Annex to:

EFSA AHAW Panel (EFSA Panel on Animal Health and Welfare), Nielsen SS, Alvarez J, Bicout DJ, Calistri P, Canali E, Drewe JA, Garin-Bastuji B, Gonzales Rojas JL, Gortázar Schmidt C, Herskin M, Michel V, Miranda Chueca MA, Padalino B, Pasquali P, Stahl K, Velarde Calvo A, Viltrop A, Winckler C, De Clercq K, Sjunnesson Y, Gervelmeyer A and Roberts HC, 2022. Assessment of the control measures of the category A diseases of the Animal Health Law: Prohibitions in restricted zones and risk-mitigating treatments for products of animal origin and other materials. EFSA Journal 2022;20(8):7443, doi: 10.2903/j.efsa.2022.7443

Annex B – Extensive literature search on the presence of selected Category A disease pathogens in animal products, animal by-products and feed of plant origin and straw

CoVetLab consortium (Swedish National Veterinary Institute (SVA), Sweden; Wageningen Bioveterinary Research (WBVR), The Netherlands; Animal and Plant Health Agency (APHA), UK)
University of Surrey, UK)

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1 Context

The EFSA has been requested to provide scientific opinions to support the European Commission (EC) in the production of amending and implementing acts related to Regulation 2016/429 (the 'Animal Health Law' (AHL)) which lays down rules for the prevention and control of diseases included in the list of Category A diseases. The Commission has developed and adopted a Delegated Regulation ("the Delegated Regulation") supplementing the rules laid down in AHL. Certain disease control measures proposed in the Annexes of the Delegated Regulation are considered as outdated and need to be updated by reviewing the current scientific literature.

As part of this, and in order to answer ToR 4.1 to assess the effectiveness of the control measures related to animal products, animal by-products and feed of plant origin and straw set out in Annex VI to the Delegated Regulation, the EFSA has asked COVETLAB to carry out an extensive literature search (ELS).

2 Review question

As described in the final protocol (**Appendix A**), the aim of the ELS was to answer the question whether *animal products, animal by-products and feed of plant origin and straw* (i.e., "matrices") collected from affected animals of listed species in affected establishments pose a risk to transmit the following diseases:

- Foot and Mouth Disease (FMD)
- Infection with Rinderpest virus (RP)
- Infection with Rift Valley Fever virus (RVF)
- Infection with Lumpy Skin Disease virus (LSD)
- Infection with Mycoplasma mycoides subsp. mycoides (Contagious Bovine Pleuropneumonia) (CBPP)
- Sheep Pox and Goat Pox (SPGP)
- Infection with Peste des Petits Ruminants virus (PPR)
- Contagious Caprine Pleuropneumonia (CCPP)
- Classical Swine Fever (CSF)
- African Swine Fever (ASF)
- African Horse Sickness (AHS)
- Highly Pathogenic Avian Influenza (HPAI
- Newcastle Disease (ND)

3 Results

3.1 Disease-specific evidence extracted

3.1.1 Experimental infection studies

The evidence identified in the ELS is presented in a table showing all matrices in which viable disease agent was identified by virus isolation, inoculation experiment or culture following an experimental infection of susceptible hosts and the number of animals sampled for the matrix in question. The results have been pooled across different strains or subtypes.

Foot and Mouth Disease

Host	Matrix found positive	Number of animals sampled	refID[(a)]
Buffalos	Lesion Swab	6	232375
Buffalos	Nasal Swab	6	232375
Buffalos	Serum	3	232725
Camelus	Serum	5	232318; 232361
Cattle	Blood	139	231909; 232034; 232073; 232192; 232211; 232289; 232324; 232427; 232466; 232480; 232499; 232501; 232510; 232599; 232609
Cattle	Coronary Band	18	231835
Cattle	Esophageal Swab	17	232722
Cattle	Faeces	22	232034
Cattle	Kidney	17	232722
Cattle	Lesion Swab	4	232375
Cattle	Lymph node	55	231835; 231934; 232722
Cattle	Lung	78	231835; 231934; 232268; 232301; 232722
Cattle	Milk	24	231851; 232466
Cattle	Nasal Swab	158	231711; 231715; 231723; 231729; 231808; 231879; 231882; 231934; 231945; 231957; 232012; 232076; 232087; 232156; 232191; 232192; 232211; 232301; 232339; 232375; 232427; 232599; 232707
Cattle	Oroparhyngeal Swab	68	231646; 231729; 232034; 232191; 232289; 232589
Cattle	Saliva	47	231723; 231808; 231934; 231945; 232191; 232298; 232488
Cattle	Serum	94	231646; 231711; 231715; 231723; 231808; 231934; 231945; 231957; 232012; 232087; 232123; 232190; 232298; 232301; 232488
Cattle	Thyroid	16	232268
Cattle	Tongue	106	231835; 231934; 232002; 232012; 232268; 232707; 232722
Cattle	Tonsil	56	231835; 231909; 231934; 232268
Cattle	Trachea	36	231934; 232268

Host	Matrix found positive	Number of animals sampled	refID[(a)]
Cattle	Urine	32	232034; 232073
Deers	Blood	14	231724; 232178
Deers	Liver	4	232178
Deers	Lung	4	232178
Deers	Nasal Swab	20	231724; 231943
Deers	Serum	14	231943; 232178
Deers	Spleen	4	232178
Deers	Thyroid	4	232178
Deers	Tongue	4	232178
Deers	Tonsil	4	232178
Domestic pigs	Blood	215	232004; 232046; 232090; 232291; 232295; 232297; 232326; 232336; 232359; 232362; 232390; 232437; 232479; 232495; 232559; 232580; 232609; 232617; 232660; 232713
Domestic pigs	Bone Marrow	24	232326
Domestic pigs	Coronary Band	19	232101
Domestic pigs	Esophageal Swab	6	231876
Domestic pigs	Faeces	27	232048; 232326
Domestic pigs	Heart	25	231876; 232101
Domestic pigs	Kidney	39	232101; 232326
Domestic pigs	Lymph node	19	232101
Domestic pigs	Liver	51	232101; 232326; 232615
Domestic pigs	Lung	49	231876; 232101; 232326
Domestic pigs	Muscle	43	232101; 232326
Domestic pigs	Nasal Swab	244	231646; 231723; 231876; 231944; 231945; 231979; 232004; 232030; 232048; 232063; 232076; 232090; 232171; 232204; 232252; 232260; 232291; 232326; 232362; 232425; 232479; 232495; 232559; 232580
Domestic pigs	Oroparhyngeal Swab	92	231646; 232046; 232228; 232281; 232341; 232465; 232483; 232537; 232589

Host	Matrix found positive	Number of animals sampled	refID[(a)]
Domestic pigs	Pancreas	43	232101; 232326
Domestic pigs	Peyer Patches	19	232101
Domestic pigs	Saliva	49	231723; 231876; 231945; 231979; 232030; 232048; 232171; 232425
Domestic pigs	Serum	132	231646; 231723; 231876; 231944; 231945; 231979; 231998; 232048; 232063; 232171; 232204; 232252; 232287; 232320; 232481; 232575; 232593; 232615
Domestic pigs	Skin	19	232101
Domestic pigs	Spinal Cord	24	232326
Domestic pigs	Spleen	57	231876; 232101; 232326; 232615
Domestic pigs	Stomach	6	231876
Domestic pigs	Testicles	24	232326
Domestic pigs	Thymus	6	231876
Domestic pigs	Tongue	49	231876; 232101; 232326
Domestic pigs	Tonsil	51	232101; 232326; 232615
Domestic pigs	Trachea	57	231876; 232101; 232326; 232615
Domestic pigs	Vagina	24	232326
Goats	Blood	18	231687; 232164; 232290; 232609
Goats	Nasal Swab	26	231723; 232087; 232164; 232290
Goats	Saliva	12	231723
Goats	Serum	16	231723; 232087
Llama	Blood	30	232705
Sheep	Blood	268	231687; 232033; 232040; 232073; 232164; 232290; 232382; 232454; 232539; 232559; 232586; 232599; 232600; 232638; 232659
Sheep	Faeces	20	232073
Sheep	Heart	4	231749
Sheep	Nasal Swab	54	231841; 232164; 232290; 232382; 232559; 232599; 232659
Sheep	Oroparhyngeal Swab	68	232033; 232040; 232454; 232589
Sheep	Cloacal Swab	10	232599
Sheep	Saliva	14	232382; 232659
Sheep	Serum	20	231749; 231841; 232361

Host	Matrix found positive	Number of animals sampled	refID[(a)]
Sheep	Tongue	8	231749
Wild boar	Nasal Swab	2	232171
Wild boar	Oroparhyngeal Swab	13	232228
Wild boar	Serum	4	232171

(a): The complete reference information is available at: https://animal-diseases.efsa.europa.eu/FMDV/#page-4.

Rinderpest

Host	Matrix found positive	Number of animals sampled	refID[(a)]
Cattle	Blood	13	230251; 230319; 230361; 230402; 232747
Cattle	Eye Swab	20	230183; 230251; 230288; 230402; 232269
Cattle	Heart	2	230288
Cattle	Kidney	2	230288
Cattle	Lymph node	20	230183; 230288; 230353; 230406; 232269
Cattle	Lung	2	230288
Cattle	Nasal Swab	18	230183; 230288; 230402; 232269
Cattle	Oropharyngeal Swab	6	230183
Cattle	Peyer Patches	12	230183; 232269
Cattle	Cloacal Swab	12	230183; 232269
Cattle	Spleen	17	230183; 230288; 230406; 232269
Cattle	Tongue	3	230353
Cattle	Tonsil	8	230183; 230288
Cattle	Vagina	6	230183

(a): The complete reference information is available at: https://animal-diseases.efsa.europa.eu/RPV/#page-4.

Lumpy Skin Disease

Host	Matrix found positive	Number of animals sampled	refID[(a)]
Cattle	Blood	43	231714; 232066; 232288; 232369; 232457; 232516
Cattle	Kidney	16	210551; 232369
Cattle	Lesion Swab	12	231795
Cattle	Lymph node	20	210551; 231795
Cattle	Lung	12	231795
Cattle	Muscle	12	231795
Cattle	Nose Nasal Swab	24	210551; 232369
Cattle	Oropharyngeal Swab	8	210551
Cattle	Saliva	12	231860

Cattle	Semen	6	232508
Cattle	Serum	8	210551
Cattle	Stomach	8	210551
Cattle	Testicles	12	231795

(a): The complete reference information is available at: https://animal-diseases.efsa.europa.eu/LSDV/#page-4

Contagious bovine pleuropneumonia

Host	Matrix found positive	Number of animals sampled	refID[(a)]
Bos indicus	Lymph node	19	230175
Bos indicus, Bos taurus	Lung	109	230124; 230130; 230148; 230172; 230175; 230225; 230230

(a): The complete reference information is available at: https://animal-diseases.efsa.europa.eu/CBPP/#page-4

Sheep pox and goat pox

There was no evidence from virus isolation studies for this disease/pathogen.[1]

Peste des petits ruminants

Host	Matrix found positive	Number of animals sampled	refID[(a)]
Cattle	Blood	3	210327
Goats	Blood	8	210605; 230237; 230420
Goats	Eye Swab	14	210136; 210310; 210824; 230420
Goats	Faeces	2	210136
Goats	Intestines	6	210824
Goats	Kidney	6	210824
Goats	Lymph node	11	210591; 210824
Goats	Liver	6	210824
Goats	Lung	11	210591; 210824
Goats	Nose Nasal Swab	17	210331; 210824; 230142; 230420
Goats	Oropharyngeal Swab	6	210824
Goats	Skin	6	210336
Goats	Spleen	6	210824
Sheep	Eye Swab	11	210136; 210336
Sheep	Faeces	5	210136
Sheep	Nose Nasal Swab	14	210136; 210331; 230142

(a): The complete reference information is available at: https://animal-diseases.efsa.europa.eu/PPRV/#page-4

Contagious caprine pleuropneumonia

There was not enough evidence for this disease/pathogen.[2]

[1] https://animal-diseases.efsa.europa.eu/SPPV/#page-4
[2] https://animal-diseases.efsa.europa.eu/CCPP/#page-4

Classical Swine Fever

Host	Matrix found positive	Number of animals sampled	refID[(a)]
Domestic pigs	Adrenal gland, Blood, Brain, Intestines, Kidney, Lymph node, Spleen, Tonsil	5	210218
Domestic pigs	Blood	582	210212; 210252; 210270; 210308; 210309; 210342; 210344; 210374; 210375; 210408; 210427; 210450; 210468; 210475; 210501; 210502; 210509; 210511; 210531; 210556; 210558; 210559; 210562; 210574; 210576; 210577; 210581; 210582; 210583; 210593; 210596; 210609; 210638; 210661; 210677; 210683; 210687; 210690; 210702; 210706; 210712; 210713; 210722; 210736; 210749; 210751; 210755; 210774; 210802; 210803; 231985
Domestic pigs	Blood, Nose Nasal Swab, Rectum Anal Swab	3	210373
Domestic pigs	Brain	50	210550
Domestic pigs	Faeces	84	210308; 210511; 210528; 210683; 231985
Domestic pigs	Faeces, Heart, Kidney, Lung, Lymph node, Muscle, Spleen, Tonsil	6	210581
Domestic pigs	Foetus Stillbirth Neonate	10	210704
Domestic pigs	Heart	60	210550; 210683
Domestic pigs	Intestines	6	210565
Domestic pigs	Intestines, Kidney, Lymph node, Spleen, Tonsil	3	210373
Domestic pigs	Kidney	88	210501; 210550; 210556; 210565; 210593; 210627; 210683
Domestic pigs	Lymph node	88	210493; 210501; 210550; 210556; 210565; 210587; 210593; 210627
Domestic pigs	Liver	10	210683
Domestic pigs	Lung	54	210550; 210556
Domestic pigs	Muscle	55	210550; 210674
Domestic pigs	Nose Nasal Swab	125	210270; 210308; 210427; 210450; 210501; 210556; 210576; 210582; 210593; 210683; 210774; 231985

Domestic pigs	Oroparhyngeal Swab	173	210344; 210374; 210468; 210511; 210528; 210560; 210596; 210638; 210713; 210732; 210736
Domestic pigs	Rectum Anal Swab	3	210270
Domestic pigs	Saliva	2	210556
Domestic pigs	Salivary gland	10	210413
Domestic pigs	Serum	119	210168; 210304; 210413; 210474; 210517; 210565; 210587; 210596; 210615; 210628; 210638; 210674; 210712; 210817
Domestic pigs	Skin	7	210592
Domestic pigs	Spleen	127	210046; 210212; 210413; 210493; 210501; 210550; 210556; 210565; 210574; 210593; 210627; 210674; 210683
Domestic pigs	Testicles	5	210684
Domestic pigs	Tonsil	208	210212; 210396; 210413; 210427; 210450; 210501; 210509; 210550; 210556; 210565; 210593; 210683
Wild boar	Blood	14	210556; 210582; 210701
Wild boar	Kidney	3	210556
Wild boar	Lymph node	3	210556
Wild boar	Lung	3	210556
Wild boar	Nose Nasal Swab	3	210556; 210582
Wild boar	Semen	6	210643; 232524
Wild boar	Skin	6	210592
Wild boar	Spleen	3	210556
Wild boar	Tonsil	3	210556

(a): The complete reference information is available at: https://animal-diseases.efsa.europa.eu/CSFV/#page-4

African Swine Fever

Host	Matrix found positive	Number of animals sampled	refID[(a)]
Domestic pigs	Blood	659	36; 92; 238; 251; 388; 460; 667; 832; 1442; 1588; 1930; 1959; 2053; 2227; 2347; 2513; 2545; 2577; 2595; 2693; 2903; 3123; 3146; 3187; 3220; 3298; 3339; 3356; 3358; 3359; 3360; 3364; 3856; 3987; 202062; 202388; 202559; 202608; 204000; 210721; 210783; 210800; 210808; 210821; 230434; 230447; 230461; 230462; 230540; 230548; 230576

Host	Matrix found positive	Number of animals sampled	refID[(a)]
Domestic pigs	Bone marrow	34	3187; 3987; 230576
Domestic pigs	Brain	22	3187; 3987
Domestic pigs	Cervix, Ovary, Uterus, Vagina	6	3187
Domestic pigs	Eye Swab	10	667
Domestic pigs	Faeces	40	667
Domestic pigs	Foetus Stillbirth Neonate	39	3187
Domestic pigs	Heart	24	36; 3187; 230576
Domestic pigs	Kidney	64	36; 2513; 3187; 3987; 230548; 230576
Domestic pigs	Lymph node	120	36; 902; 1442; 2513; 2545; 2577; 2595; 3187; 3987; 230548; 230555; 230576
Domestic pigs	Liver	50	36; 1442; 2545; 3187; 3987; 230576
Domestic pigs	Lung	78	36; 1442; 2513; 3187; 3987; 230555; 230576
Domestic pigs	Muscle	10	3187; 230548
Domestic pigs	Nose Nasal Swab	108	388; 460; 667; 1930; 3123; 3358; 202559
Domestic pigs	Oroparhyngeal Swab	82	667; 2053; 3123; 3358
Domestic pigs	PeyerPatches	6	2545
Domestic pigs	Placenta, Foetus Stillbirth Neonate	13	3187
Domestic pigs	Salivary gland	12	230555
Domestic pigs	Serum	62	202143; 202401; 230576
Domestic pigs	Spleen	133	36; 902; 1442; 2513; 2545; 2577; 2595; 3187; 3987; 230548; 230555; 230576
Domestic pigs	Thymus	12	2545; 3187
Domestic pigs	Tonsil	149	36; 460; 902; 1930; 2513; 2545; 2577; 3187; 3987; 202062; 230548; 230555; 230576

Host	Matrix found positive	Number of animals sampled	refID[(a)]
Domestic pigs	Vagina	28	667; 3358
Wild boar	Blood	12	92
Wild boar	Lymph node	15	202100; 230555
Wild boar	Lung	13	202100; 230555
Wild boar	Salivary gland	13	202100; 230555
Wild boar	Serum	10	202100
Wild boar	Spleen	27	92; 202100; 230555
Wild boar	Tonsil	13	202100; 230555

(a): The complete reference information is available at: https://animal-diseases.efsa.europa.eu/ASFV/#page-5

African Horse Sickness

Host	Matrix found positive	Number of animals sampled	refID[(a)]
Horses	Blood	46	2624; 2838; 2842; 2944; 2950; 3871; 3900
Horses	Heart	1	2950
Horses	Lymph node	2	2950
Horses	Liver	1	2950
Horses	Lung	4	2950; 3427
Horses	Salivary gland	1	2950
Horses	Spleen	10	2838; 2950; 3427; 3871

(a): The complete reference information is available at: https://animal-diseases.efsa.europa.eu/AHSV/#page-5

Highly Pathogenic Avian Influenza

Host	Matrix found positive	Number of animals sampled	refID[(a)]
Chickens	Blood	102	230693; 230702; 230718; 230839; 230910; 230969; 231106; 231578
Chickens	Bone Marrow	42	231592
Chickens	Brain	917	220577; 230629; 230669; 230688; 230692; 230693; 230697; 230702; 230704; 230714; 230718; 230729; 230733; 230737; 230794; 230797; 230816; 230823; 230839; 230844; 230849; 230877; 230885; 230910; 230923; 230936; 230942; 230943; 230969; 230982; 230991; 231016; 231033; 231048; 231100; 231106; 231117; 231124; 231128; 231131; 231138; 231257; 231345; 231425; 231512; 231531; 231534; 231578; 231592; 231599
Chickens	Brain, Heart, Kidney, Liver, Lung, Cloacal Swab, Spleen	33	231527
Chickens	Bursa fabricii	106	220577; 230688; 230794; 230969; 230991; 231100; 231512; 231534

Host	Matrix found positive	Number of animals sampled	refID[(a)]
Chickens	Esophageal Swab	10	231100
Chickens	Eye Swab	44	230693; 230718
Chickens	Feathers	53	230843; 230986; 231345
Chickens	Heart	572	230693; 230702; 230718; 230733; 230737; 230794; 230797; 230823; 230849; 230877; 230885; 230910; 230923; 230942; 230943; 230969; 230982; 230991; 231016; 231033; 231100; 231114; 231124; 231138; 231257; 231425; 231511; 231531; 231534; 231599
Chickens	Intestines	385	220577; 230629; 230669; 230688; 230697; 230714; 230718; 230729; 230733; 230737; 230823; 230839; 230844; 230877; 230885; 230910; 230936; 231016; 231100; 231257; 231320; 231425; 231498; 231512; 231531; 231563; 231578; 231603
Chickens	Kidney	763	230629; 230669; 230688; 230692; 230693; 230697; 230702; 230704; 230714; 230718; 230729; 230733; 230737; 230794; 230797; 230823; 230839; 230844; 230849; 230877; 230885; 230910; 230923; 230936; 230942; 230943; 230969; 230982; 230991; 231016; 231033; 231048; 231100; 231117; 231124; 231131; 231257; 231320; 231421; 231425; 231498; 231505; 231512; 231531; 231534; 231563; 231578; 231592; 231603
Chickens	Liver	609	230629; 230688; 230692; 230693; 230697; 230702; 230704; 230718; 230729; 230733; 230737; 230794; 230797; 230823; 230843; 230849; 230877; 230885; 230910; 230923; 230942; 230943; 230969; 230982; 230991; 231016; 231033; 231100; 231114; 231117; 231128; 231425; 231512; 231534; 231578; 231603
Chickens	Lung	1,120	220551; 220577; 230610; 230629; 230669; 230688; 230692; 230693; 230697; 230702; 230704; 230714; 230718; 230729; 230733; 230737; 230794; 230797; 230814; 230816; 230823; 230839; 230844; 230849; 230877; 230885; 230910; 230923; 230933; 230936; 230942; 230943; 230969; 230982; 230991; 231016; 231033; 231048; 231100; 231106; 231117; 231124; 231128; 231131; 231138; 231257; 231320; 231421; 231425; 231512; 231531; 231534; 231578; 231592; 231599; 231602; 231603
Chickens	Muscle	323	230669; 230693; 230718; 230843; 230910; 230923; 230982; 231124; 231138; 231345; 231511; 231512; 231602

Host	Matrix found positive	Number of animals sampled	refID[(a)]
Chickens	Nasal Swab	21	230885
Chickens	Oropharyngeal Swab	915	220087; 220292; 220577; 220933; 230609; 230688; 230692; 230700; 230704; 230733; 230737; 230744; 230754; 230765; 230794; 230797; 230823; 230830; 230837; 230839; 230849; 230852; 230854; 230935; 230936; 230943; 230981; 230982; 230986; 230991; 231016; 231033; 231048; 231100; 231114; 231115; 231117; 231128; 231138; 231257; 231342; 231345; 231369; 231416; 231531; 231533; 231599; 231602; 231603
Chickens	Oropharyngeal Swab, Cloacal Swab	20	231450
Chickens	Pancreas	278	230688; 230693; 230702; 230718; 230733; 230794; 230823; 230877; 230923; 230969; 230982; 230991; 231138; 231425; 231512; 231534; 231578
Chickens	Cloacal Swab	1,531	220080; 220087; 220292; 220577; 220933; 221063; 230593; 230609; 230688; 230692; 230693; 230700; 230702; 230704; 230711; 230714; 230718; 230733; 230737; 230744; 230754; 230765; 230794; 230797; 230800; 230814; 230816; 230823; 230830; 230837; 230839; 230844; 230849; 230854; 230872; 230885; 230925; 230935; 230936; 230943; 230969; 230981; 230982; 230986; 230991; 231016; 231033; 231037; 231048; 231069; 231100; 231114; 231115; 231117; 231128; 231138; 231257; 231262; 231315; 231320; 231342; 231345; 231357; 231369; 231416; 231420; 231425; 231437; 231456; 231457; 231498; 231505; 231531; 231533; 231539; 231563; 231590; 231599; 231602; 231603; 231608; 231611
Chickens	Skin	15	231345
Chickens	Spleen	686	220551; 230629; 230688; 230692; 230693; 230702; 230704; 230718; 230729; 230733; 230737; 230794; 230797; 230823; 230844; 230849; 230877; 230885; 230910; 230923; 230933; 230942; 230943; 230969; 230982; 230991; 231016; 231033; 231100; 231106; 231117; 231124; 231131; 231138; 231257; 231421; 231425; 231512; 231531; 231534; 231603
Chickens	Thymus	40	230991; 231100; 231512

Host	Matrix found positive	Number of animals sampled	refID[(a)]
Chickens	Trachea	550	230629; 230669; 230688; 230692; 230693; 230697; 230702; 230704; 230714; 230718; 230733; 230794; 230823; 230839; 230844; 230910; 230923; 230936; 230982; 230991; 231100; 231117; 231124; 231131; 231320; 231425; 231498; 231505; 231512; 231531; 231534; 231563; 231578; 231602; 231603
Ducks	Blood	38	230693; 230711; 231113
Ducks	Brain	842	220933; 230605; 230669; 230693; 230711; 230737; 230754; 230791; 230794; 230839; 230936; 230987; 230991; 231004; 231016; 231032; 231033; 231048; 231070; 231083; 231102; 231124; 231128; 231142; 231178; 231248; 231251; 231257; 231519; 231526; 231578; 231583; 231599
Ducks	Bursa fabricii	121	230605; 230794; 230987; 230991; 231033; 231083; 231251
Ducks	Eye Swab	30	230693; 231032
Ducks	Feathers	41	230986; 231350
Ducks	Heart	580	230693; 230711; 230737; 230794; 230797; 230882; 230987; 230991; 231004; 231016; 231032; 231033; 231035; 231070; 231102; 231124; 231138; 231178; 231257; 231526; 231583; 231599
Ducks	Intestines	198	230669; 230737; 230839; 230882; 230936; 230987; 231016; 231032; 231033; 231035; 231142; 231257; 231578
Ducks	Kidney	651	230605; 230669; 230693; 230711; 230733; 230737; 230754; 230794; 230797; 230839; 230936; 230987; 230991; 231004; 231016; 231032; 231033; 231048; 231070; 231083; 231113; 231124; 231128; 231142; 231178; 231248; 231251; 231257; 231519; 231578; 231583
Ducks	Liver	372	230693; 230711; 230733; 230737; 230754; 230794; 230797; 230987; 230991; 231004; 231016; 231033; 231070; 231142; 231178; 231519; 231578
Ducks	Lung	1,036	220933; 230605; 230669; 230693; 230711; 230733; 230737; 230754; 230791; 230794; 230797; 230839; 230882; 230936; 230987; 230991; 231004; 231016; 231032; 231033; 231035; 231048; 231070; 231083; 231102; 231113; 231124; 231128; 231138; 231142; 231178; 231248; 231251; 231257; 231519; 231526; 231578; 231583; 231599

Host	Matrix found positive	Number of animals sampled	refID[(a)]
Ducks	Muscle	282	230669; 230693; 231004; 231035; 231102; 231124; 231128; 231138; 231178; 231526; 231583
Ducks	Nasal Swab	4	230987
Ducks	Oropharyngeal Swab	1,071	220933; 230605; 230697; 230725; 230733; 230737; 230754; 230781; 230791; 230794; 230797; 230830; 230839; 230854; 230882; 230936; 230986; 230987; 230991; 231004; 231016; 231032; 231033; 231035; 231048; 231070; 231124; 231128; 231138; 231177; 231178; 231251; 231257; 231390; 231405; 231467; 231470; 231519; 231526; 231561; 231583; 231599; 231606; 231615
Ducks	Oropharyngeal Swab, Cloacal Swab	30	231450
Ducks	Pancreas	289	230605; 230693; 230711; 230733; 230794; 230987; 230991; 231004; 231032; 231035; 231083; 231138; 231251; 231519
Ducks	Cloacal Swab	1,108	220933; 230605; 230693; 230697; 230711; 230718; 230725; 230733; 230737; 230754; 230781; 230791; 230794; 230797; 230830; 230839; 230854; 230882; 230936; 230969; 230986; 230987; 230991; 231004; 231016; 231032; 231033; 231035; 231048; 231069; 231070; 231113; 231124; 231128; 231177; 231178; 231251; 231257; 231390; 231405; 231467; 231470; 231476; 231519; 231526; 231537; 231561; 231583; 231599; 231606
Ducks	Spinal Cord	4	230987
Ducks	Spleen	659	230605; 230693; 230711; 230737; 230754; 230791; 230794; 230797; 230987; 230991; 231004; 231016; 231032; 231033; 231035; 231070; 231083; 231102; 231124; 231128; 231138; 231178; 231251; 231257; 231519
Ducks	Thymus	32	230605; 230991
Ducks	Tonsil	8	230605
Ducks	Trachea	400	230605; 230669; 230693; 230711; 230733; 230794; 230839; 230882; 230936; 230987; 230991; 231004; 231033; 231035; 231070; 231113; 231124; 231142; 231248; 231519; 231578
Pigeons	Brain	158	230823; 231038; 231265; 231483; 231531
Pigeons	Brain, Heart, Kidney, Liver, Lung, Cloacal Swab, Spleen	26	231527
Pigeons	Bursa fabricii	48	231483

Host	Matrix found positive	Number of animals sampled	refID[(a)]
Pigeons	Heart	118	230823; 231483; 231531
Pigeons	Intestines	28	230823; 231038; 231531
Pigeons	Kidney	184	230823; 231265; 231483; 231531
Pigeons	Liver	136	230823; 231265; 231483
Pigeons	Lung	200	230823; 231265; 231483; 231531
Pigeons	Oropharyngeal Swab	43	230823; 231038; 231466; 231531
Pigeons	Pancreas	102	230823; 231483
Pigeons	Cloacal Swab	188	230823; 231038; 231265; 231466; 231483; 231531
Pigeons	Spleen	120	230823; 231265; 231483; 231531
Pigeons	Trachea	134	230823; 231483; 231531
Raptor birds - Birds of prey	Brain	6	230664
Raptor birds - Birds of prey	Feathers	6	230664
Raptor birds - Birds of prey	Heart	6	230664
Raptor birds - Birds of prey	Intestines	6	230664
Raptor birds - Birds of prey	Kidney	6	230664
Raptor birds - Birds of prey	Liver	6	230664
Raptor birds - Birds of prey	Lung	6	230664
Raptor birds - Birds of prey	Oropharyngeal Swab	27	230664; 231404; 231560
Raptor birds - Birds of prey	Oropharyngeal Swab, Cloacal Swab	17	231450

Host	Matrix found positive	Number of animals sampled	refID[(a)]
Raptor birds - Birds of prey	Pancreas	6	230664
Raptor birds - Birds of prey	Cloacal Swab	27	230664; 231404; 231560
Raptor birds - Birds of prey	Spleen	6	230664
Raptor birds - Birds of prey	Trachea	6	230664
Turkeys	Blood	15	231488
Turkeys	Brain	12	231048
Turkeys	Kidney	12	231048
Turkeys	Lung	27	231048; 231488
Turkeys	Oropharyngeal Swab	117	230700; 230840; 231048
Turkeys	Cloacal Swab	117	230700; 230840; 231048

(a): The complete reference information is available at: https://animal-diseases.efsa.europa.eu/HPAI/#page-4

Newcastle Disease

Host	Matrix found positive	Number of animals sampled	refID[(a)]
Chickens	Blood	26	221137; 221366
Chickens	Brain	280	220109; 220134; 220266; 220360; 220369; 220393; 220406; 220520; 220575; 220629; 220833; 221280; 221281; 221309
Chickens	Bursa fabricii	180	220109; 220369; 220520; 220629; 221280; 221281
Chickens	Faeces	16	221137
Chickens	Heart	58	220629; 220722; 221137
Chickens	Intestines	122	220369; 220406; 220629
Chickens	Kidney	181	220109; 220406; 220520; 220629; 220722; 221137; 221280; 221281; 221309
Chickens	Liver	117	220109; 220629; 220722; 221280; 221281; 221309
Chickens	Lung	257	220109; 220266; 220406; 220520; 220551; 220575; 220629; 220722; 220833; 221280; 221281; 221309; 221471

Host	Matrix found positive	Number of animals sampled	refID[(a)]
Chickens	Oropharyngeal Swab	516	220083; 220109; 220141; 220197; 220222; 220266; 220289; 220292; 220321; 220421; 220433; 220460; 220496; 220500; 220520; 220557; 220572; 220575; 220629; 220660; 220714; 221011; 221016; 221085; 221119; 221310
Chickens	Ovary	12	220524
Chickens	Pancreas	12	220629
Chickens	Cloacal Swab	775	220080; 220083; 220109; 220141; 220197; 220204; 220222; 220251; 220289; 220292; 220321; 220391; 220393; 220421; 220433; 220447; 220453; 220495; 220496; 220500; 220520; 220524; 220557; 220572; 220575; 220601; 220629; 220685; 220714; 220833; 220840; 220897; 221011; 221016; 221052; 221085; 221119; 221165; 221309; 221310; 221314; 231420
Chickens	Spleen	381	220109; 220313; 220369; 220393; 220406; 220520; 220551; 220575; 220629; 220722; 220833; 221137; 221280; 221281; 221309
Chickens	Stomach	10	220109
Chickens	Thymus	140	220369; 220520; 220575; 220629
Chickens	Tonsil	68	220393; 220520; 220629; 221281
Chickens	Trachea	143	220109; 220266; 220520; 220629; 220833; 221280; 221281; 221309
Chickens	Uterus	12	220524
Chickens	Vagina	12	220524
Ducks	Brain	95	220607; 220629; 220631; 220755
Ducks	Bursa fabricii	206	220520; 220607; 220629; 220631; 220755
Ducks	Heart	79	220629; 220631; 220755
Ducks	Intestines	62	220607; 220629; 220631
Ducks	Kidney	148	220520; 220629; 220631; 220755
Ducks	Liver	28	220755
Ducks	Lung	136	220520; 220607; 220629; 220631; 220755
Ducks	Oropharyngeal Swab	241	220520; 220629; 220631; 220755
Ducks	Pancreas	144	220629; 220631; 220755
Ducks	Cloacal Swab	205	220520; 220629; 220631; 220755; 221102
Ducks	Spleen	122	220520; 220607; 220629; 220631; 220755
Ducks	Thymus	178	220520; 220607; 220629; 220631; 220755
Ducks	Tonsil	66	220520; 220607; 220629
Ducks	Trachea	80	220520; 220629; 220631
Ostriches	Bone Marrow	10	221354
Ostriches	Muscle	10	221354
Pigeons	Brain	24	220216; 220520
Pigeons	Bursa fabricii	24	220216; 220520

Host	Matrix found positive	Number of animals sampled	refID[(a)]
Pigeons	Kidney	30	220216; 220520
Pigeons	Lung	30	220216; 220520
Pigeons	Oropharyngeal Swab	90	220141; 220388; 220520; 221119
Pigeons	Cloacal Swab	96	220141; 220388; 220520; 221119
Pigeons	Spleen	30	220216; 220520
Pigeons	Thymus	18	220520
Pigeons	Tonsil	18	220520
Pigeons	Trachea	24	220216; 220520
Turkeys	Oropharyngeal Swab	16	221119
Turkeys	Cloacal Swab	76	221119; 221314

(a): The complete reference information is available at: https://animal-diseases.efsa.europa.eu/NDV/#page-4

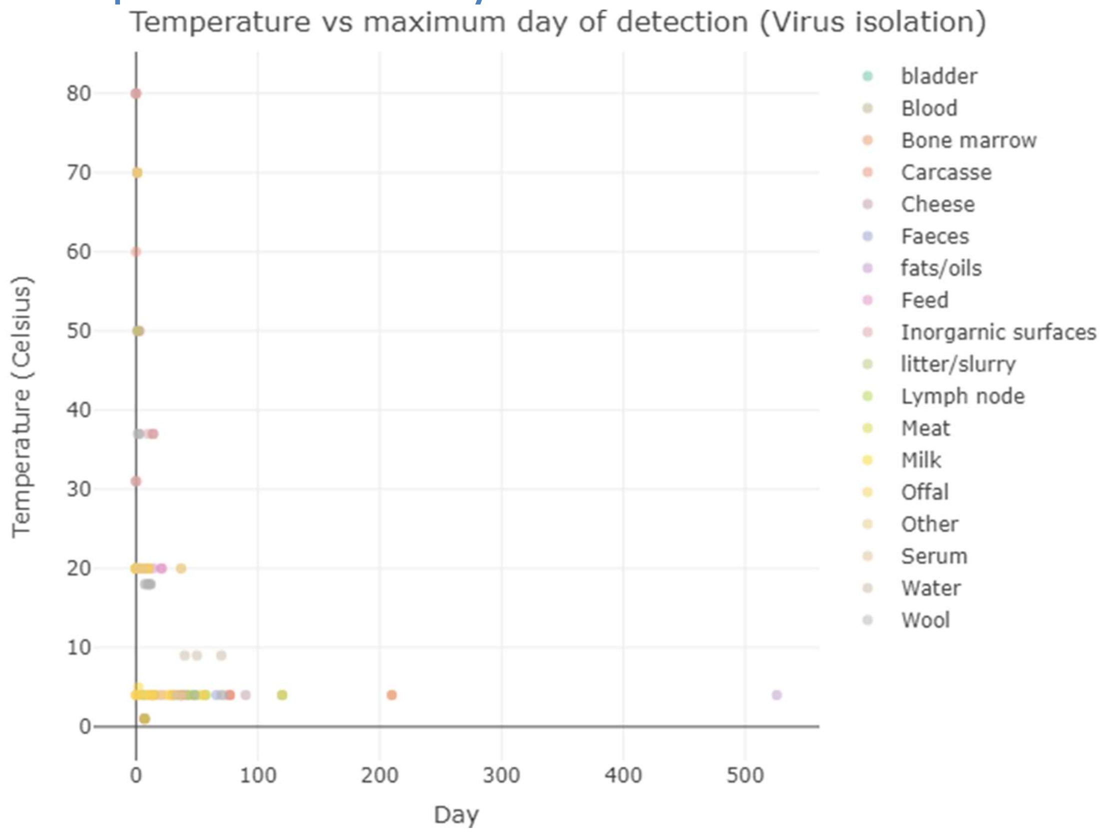
3.1.2 Surveillance studies

Foot and Mouth Disease

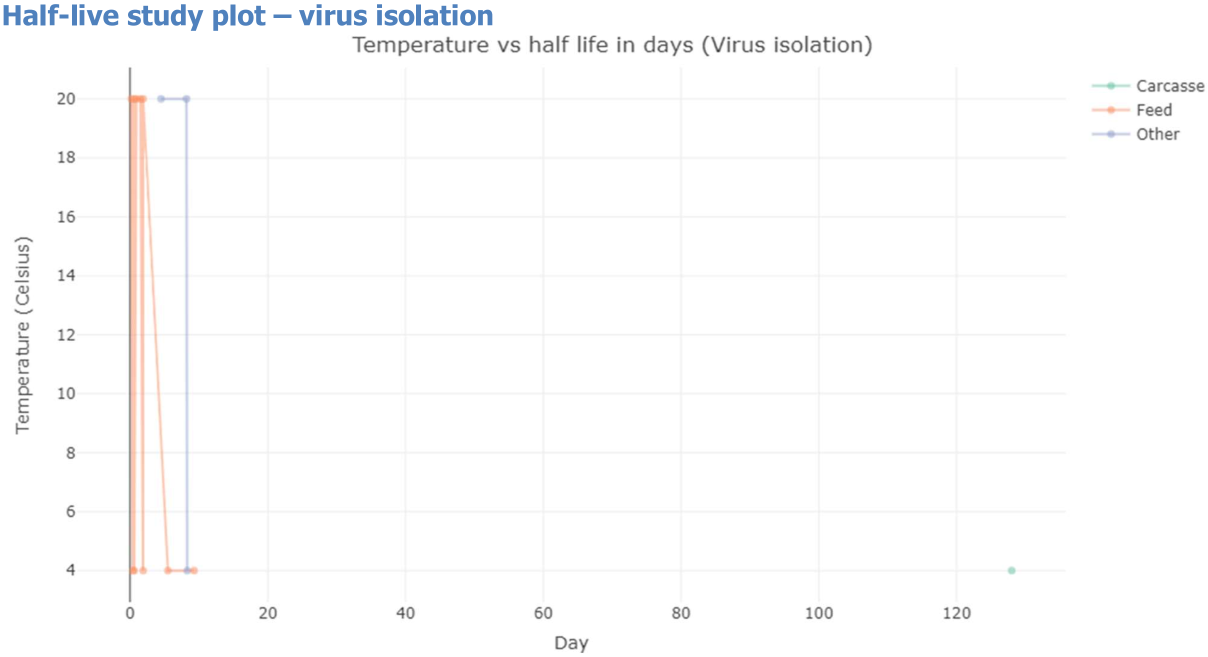
27 publications studying the survival of FMDV in various products and materials have been identified by the ELS[3]. The findings are presented in a survival plot indicating the maximum number of days the virus was detected by virus isolation in different matrices under different conditions (temperature). Further, results from half-life studies which documented virus viability decay over time under different temperatures are shown.
A meta-analysis of FMDV survival in different matrices was done to account explicitly for the effect of censoring, that is, studies which were interrupted while the agent was still detectable in the matrices investigated. Only studies with temperature between 0 and 30 degrees Celsius (materials not frozen or heated) were eligible, as comparisons among studies with larger temperature variation would not be meaningful. Plots show the parametric confidence intervals for the mean survival time when at least 4 study groups are reported and the interquartile ranges (IQ, Q1-Q3). The exact number for these intervals for each of the matrices reported is shown in a table.

[3] https://animal-diseases.efsa.europa.eu/FMDV/#page-3

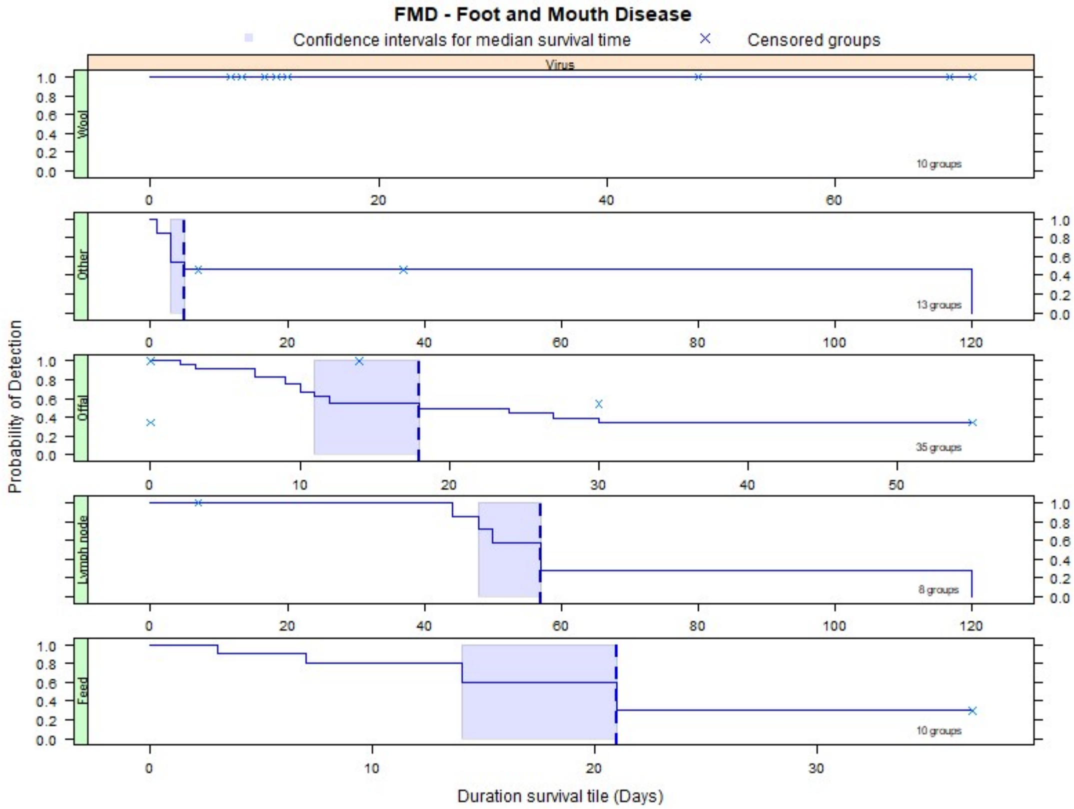
Survival plot – virus isolation in days after animal infection



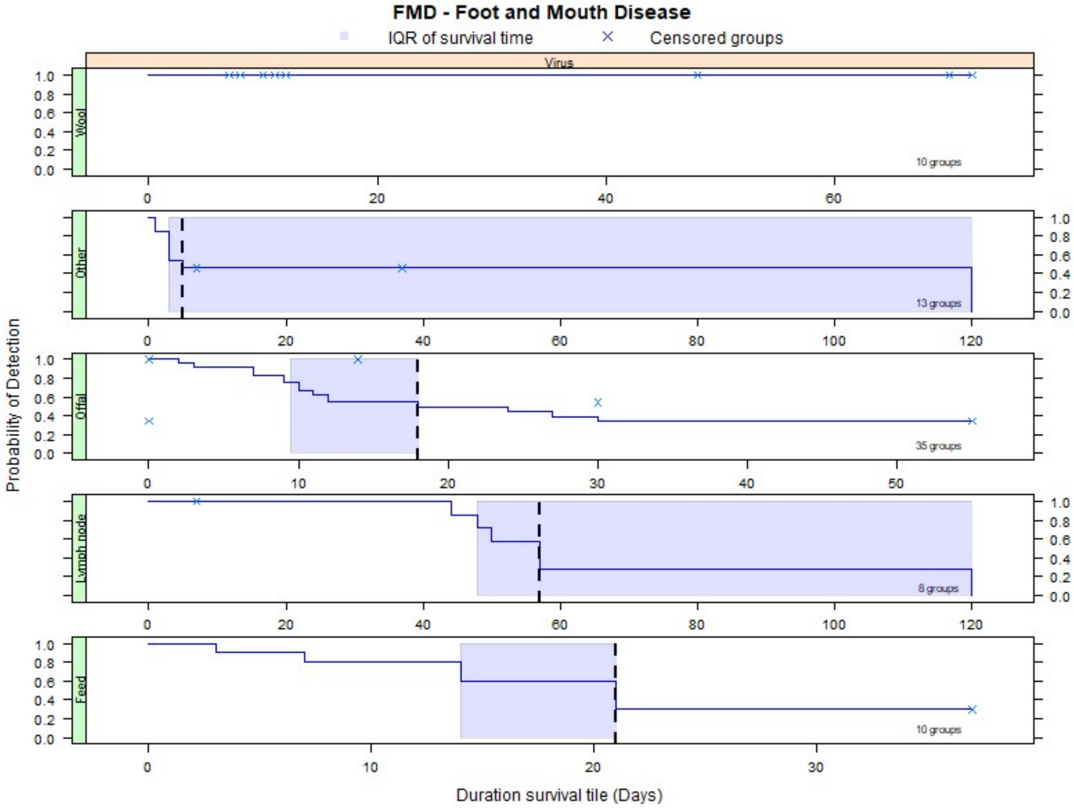
Half-live study plot – virus isolation

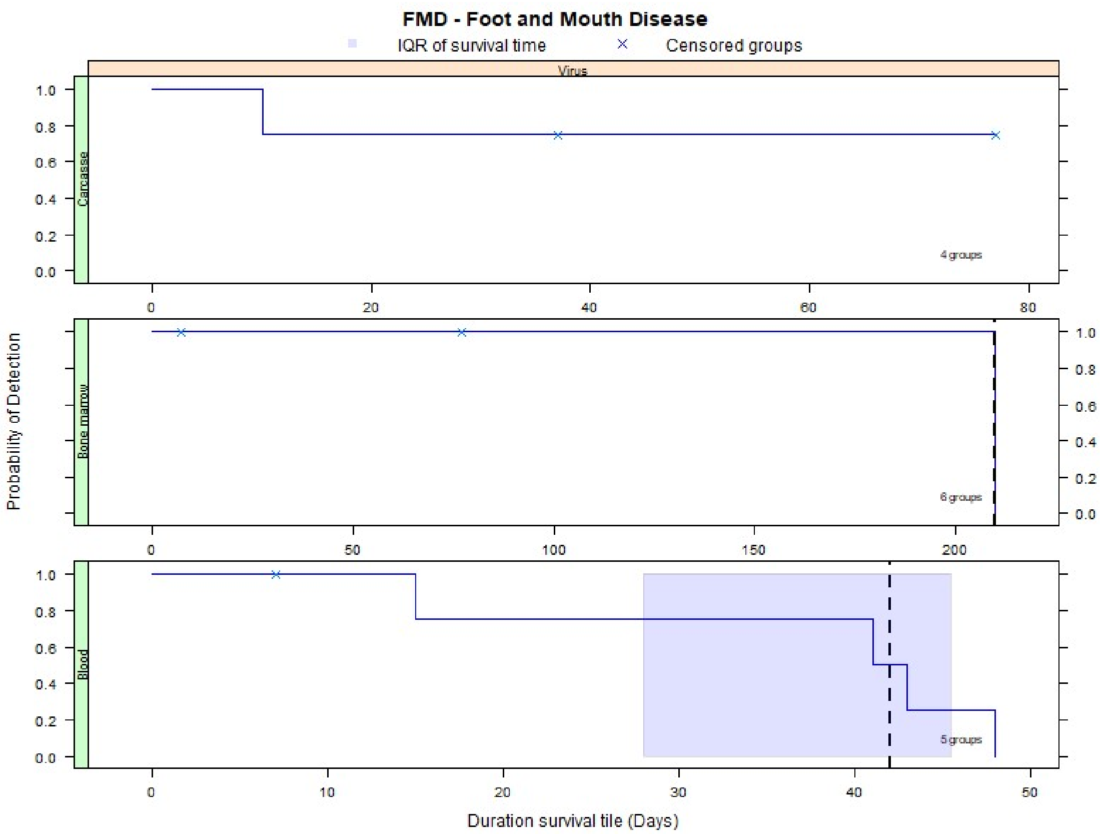


Meta-analysis - Virus detection (0-30°C) (parametric intervals)



Meta-analysis - Virus detection (0-30°C) (IQ range)





Meta-analysis – Median FMD virus survival (in days) in different matrices

matrix	targetLab	n.rows	median	lower.CI	upper.CI	q1	q3
Blood	Virus	5	42.0	15	NA	28.0	45.5
one marrow	Virus	6	210.0	NA	NA	210.0	210.0
Carcasse	Virus	4	NA	10	NA	43.5	NA
Feed	Virus	10	21.0	14	NA	14.0	NA
Lymph node	Virus	8	57.0	48	NA	48.0	120.0
Offal	Virus	35	18.0	11	NA	9.5	NA
Other	Virus	13	5.0	3	NA	3.0	120.0
Wool	Virus	10	NA	NA	NA	NA	NA

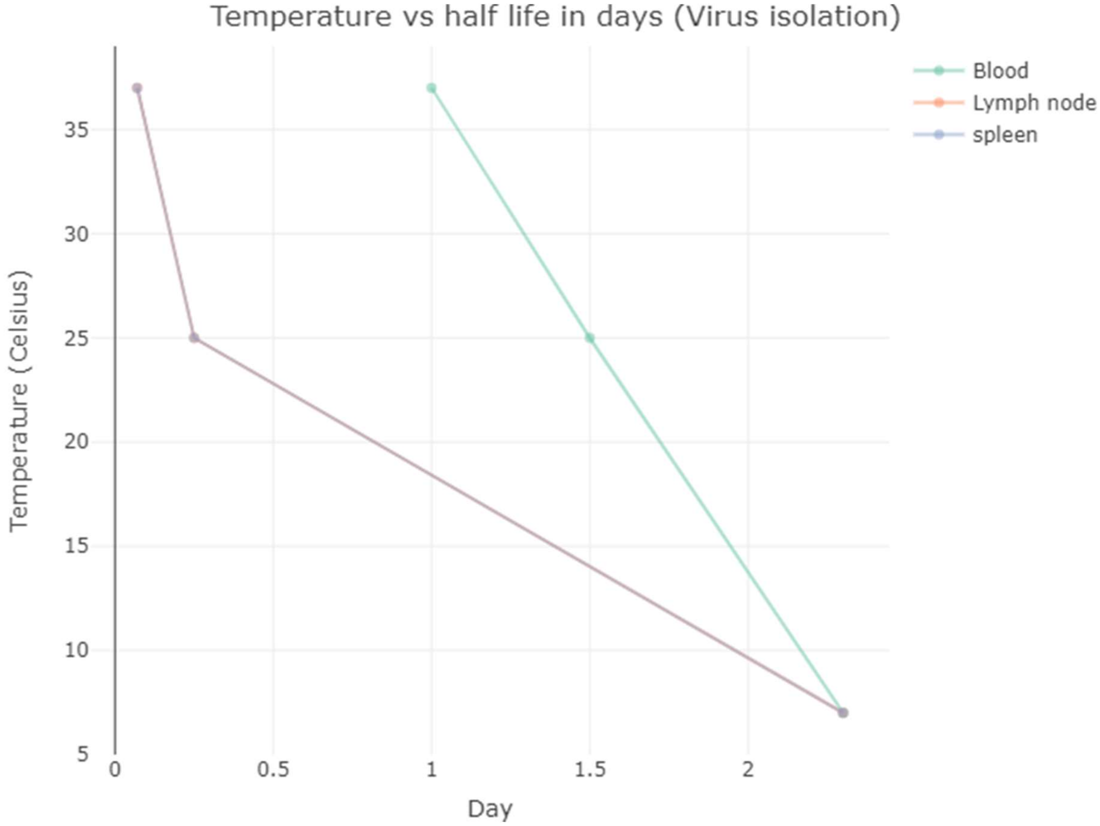
lower.CI, upper.CI= lower and upper control limit of a 95% confidence interval accounting for censoring (lack of information about true maximum when experiments ended while the agent was still detectable); q1, q3= first and third quartiles (25% and 75% of values); n.rows= number of experiments from which pathogen survival data was available

Rinderpest

2 publications studying the survival of RPV in various products and materials have been identified by the ELS[4]. These results from half-life studies which documented virus viability decay over time under different temperatures are shown.

[4] https://animal-diseases.efsa.europa.eu/RPV/#page-3

Half-live study plot – virus isolation



Meta-analysis – Median RP virus survival (in days) in different matrices

Meta-analysis was not performed for this agent/disease. There was not enough evidence.

Lumpy Skin Disease

There was not enough evidence for this disease/pathogen[5].

Contagious bovine pleuropneumonia

There was not enough evidence for this disease/pathogen[6].

Sheep pox and goat pox

There was not enough evidence for this disease/pathogen.[7]

Peste des petits ruminants

There was not enough evidence for this disease/pathogen.[8]

[5] https://animal-diseases.efsa.europa.eu/LSDV/#page-3
[6] https://animal-diseases.efsa.europa.eu/CBPP/#page-3
[7] https://animal-diseases.efsa.europa.eu/SPPV/#page-3
[8] https://animal-diseases.efsa.europa.eu/PPRV/#page-3

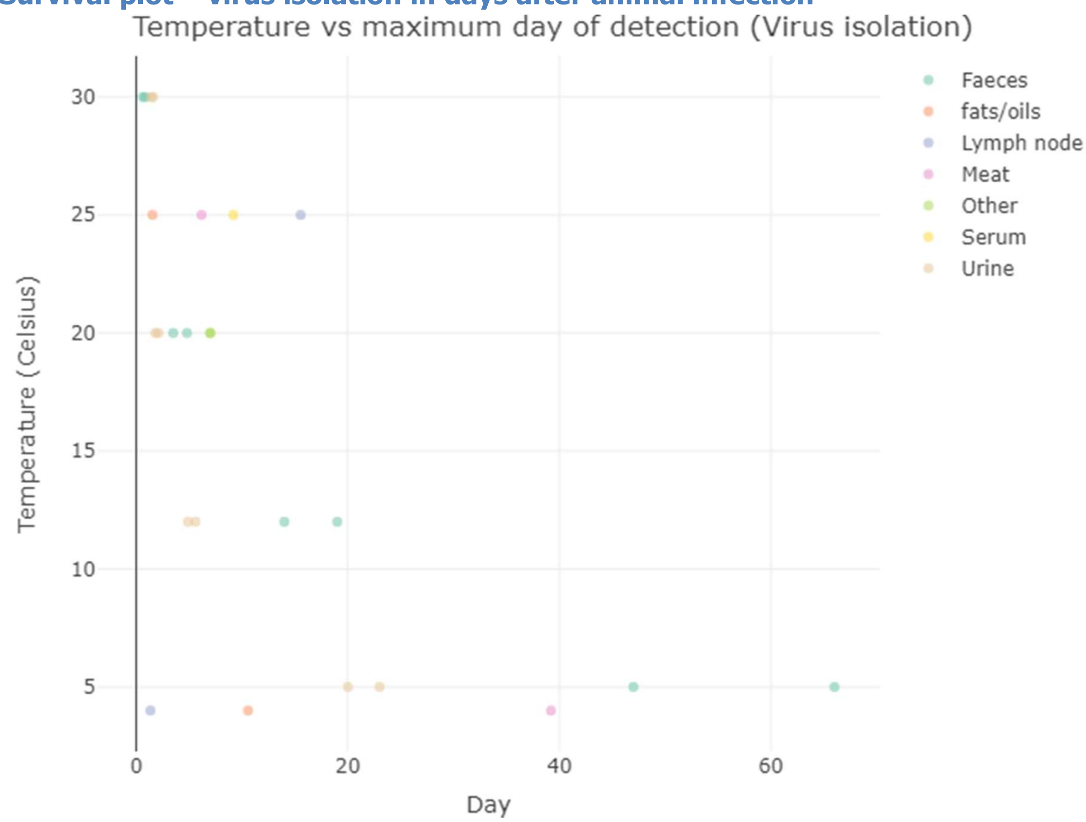
Contagious caprine pleuropneumonia

There was not enough evidence for this disease/pathogen.[9]

Classical Swine Fever

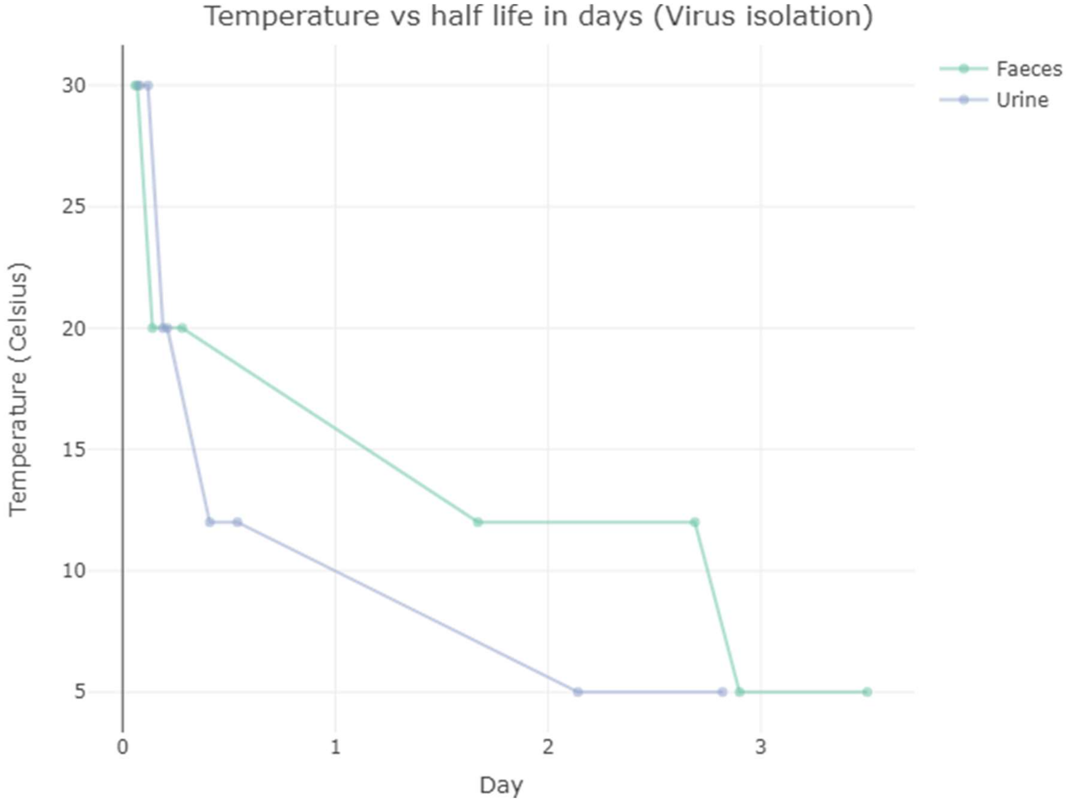
Six publications studying the survival of CSFV in various products and materials have been identified by the ELS[10]. The findings are presented in a survival plot indicating the maximum number of days the virus was detected by virus isolation in different matrices under different conditions (temperature). Further, results from half-life studies which documented virus viability decay over time under different temperatures are shown.
A meta-analysis of CSFV survival in different matrices was done to account explicitly for the effect of censoring, that is, studies which were interrupted while the agent was still detectable in the matrices investigated. Only studies with temperature between 0 and 30 degrees Celsius (materials not frozen or heated) were eligible, as comparisons among studies with larger temperature variation would not be meaningful. Plots show the parametric confidence intervals for the mean survival time when at least 4 study groups are reported and the interquartile ranges (IQ, Q1-Q3). The exact number for these intervals for each of the matrices reported is shown in a table.

Survival plot – virus isolation in days after animal infection

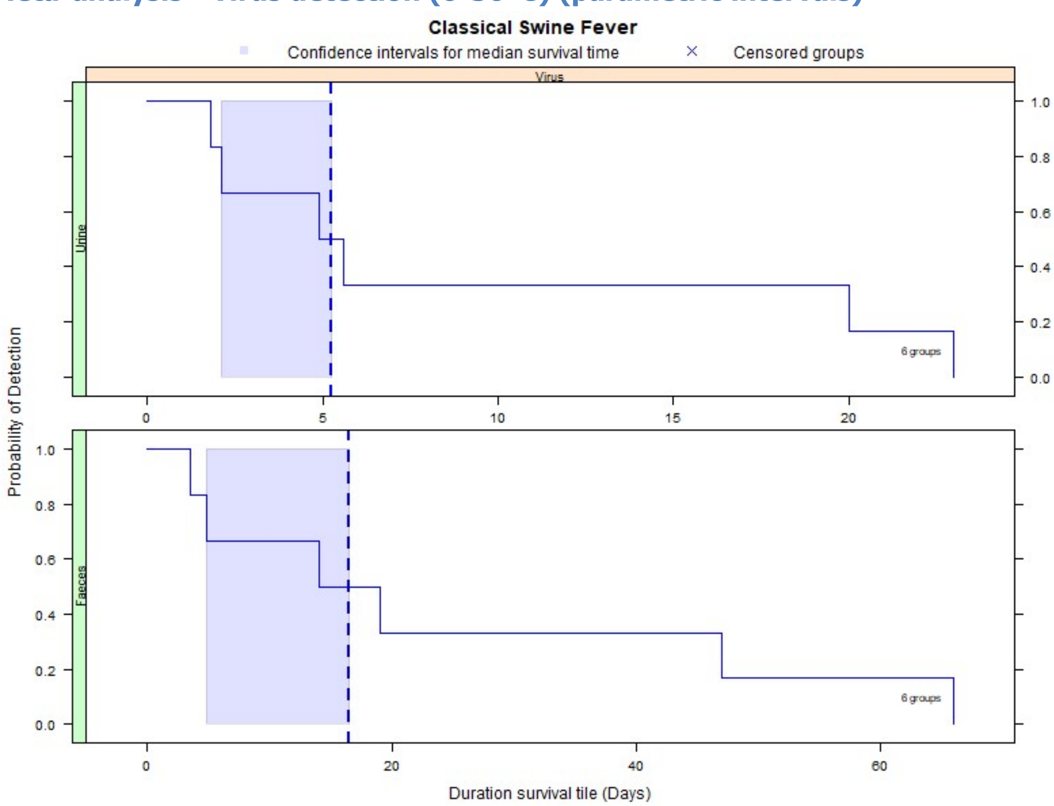


[9] https://animal-diseases.efsa.europa.eu/CCPP/#page-3
[10] https://animal-diseases.efsa.europa.eu/CSFV/#page-3

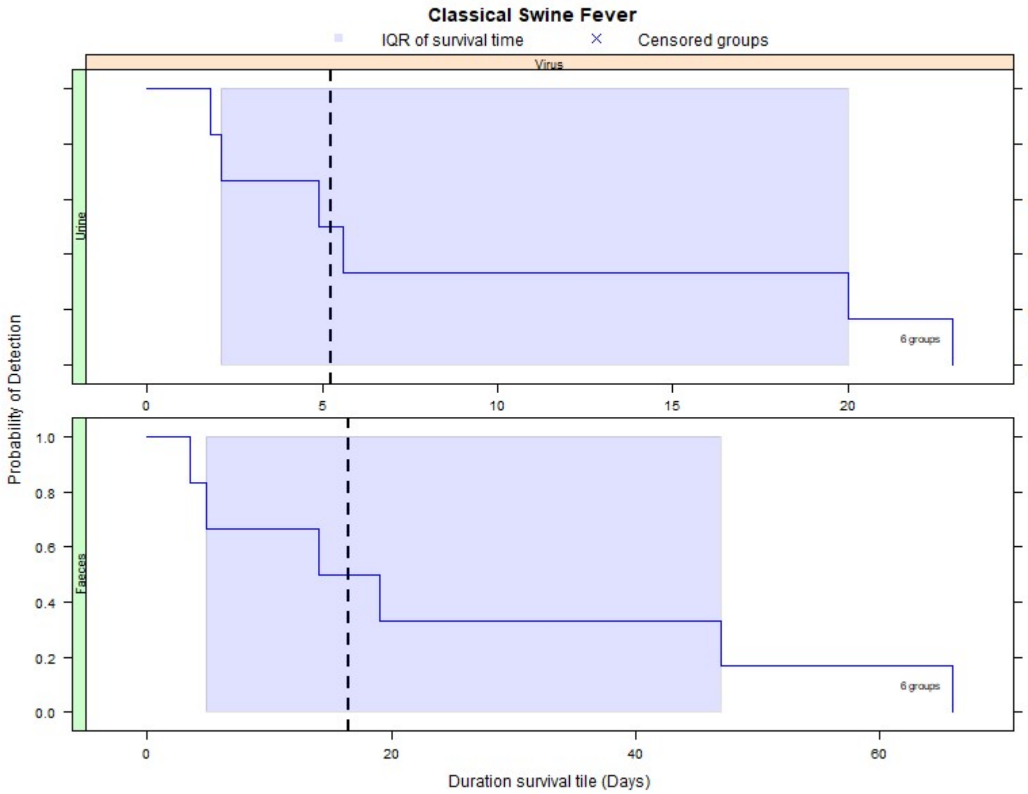
Half-live study plot – virus isolation



Meta-analysis - Virus detection (0-30°C) (parametric intervals)



Meta-analysis - Virus detection (0-30°C) (IQ range)



Meta-analysis – Median CSF virus survival (in days) in different matrices

matrix	targetLab	n.rows	median	lower.CI	upper.CI	q1	q3
Faeces	Virus	6	16.5	4.8	NA	4.8	47
Urine	Virus	6	5.2	2.1	NA	2.1	20

lower.CI, upper.CI= lower and upper control limit of a 95% confidence interval accounting for censoring (lack of information about true maximum when experiments ended while the agent was still detectable); q1, q3= first and third quartiles (25% and 75% of values); n.rows= number of experiments from which pathogen survival data was available

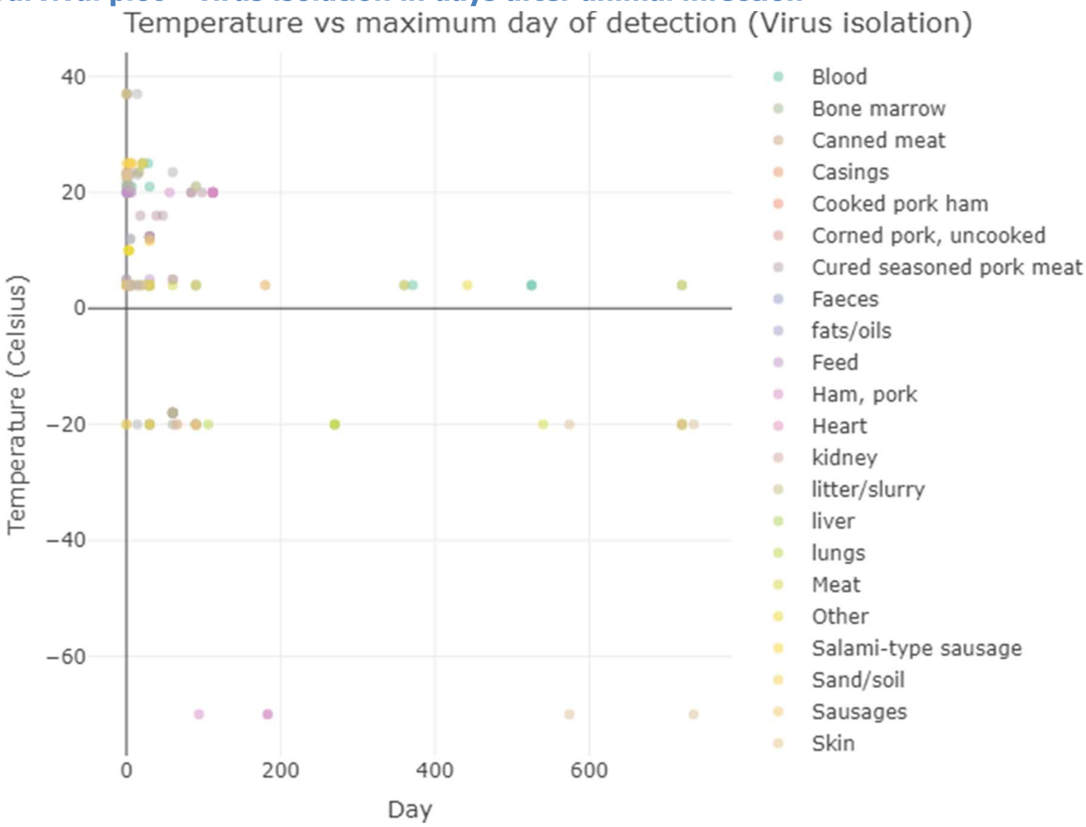
African Swine Fever

22 publications studying the survival of ASFV in various products and materials have been identified by the ELS[11]. The findings are presented in a survival plot indicating the maximum number of days the virus was detected by virus isolation in different matrices under different conditions (temperature). Further, results from half-life studies which documented virus viability decay over time under different temperatures are shown.
A meta-analysis of ASFV survival in different matrices was done to account explicitly for the effect of censoring, that is, studies which were interrupted while the agent was still detectable in the matrices investigated. Only studies with temperature between 0 and 30 degrees Celsius (materials not frozen or heated) were eligible, as comparisons among

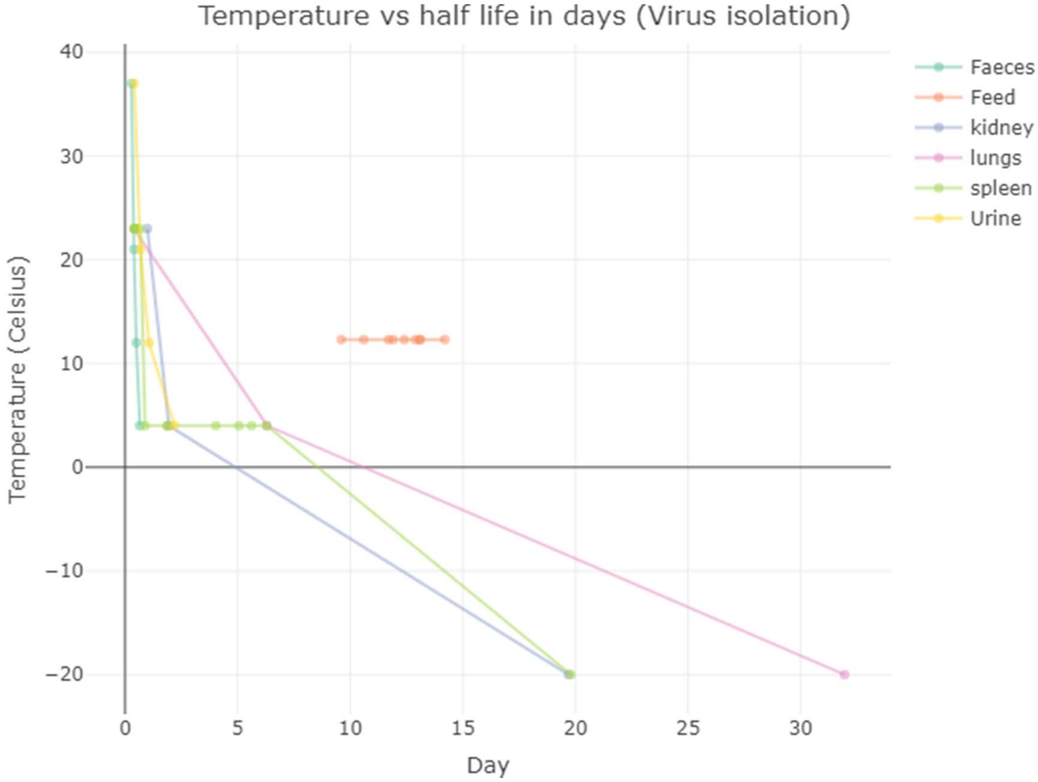
[11] https://animal-diseases.efsa.europa.eu/ASFV/#page-4

studies with larger temperature variation would not be meaningful. Plots show the parametric confidence intervals for the mean survival time when at least 4 study groups are reported and the interquartile ranges (IQ, Q1-Q3). The exact number for these intervals for each of the matrices reported is shown in a table.

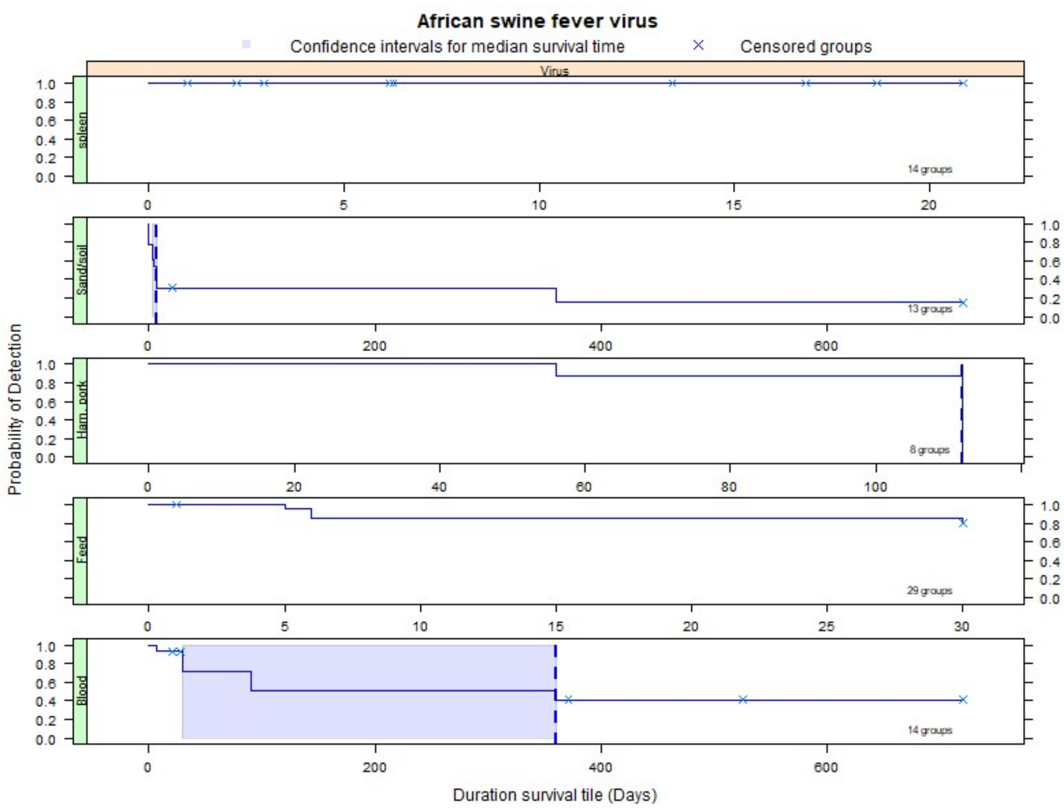
Survival plot – virus isolation in days after animal infection

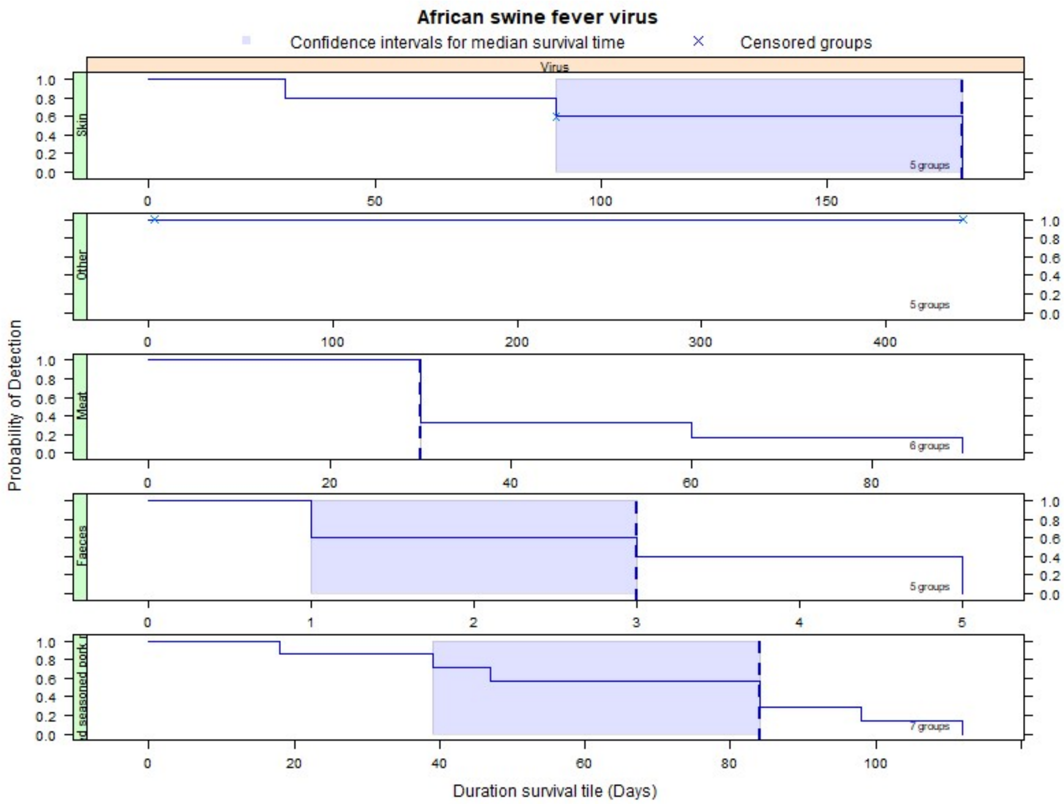


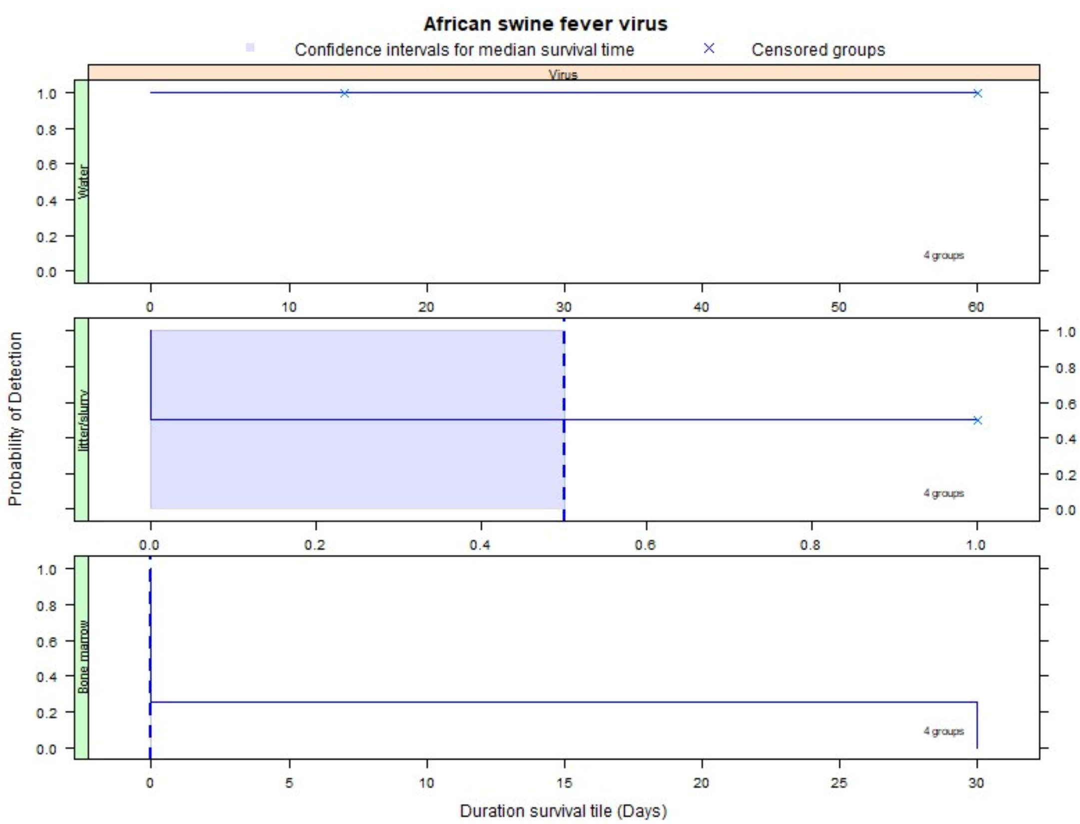
Half-live study plot – virus isolation



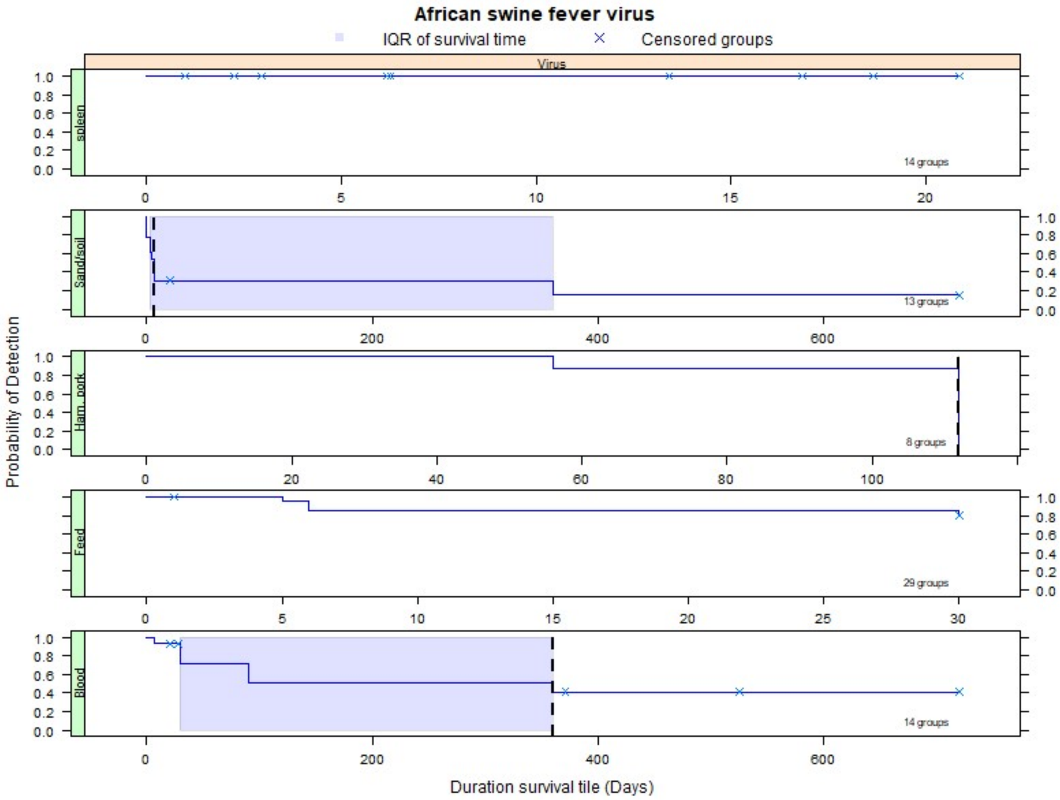
Meta-analysis - Virus detection (0-30°C) (parametric intervals)

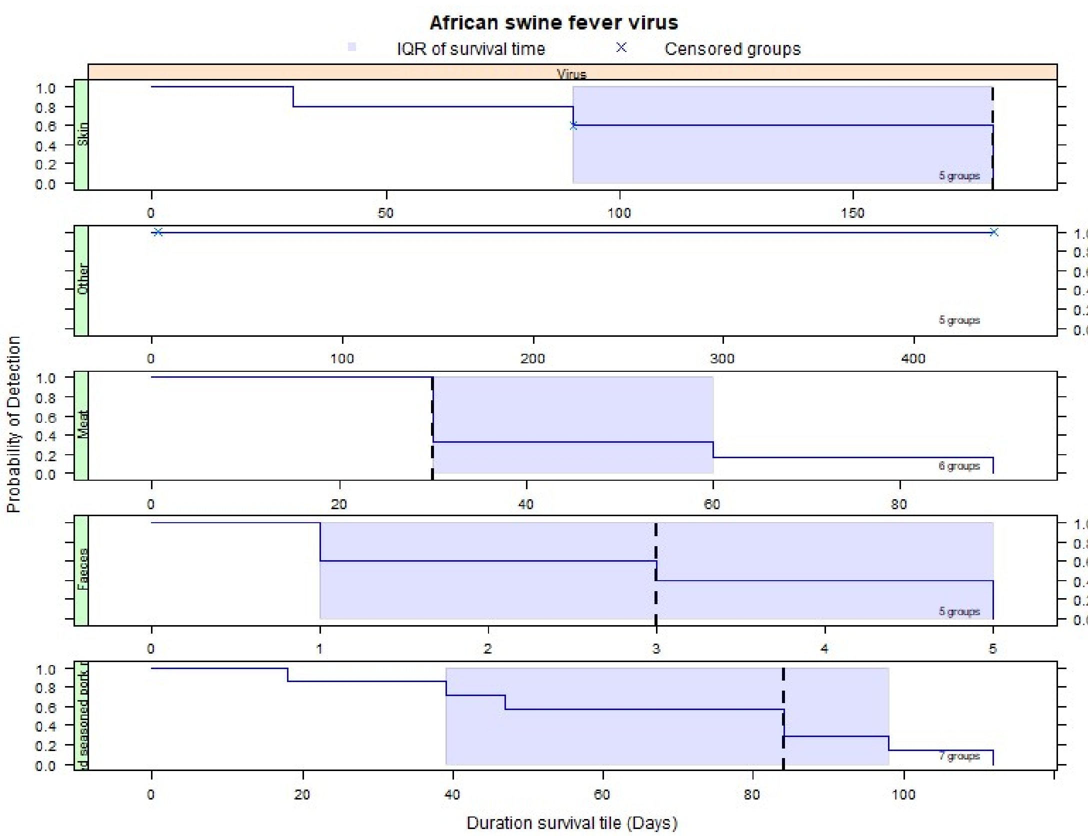



African swine fever virus
Confidence intervals for median survival time
Censored groups
Virus
Skin
Other
Meat
Faeces
d seasoned pork
5 groups
5 groups
6 groups
5 groups
7 groups
Probability of Detection
Duration survival tile (Days)


African swine fever virus
Confidence intervals for median survival time
Censored groups
Virus
Water
litter/slurry
Bone marrow
4 groups
4 groups
4 groups
Probability of Detection
Duration survival tile (Days)

Meta-analysis - Virus detection (0-30°C) (IQ range)





Meta-analysis – Median ASF virus survival (in days) in different matrices

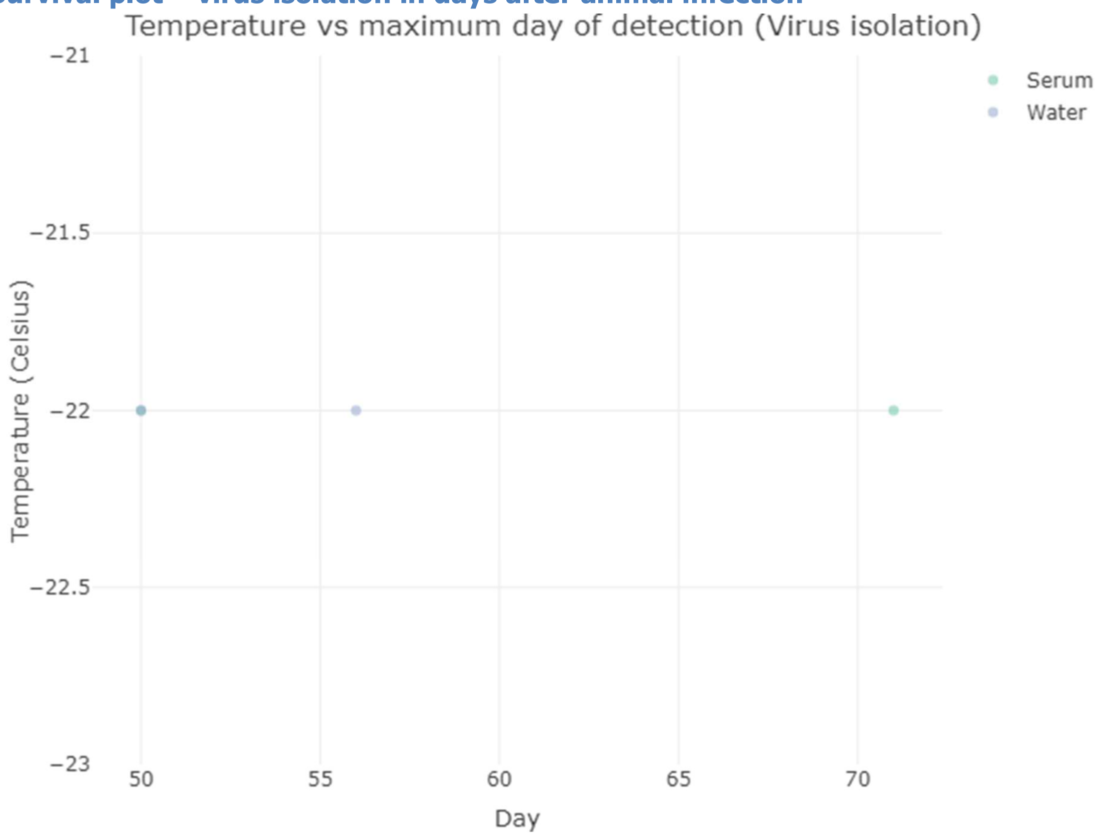
matrix	targetLab	n.rows	median	lower.CI	upper.CI	q1	q3
Blood	Virus	14	360.0	30	NA	30	NA
Bone marrow	Virus	4	0.0	0	NA	0	15
Cured seasoned pork meat	Virus	7	84.0	39	NA	39	98
Faeces	Virus	5	3.0	1	NA	1	5
Feed	Virus	29	NA	NA	NA	NA	NA
Ham, pork	Virus	8	112.0	NA	NA	112	112
litter/slurry	Virus	4	0.5	0	NA	0	NA
Meat	Virus	6	30.0	30	NA	30	60
Other	Virus	5	NA	NA	NA	NA	NA
Sand/soil	Virus	13	7.0	3	NA	3	360
Skin	Virus	5	180.0	90	NA	90	180
spleen	Virus	14	NA	NA	NA	NA	NA
Water	Virus	4	NA	NA	NA	NA	NA

lower.CI, upper.CI= lower and upper control limit of a 95% confidence interval accounting for censoring (lack of information about true maximum when experiments ended while the agent was still detectable); q1, q3= first and third quartiles (25% and 75% of values); n.rows= number of experiments from which pathogen survival data was available

African Horse Sickness

One publication studying the survival of AHSV in various products and materials have been identified by the ELS[12]. The findings are presented in a survival plot indicating the maximum number of days the virus was detected by virus isolation in different matrices under different conditions (temperature).
Meta-analysis was not performed for this agent/disease due to lack of evidence. When evidence was available through systematic literature review for a minimum of 4 data points per animal matrix, this evidence was subjected to meta-analysis. In such cases, Kaplan-Meier curves would be fit to the data, in order to estimate confidence intervals (CI) and interquartile ranges (IQ) for the duration of the pathogen survival explicitly taking into account the data censoring issue (lack of information about true maximum when experiments ended while the agent was still detectable). There was not enough evidence for this disease/pathogen.

Survival plot – virus isolation in days after animal infection



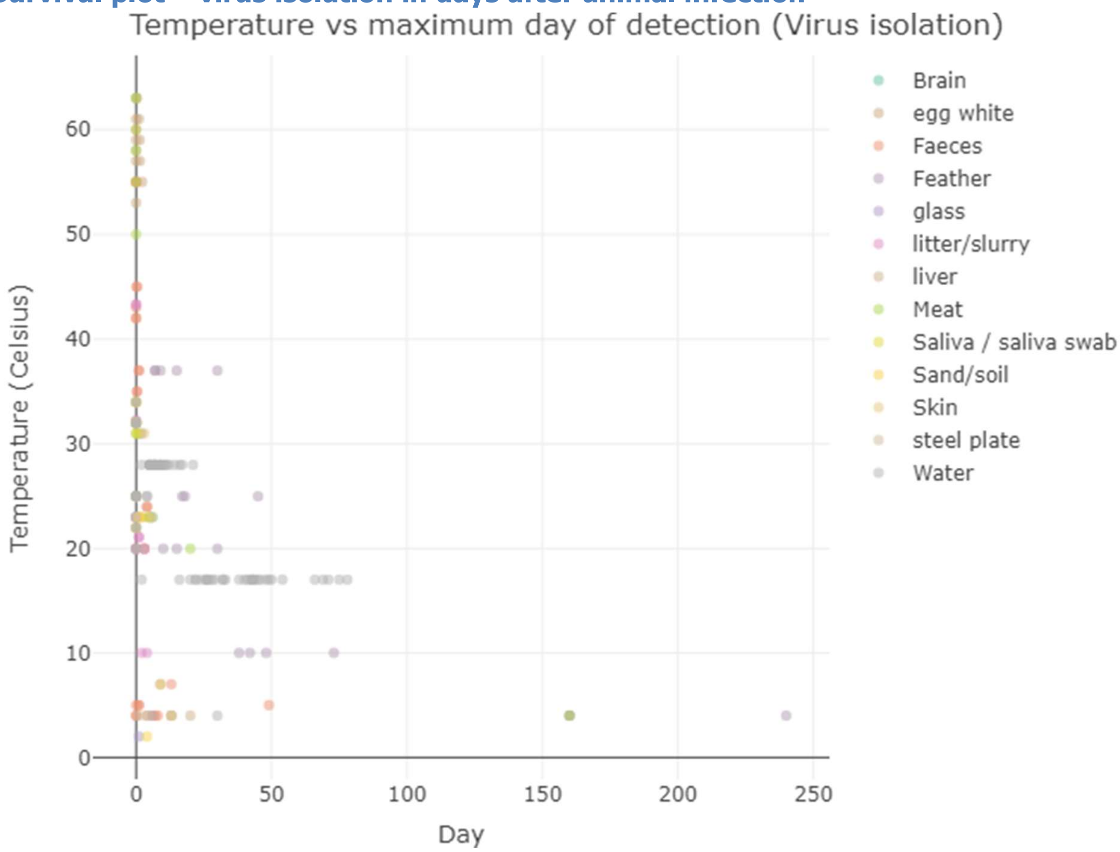
Highly Pathogenic Avian Influenza

16 publications studying the survival of HPAIV in various products and materials have been identified by the ELS[13]. The findings are presented in a survival plot indicating the maximum number of days the virus was detected by virus isolation in different matrices under different conditions (temperature).

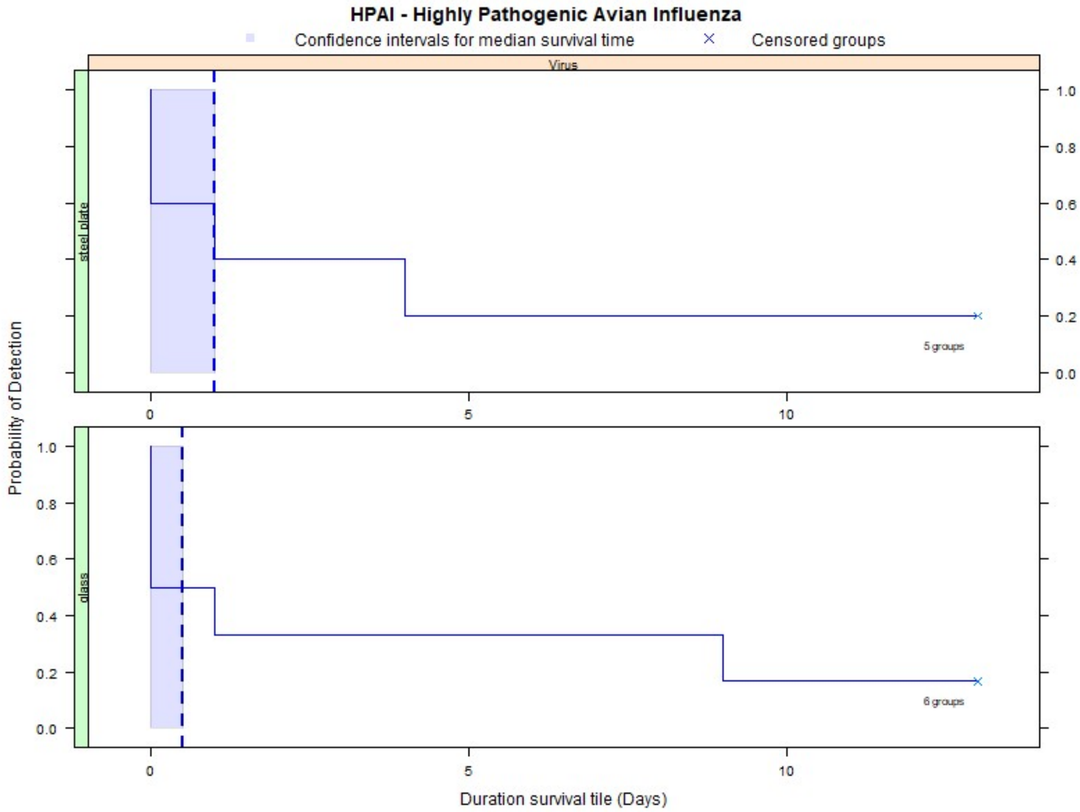
[12] https://animal-diseases.efsa.europa.eu/AHSV/#page-4
[13] https://animal-diseases.efsa.europa.eu/HPAI/#page-3

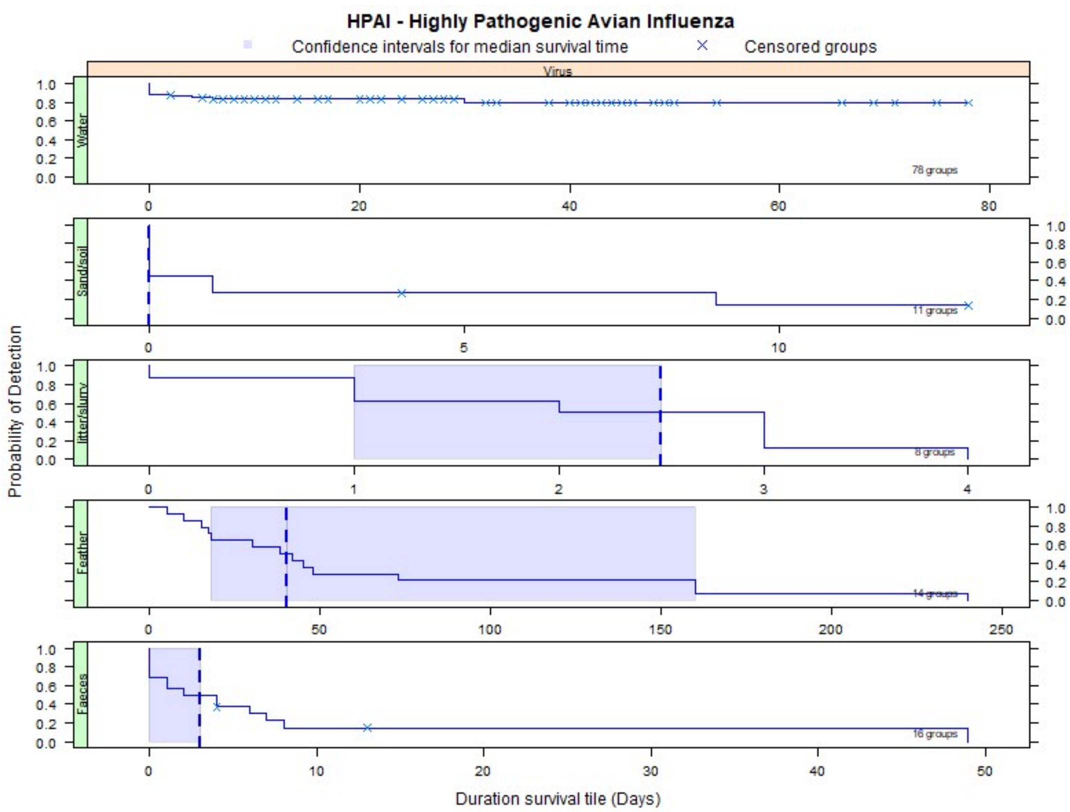
A meta-analysis of HPAIV survival in different matrices was done to account explicitly for the effect of censoring, that is, studies which were interrupted while the agent was still detectable in the matrices investigated. Only studies with temperature between 0 and 30 degrees Celsius (materials not frozen or heated) were eligible, as comparisons among studies with larger temperature variation would not be meaningful. Plots show the parametric confidence intervals for the mean survival time when at least 4 study groups are reported and the interquartile ranges (IQ, Q1-Q3). The exact number for these intervals for each of the matrices reported is shown in a table.

Survival plot – virus isolation in days after animal infection

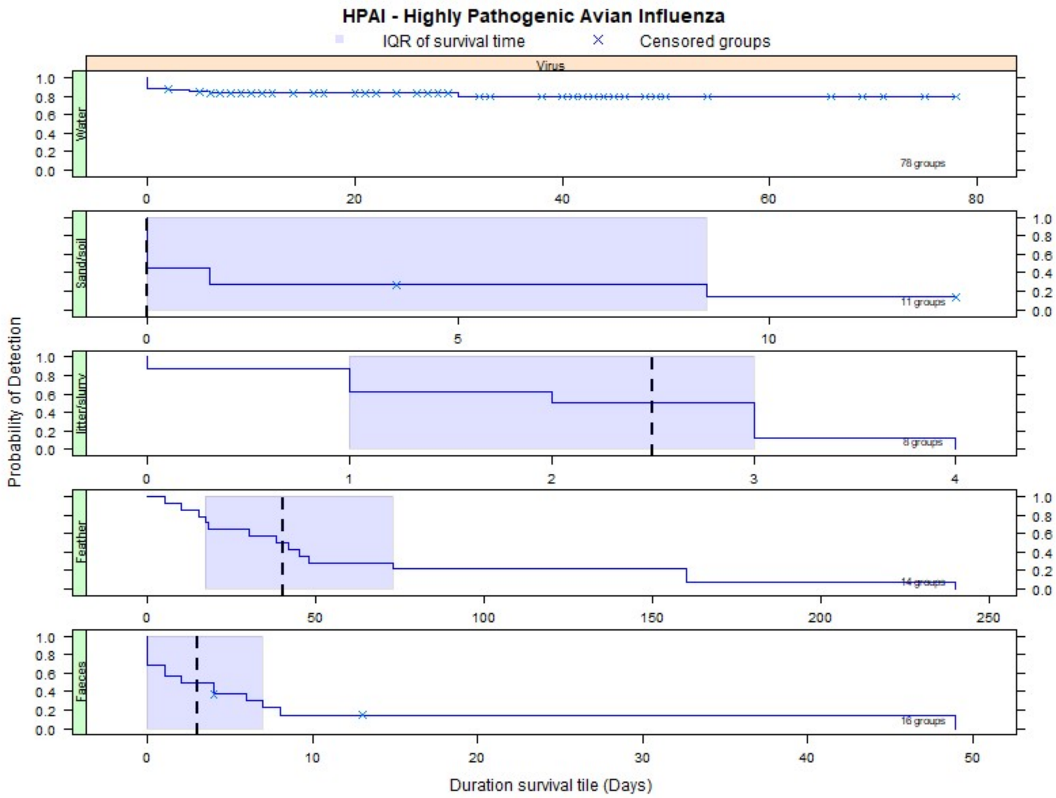


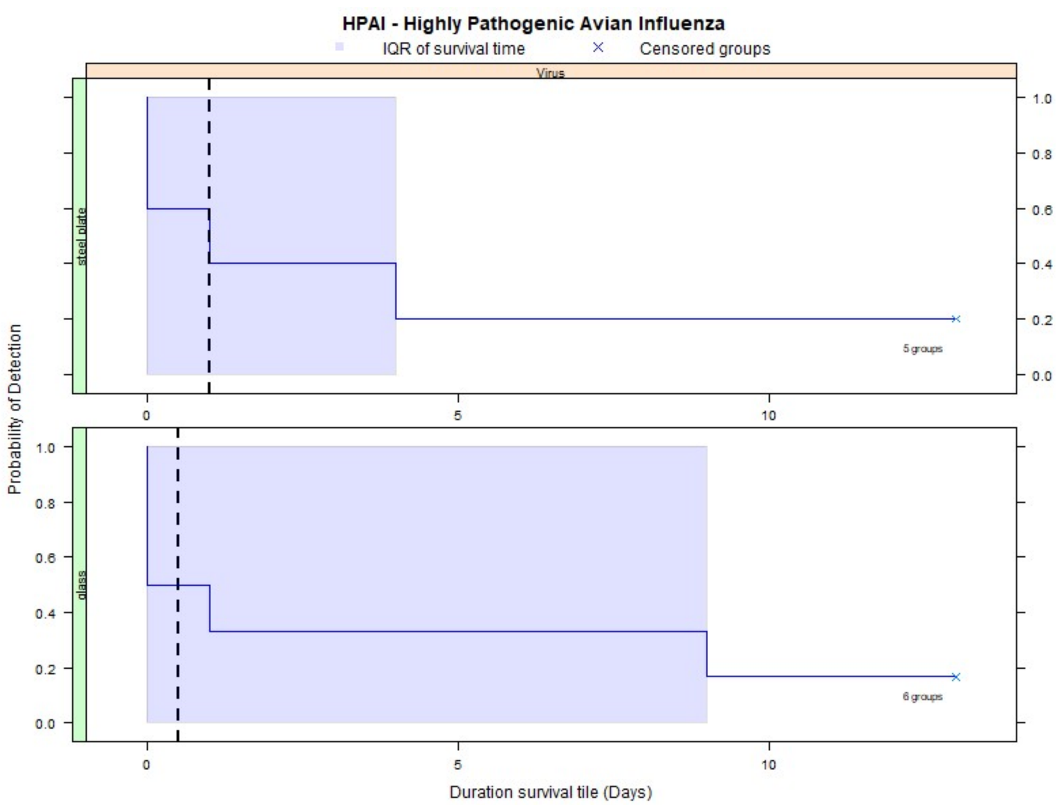
Meta-analysis - Virus detection (0-30°C) (parametric intervals)





Meta-analysis - Virus detection (0-30°C) (IQ range)





Meta-analysis – Median HPAI virus survival (in days) in different matrices

matrix	targetLab	n.rows	median	lower.CI	upper.CI	q1	q3
Faeces	Virus	16	3.0	0	NA	0	7
Feather	Virus	14	40.0	18	160	17	73
glass	Virus	6	0.5	0	NA	0	9
litter/ slurry	Virus	8	2.5	1	NA	1	3
Sand/ soil	Virus	11	0.0	0	NA	0	9
steel plate	Virus	5	1.0	0	NA	0	4
Water	Virus	78	NA	NA	NA	NA	NA

lower.CI, upper.CI= lower and upper control limit of a 95% confidence interval accounting for censoring (lack of information about true maximum when experiments ended while the agent was still detectable); q1, q3= first and third quartiles (25% and 75% of values); n.rows= number of experiments from which pathogen survival data was available

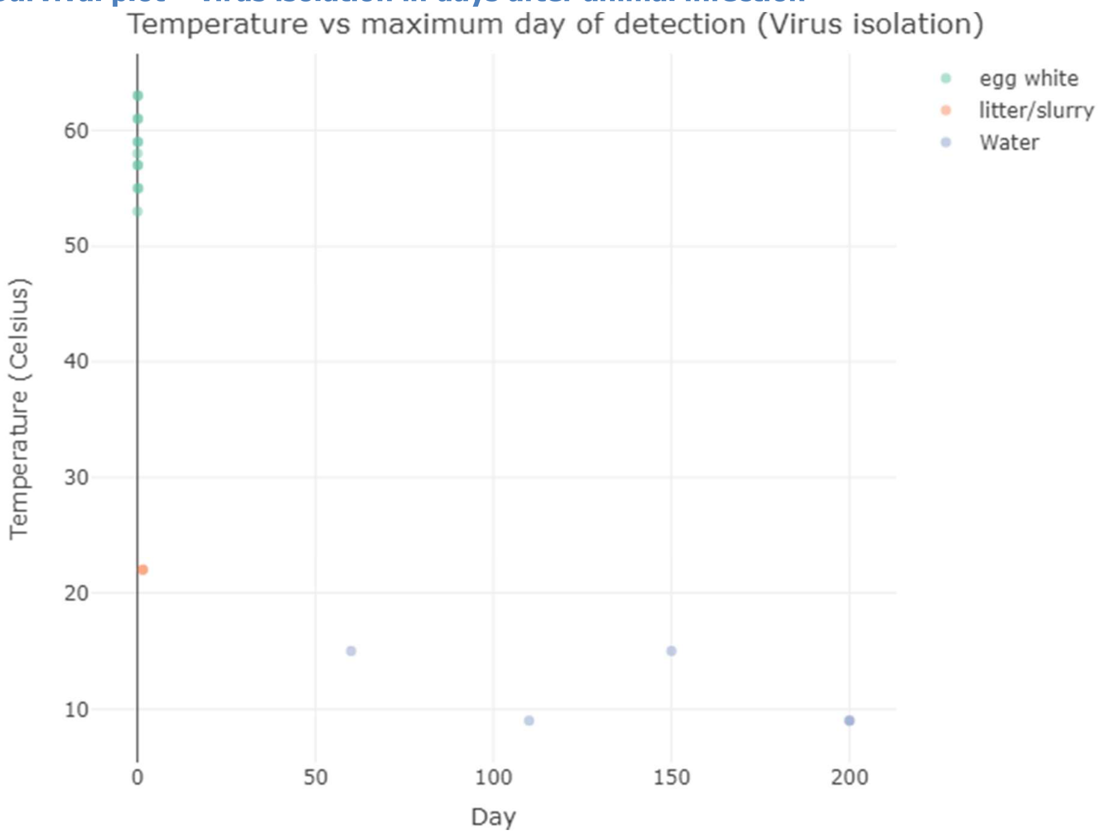
Newcastle Disease

Seven publications studying the survival of NDV in various products and materials have been identified by the ELS[14]. The findings are presented in a survival plot indicating the maximum number of days the virus was detected by virus isolation in different matrices under different conditions (temperature).
A meta-analysis of NDV survival in different matrices was done to account explicitly for the effect of censoring, that is, studies which were interrupted while the agent was still detectable in the matrices investigated. Only studies with temperature between 0 and 30 degrees Celsius (materials not frozen or heated) were eligible, as comparisons among studies with larger temperature variation would not be meaningful. Plots show the

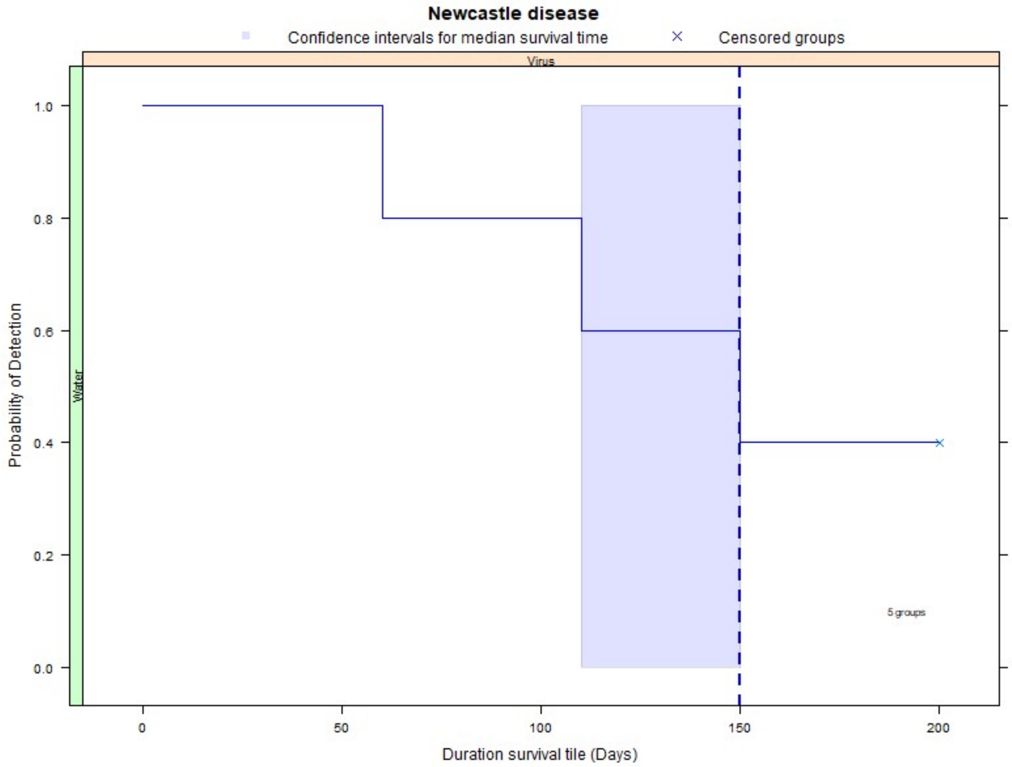
[14] https://animal-diseases.efsa.europa.eu/NDV/#page-3

parametric confidence intervals for the mean survival time when at least 4 study groups are reported and the interquartile ranges (IQ, Q1-Q3). The exact number for these intervals for each of the matrices reported is shown in a table.

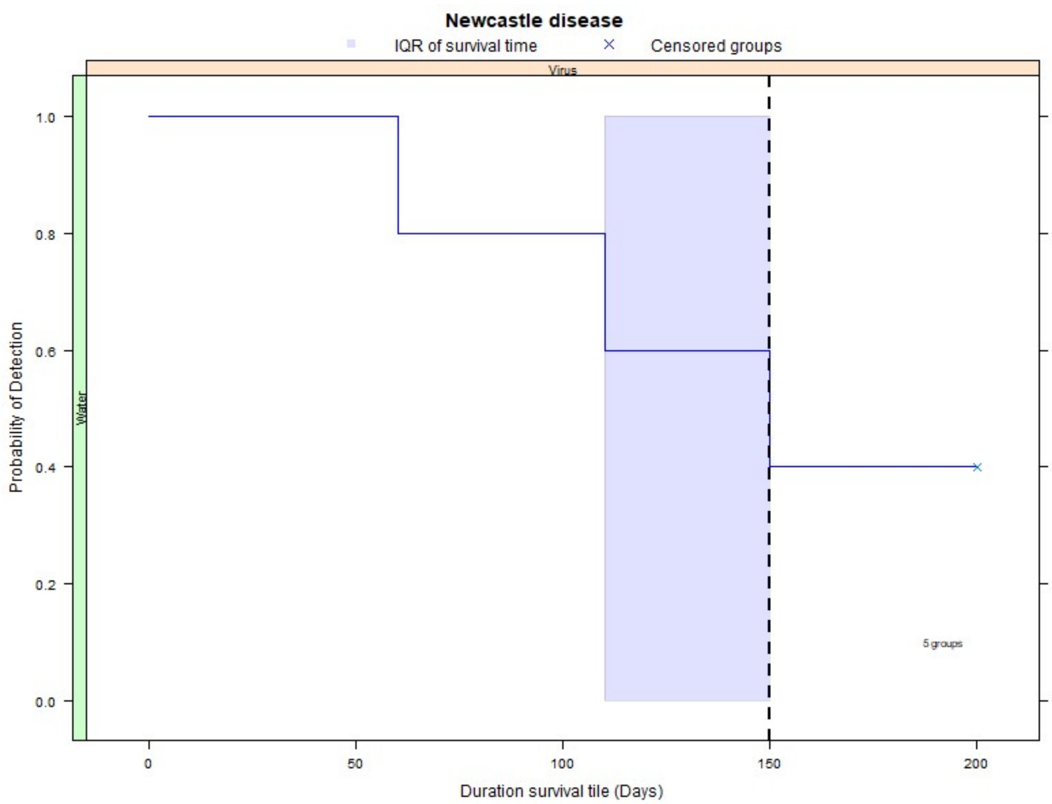
Survival plot – virus isolation in days after animal infection



Meta-analysis - Virus detection (0-30°C) (parametric intervals)



Meta-analysis - Virus detection (0-30°C) (IQ range)



Meta-analysis – Median NDV survival (in days) in different matrices

matrix	targetLab	n.rows	median	lower.CI	upper.CI	q1	q3
Water	Virus	5	150	110	NA	110	NA

lower.CI, upper.CI= lower and upper control limit of a 95% confidence interval accounting for censoring (lack of information about true maximum when experiments ended while the agent was still detectable); q1, q3= first and third quartiles (25% and 75% of values); n.rows= number of experiments from which pathogen survival data was available

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Appendix A – Extensive literature search protocol

Review questions and eligibility criteria

Experimental infection studies

This SLR aims to gather all scientific evidence available regarding incubation period, infectious period, characterisation of clinical signs, and mortality and morbidity rates for the diseases in scope.

Review questions for experimental infection studies

What is the effect of an exposure in susceptible hosts - being experimentally infected with an agent - on these specific outcomes relating to the pathogenesis of the disease:

→ What is the minimum and maximum time post inoculation to observe clinical signs?

→ What is the minimum and maximum minimum infectious period in days?

→ What is the minimum and maximum mortality rate?

→ What is the minimum and maximum morbidity rate?

→ What are the main clinical signs?

Study eligibility criteria for experimental infection studies

Element	Criteria	Level of screening
Publication type	Primary research publications	Title and abstract
Language	English	Title and abstract Full-text
Study type	Experimental infections	Title and abstract
Study design	Experimental study design Susceptible hosts must be experimentally exposed to the pathogen, either by inoculation, or direct or indirect contact transmission Only a single exposure with an 'outbreak strain' or 'wild type strain' of the agent (AHL-A disease agent), in not-immunised or not-vaccinated or not-treated hosts, will be considered.	Title and abstract Full-text
Population	The susceptible host species	Title and abstract Full text
Exposure	Exposure of susceptible species with one of the AHL-A disease agents. Agent infection should be confirmed by an established test	Title and abstract Full-text
Outcome of interest	The article is excluded if there is no description of one of the outcomes of interest, i.e., time of detection of the	Full-text

	pathogen after exposure, number of positive or dead animals, or the clinical signs	
Publishing date	1990-2021	Title and abstract

Pathogen survival studies

Aims at collecting data relating to the survival time of the disease agents in scope. Information should concern the persistence of the pathogen in different matrices.

Review questions for agent survival studies

What is the minimum and maximum number of days post inoculation to detect active pathogen in different relevant matrices?

Study eligibility criteria for agent survival studies

Element	Criteria	Level of screening
Publication type	Primary research publications	Title and abstract
Language	English	Title and abstract Full-text
Study type	Pathogen survival experiments	Title and abstract
Study design	The study should provide details on the strain/isolate of the pathogen, the dose (in case of experimentally infected animals), and the temperature at which the matrix is stored	Title and abstract Full-text
Exposure	Matrices of susceptible species exposed with one of the AHL-A disease agents in scope. Alternatively, matrices can be experimentally contaminated (spiked) with one of the agents in scope.	Title and abstract Full-text
Outcome of interest	The article is excluded if there is no description of one of the outcomes of interest, i.e., pathogen survival time	Full-text
Publishing date	1990-2021	Title and abstract

Information sources

Scopus will be used as the primary platform for literature searches.

Search strategy

Search strategies for experimental infection studies

The search strings for experimental infections are always a combination of 4 elements:

1) String I: agent/disease description. Name of the pathogen and diseases, with alternative names when relevant
2) String II: host description.
3) String III: selection of experimental studies (*Experiment* OR Inoculat**)
4) Publication years selection

These elements are joined with "AND" statements. As an example, the search string below was constructed to retrieve experimental infection studies involving sheep pox, goat pox, peste des petits ruminants and classical swine fever:

TITLE-ABS-KEY (
("Sheep pox" OR "goat pox" OR "peste des petits ruminants" OR "Classical swine fever")
AND
(Goat OR Capra OR caprine OR Sheep OR Ovis or Ovine OR Camel or Camelid OR Dromedary OR Alpaca OR Vicugna OR Llama OR Lama OR Vicuna OR Vicuña OR Deer OR Cervidae OR Pig OR Hog OR Suis OR Suidae)
AND
(Experiment* OR Inoculat*)
) AND (PUBYEAR AFT 1989)

Search strategies for pathogen survival studies

The search strings for pathogen survival are always a combination of 3 elements:

1) String I: agent/disease description. Name of the pathogen and diseases, with alternative names when relevant
2) String II: selection of survival experiments (*Surviv* OR Persist* OR stability OR inactivat* OR disinfect**). The abbreviation Surviv* is to include terms like Survival study, Survival experiment, Survival duration, Survival period, etc. The abbreviation Persist* is to include terms like Persistence, Persistent, etc.
3) Publication years selection

These elements are joined with "AND" statements. See example in the section describing the search strategy for experimental infections.

The search is not restricted using any species keywords, nor specific types of matrices in which the pathogens were evaluated. Instead, we will use a string to search specifically for survival experiments, as detailed above.

Selection procedure

The level 1 selection process (title and abstract review) will involve the screening of title and abstract using a screening check list developed according to the eligibility criteria defined in the relevant section above. The checklists already setup in Distiller for previous VBD reviews will be reused and adapted as needed to extend the scope to the AHL-A diseases.

If the information contained in the title or abstract is not relevant for the research objectives (any f the eligibility criteria are not met), the article will not be selected for full text assessment. The first level of screening will be performed independently and blindly by two researchers (i.e., two reviewers per study). Publications judged to be relevant by at least one reviewer will be automatically selected for further screening, while only publications rejected by both reviewers will be excluded. References without abstract will be carried over to level 2 screening, unless the title is explicit enough to make clear the lack of compliance to one or more eligibility criteria.

Level 2 screening will involve the screening of full text articles identified in level 1, one reviewer per study, based on reading the full text. Both level 1 and level 2 screenings will involve an initial phase of harmonisation and training regarding the assessment of study eligibility criteria, across all screeners of each objective.

Attempts will be made to obtain electronic versions of the full papers for all references that fulfil the eligibility and relevance criteria (i.e., those passing Level 1 screening). The CoVetLab's joint access to bibliographic resources is extensive but it is not possible, at the outset, to have a full overview of what journals eligible papers have been published in. Furthermore, the extent to which older publications are available in electronic format differs between publishers. In line with what was offered we will not account for requisition of publications that are not accessible through our existing channels, and/or publications that implies an extra cost for acquisition.

Documenting the selection

The study selection process will be fully documented in Distiller, allowing tracking and reporting of:

- Number of records identified through each electronic database or other source
- Total number of unique records (title/abstracts) identified through electronic search
- Number of records excluded after level 1 screening
- Records (full text) potentially eligible
- Number of records excluded after level 2 screening (by reason for exclusion)
- Final number of studies included in the review

Methods for data collection

Data collection will be performed using forms set up in Distiller® during previous SLRs. The structure of data collection has been extensively detailed at the end of the DACRAH3 project (RC_EFSA_ALPHA_2018_01). These forms ensure that data validity checks are performed during data collection, in particular compliance to the data types agreed.

One reviewer per study will individually extract data from studies that have passed screening for relevance, but a quality assurance process will be applied, as detailed below.

Authors of primary studies will not be contacted to provide missing or additional data.

Analysis and reporting

Evidence from experimental infections identified by the ELS

The extracted evidence will be displayed in a table showing all matrices in which viable disease agent was identified by virus isolation, inoculation experiment or culture. The results will be pooled across different strains or subtypes, as control measures do not differentiate between these either.

Evidence from survival studies identified by the ELS

The findings from survival studies will be presented in a survival plot indicating the maximum number of days the virus was detected by virus isolation in different matrices under different conditions (temperature). When sufficient evidence is identified by the ELS for a minimum of 4 data points per animal matrix, this evidence will be subjected to meta-analysis. In such cases, Kaplan-Meier curves will be fit to the data, in order to estimate confidence intervals (CI) and interquartile ranges (IQ) for the duration of the pathogen survival, explicitly taking into account the data censoring issue (lack of information about true maximum when experiments ended while the agent was still detectable).