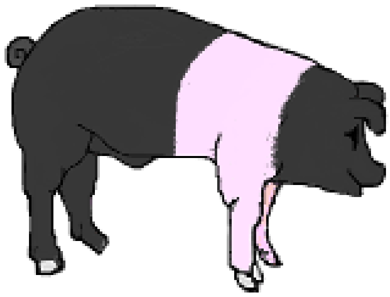
Animal & Plant Health Agency



SRUC

GB pig quarterly report

Disease surveillance and emerging threats

Volume 25: Q1 – January to March 2021

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Introduction and overview

This quarterly report reviews disease trends and disease threats for the first quarter of 2021, January to March. 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:
https://www.gov.uk/government/publications/information-on-data-analysis

Pig disease surveillance dashboard outputs

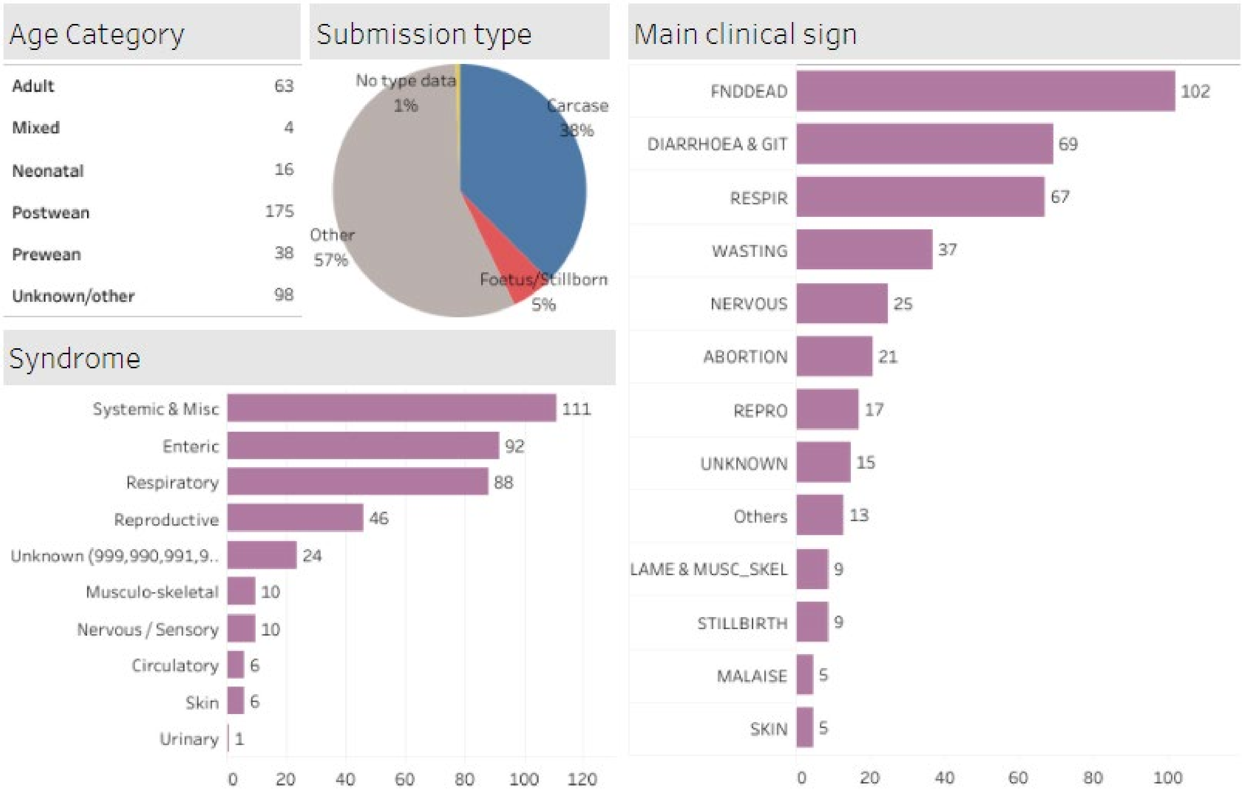
Diagnoses made in the first quarter of 2021 compared to the same quarter in 2020 through the GB scanning surveillance network are illustrated in Tables 1a and 1b. These can be interrogated further using the interactive pig disease surveillance dashboard which was launched in October 2017 and can be accessed from this link: http://apha.defra.gov.uk/vet-gateway/surveillance/scanning/disease-dashboards.htm

Table 1: GB scanning surveillance 15 most frequent diagnoses in Q1-2021 and Q1-2020

Table 1a: Fifteen most frequent diagnoses Q1-2021 (total 253)	Table 1b: Fifteen most frequent diagnoses Q1-2020 (total 226)
Salmonellosis - Typhimurium	PRRS - pneumonia
Streptococcus suis	*Streptococcus suis*
Rotavirus	PRRS - systemic
Pneumonia – other cause	Salmonellosis - Typhimurium
PRRS - pneumonia	Swine influenza
Colibacillosis - enteric	Rotavirus
Lawsonia sp. associated disease	Colibacillosis - enteric
Mycoplasma hyopneumoniae pneumonia	*Lawsonia* sp. associated disease
Swine influenza	*Brachyspira pilosicoli*
Torsion small intestine	Pneumonia – other cause
Streptococcal infection	Arthritis – other cause
Pasteurella multocida pneumonia	*Haemophilus parasuis* disease
PRRS - systemic	*Actinobacillus pleuropneumoniae*
Colibacillosis – oedema disease	*Pasteurella multocida* pneumonia
Colisepticaemia	*Mycoplasma hyopneumoniae* pneumonia

Note that further diagnoses are likely to be added for records for submissions made in Q1-2021 which are finalised at a later date.

Figure 1: Summary data for 394 submission records in Q1-2021 (405 in Q1-2020)



These diagnostic submissions are voluntary and subject to several sources of bias. The profile of submissions for the first quarter of this year differs from that of Q1 of 2020 in that systemic syndrome is most frequent in Q1-2021 (Figure 1) rather than enteric in Q1-2020. Total GB diagnostic submissions for the quarter (356) were slightly higher than totals for the same quarter in 2017 to 2020 (range from 313 to 341) although the proportion of carcase submissions has reduced compared to the same quarter in 2020, reflecting lower numbers of carcase submissions to SRUC. APHA carcase submissions have been maintained at numbers similar to or exceeding those in the same quarter in the previous four years. The increased number of non-carcase submissions to SRUC VS seen in Q1-2020 has been maintained and, in this quarter, there was also a continued uplift in the numbers of non-carcase submissions to APHA. Three of the five most common diagnoses in Q1-2021 were also in the top five diagnoses in Q1-2020; namely disease due to *Streptococcus suis*, PRRS, and salmonellosis due to *S*. Typhimurium. The geographical areas where free carcase collection is offered for delivery to post-mortem examination sites within the APHA network were expanded in 2017. The availability of this service is regularly publicised and there is regular uptake of the service.

During Q1-2021, 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

Please refer to the annexe on Gov.UK for more information on the data and analysis.

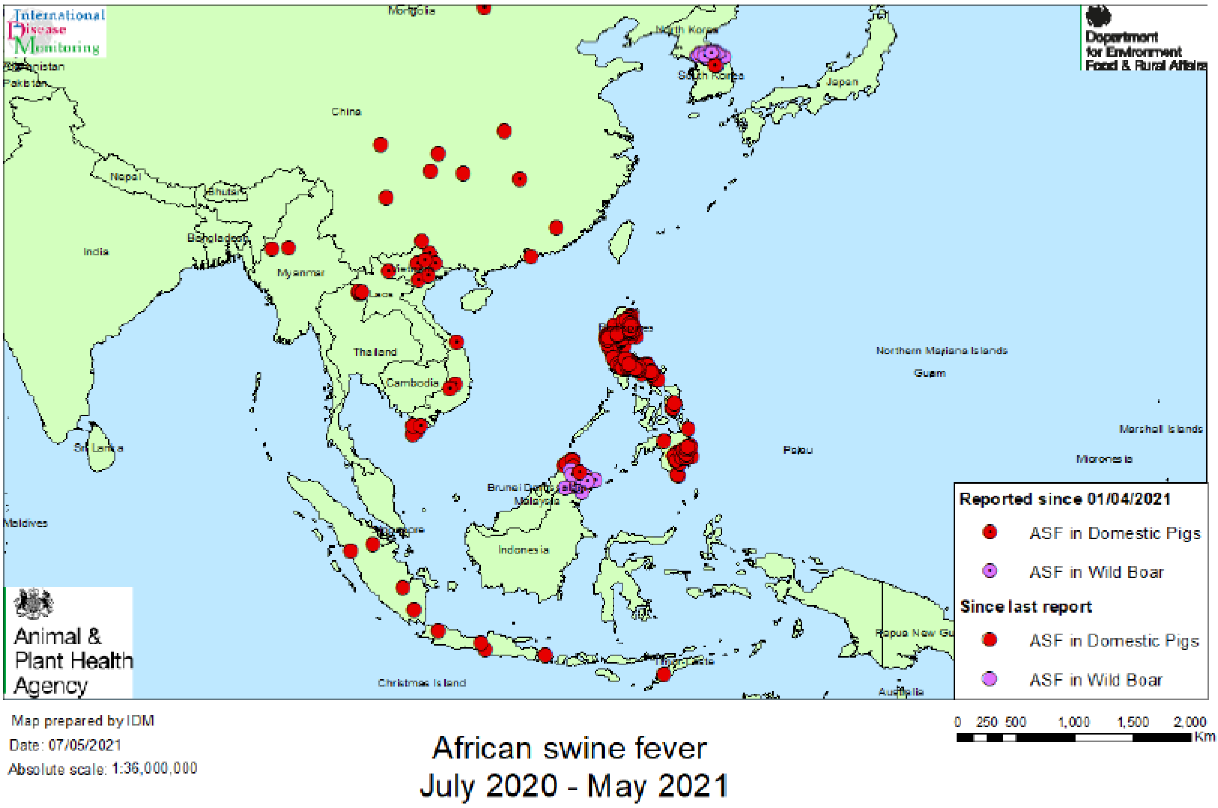
African swine fever summary in South East Asia and Europe

Updated assessments continue to be published on African swine fever (ASF) in Asia and Oceania, and in Europe including Germany:
https://www.gov.uk/government/collections/animal-diseases-international-monitoring

Briefly, since the last report on 16th July 2020 by the APHA International Disease Monitoring Team (IDM), ASF outbreaks in domestic pigs have been reported in China, Hong Kong, India, Indonesia, Laos, Myanmar, Philippines, South Korea and Vietnam demonstrating the wide geographic distribution of the virus in Asia and ASF has been reported in Malaysia for the first time in both domestic pigs and wild boar. Multiple outbreaks have been reported in the Philippines, mainly in backyard pigs. Most ASF reported in this region is in domestic pigs (Figure 2); the situation in wild boar is less clear with few reports in wild boar in ASF-affected countries apart from South Korea which continues to report ASF in wild boar in its northern region bordering North Korea and an outbreak was reported in the pig industry media in domestic pigs shortly after the IDM update was issued. The naturally mutated ASF virus strain with lower pathogenicity in China described in the Q4-2020 report (APHA, 2020a) has been identified in samples collected between June and December 2020 from domestic pigs in Hubei, Heilongjiang and Hebei provinces in China. Full details are in the report available at:
https://www.gov.uk/government/publications/african-swine-fever-in-pigs-in-china

On a positive note, field trials of ASF vaccines are reportedly in progress in China, Philippines and Vietnam. A US Department of Agriculture ASF vaccine is being trialled in Vietnam; this is a live attenuated vaccine with a deleted gene, ASFv-G-ΔI177L, selected because it is involved in immuno-modulation. A paper on progress with ASF vaccines was presented at an OIE/FAO meeting of the Standing Group of Experts on African Swine Fever for Asia in February 2021 and is available on this link: https://rr-asia.oie.int/en/events/virtual-meeting-of-the-standing-group-of-experts-on-african-swine-fever-for-asia/. Other papers presented at the same meeting can be accessed via this link including one on the situation in China showing the relative importance of the main transmission routes of ASF virus in different regions; namely spread by swill feeding, mechanical dissemination by contaminated vehicle and personnel, or movement of pigs and pig products.

Figure 2: ASF cases reported in SE Asia from July 2020 to May 2021 (mapped on 07-05-21)



Updates on the ASF situation in Europe were issued in February and May 2021. Full details are in the reports available at: https://www.gov.uk/government/publications/african-swine-fever-in-pigs-and-boars-in-europe

ASF in wild boar continues to be reported in Germany, across the states of Brandenburg and Saxony. At the end of January, following ASF virus (ASFV) detection in a dead wild boar in the buffer zone around the core area in Saxony, the restriction zone was expanded southwards and a temporary electric fence was initially erected. Core infected areas in Brandenburg and Saxony have now been surrounded by permanent fencing. Mobile fencing is still in place along much of the border with Poland, and will be replaced with permanent fencing. There have been no reports of ASF in domestic pigs in Germany to date. In March 2021 Poland reported its first outbreak in domestic pigs since October 2020 on a holding with almost 16,000 pigs located in the west of the country around 40 miles from the border with Germany. This was the second largest ASF outbreak in Poland since ASF was first detected there in 2014. Wild boar cases of ASF were reported in the area, the closest just 0.5km away. A suggested route of infection was fodder fed to the pigs that contained maize from surrounding fields.

Figures 3 and 4 illustrate the ASF cases reported in Europe in domestic pigs and wild boar respectively between November 2020 and April 2021. There have been large numbers of outbreaks on backyard pig premises and a small number on large commercial pig farms in Romania. In Russia and Ukraine, a small number of outbreaks have occurred both on backyard and large commercial pig farms. Cases of ASF in wild boar continue across most of the ASF-affected countries in Europe, particularly in Hungary and Romania, in addition to Poland.

Figure 3: ASF reports in domestic pigs in Europe November 2020-April 2021 (mapped 28-04-21)

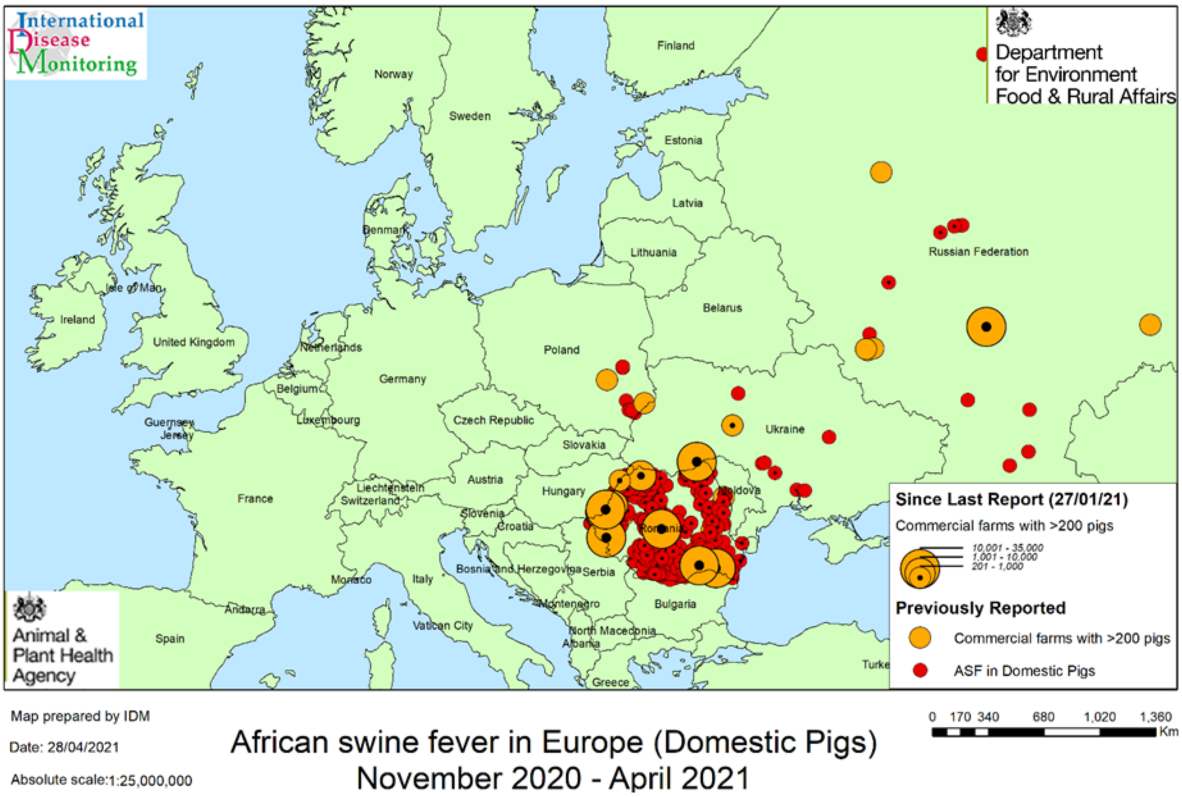
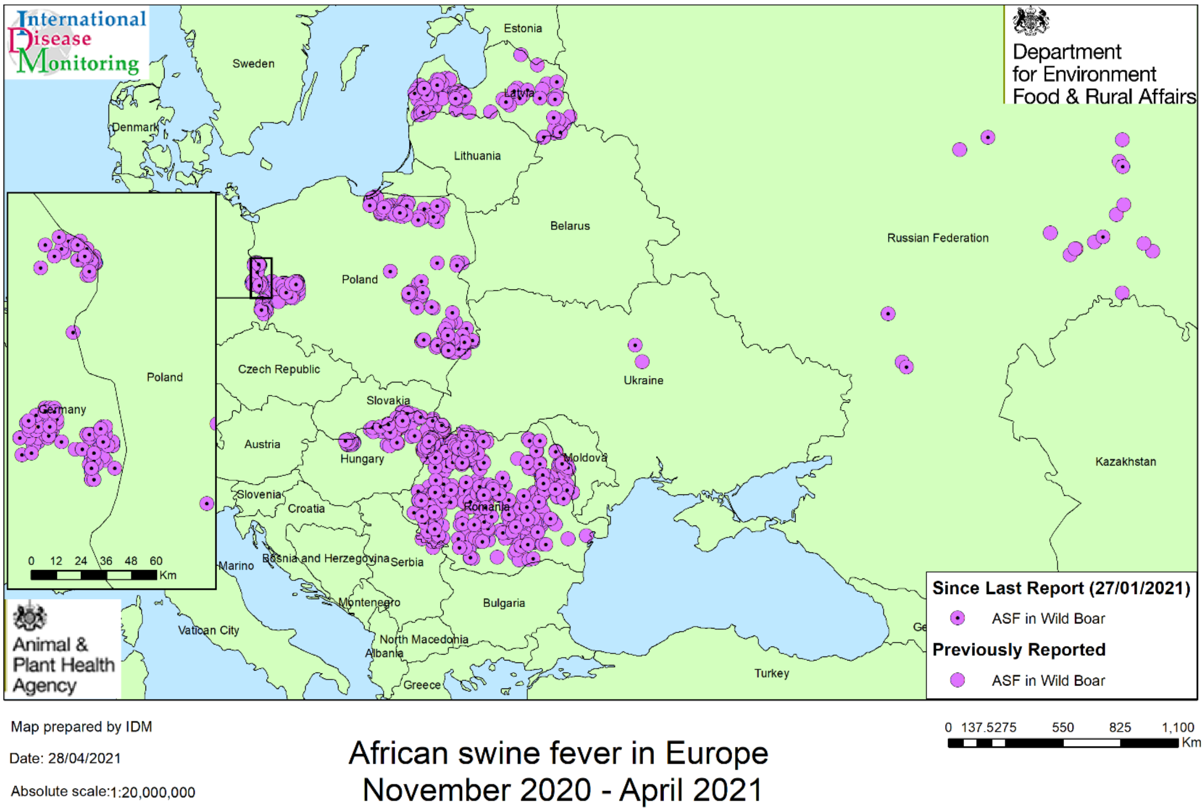


Figure 4: ASF reports in wild boar in Europe November 2020-April 2021 (mapped 28-04-21)



Two EFSA Scientific Opinions have been published. One was an assessment of ASF control measures (EFSA, 2021a) and contains useful information on time to detection in herds. The second was 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. This is a complex risk assessment, and includes information on how the risk ranking of a matrix could be influenced by an effective storage period or a virus inactivation step. A timely paper with respect to the subject of feed as a risk pathway for ASFV introduction was published by Niederwerder (2021); this review provides information on the risk of African swine fever virus introduction in feed and potential mitigation strategies to help protect the global swine population from introduction and spread of ASF virus through feed.

Other recent publications include a valuable and detailed description of the gross and microscopic pathology of ASF (Sánchez-Cordón and others, 2021).

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: https://www.swinehealth.org/global-disease-surveillance-reports/

Information on ASF reports 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 remains pigs or wild boar eating pork or pork products derived from infected animals. The ASF virus 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/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: https://www.gov.uk/guidance/african-swine-fever and http://apha.defra.gov.uk/documents/surveillance/diseases/african-swine-fever-images.pdf

Aujeszky's disease virus detected in captive wild boar in France

Aujeszky's disease virus (ADV) was detected in a wild boar in France in March 2020 in animals kept for restocking for hunting purposes and tested as part of active ADV surveillance. The group comprised 35 adults and 30 young animals; only two tested positive. Infection with ADV was strongly suspected to be through contact with local free-ranging wild boar in which infection is known to be present.

Negated notifiable disease clinical report case in Q1-2021

Passive surveillance is an important component for detection of exotic notifiable diseases. One clinical report case of suspect swine fever resulted from the death of two wild boar at the same time and place which was reported to APHA during Q1-2021. These underwent official investigation and African and Classical swine fevers were negated following testing. Differential diagnostic investigation was undertaken although limited by the material available; lungworm infestation was confirmed and other diagnostic testing is still in progress. Single wild boar carcases found dead in the Forest of Dean are tested for ASFV under a pilot ASF surveillance scheme and all those tested to date have been negative.

Porcine epidemic diarrhoea surveillance

Porcine Epidemic Diarrhoea (PED) due to any strain remains notifiable in England and Scotland and suspicion of disease, or confirmation of infection, must be reported (Defra, 2015; 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 1190 diagnostic submissions tested under Agriculture and Horticulture Development Board (AHDB) Pork funding from June 2013 to March 2021. The AHDB PED contingency plan has been updated and a PED exercise is planned for 2021, led by the Pig Health and Welfare Council. Further information on PED is available on this link: https://pork.ahdb.org.uk/health-welfare/health/emerging-diseases/pedv

PCV3 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, Spain and others. Information from an increasing number of countries indicates that PCV3 is widespread in pigs globally and publications suggest that this virus, although newly discovered in pigs, has been present in the pig population for a number of years. PCV3 is genetically distinct from 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 from England. Investigations through APHA's scanning surveillance detected PCV3 at high viral loads in stillborn and/or neonatal piglets, some with arthrogryposis in three incidents, one in 2018, one in 2020 and the other tested retrospectively from 2014 (APHA, 2018a; APHA, 2020b). Thus PCV3 is known to be present in the national pig herd, but at unknown frequency.

Porcine circoviral infections are not OIE listed, nor notifiable in EU/UK, or of zoonotic concern.

A PCV3 baseline study to estimate prevalence of PCV3 in sera of pigs from England and Wales sampled at abattoirs in 2019 was funded by AHDB Pork with PCV3 testing by qPCR. The PCV3 prevalence was 38.3% (95% confidence intervals 34.7-42.0) indicating that this virus is common in the national pig population, as studies in other countries have found. Most sera had a Ct value of more than 30, consistent with low PCV3 loads; in a Spanish study sampling healthy pigs from weaning to slaughter, the viral loads were also low, suggesting subclinical infections (Klaumann and others, 2019). The pigs which were tested were sampled at slaughter using, as closely as possible, a similar sampling frame to that followed in a 2013 baseline study for other pathogens (Powell and others, 2016). Direct comparison of the PCV3 prevalence detected here with those reported in studies on PCV3 in other countries is not possible as the sera tested are sourced in different ways, often not randomly, and some are tested in pools rather than individually. PCV3 was detected in 28.0% of serum pools from finishers in a study of 14 Polish pig farms (Stadejek and others, 2017). A study in Spain compared PCV3 prevalence in the sera of pigs with respiratory or enteric disease with the prevalence in sera from healthy age-matched pigs and found no difference (Saporiti and others, 2020). The percentage of PCV3 positive sera was generally lower in their study than detected here with 6.7% of the healthy pigs testing PCR positive, although only 60 healthy pigs were tested. Publications reporting detection in sow sera describe PCV3 presence in 29% of sows tested in farms in Poland and 47.37% in Thailand (Kedkovid and others, 2018). Klaumann and others (2019) describe longitudinal sampling of pigs and testing for PCV3 on four pig farms in Spain; the frequency of infection was not consistently higher at any particular age and the prevalence at 25 weeks old ranged from around 10 to 32% on the four farms. In wild boar sera, the prevalence of PCV3 was similar to, or higher than, that found in domestic pigs, ranging from 33 to 42.6% (Klaumann and others, 2018; Franzo and others, 2018). This study could be repeated in future years to assess changes in national-level PCV3 prevalence and the pattern of virus diversity.

Surveillance for non-suppurative myocarditis continues on all diagnostic submissions of pigs or foetuses to APHA and PCV2 immunohistochemistry and PCV3 *in situ* hybridisation (ISH) are undertaken on any found to have non-suppurative myocarditis. This testing resulted in another incident of stillbirths with myocarditis associated with PCV3 infection being diagnosed in January 2021. The clinical disease was apparently limited in nature, and the abnormal neonates or arthrogryposis seen in previous incidents were not reported. This is only the fourth PCV3-associated incident involving stillborn/neonatal pigs diagnosed at APHA although screening for myocarditis has been in place (originally for PCV2 foetopathy) since 2011. This disease manifestation associated with PCV3 has been reported in other countries, including the United States, Colombia and Spain.

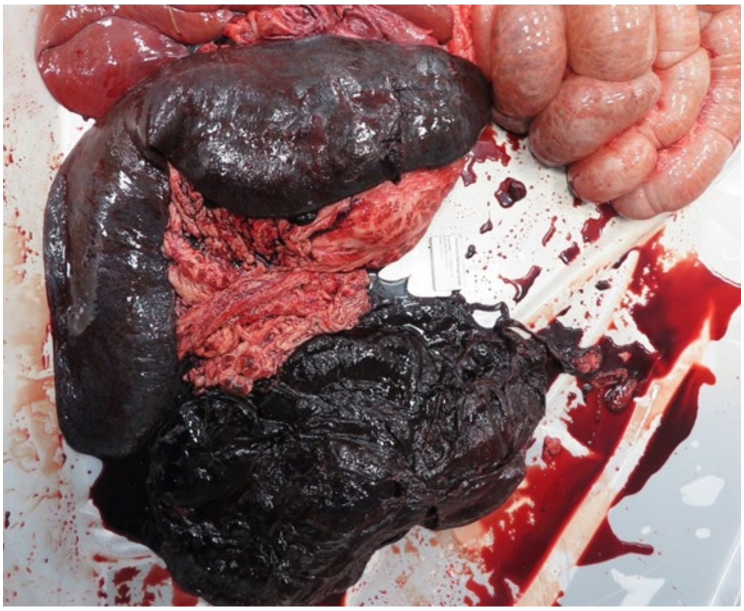
Other than these incidents in stillborn and neonatal pigs, only four other individual pigs in have been found to date to have myocarditis with high PCV3 viral loads and/or PCV3 ISH positive during 2019-2021. These have been individual pigs in batches in which the other pigs did not show PCV3-associated heart lesions; the PCV3 may not be of clinical significance in these pigs and requires more research. All hearts which have been screened histologically will be tested for PCV3 by qPCR as a batch. Interestingly, experimental infections of caesarean-derived, colostrum deprived pigs with PCV3 at five (Temeeyasen and others, 2021) or six weeks old (Mora-Díaz and others, 2020) produced multisystemic inflammation and perivasculitis without significant clinical signs in the infected pigs. A useful summary of PCV3 research findings in Spain was compiled recently by Pig Progress (2021) and a clinical club presentation at the Pig Veterinary Society's autumn conference (https://www.pigvetsoc.org.uk/resources) described the 2020 case diagnosed at APHA.

Unusual diagnoses or presentations

Splenic torsion

A case of splenic torsion was diagnosed by the University of Surrey, a partner post-mortem provider, in a lactating sow found dead in a small herd. The sow also had a fibrinous pericarditis and an empty stomach and gas-filled intestines and had likely been inappetant. The abdomen contained many litres of unclotted blood and clotted blood was loosely adherent to a linear rupture in the splenic capsule. The spleen was displaced to the right side of the abdomen, and was markedly enlarged, red-black and meaty in texture (Figure 5), weighing 2.2 kg.

Figure 5: Enlarged spleen with clotted blood due to torsion



An enlarged, dark and friable spleen is a lesion which is described in cases of African swine fever, however other findings in the sow and the herd from which she derived allayed concerns and swine fevers were not suspected. Splenic torsion alone is more common in sows than in fattening pigs and the relatively long gastrosplenic ligament in the adult pig may predispose to its occurrence (Morin and others, 1984) with death attributed to sequestration of large amounts of blood in the spleen and/or to haemorrhage secondary to splenic rupture, as in this case.

Unusual age occurrence in enteric disease cases

Diagnostic investigations at SRUC have identified cases of enteric disease occurring at unusual ages for the pathogens involved. Post-weaning colibacillosis involving an attaching and toxigenic strain of *Escherichia coli* was diagnosed in pigs up to eight weeks of age; older than generally associated with this disease which is usually seen in the immediate post-weaning period. Conversely, unusually young weaned pigs were affected at five weeks of age with extensive lesions of proliferative enteropathy due to *Lawsonia intracellularis*. This included cases with pathology apparently confined to the colon, with no histological evidence of lesions in the ileum, as well as cases of haemorrhagic enteropathy due to *L. intracellularis* involving lesions, also primarily affecting the colon. These findings in pigs at five weeks old suggest that they were infected with *L. intracellularis* at approximately three weeks of age before they were weaned. This will be kept under review to determine if these are one-off incidents or reflect a change in disease trend.

Osteomyelitis due to Actinobacillus lignieresii

An unusual cause of osteomyelitis in a five-week-old commercial pig was found when *Actinobacillus lignieresii* was cultured from the lesion (Figure 6) affecting the tibia. *A. lignieresii* is not a recognised pig pathogen and is known best as a commensal and pathogen of ruminants (wooden tongue), and also exists in the environment. It seems likely that this was an opportunist infection there was no known direct or indirect association with ruminants or horses. This pig also has enteric salmonellosis.

Figure 6: Tibial osteomyelitis due to *A. lignieresii*

Changes in disease patterns and risk factors

Please refer to the annexe on Gov.UK for more information on the data and analysis.

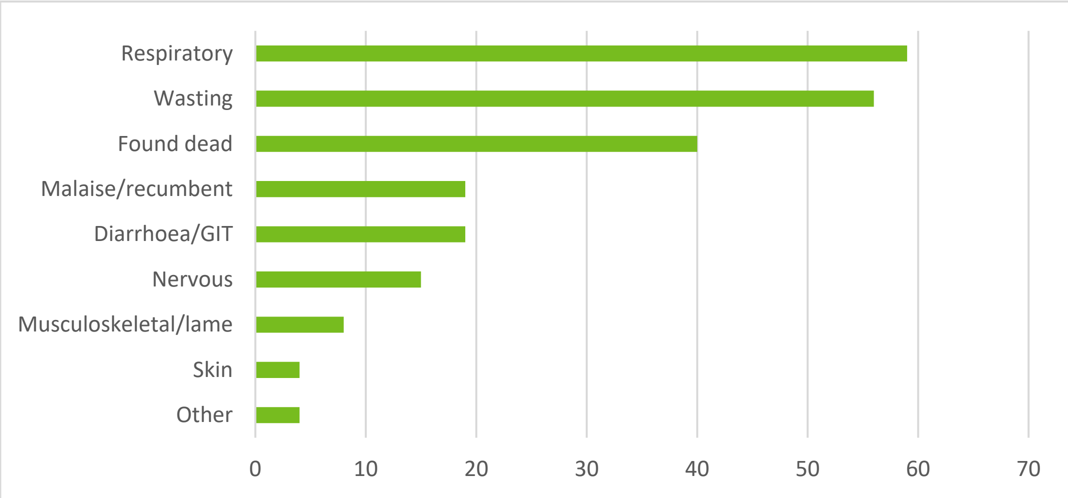
Porcine reproductive and respiratory syndrome dashboard updated

The APHA porcine reproductive and respiratory syndrome (PRRS) dashboard has been updated with data from 2020 to include clinical and pig details from diagnostic submissions to the GB surveillance network from 2012 to 2020 in which PRRS was diagnosed. No PRRS virus – 2 (PRRSV-2) has been detected in GB pigs to date, thus all data described relate to submissions in which disease was due to PRRSV-1. The updated dashboard is available on the link below (copy and paste the link into a browser): https://public.tableau.com/profile/siu.apha#!/vizhome/Porcinereproductiveandrespiratorysyndrome/PRRS

In 2020, 140 diagnoses of PRRS were made, eight of which were recorded as reproductive disease (abortion, stillbirths, weak neonates) and the remainder were recorded as systemic or respiratory disease, with the majority of diagnoses (106) made in post-weaned pigs. As systemic disease and pneumonia due to PRRS are often present together in the same outbreak, data from these are grouped together in the PRRS dashboard. The annual diagnostic rate is shown in the dashboard and has shown a general upward trend, in part reflecting anecdotal reports of disease from the field, but also likely to reflect the increased focus on efforts to control PRRS and also to reduce antimicrobial use. The prominence of PRRS as a diagnosis emphasises the need for collaborative efforts to control this virus, limit spread from infected units, and protect units which are free of PRRSV so they can maintain their infection-free status.

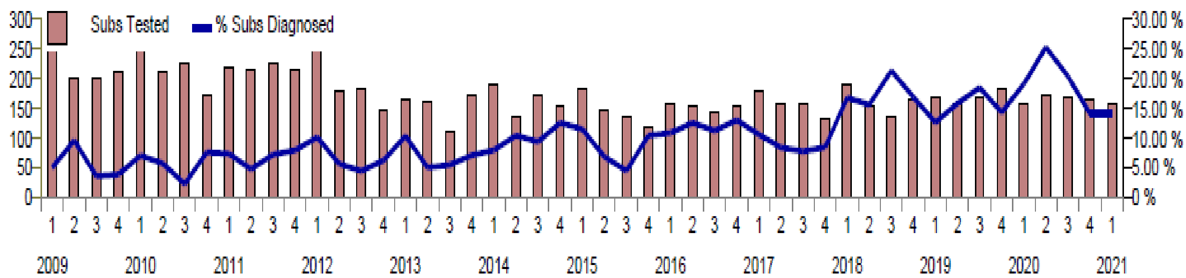
The frequency of clinical signs reported, whether main or secondary, in pigs diagnosed with PRRS (systemic or pneumonia) in 2020 are illustrated in the PRRS dashboard (adapted for Figure 7) with respiratory, wasting and pigs being found dead as the most common in that order. Where reproductive disease due to PRRS was diagnosed, abortion/stillbirth was the most frequent sign, followed by malaise and/or recumbency in the breeding pigs.

Figure 7: Clinical signs described for respiratory and systemic PRRS diagnoses in 2020



The seasonality data shows that PRRS remained a prominent diagnosis throughout 2020 although the diagnostic rate has declined from its peak in Q2-2020 (Figure 8). Previously there was a tendency for a seasonal increase in diagnoses over the winter months, however since 2018, this pattern has not been evident.

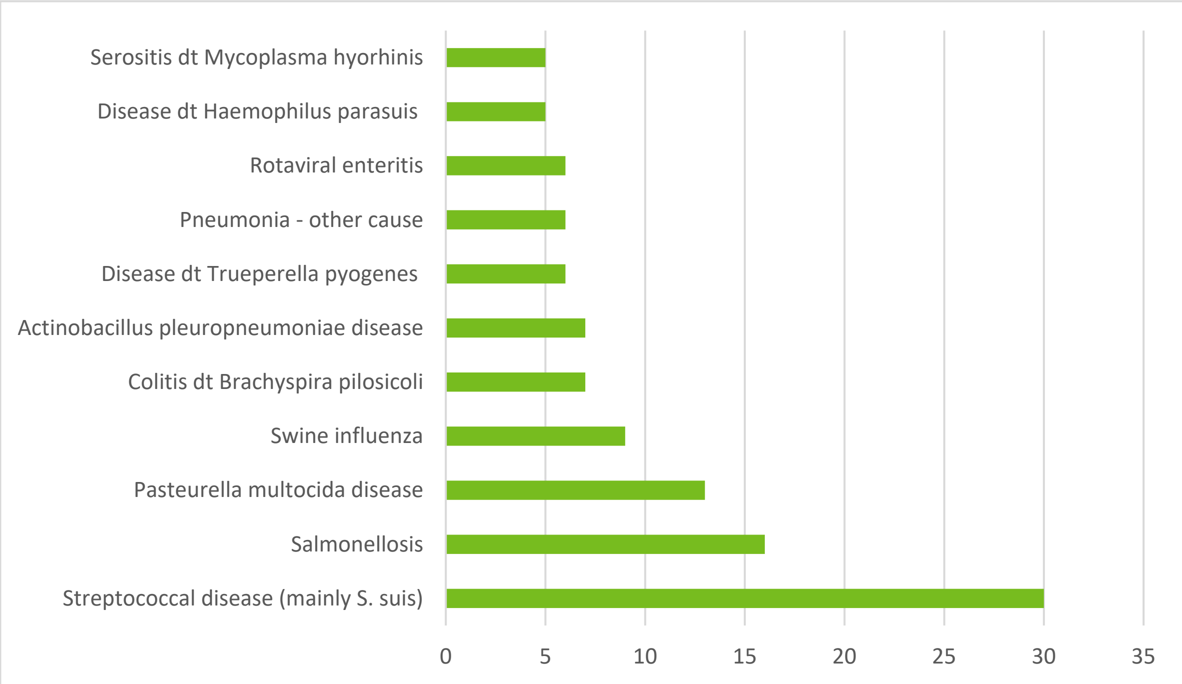
Figure 8: Seasonality of GB PRRS diagnoses as a % diagnosable submissions



The dashboard also shows the distribution of PRRS diagnoses by county. Counts of diagnoses in a country and county are influenced by several factors, these include: more disease due to PRRS; more numerous submissions due to a larger number of pigs or pig holdings in a region; increased vigilance among the local farmers and vets; diagnostic investigations as part of disease control initiatives being implemented; differences in use of the GB diagnostic network compared to other laboratories; and diagnostic initiatives offered. In view of these variables, and as the disease status of non-submitting herds is not known, the level (prevalence) of disease or virus within individual counties cannot be inferred, and the data cannot be used to make accurate comparisons between different regions. However, the highest counts of diagnoses are, not surprisingly, found in counties where the commercial pig population is highest. PRRS diagnoses made outside the surveillance network are not currently captured in the dashboard.

Concurrent diagnoses made in addition to PRRS in the same submission are collated in the dashboard. In 2020, streptococcal disease (mainly *Streptococcus suis*), salmonellosis and disease due to *Pasteurella multocida* were the most frequently identified diseases concurrent with PRRS in carcase submissions (Figure 9). Very few concurrent diagnoses were made in postal non-carcase submissions (total of nine diagnoses) emphasising the value of the full diagnostic investigation that carcase submissions enable. As these findings illustrate, PRRS can act as a driver for antimicrobial use with bacterial disease prominent amongst the concurrent diagnoses which reflects, in part, the immunosuppressive nature of the PRRS virus. Full diagnostic investigations in disease outbreaks assist veterinarians in developing targeted disease control, including antimicrobial treatment and/or vaccination for other pathogens where appropriate. Controlling and, where possible, eliminating PRRS is a focus for disease control initiatives in the Pig Health and Welfare Pathway being developed by the pig industry in partnership with Defra.

Figure 9: Diagnoses made concurrent with PRRS in carcase submissions in 2020 (showing those recorded at least five times)

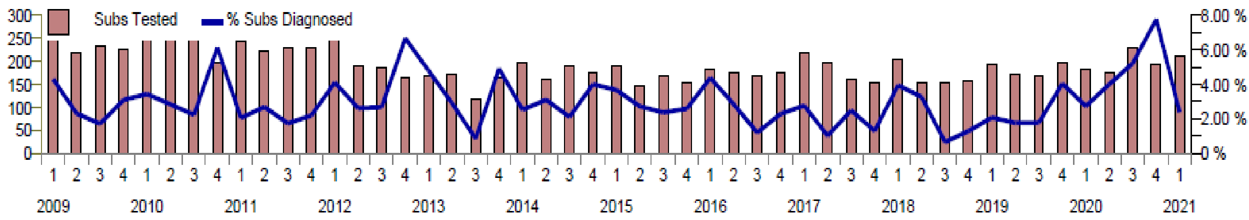


Defra, Welsh and Scottish Governments have announced new disease reporting requirements to Government that were introduced to comply with the EU's Animal Health Regulation. A requirement to report detection of PRRSV following analysis of a sample from a pig or pig carcase came into force in England from 21 April 2021, under The Specified Diseases (Notification and Control) (Amendment, etc.) (England) Order 2021 (Defra, 2021). Similar legislation has been introduced in Scotland and Wales. PRRSV-1 (or PRRSV if genotype is not distinguished) is reportable on a monthly basis, PRRSV-2 which has not been detected in GB pigs to date, is reportable immediately.

Diagnostic rate for Actinobacillus pleuropneumoniae declines

The Q4-2020 pig report described a rise in the diagnostic rate of *Actinobacillus pleuropneumoniae* (APP), which has not continued into Q1-2020 (Figure 10). Although there were three cases in 2020 which involved beta-lactam resistant APP, other 2020 isolates did not show this resistance and it did not explain the rise in the diagnostic rate. To investigate further, Apx toxin gene typing was undertaken on APHA's APP isolates archived from November 2018 to December 2020; all but one of the isolates from 31 submissions were positive for Apx2 and Apx3 genes. One was positive for just Apx2 gene and none were positive for the Apx1 gene which is associated with more virulent disease and is rarely detected in GB APP isolates: the last one was described in 2018 (APHA, 2018b). Thus there was no emergence of Apx1 toxin gene-bearing APP to explain the rise in diagnoses in 2020. Interestingly, the occurrence of APP disease in younger pigs mentioned in the last quarterly report was also a feature in two diagnoses in Q1-2020, with pigs affected at five and seven weeks old.

Figure 10: GB APP diagnoses as a percentage of diagnosable submissions

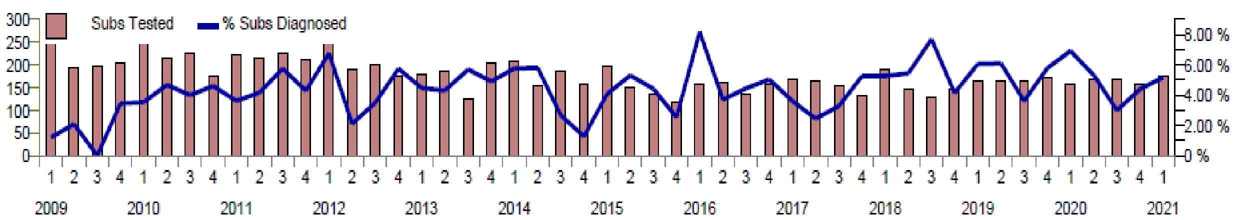


Isolates with Apx1 toxin gene of APP are found in serotypes 1, 5, 9, 10, 11 and 14. Virulence is multifactorial in APP and is influenced by exotoxin production and other factors. In general, serovars producing Apx1 are considered to be more virulent and to cause higher mortality in pigs, especially when in combination with Apx2. Testing between 1995 and 2015 in England and Wales did not detect serotypes producing Apx1, and serotype 8 was predominant (O'Neill and others, 2010; Li and others, 2016) while in Scotland, one serotype 9 isolate was identified in 2012 on a single occasion (APHA, 2012). A useful summary of disease due to APP is at this link: https://www.nadis.org.uk/disease-a-z/pigs/actinobacillus-pleuropneumonia/

Swine influenza rise during the first quarter of 2021

A modest rise in the diagnostic rate of swine influenza was noted in Q1-2021 (Figure 11), though not as high as in Q1-2020. Diagnoses were made from testing either tissues from pigs examined post-mortem, or nasal swabs submitted from live affected pigs. Most cases were diagnosed in pigs aged five to seven weeks old, one in 10-week-old pigs, one in six month old pigs and one in preweaned pigs.

Figure 11: GB swine influenza diagnoses as a percentage of diagnosable submissions



Where full subtyping was successful, the outbreaks in Q1-2021 were found to involve pandemic H1N1 2009 or H1N2 and examples of each are described below. Avian-like H1N1 has only occasionally been detected in recent years, while H3N2 has not been identified in GB pigs since 1997. Two collaborative projects on swine influenza in which APHA is involved are to start soon and will add to the knowledge base on swine influenza in Europe and elsewhere.

Swine influenza due to strain H1N2 was diagnosed in a group of outdoor maiden gilts, 10% of which were coughing. One gilt died and was submitted; there was red cranioventral consolidation of 35% of the lung mass, froth in the airways and the stomach contained very little food. Histopathology showed a severe acute suppurative bronchointerstitial pneumonia likely to have complicated the swine influenza and, with respiratory distress, to have resulted in the gilt's death.

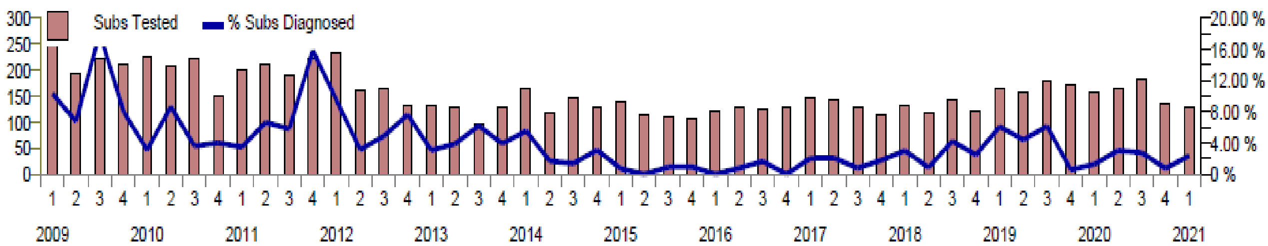
More complex respiratory disease was diagnosed in ten-week-old pigs submitted from an indoor breeder-finisher unit to investigate the cause of their sudden death. All had severe fibrinous pleuropneumonias with pericardial and peritoneal effusions. Bacteriology confirmed *Actinobacillus pleuropneumoniae* (APP) as the cause of the pleuropneumonia lesions, the respiratory disease involved both swine influenza and porcine reproductive and respiratory syndrome (PRRS), which were detected by PCR testing. The PRRS virus strain was identified as a field strain by ORF-5 gene sequencing and the swine influenza virus was found to be pandemic H1N1 2009. An interesting commentary containing useful data on survival and transmission of swine influenza virus was published recently (Desrosiers, 2021).

Defra-funded surveillance provides free of charge PCR testing of respiratory tissues or nasal swabs for swine influenza virus (SIV) which should be collected at the first signs of respiratory disease or malaise. The window of opportunity for detection of SIV is short with individual pigs only excreting virus for only about seven days. For more information on accessing this surveillance, see this information note:
http://apha.defra.gov.uk/documents/surveillance/diseases/Swine%20influenza%20surveillance%20vets%20Dec2020.pdf

Brachyspira hyodysenteriae isolate MLST dashboard launched

Diagnoses of swine dysentery (SD) due to *Brachyspira hyodysenteriae* remained low in Q1-2021 (Figure 12). SD has been identified as a priority disease for control by the pig industry, thus any diagnoses of SD in GB remain a concern. Three GB diagnoses were recorded in VIDA in Q1-2021, *Lawsonia intracellularis*-associated disease was also diagnosed in the same submissions.

Figure 12: GB swine dysentery as a percentage of diagnosable submissions



When *B. hyodysenteriae* is isolated from diagnostic or monitoring samples from GB pigs at APHA or SRUC Veterinary Services, whole genome sequencing (WGS) is undertaken under pig disease surveillance funding. From the sequence data, the multilocus sequence type (MLST) of the *B. hyodysenteriae* isolate can be ascertained. MLST is a typing tool for characterising isolates of a bacterial species for epidemiological investigations and surveillance. The presence of selected antimicrobial resistance (AMR) genes or single nucleotide polymorphisms (SNPs) associated with a specific *B. hyodysenteriae* isolate is also determined from the WGS data.

The *B. hyodysenteriae* isolate MLST dashboard has been launched as a means of sharing the MLST of *B. hyodysenteriae* isolates from pigs so that veterinarians and others can see where and when certain MLST have been detected in pigs, and the AMR genes/SNPs associated with them. The dashboard is available on the link below (copy and paste the link into a browser):
https://public.tableau.com/profile/siu.apha#!/vizhome/BrachyspirahyodysenteriaeMLSTdashboard/Intro

The isolates derive from samples collected for either diagnostic (diseased pigs) or monitoring (healthy pigs) purposes. The dashboard can be interrogated to show results by month, quarter and/or year of submission, county and/or MLST group. It is only possible to obtain WGS data for submissions from which *B. hyodysenteriae* was successfully cultured - thus undetected infection and/or cases where *B. hyodysenteriae* was not isolated may exist in counties in addition to those shown in the dashboard. The map shows the county where pigs were located when sampled for individual *B. hyodysenteriae* isolates (where information provided), importantly, it does not indicate current swine dysentery status. Some MLST, for example, ST52, have been found in multiple regions while others have been detected mainly in one region, such as ST251 in North Yorkshire. At the time of writing, the dashboard shows data for a total of 183 *B. hyodysenteriae* isolated from 2004 onwards, but only since 2017 has WGS been more comprehensively performed on a representative isolate obtained from each premises with 76 of those examined being isolated in 2017 and later. A focus surveillance article is to be published in the Veterinary Record to raise awareness of this dashboard.

Advice on swine dysentery, its control and information about the pig industry's Significant Diseases Charter can be found on these links:
http://pork.ahdb.org.uk/health-welfare/health/swine-dysentery/
https://pork.ahdb.org.uk/health-welfare/health/significant-diseases-charter/
http://apha.defra.gov.uk/documents/surveillance/diseases/swine-dysentery.pdf
www.nadis.org.uk/disease-a-z/pigs/swine-dysentery/

Detection of *Brachyspira hampsonii* in healthy pigs

Whole genome sequencing (WGS) of a *Brachyspira* species showing strong haemolysis from healthy pigs in England, provided by SRUC, was undertaken under pig disease surveillance funding, and identified *Brachyspira hampsonii*. This was the second detection of *B. hampsonii* in GB pigs by APHA; the first was described in 2019 (APHA, 2019a). WGS analysis indicated it was not closely related to the *B. hampsonii* detected in pigs in 2019;

the source of infection has not been established. *B. hampsonii* was described as a new potentially pathogenic species in pigs in North America in 2012, and experimental infection confirmed it as a potential cause of diarrhoea. *B. hampsonii* has been reported in European pigs imported to Germany from Belgium, and pigs imported to Belgium from the Czech Republic. *B. hampsonii* has also been detected in wild waterfowl (greylag geese and mallards) in Spain, and wild birds have been implicated in transmission of infection. Transmission of *Brachyspira* species is oro-faecal; *B. hampsonii* is not a notifiable or reportable disease, it is not zoonotic and pork/pork products are not a recognised route of transmission. The veterinary practice involved is undertaking follow-up testing on linked herds. Information about possible risk factors for the introduction of *B. hampsonii*, including any links with imported pigs, and waterfowl contact, has been requested. The isolate was fully sensitive to licensed antimicrobials tested and no antimicrobial resistance genes were identified from the WGS data.

Streptococcus suis serotypes in the first quarter of 2021

Streptococcus suis is a prominent cause of disease in GB pig submissions (Table 1) and isolates are serotyped to monitor those causing primary or secondary disease, and to detect significant changes. In GB pigs, primary disease is mainly due to serotypes 1, 2, 7 and 14 with serotype 2 invariably the most frequently identified. During Q1-2021, serotype 7 was detected in a similar number of submissions as serotype 2 (Table 2); this will be kept under review.

Table 2: *Streptococcus suis* serotypes detected in GB pig diagnostic submissions

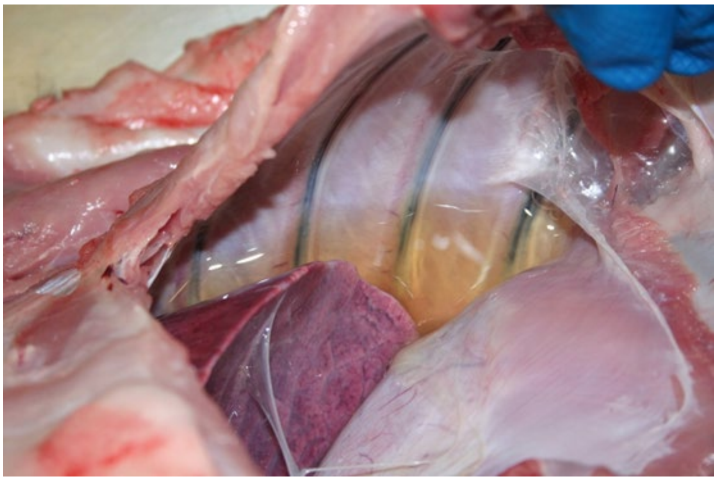
S.suis serotype	1	2	3	5	7	8	13	14	16	24	33	NT	TOTAL
Number of submissions	9	15	1	1	15	2	1	3	1	1	1	3	53

Two recent publications on *S. suis* are worth highlighting; one reviews the role of co-infections in *S. suis*-associated disease in pigs (Obradovic and others, 2021), the second is a report of a workshop and provides an update on *S. suis* research and prevention (Segura and others, 2021), which is relevant to current efforts to reduce antimicrobial use in pigs; treatment of *S. suis*-associated disease being a frequent reason for antimicrobial use.

Bracken and salt (water deprivation) toxicity incidents

Pigs in small herds can sometimes access a greater range of plants in woodland or rough grazing than pigs in commercial pig herds, resulting in a higher risk of plant toxicity incidents. Bracken (*Pteridium aquilinum*) is the most common plant toxicity diagnosed in pigs at APHA, and several deaths due to bracken were diagnosed in Q1-2021 in a small finisher herd on an area with significant bracken growth, and fed a non-pig commercial diet. Cardiomyopathy was demonstrated at post-mortem examination and histopathology raised the possibility of bracken toxicity, with differentials such as PCV2-associated disease, subacute mulberry heart disease and ionophore toxicity ruled out by PCV2 immunohistochemistry and findings at an APHA veterinary visit, which confirmed exposure of the affected pigs to substantial amounts of bracken. The owner sought veterinary advice when deaths occurred and moved the pigs to a different area when the possibility of bracken toxicity was recognised. Bracken toxicity causes heart failure in pigs (Figure 13) due to the effects of thiaminase and is reportable 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. An information note is available on this link: http://apha.defra.gov.uk/documents/surveillance/diseases/bracken-poisoning-pigs.pdf

Figure 13: Pulmonary oedema and pleural effusion in a case of bracken toxicity



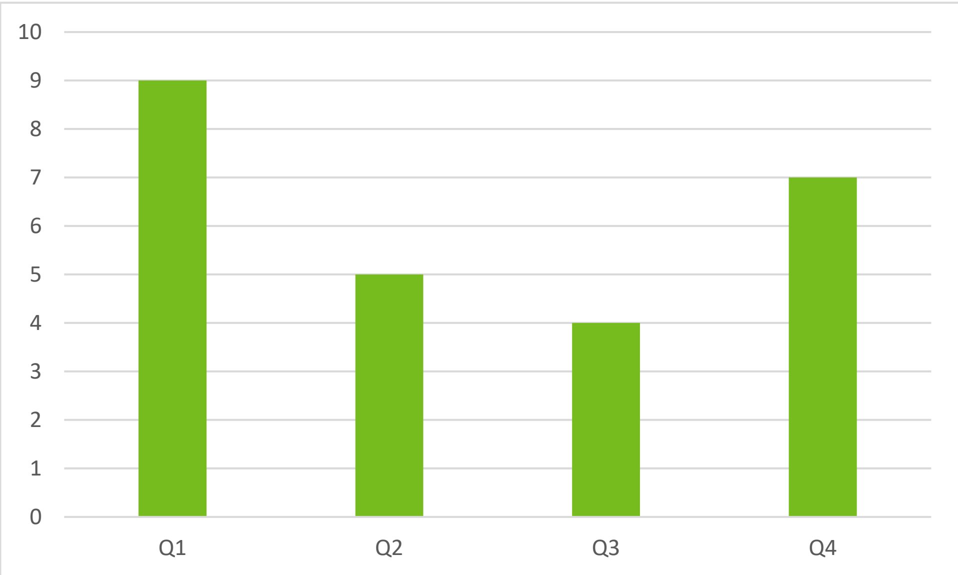
Three diagnoses of water deprivation (salt toxicity) were made in growing pigs with nervous disease in separate incidents in Q1-2021 and an item was included in the Veterinary Record monthly surveillance report describing two of these. In one, five-week-old pigs were submitted to investigate an outbreak of neurological disease in a batch recently arrived on the farm. Clinical signs included recumbency, ataxia, fitting, opisthotonus and head pressing, suggesting pain. The pigs received paracetamol-treated water on arrival and the mains water drinker setup was new but there had not been problems with other batches treated similarly and older pigs on the same supply were unaffected. Post-mortem examination revealed few gross findings other than lack of food in the stomachs, dry faeces, engorged meningeal vessels and a visible loss of definition to the cerebral sulci due to swelling of the cerebral hemispheres. Histopathology on the brain revealed severe, acute, multifocal, segmental, laminar cerebrocortical neuronal necrosis with lymphohistiocytic and eosinophilic perivascular cuffs in all three piglets with eosinophils within perivascular cuffs, consistent with sodium toxicity (salt poisoning), in this case most likely due to water deprivation rather than excess salt.

The second incident was similar in that a specific period of water deprivation was not identified, six-week-old pigs were affected and in this case too, the cerebral hemispheres of each pig were visibly swollen, with mild to moderate cerebellar “coning” which occurs as intracranial pressure forces the cerebellum into the foramen magnum.

Pigs appear to be particularly susceptible to the effects of water deprivation and care must be taken to restore water intake gradually in pigs that have been water deprived to avoid triggering severe disease; sudden water intake after deprivation can lead to rapid swelling of the brain. A specific period or reason for water deprivation is not always identified; where morbidity is low, some may have failed to establish normal drinking and eating at weaning, or to access water points. It is important that any predisposing factors including intercurrent disease (especially diarrhoea), are identified and resolved, and that the water supply to all watering points is checked.

Interestingly, when incidents of water deprivation/salt toxicity recorded in VIDA in the last 10 years are analysed by quarter, there is a tendency for more to occur between October and March (Figure 14), some of these may relate to freezing conditions, although the incidents in Q1-2021 did not. There is useful guidance for pig keepers on water provision to pigs in the pig welfare code and on the AHDB website: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/908108/code-practice-welfare-pigs.pdf; https://ahdb.org.uk/knowledge-library/water-guidance-for-pig-farmers.

Figure 14: Water deprivation diagnoses by quarter in GB pigs in April 2011 to March 2021



Horizon scanning

Mycoplasma infections – new findings in Europe

Two publications describe unusual presentations due to *Mycoplasma* species infection in pigs. Conjunctivitis due to a *Mycoplasma* closely related to *M. hyorhinis* was reported by Hennig-Pauka and others (2021) in growing pigs on three farms in Germany. A novel *Mycoplasma* species, provisionally named *Mycoplasma* sp. 1654_15, was detected in the conjunctivae of affected pigs and the paper has useful images illustrating a range of ocular lesions. Other bacterial and viral pathogens were playing a role in the wider disease picture on two farms, on which respiratory disease was a concern as well as conjunctivitis.

The authors acknowledge that further investigations are necessary to confirm the pathogenicity of *Mycoplasma* sp. 1654_15 to support their proposal that the novel mycoplasma species is a primary cause of swine conjunctivitis.

In a paper from Austria, *Mycoplasma hyorhinis* was proposed as a cause of fibrinopurulent meningitis in weaned pigs on four different farms (Bünger and others, 2021). *M. hyorhinis* is a recognised cause of polyserositis and polyarthritis in weaned piglets, and has been associated with other disease presentations in pigs including pneumonia, otitis media and conjunctivitis. This publication describes its association with central nervous disease in pigs in which no other pathogens were consistently identified. As in the German paper, further investigations are needed to establish causality; in the meantime, collecting both charcoal and plain swabs from the brains of nervous disease cases allows the option of testing for *Mycoplasma* (DGGE-PCR) if initial meningeal cultures are negative, alongside investigation of other differential diagnoses.

Streptococcus equi subsp. *zooepidemicus* septicaemia in Indiana

Previous reports from the US Swine Health Information Centre (SHIC) described unusual US and Canadian cases of fatal streptococcal infection in adult sows and finishers due to *Streptococcus equi* subsp. *zooepidemicus*, and sows also aborted (APHA, 2019b). Genetic analysis of those North American isolates revealed that they were sequence type ST-194 with close genetic sequence similarity to ST-194 isolates from pigs in China involved in high mortality outbreaks in the 1970s. This strain of *S. equi* subsp. *zooepidemicus* ST-194 appears to be particularly virulent to pigs. In January 2021, cyanotic ears, abortion and uterine discharge reported with mortality in adult sows in Indiana was diagnosed as being due to *S. equi* subsp. *zooepidemicus* septicaemia. This prompted analysis of the isolates from the outbreak, and these Indiana isolates were found to be genetically distant and independent of the Ohio and Tennessee isolates. Plans are in place to investigate the underlying virulence mechanisms. Disease outbreaks in GB pigs due to *Streptococcus equi* subsp. *zooepidemicus* have not been recorded to date.

Getah virus – updated factsheet

Getah virus (GETV) is a mosquito-borne arbovirus found throughout Eurasia. It has mainly been associated with outbreaks of disease in horses, particularly in Japan. However, GETV is also known to cause disease in neonatal pigs and fetal death in pregnant sows and SHIC have recently updated their factsheet: https://www.swinehealth.org/wp-content/uploads/2021/03/SHIC-Getah-Virus-Fact-Sheet.pdf. Disease has been identified in pigs, but the importance of GETV as a swine pathogen remains unclear. This virus has not been identified in GB pigs.

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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.

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