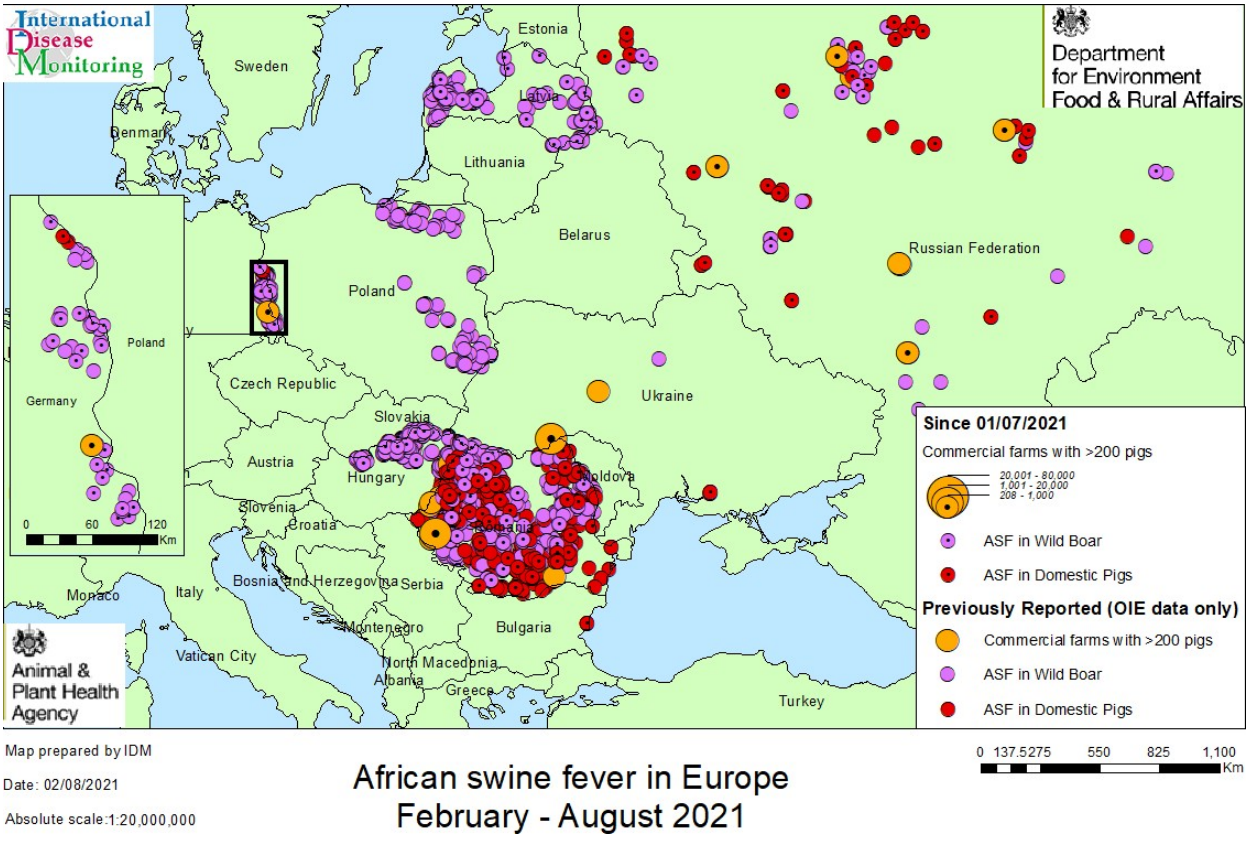
One was an organic farm with about 300 pigs and open-air husbandry and the other involved just had two pigs. In both instances the virus was detected through testing of dead pigs as part of current routine surveillance for ASF.

Two days later another outbreak was reported on a premises with four pigs near the affected farm with two dead pigs.

ASF in wild boar continues to be detected in eastern Germany across the states of Brandenburg and Saxony. Core areas in Brandenburg and Saxony have been enclosed by permanent fencing creating surrounding buffer zones from which wild boar are being

actively cleared. Mobile fencing is still in place along much of the border with Poland and will be replaced with permanent fencing.

Figure 3: ASF reports in Europe for February to August 2021 (mapped 2 August 2021)

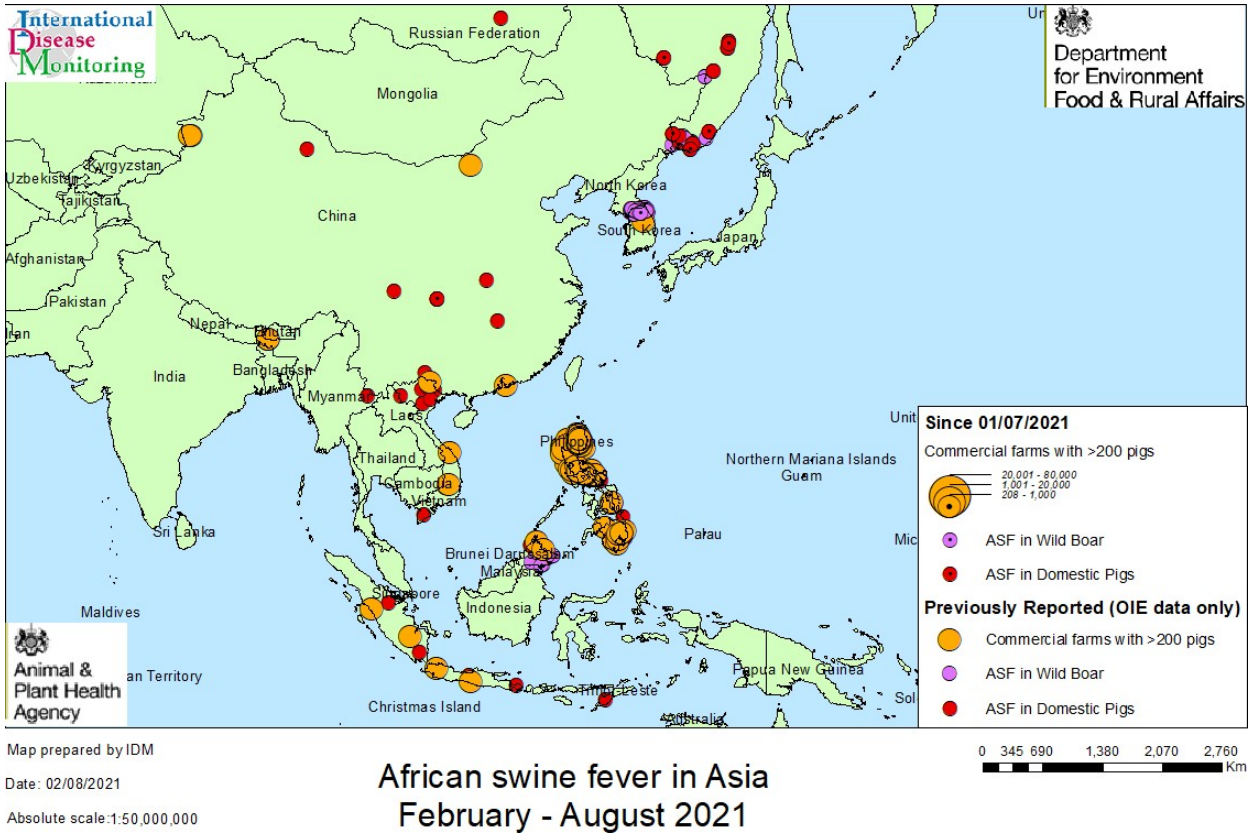


Poland continues to report ASF in domestic pigs and wild boar. Large numbers of outbreaks were reported on backyard pig premises and a small number on large commercial pig farms in Romania. Bulgaria has reported outbreaks in domestic pigs in August, the first to be reported during 2021 in this country.

Smaller numbers of outbreaks continue to be reported regularly in backyard and large commercial pig farms in Russia and Ukraine. Cases of ASF in wild boar continue across most of the previously affected countries in Europe.

An update on the ASF situation in Asia was issued by IDM in May 2021. Full details are in the report on GOV.UK. Figure 4 illustrates only those outbreaks reported from February to August 2021.

Figure 4: ASF cases reported in Asia from February to August 2021 (mapped on 2 August 2021)



A review published by Shurson and others (2021) aims to provide a more holistic understanding of the relative potential risks of ASFV contamination in various global feed ingredient supply chains and to provide recommendations for addressing the challenges identified.

This complements the recently published EFSA Scientific Opinion (EFSA, 2021a) on the ability of different matrices to transmit ASF virus, in particular, feed and feed ingredients, enrichment, bedding materials and empty live pig transport vehicles returning from ASF-affected areas.

It also complements the review by Niederwerder (2021) which provided information on the risk of ASFV introduction in feed and potential mitigation strategies to help protect the global swine population from introduction and spread of ASFV through feed.

Another EFSA Scientific Opinion was published (EFSA 2021b) which assessed the risk of ASF introduction and spread associated with outdoor pig farms and described types of outdoor farming of pigs in the EU.

The publication proposed biosecurity and control measures for outdoor pig farms in ASF-affected areas of the EU and the implementation of independent standardised and objective on-farm biosecurity assessments to evaluate their biosecurity risk and identify weaknesses that could be rectified.

This is particularly important where significant wild boar populations are present. The contribution of wild boar to local spread of ASF was highlighted in a publication on predicting spread and effective control measures for ASF (Taylor and others, 2021).

The authors developed a model to estimate the risk of infection with ASF in wild boar and pigs due to natural movement of wild boar in Europe. This model suggested, perhaps not unexpectedly, that wild boar movement is responsible for local transmission of disease, with other pathways more dominant in medium and long distance spread of the disease.

Global disease reports produced monthly by the US Swine Health Information Center are also a good source of information and these can be viewed and received by email by signing up here.

A UK-wide exercise, named Exercise Holly, simulating an outbreak of ASF took place in July to test government contingency plans to contain and eliminate ASFV in the event of its detection in pigs or wild boar in the UK.

The exercise involved APHA, Defra, Scottish Government, the Welsh Government and the Department of Agriculture, Environment and Rural Affairs in Northern Ireland (DAERA-NI) working together to test the government's contingency plans to respond to a national outbreak of ASF, enabling teams from across the country to work together to assess the UK's state of readiness to manage such an outbreak.

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 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 wild boar 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 products brought into the UK from affected countries as personal imports represent the most significant risk of introduction, the commercial trade of such products is not permitted from ASF-affected areas.

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 GB diagnostic database (VIDA) was in 2002 on a farm in England. No suspect incidents of PED have been reported in England or Scotland since January 2018.

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) on a weekly basis.

None have been positive for PED in 1210 diagnostic submissions tested under Agriculture and Horticulture Development Board (AHDB) Pork funding from June 2013 to June 2021. Refresher training on the roles of colleagues in relation to PED is taking place within APHA and AHDB. A desktop PED exercise is planned for October 2021, led by the Pig Health and Welfare Council. Further information on PED is available.

PCV3 enhanced surveillance findings

Porcine circovirus 3 (PCV3) was first reported in pigs in the US (Palinski and others, 2016). Since then, it has been reported in a growing number of countries globally, including the US, China, Poland, Italy, Germany and Spain. Publications indicate that PCV3 is widespread in pigs and also in wild boar, and that this virus, although newly discovered in pigs, has been present in the pig population for a number of years.

A publication described a retrospective study which detected PCV3 in tissues archived from pigs in Brazil back to 1967 (Rodrigues and others, 2020).

PCV3 is genetically distinct from porcine circovirus 2 (PCV2) and there is not believed to be any cross-immunity. Collins and others (2017) described detection of PCV3 in 20% of samples collected between 2002 and 2017 in Northern Ireland and in 5% of a small set of 80 tissue samples collected between 2001 and 2004 in England.

Investigations through APHA's scanning surveillance have now detected PCV3 at high viral loads in stillborn and/or abnormal neonatal piglets in four incidents occurring in 2018, 2020 and 2021 and one tested retrospectively from 2014 (APHA, 2018a and APHA, 2020a). Porcine circoviral infections are not OIE listed, or notifiable in the EU or UK and they are not of zoonotic concern.

Enhanced surveillance to investigate the occurrence of myocarditis lesions in pigs submitted for diagnostic investigation to APHA continues with hearts undergoing histopathology and any with non-suppurative myocarditis being routinely subjected to PCV3 *in situ* hybridisation (ISH) and PCV2 immunohistochemistry (IHC).

Hearts are also being batch-tested for PCV3 by PCR. Around 400 hearts have been processed so far from 170 diagnostic submissions and approximately 9% tested positive for PCV3 by PCR, a lower prevalence than the 38.3% PCR-positive sera detected in healthy pigs from bloods collected at slaughter reported in the Q1-2021 report (APHA, 2021).

A minority of PCR-positive hearts had Ct values suggesting moderate to high viral loads and, when abortion/stillbirth submissions are excluded, myocarditis associated with PCV3 nucleic acid labelling by ISH and high viral loads has so far only been detected in individual pigs in submissions of batches of three pigs. The clinical significance of the PCV3 and lesions detected in these individual pigs is not known and requires more research.

Figure 5: table reproduced from Saporiti and others (2021) with proposed diagnostic criteria for the individual case definition of PCV-3 associated diseases (PCV-3-AD)

Saporiti, V., Franzo, G., Sibila, M., and Segalés, J. (2021). Porcine circovirus 3 (PCV-3) as a causal agent of disease in swine and a proposal of PCV-3 associated disease case definition. Transboundary Emerging Diseases, 00, pages 1 to 13 https://doi.org/10.1111/tbed.14204

PCV-3-AD proposed name (acronym)	Main clinical sign	Individual diagnostic criteria
PCV-3-reproductive disease (PCV-3-RD)	Late abortion, malformations, mummified fetuses, stillborn fetuses, weak-born piglets	1. Late reproductive problems and higher perinatal mortality 2. Multisystemic lymphoplasmacytic to lymphohistiocytic perivascular inflammation 3. Moderate to high amount of PCV-3 genome in damaged tissues
PCV-3-systemic disease (PCV-3-SD)	Wasting, weight loss, ill thrift or poor-doers, neurological signs	1. Weight loss, rough hair, neurological signs 2. Multisystemic lymphoplasmacytic to lymphohistiocytic perivascular inflammation 3. Moderate to high amount of PCV-3 genome in damaged tissues

Case definitions for PCV3-reproductive disease (PCV3-RD) and PCV3-systemic disease (PCV3-SD) have been proposed by Saporiti and others (2021). Figure 5 reproduces the proposed diagnostic criteria for the individual case definition of PCV-3 associated diseases (PCV-3-AD) and these criteria align with those that have been applied in APHA surveillance investigations.

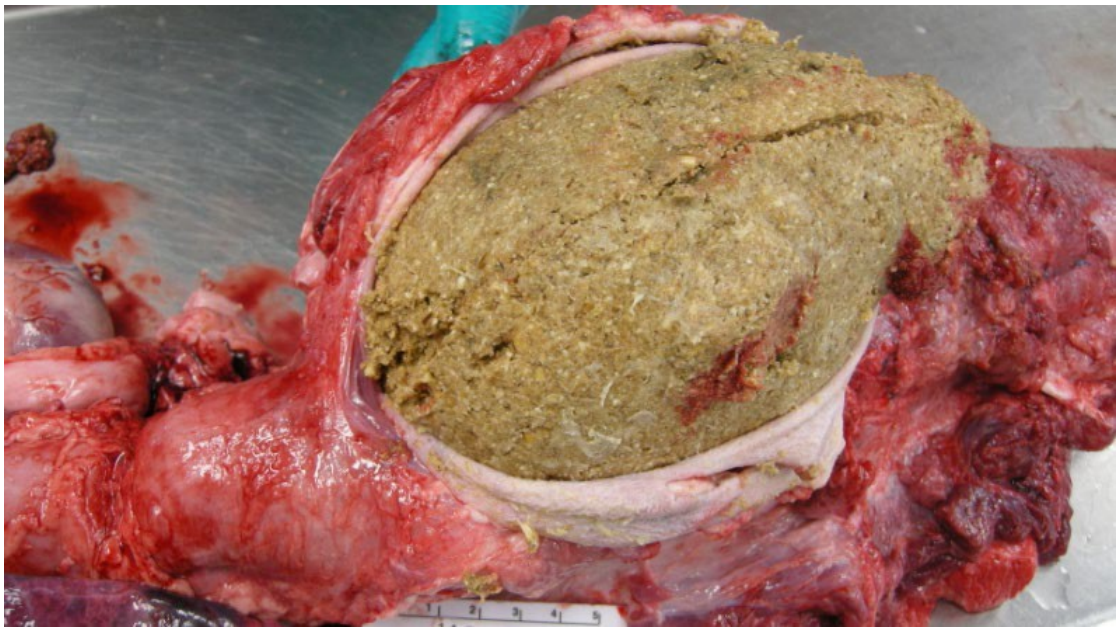
A narrated presentation from APHA on key features of PCV3 and scanning surveillance findings in Great Britain recorded in June 2021 is available on YouTube.

Unusual diagnoses or presentations

Megaoesophagus in a sow

A maiden gilt in good body condition was submitted to investigate the cause of seven recent sudden deaths in different sow groups on an outdoor breeding unit. The only remarkable, and unusual, finding was marked dilatation of the cervical oesophagus which was impacted with feed (see figure 6) with a fibrous band within the oesophageal wall caudal to the dilation.

Figure 6: dilated cervical oesophagus of a gilt, filled with feed



Possible explanations for the dilation could include a congenital lesion, neuromuscular disease (failure of peristalsis) or stricture due to neoplasia, foreign body, chronic inflammation or fibrosis as a sequel to trauma.

Histopathology did not help identify a specific aetiology but ruled out neoplasia and active inflammation. Fibrosis of the oesophagus secondary to previous trauma or a congenital abnormality were thought most likely explanations in this case which was considered to be an individual issue. This gilt was not likely to be representative of the mortalities occurring and further submissions were recommended to investigate those further.

Changes in disease patterns and risk factors

Refer to the annexe on GOV.UK for more information on the data and analysis.

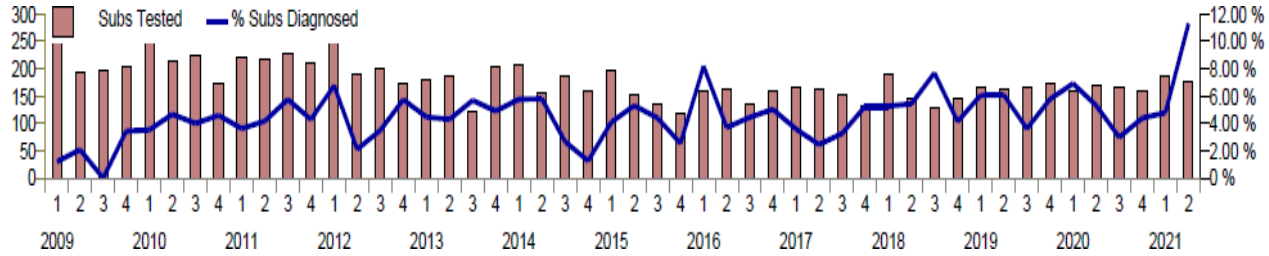
Swine influenza diagnostic rate rises in second quarter of 2021

A sharp rise in the diagnostic rate of swine influenza was recorded in quarter 2 of 2021 (Figure 7) continuing the trend reported in the first quarter of 2021 (APHA 2021b). Diagnoses were made by PCR testing on respiratory tissues from pigs examined post-mortem, or nasal swabs submitted from live affected pigs.

Twenty-two diagnoses of swine influenza were recorded in VIDA during quarter 2 of 2021. Pig ages were provided for 18 of the diagnoses made, most incidents (14 of these 18) were diagnosed in pigs aged three to nine weeks old. The higher diagnostic rate for swine influenza may have been influenced by the provision of sampling kits to pig veterinary practices to encourage use of the free virological testing at APHA under the UK Government-funded swine influenza surveillance project as described in this information note on GOV.UK.

However anecdotal reports suggest that the experience of clinical vets in the field also supports the suggestion that swine influenza has been prominent in pigs in the second quarter of 2021.

Figure 7: Great Britain swine influenza diagnoses as a percentage of diagnosable submissions



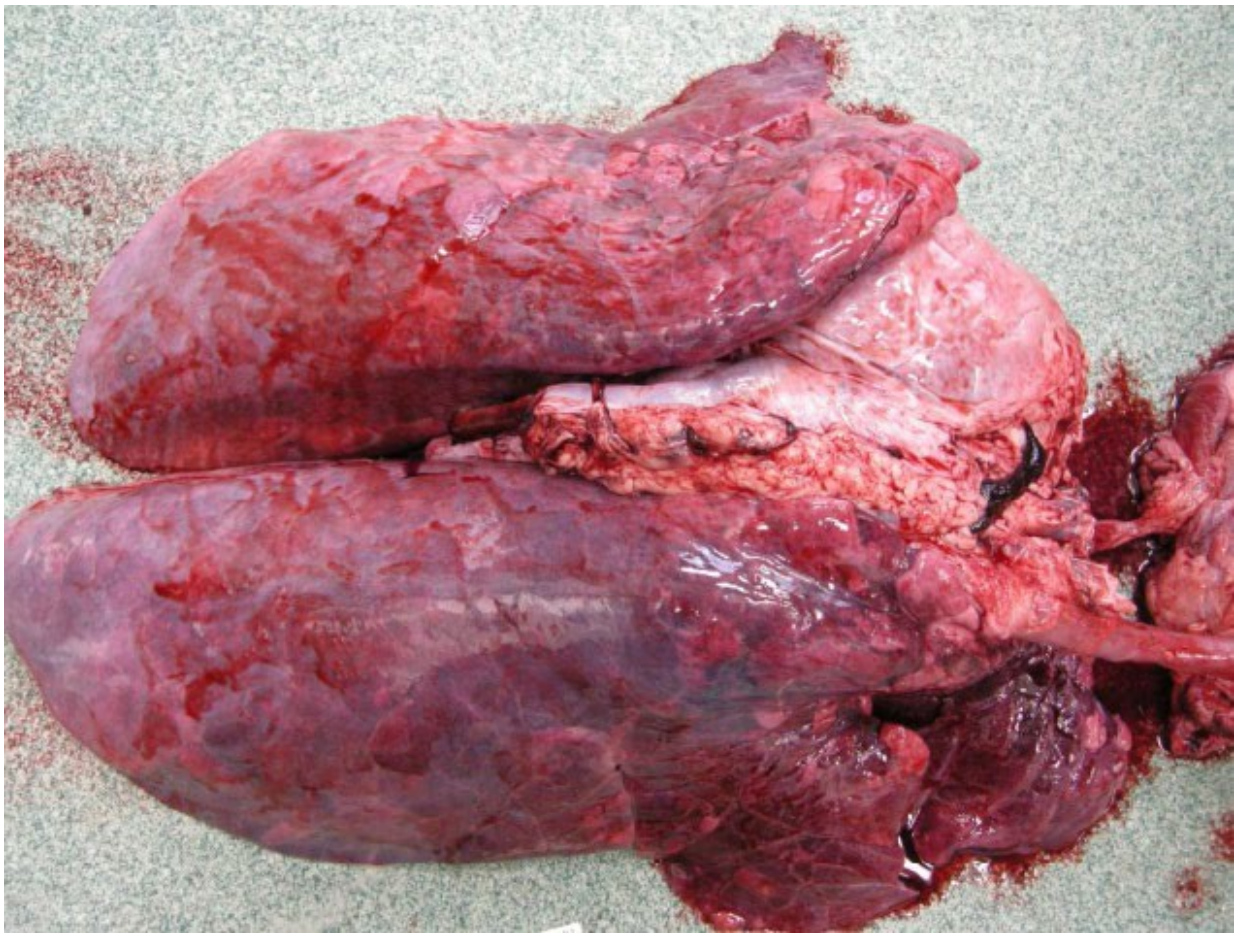
Where full subtyping was successful, the outbreaks in quarter 2 Of 2021 were found to involve pandemic H1N1 2009 (pH1N109) or H1N2 and an example of an outbreak involving pH1N109 in breeding gilts is described below. Avian-like H1N1 has only occasionally been detected in recent years, while H3N2 has not been identified in British pigs since 1997.

Swine influenza A virus (swIAV) was detected in ten-month-old gilts on an outdoor breeding unit on which respiratory signs with coughing were reported in a batch of in-pig gilts moved from an indoor unit 11 days earlier. Thirty pigs were affected with signs in eight pigs and three deaths when the first gilt was submitted.

Pneumonias were evident, with a viral appearance; gross lesions in the first gilt included non-collapsing dark red-purple lungs with a firm rubbery consistency and lobular pattern

(see figure 8), consolidation of cranioventral lung with mucopurulent material on the cut surface and white froth in the trachea. SwIAV was detected in lung by PCR and immunohistochemistry.

Figure 8: Swine Influenza, dark red-purple, rubbery and non-collapsed lungs



Histologically there was a marked, multifocal, acute to subacute, necrotising, fibrinosuppurative broncho-interstitial pneumonia. No bacteria were isolated, likely due to recent antimicrobial treatment.

In the second gilt, there was a severe suppurative fibrino-necrotic broncho-pneumonia, swIAV PCR was positive and *Streptococcus dysgalactiae equisimilis* was isolated from two areas of consolidated lung, as a secondary pathogen.

SwIAV subtyping PCRs did not identify the influenza strain, therefore whole genome sequencing (WGS) was undertaken and detected pH1N109 in both gilts. Serology on the cohort was also consistent with exposure to pandemic H1N1 2009 virus.

Subtyping PCRs in one gilt had detected N2 and the additional presence of N2 sequences was confirmed by whole genome sequencing (WGS), suggesting the possibility of dual infection, although the pandemic strain was dominant at the time of submission. Abortions were also reported in the group which can be a consequence of the maternal effects of swIAV in acute disease.

PRRS virus was detected in foetuses in one litter and, as the gilts had been recently vaccinated, sequencing was attempted to differentiate vaccine from field PRRSV, but the viral load was too low for sequencing to be successful. This incident was described in the APHA Veterinary Record July 2021 disease surveillance report (APHA, 2021c).

Porcine reproductive and respiratory syndrome (PRRS) diagnoses in Quarter 2

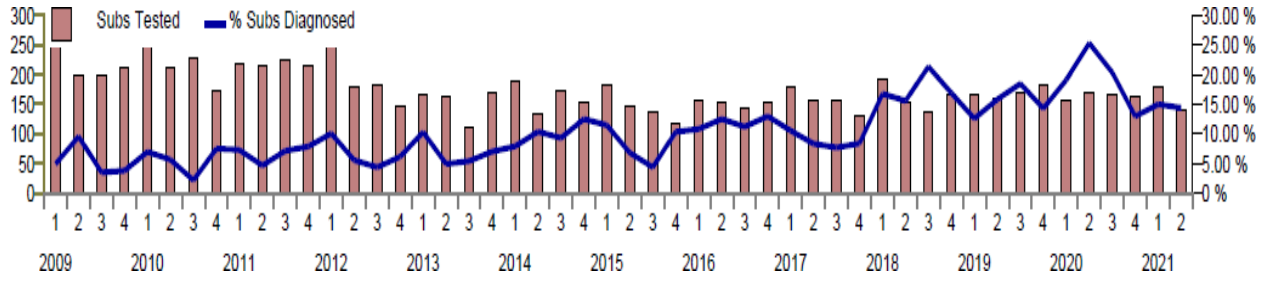
The diagnostic rate for incidents in Great Britain of PRRS remained at the same level as quarter 1 of 2021 (Figure 9) and lower than the peak seen in quarter 2 of 2020. All PRRS incidents diagnosed in Great Britain in quarter 2 of 2021 involved PRRSV-1, detection of which is now reportable by the testing laboratory on a monthly basis with no premises details required.

Twenty-three diagnoses of PRRS were made in the quarter 2 of 2021, two of which were reproductive disease incidents. In the respiratory and systemic PRRS cases, concurrent swine influenza was diagnosed in five incidents and was, together with streptococcal disease (mainly due to *Streptococcus suis*), the most frequent concurrent diagnoses made with PRRS.

In each PCR-positive diagnostic submissions to APHA, one sample is being sequenced under pig disease surveillance funding to support surveillance of PRRSV diversity. Any vaccine-like strains (based on ORF5 sequence) detected are analysed further by sequencing the non-structural protein 2 (nsp2).

Vaccine-like strains representing all four licensed vaccines in UK have been detected in 2020 and 2021. So far, analyses of strains from 2020 to 2021 show that similarity between the ORF5 sequence and a vaccine has been mirrored by similarity in the nsp2 also, which suggests that they do not represent strains from recombination events.

Figure 9: seasonality of British PRRS diagnoses as a percentage of diagnosable submissions



Information from the pig industry media (Pig Progress, 2021) and through the US Swine Health Information Center (SHIC, 2021) describes severe outbreaks of PRRS in the US due to a PRRSV-2 known as PRRSV 1-4-4 lineage 1c. This is a virulent strain of PRRSV-2 and is causing severe disease in upper Midwest pig herds (mostly southern Minnesota and northern Iowa) since late 2020.

To share information on this virulent strain impacting pork producers regionally, SHIC and the American Association of Swine Veterinarians have held webinars and podcasts on PRRSV 1-4-4 which is exhibiting dramatic clinical signs in all stages of pig production. It is suspected to have evolved from endemic PRRSV strains. SHIC has funded projects on biosecurity that could help to prevent farm outbreaks.

Veterinarians and diagnosticians describe how outbreaks due to this strain do not substantially differ from other PRRSV in the means of spread and the nature of the clinical signs, but disease is distinguished clinically as being more severe and rapidly spreading, with higher mortality. Sow mortality has been recorded at 10 to 20% over a two to three-week period.

Preweaning and weaner mortality is high (18 to 25% mentioned for nursery stage) especially if other disease challenges are present (particularly swine influenza) and there is slow growth in the finishers. Severe disease tends to last 2 to 4 weeks with 'devastating losses' described after which the herd recovers.

Outbreaks have affected herds that veterinarians would have expected to be immune, through either vaccination or recent challenge. The virus is detected with current diagnostic PRRSV PCRs used in US and high virus titres are detected which are thought to be contribute to the rapid spread.

Control utilises conventional approaches as for other PRRS outbreaks. There is no genetic marker yet identified for the increased virulence, which likely reflects changes in the genome affecting the tropism of the virus strain and/or enabling higher proliferation rates within infected pigs.

Should a PRRS with similar virulence to 1-4-4 lineage 1c evolve in British pigs, or be imported, the severity of disease may trigger suspicion of porcine notifiable disease (swine fevers or Aujeszky's disease).

PRRSV-2 has not been detected in British pigs and diagnostic PCRs used by APHA and SRUC distinguish PRRSV-1 and PRRSV-2 at the outset. Laboratory detection of PRRSV-2 is now reportable to APHA immediately, with premises details (Defra, 2021).

The main risk for introduction of new PRRSV strains into UK is in imports of live pigs or semen and testing to ensure that PRRSV is not present in these is part of the National Pig Association (NPA) import protocol.

Although testing for PRRSV in live pig imports is not a statutory requirement, herds under the Red Tractor assurance scheme are required to declare that this NPA protocol has been followed.

Limiting virus multiplication and spread as much as possible is key to reducing the risk of virulent PRRSV strains evolving from resident strains and the pig industry in Great Britain is focussing on PRRS as a key endemic pig disease for control.

Proactive testing for PRRSV in subsidised post-mortem diagnostic investigations and sequencing of the ORF-5 gene in PCR-positive submissions are undertaken within APHA's pig disease scanning surveillance project.

An update on 'PRRS: the disease and virus' was arranged for APHA VIOs and partner PME provider vets in July 2021 and information on the US PRRSV 1-4-4 lineage 1c was provided to the Pig Veterinary Society and Pig Health and Welfare surveillance subgroup.

Porcine circovirus 2-associated disease remains a threat

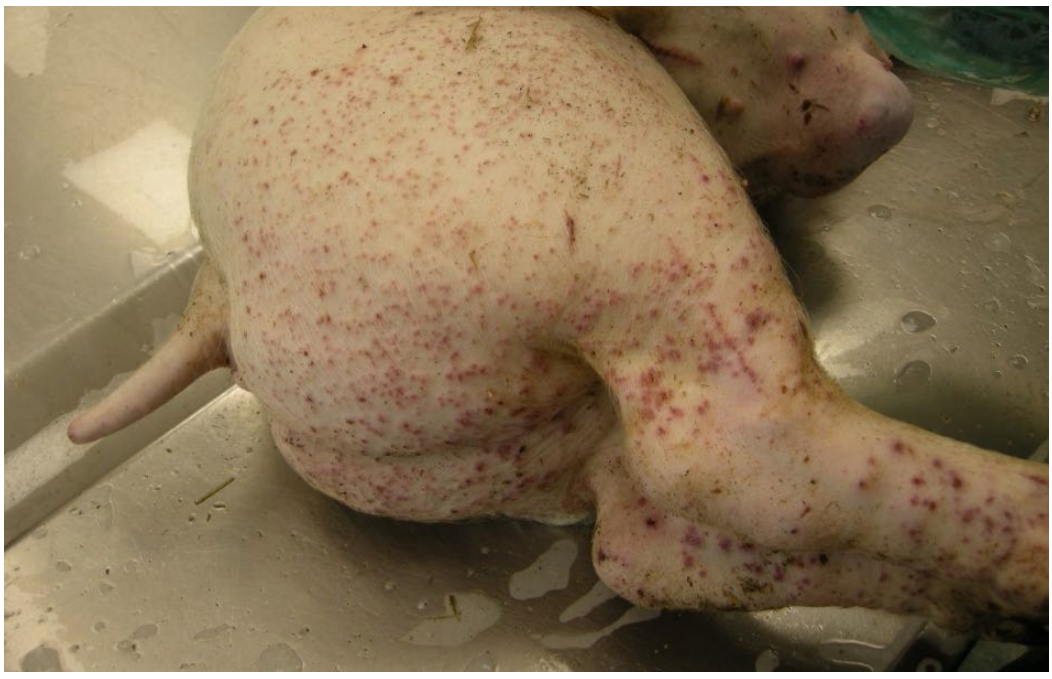
Although only four diagnoses of porcine circovirus 2-associated disease (PCV2-AD) have been recorded in VIDA in 2021 to date, these diagnoses demonstrate that PCV2-AD remains a threat to unvaccinated herds, or groups of pigs which have for some reason not been vaccinated according to agreed protocols, or at the correct time.

An outbreak of PCV2-AD with porcine dermatitis and nephropathy syndrome (PDNS) in finisher pigs was described in the Veterinary Record June 2021 disease surveillance report (APHA, 2021d).

In this outbreak, wasting, inappetence and multifocal skin lesions in one batch of pigs, some with respiratory signs, were investigated in 13-week-old growers on an indoor finisher unit. Mortality was 8.4 per cent over a five week-period, most euthanised on welfare grounds.

Three submitted pigs had red, raised crusty two to four mm multifocal coalescing skin lesions over the rear limbs, ears and shoulders (see figure 10), there was mild to moderate patchy purple, mainly cranioventral pulmonary consolidation and enlarged pale kidneys which, in one pig, had pinpoint haemorrhages over the cortices (see figure 11).

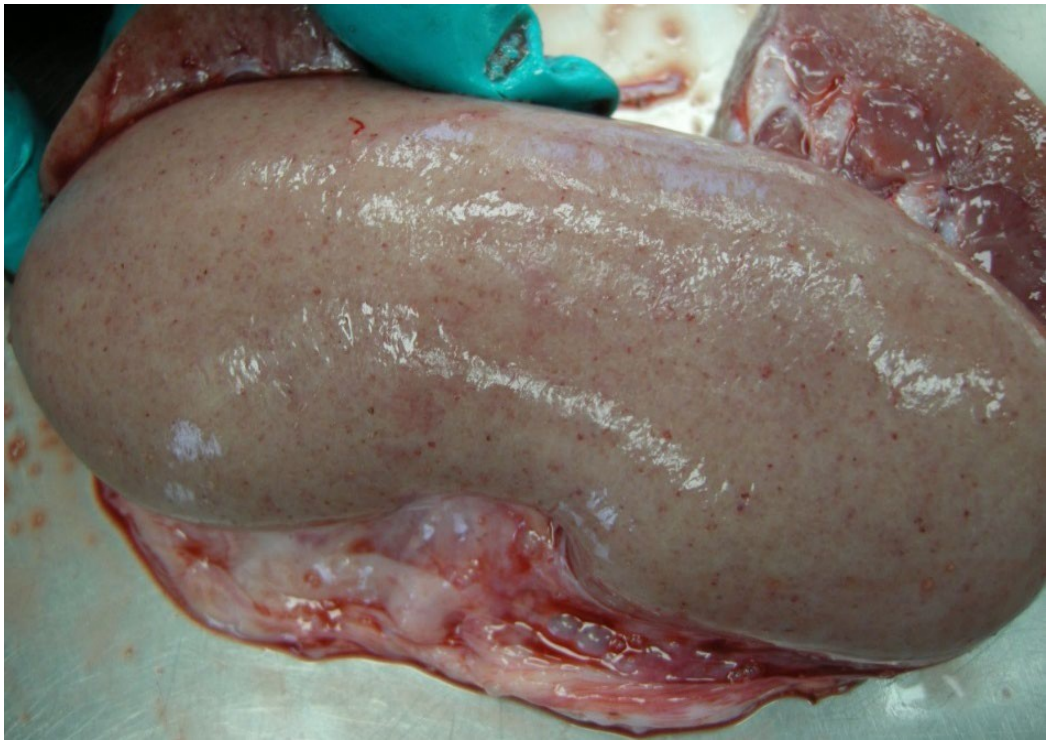
Figure 10: multifocal necrotising dermatitis in pig with PDNS and PCV2-associated disease



Granulomatous lymphadenopathy in all the submitted pigs and pneumonia in one were confirmed by immuno-histochemistry as being associated with PCV-2. Microscopic lesions in the skin and kidney were of necrotising dermatitis and fibrinonecrotising glomerular nephritis respectively with vasculitis at both sites, confirming PDNS.

PCV2 vaccination was supposed to have been given at weaning, pigs in previous and subsequent weaning batches from the same breeding source with the same vaccination regime were not similarly affected raising suspicion that this batch was not vaccinated properly, or possibly not at all.

Figure 11: pinpoint haemorrhages over pale renal cortices in pig with PDNS and PCV2-associated disease



When PDNS-like lesions are seen in multiple pigs, swine fevers should be considered and, if suspected, reported to APHA. Following discussion with the submitting vet and based on clinical, pathological and epidemiological evidence, swine fevers were not suspected in this case. Respiratory disease in these pigs was exacerbated by active swine influenza infection (partially subtyped as N2) and PRRSV was also suspected to be playing a role with typical microscopic PRRS lesions in the lung although immunohistochemistry was negative and the PRRSV strain detected was similar (98.8%) to the vaccine used in the pigs.

Genotyping of PCV2 involved in disease incidents in recent years has shown a shift from PCV2b to PCV2d globally including in the UK (APHA, 2020b). The significance of this shift is uncertain, PCV2a-based vaccines have been shown to be effective against PCV2d challenge under experimental conditions (Opriessnig and others, 2014).

PCV2 disease diagnoses in British pigs have been at a low level since commercial PCV2 vaccines became widely used in commercial pigs from the mid-2000s.

Bracken toxicity causing deaths in small pig herds

APHA diagnosed two incidents of bracken toxicity in small herds in South West England and Wales, in June and July.

In one of these, two young gilts from a group of four destined for breeding, with access to bracken (*Pteridium aquilinum*) in paddocks not previously used for pigs, were found dead. In the other herd, one growing pig died after developing lethargy, inappetance and a raised respiratory rate but without fever.

This pig was one of four brought onto a holiday park three months earlier, being fed pig nuts and kept in a paddock containing bracken. In pigs, the thiaminase component in bracken results in degenerative changes in the myocardium with death due to heart failure.

Ruling out other potential differentials such as PCV2-associated cardiomyopathy, mulberry heart disease, endocarditis and ionophore toxicity, together with the presence of histological lesions and known exposure to bracken, enabled a diagnosis of bracken poisoning.

To protect the food chain, pigs for meat production must be kept away from bracken for at least 15 days prior to slaughter. To prevent further cases in these herds, the remaining pigs in one herd were moved and the bracken is to be cleared from the original paddock whilst, in the other, bracken was removed or fenced off.

Bracken toxicity events are reported to the Food Standards Agency as a potential food safety incident, pigs must be withdrawn from potential exposure to bracken for at least 15 days prior to slaughter for human consumption.

The public had been seen feeding bracken to pigs in one of the herds which prompted the owner to put up signs not to feed the pigs. This is a timely reminder of the risk of introducing disease, in particular African swine fever (as well as Classical swine fever and Foot and mouth disease) if pigs are fed kitchen scraps or other food waste.

This is illegal and signs visible to the public are important to prevent such feeding information on these can be obtained from the AHDB. An item on bracken poisoning is to be included in the next publication of Practical Pigs and an information note is available on APHA's Vet Gateway.

Swine dysentery diagnostic rate remain low

Diagnoses of swine dysentery (SD) due to *Brachyspira hyodysenteriae* remained low in quarter 2 of 2021 (see figure 12). SD has been identified as a priority disease for control by the pig industry, thus any diagnoses of SD in Great Britain remain a concern.

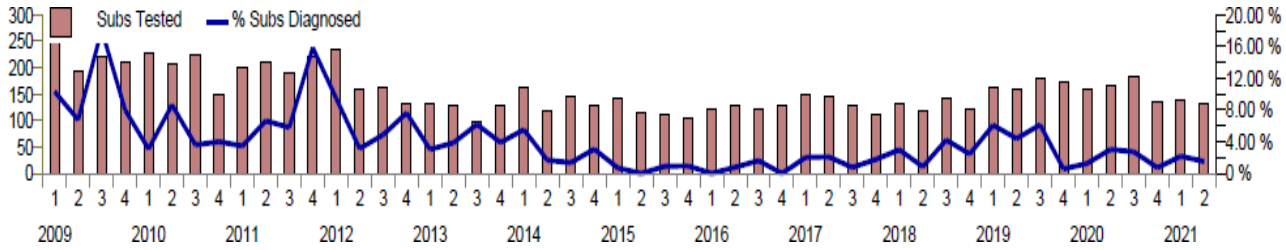
Five diagnoses in Great Britain have been recorded in the Veterinary Investigation Diagnosis Analysis (VIDA) database in 2021 to date, on premises in North Yorkshire and Dorset in those cases in which the location was provided with the diagnostic submission.

Where *B. hyodysenteriae* isolates are successfully obtained, they undergo whole genome sequencing (WGS) and antimicrobial sensitivity testing under APHA's pig disease and antimicrobial resistance surveillance projects, respectively.

In the latest batch, WGS identified isolates of multi-locus sequence types (MLST) ST 52, 240, 242 and 266. The ST52 isolate was from a small pig herd in which this ST is more common.

The antimicrobial sensitivity testing has not identified any tiamulin resistant isolates so far in 2021. The *B. hyodysenteriae* MLST dashboard provides information about sequence types detected over time and in different counties (APHA 2021e).

Figure 12: Great Britain swine dysentery as a percentage of diagnosable submissions



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

- ADHB guidance on Swine Dysentery
- ADHB significant diseases charter
- APHA surveillance assessment for Swine Dysentery (PDF)
- NADIS guidance on Swine Dysentery

Horizon scanning

Morbillivirus associated with porcine fetopathy in Mexico

A publication from the US described detection of a novel porcine morbillivirus (PoMV) as a putative cause of foetal death, encephalitis and placentitis, evidenced by histopathology, metagenomic sequencing, and *in situ* hybridisation (Arruda and others, 2021).

Viruses in the Morbillivirus genus are very contagious and include measles virus, canine distemper virus (CDV), phocine distemper virus (PDV), peste des petits ruminants virus, rinderpest virus, and feline morbillivirus.

The PoMV was most closely related to canine and phocine distemper viruses and cellular tropism was similar to other morbilliviruses, with PoMV viral RNA detected in neurons, respiratory epithelium, and lymphocytes. Disease was investigated in spring 2020 on a commercial breeding farm in Mexico which reported a significant increase (18%) in mummified foetuses and stillbirths.

If this represents a naturally occurring morbillivirus in pigs, and not a spill-over from other unknown source, it is the first such detection in pigs and involved this one herd in Mexico. The geographic distribution and species susceptibility of PoMV is currently not known.

Researchers in the US have been funded to isolate PoMV and determine if it is present in the US pig population. Import records from 2014 onwards indicate that no live pigs or pig semen have been imported from Mexico into the UK.

Virus discovery methods are available for use where appropriate if suspect histological lesions are detected or significant foetopathy or nervous disease outbreaks remain undiagnosed.

Veterinarians involved in scanning surveillance investigations have been reminded of the need for comprehensive sampling to allow neuropathology and virus discovery to be undertaken where indicated and updated internal APHA guidance has been issued on the causes of infectious causes of porcine abortion and stillbirth, including protocols for sampling and testing.

A recent Young Pig Vet Continuing Professional Development (CPD) event on porcine reproduction held by Zoetis provided the opportunity to share this guidance with veterinarians attending pigs in UK.

Atypical porcine pestivirus in experimentally inoculated pigs

Atypical porcine pestivirus (APPV) is a cause of congenital tremor (CT) type AII in pigs and has been found in pig populations around the globe, including the UK (Williamson, 2017). This is a non-statutory pathogen with no recognised zoonotic risk and with no international trade implications.

Control of CT type AII has long been based on empirical measures relating to improving breeding gilt acclimatisation and avoiding selection of breeding replacements from litters or farrowing batches in which CT-affected pigs were present.

A publication by Buckley and others (2021) on the distribution and persistence of APPV in experimentally inoculated pigs provides evidence to support this generic advice on selecting breeding replacements. A component of the study involved rearing to 11 months of age two boars born with CT in litters from sows inoculated at 45 or 62 days of gestation with APPV.

After euthanising the boars, APPV virus was shown to persist in a wide range of tissues, including testes, in the boars in which clinical signs of CT had earlier resolved. This suggests persistence of APPV in pigs infected *in utero*, similar to the persistent infections seen with other pestiviruses. APPV has been demonstrated in semen from boar studs in the USA by PCR testing, although virus infectivity is unproven (Gatto and others, 2018).

Survey of porcine neurotropic viruses in Swiss pigs

Porcine neurotropic viruses include porcine teschovirus (PTV), porcine sapelovirus (PSV-A), and enteroviruses (EV-G). These are enteric viruses that infect pigs and wild boar worldwide and are considered to be widespread as subclinical infections but have also been associated with various disease manifestations, particularly nervous and reproductive disease.

Nervous disease due to porcine sapelovirus has been confirmed in APHA diagnostic submissions previously (Schock and others, 2014, APHA, 2019) using histopathology and specific PCR testing of brain and/or spinal cord, however no up to date information is available on the prevalence of these neurotropic viruses in UK pigs.

A publication reports the frequency of these viruses in different samples from healthy and diseased Swiss pigs based on testing faeces, brain, and placenta or abortion samples using a modified multiplex reverse-transcription PCR (Stäubli and others, 2021).

All three viruses were detected in faeces at high frequencies (greater than 50%) in both healthy pigs and pigs with different disease syndromes (not necessarily due to the viruses being detected). Faeces from post-weaned growing pigs were more likely to contain these viruses than faeces from sucking piglets and sows and concurrent infections were common. None of the viruses were detected in placental or abortion samples or in brain samples from healthy pigs.

In brain tissue from pigs described as diseased, PSV-A and EV-G were detected in a small number of samples, however histopathological findings were not described for the pigs in which brains tested positive to determine the relevance of these PCR results. The presence of a non-suppurative encephalomyelitis might be expected in pigs with nervous disease associated with these viruses.

Australian researchers investigating disease in growing pigs in one herd detected the same three viruses in colon and lung by metagenomic sequencing (Bhatta and others, 2021) allowing their genetic characterisation although attributing any disease to their presence would require further investigation given their high prevalence in faeces from healthy pigs as detected in the Swiss study.

Experimental infection with *Mycoplasma suis* in splenectomised pigs

Clinical, haematological and pathological findings in splenectomised pigs experimentally infected with *Mycoplasma suis* were described in a publication by Stadler and others (2021). *M. suis* is a haemotrophic mycoplasma and causes infectious anaemia in pigs. Experimental infection resulted in clinical signs similar to those described in natural infection, namely, icteroanaemia, pyrexia, lethargy and anorexia.

In addition, skin lesions occurred with haemorrhagic diathesis presenting as petechiae. The main haematological changes were of a normochromic, normocytic anaemia. Post-mortem examination principally revealed evidence of haemolysis with consequent anaemia, as well as disseminated intravascular coagulation.

M. suis was found in all tissues by PCR, and the highest amounts were found in the blood and kidneys (spleens not available to test as splenectomised).

Testing of EDTA blood by *Mycoplasma* DGGE-PCR is recommended in diagnostic investigations of icteroanaemia alongside investigation for other potential causes.

References

APHA (2018a). Porcine circovirus 3 detection with multisystemic inflammation. GB pig quarterly report: Disease surveillance and emerging threats Volume 22: Q4 – October to December 2018 pages 6-7

APHA (2019). Porcine sapelovirus-associated neurological disease in growers. GB pig quarterly report: Disease surveillance and emerging threats Volume 23: Q3 – July to September 2019 pages 7-8
https://webarchive.nationalarchives.gov.uk/ukgwa/20200806204947mp_/https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/852561/pub-survrep-p0319.pdf

APHA (2020a). PCV3 associated with myocarditis in stillborn pigs and neonatal pigs. GB pig quarterly report: Disease surveillance and emerging threats Volume 24: Q4 – October to December 2020 page 10
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/971841/pub-survrep-p0420.pdf

APHA (2020b). Porcine circovirus 2 genotyping from disease-associated incidents. GB pig quarterly report: Disease surveillance and emerging threats. Volume 24: Q4 – October to December 2020 p13-14
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/971841/pub-survrep-p0420.pdf

APHA (2021a). PCV3 surveillance findings. GB pig quarterly report: Disease surveillance and emerging threats Volume 25: Q1 – January to March 2021 pages 7-9
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/992632/pub-survrep-p0121.pdf

APHA (2021b). Swine influenza rise during the first quarter of 2021. GB pig quarterly report: Disease surveillance and emerging threats Volume 25: Q1 – January to March 2021 pages 14-15
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/992632/pub-survrep-p0121.pdf

APHA (2021c). Respiratory disease investigations in breeding pigs. Disease surveillance in England and Wales, July 2021. Veterinary Record, 189: 102-106.
https://doi.org/10.1002/vetr.799

APHA (2021d). PCV-2-associated disease and PDNS in finisher pigs. Disease surveillance in England and Wales June 2021. Veterinary Record 189: 21-24 https://bvajournals.onlinelibrary.wiley.com/doi/epdf/10.1002/vetr.700

APHA (2021e). *Brachyspira hyodysenteriae* isolate MLST dashboard launched. GB pig quarterly report: Disease surveillance and emerging threats Volume 25: Q1 – January to March 2021 pages 15-17 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/992632/pub-survrep-p0121.pdf

Arruda B, Shen H, Zheng Y, Li G. (2021). Novel Morbillivirus as Putative Cause of Fetal Death and Encephalitis among Swine. Emerging Infectious Diseases. 27(7):1858-1866. https://doi.org/10.3201/eid2707.203971

Bhatta, T.R.; Chamings, A.; Alexandersen, S. (2021) Exploring the Cause of Diarrhoea and Poor Growth in 8–11-Week-Old Pigs from an Australian Pig Herd Using Metagenomic Sequencing. Viruses 2021, 13, 1608. https://doi.org/ 10.3390/v13081608

Buckley Alexandra C., Shollie M. Falkenberg, Mitchell V. Palmer, Paulo H. Arruda, Drew R. Magstadt, Kent J. Schwartz, Igor R. Gatto, John D. Neill, Bailey L. Arruda (2021). Journal of Veterinary Diagnostic Investigation 1–4 https://doi.org/10.1177/10406387211022683

Collins, P. J., John McKillen and Gordon Allan (2017). Porcine circovirus type 3 in the UK. Veterinary Record 181: 599 doi: 10.1136/vr.j5505

Defra (2015). Porcine epidemic diarrhoea: how to spot and report the disease. www.gov.uk/guidance/porcine-epidemic-diarrhoea-how-to-spot-and-report-the-disease

Defra (2021). New disease reporting requirements from 21st April 2021. http://apha.defra.gov.uk/documents/news/New-disease-reporting-requirements.pdf

EFSA (2021a). Scientific Opinion on the ability of different matrices to transmit African swine fever virus https://www.efsa.europa.eu/en/efsajournal/pub/6558

EFSA (2021b). Scientific Opinion on African swine fever and outdoor farming of pigs. https://efsa.onlinelibrary.wiley.com/doi/full/10.2903/j.efsa.2021.6639

Gatto, IRH, Arruda, PH, Visek, CA, et al. (2018). Detection of atypical porcine pestivirus in semen from commercial boar studs in the United States. Transboundary Emerging Diseases 65: e339– e343. https://doi.org/10.1111/tbed.12759

Niederwerder M.C. (2021) Risk and Mitigation of African Swine Fever Virus in Feed. Animals 2021, 11, 792. https://doi.org/10.3390/ani11030792

Opriessnig T, Gerber PF, Xiao CT, Halbur PG, Matzinger SR, Meng XJ (2014). Commercial PCV2a-based vaccines are effective in protecting naturally PCV2b-infected finisher pigs against experimental challenge with a 2012 mutant PCV2. Vaccine 32:4342-8

Palinski R., P. Piñeyro, P. Shang, F. Yuan, G. Rui, F. Ying, E. Byers, B. M. Hause (2016). A Novel Porcine Circovirus Distantly Related to Known Circoviruses Is Associated with Porcine Dermatitis and Nephropathy Syndrome and Reproductive Failure. Journal of Virology 91:16-16

Pig Progress (2021). 1-4-4: A new PRRS threat in the US pig industry. June 22nd, 2021 PigProgress - 1-4-4: A new PRRS threat in the US pig industry

Rodrigues, I.L.F., Cruz, A.C.M., Souza, A.E. et al. (2020). Retrospective study of porcine circovirus 3 (PCV3) in swine tissue from Brazil (1967–2018). Braz J Microbiol 51, 1391–1397. https://doi.org/10.1007/s42770-020-00281-6

Saporiti, V., Franzo, G., Sibila, M., & Segalés, J. (2021). Porcine circovirus 3 (PCV-3) as a causal agent of disease in swine and a proposal of PCV-3 associated disease case definition. Transboundary Emerging Diseases, 00, 1– 13 https://doi.org/10.1111/tbed.14204

Schock A., Gurrala R., Fuller H., Foyle L., Dauber M., Martelli F., Scholes S., Roberts L., Steinbach F., Dastjerdi A. (2014). Investigation into an outbreak of encephalomyelitis caused by a neuroinvasive porcine sapelovirus in the United Kingdom. Veterinary Microbiology 172: 381–389

Scottish Government (2016). The Specified Diseases (Notification) Amendment (Scotland) Order 2016. http://www.legislation.gov.uk/ssi/2016/41/contents/made

Shurson, G. C., Palowski, A., van de Ligt, J. L. G., Schroeder, D. C., Balestreri, C., Urriola, P. E., and Sampedro, F. (2021). Transboundary and Emerging Diseases, 1– 26. https://doi.org/10.1111/tbed.14174

Stadler, J., Ade, J., Hermanns, W. *et al.* (2021). Clinical, haematological and pathomorphological findings in *Mycoplasma suis* infected pigs. BMC Vet Res 17: 214 https://doi.org/10.1186/s12917-021-02919-5

Stäubli, T., Charlotte I. Rickli, Paul R. Torgerson, Cornel Fraefel, Julia Lechmann (2021). Porcine teschovirus, sapelovirus, and enterovirus in Swiss pigs: multiplex RT-PCR investigation of viral frequencies and disease association. Journal of Veterinary Diagnostic Investigation. First Published June 21, 2021 Research Article https://doi.org/10.1177/10406387211025827

Taylor, RA, Podgórski, T, Simons, RRL, et al. (2021). Predicting spread and effective control measures for African swine fever—Should we blame the boars?. Transboundary Emerging Diseases 68: 397– 416. https://doi.org/10.1111/tbed.13690

Williamson, S. (2017). Congenital tremor associated with atypical porcine pestivirus. Veterinary Record, 180: 42-43. https://doi.org/10.1136/vr.j121

Statement regarding use of this material

The material in this report has been compiled by the Animal and Plant Health Agency (APHA) Surveillance Intelligence Unit in collaboration with the APHA Surveillance and Laboratory Services Department.

The report is available on GOV.UK at: https://www.gov.uk/government/collections/animal-disease-surveillance-reports.

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

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

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