World Organisation for Animal Health

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WOAH Collaborative Centre Reports Activities 2024

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CENTRE INFORMATION

***Title of WOAH Collaborating Centre**	Risk Analysis and Modelling
***Address of WOAH Collaborating Centre**	The Royal Veterinary College (RVC), North Mymms, Hatfield, AL7 9TA, UK; Animal and Plant Health Agency (APHA) Woodham Lane, New Haw, Addlestone, Surrey, KT15 3NB, UK
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Website:	https://www.rvc.ac.uk/research/risk-analysis-and-modelling
***Name Director of Institute (Responsible Official):**	Professor Stuart Reid (RVC), Dr Jenny Stewart (APHA)
***Name (including Title and Position) of Head of the Collaborating Centre (WOAH Contact Point):**	Professor Stuart Reid, President & Principal, Royal Veterinary College
***Name of the writer:**	Professor Emma Snary (APHA), Professor Javier Guitian (RVC)

TOR 1 AND 2: SERVICES PROVIDED

1. Activities as a centre of research, expertise, standardisation and dissemination of techniques within the remit of the mandate given by WOAH

Category	Title of activity	Scope
		RVC-APHA collaboration. Extend

Epidemiology, surveillance, risk assessment, (true)	Exploration of factors associated with the reduction in persistent bTB breakdowns in England	previous analysis to incorporate additional bovine Tuberculosis (bTB) breakdowns, re-calculate the metrics for assessing the percentage and rate of persistent breakdowns over time, and re-run models using the larger dataset and including additional variables.
Epidemiology, surveillance, risk assessment (true)	Bluetongue vector active period risk assessments	Development of rapid qualitative risk assessment methodologies to consider the risk of spread of bluetongue virus due to moving animals between farms during vector active periods.
Epidemiology, surveillance, risk assessment (true)	BSE landfill risk assessment	Quantitative risk assessment to consider the viability of Bovine spongiform encephalopathy (BSE) prions that may have been buried in landfill.
Epidemiology, surveillance, risk assessment (true)	BSE entry and exposure risk assessments	GB entry and exposure risk assessments for Bovine spongiform encephalopathy (BSE), to support application for WOAH negligible risk status
Epidemiology, surveillance, risk assessment (true)	Bluetongue entry assessment	Entry of bluetongue virus (BTV) via import of alpacas and llamas from Australia. Includes incorporating new information obtained from an audit.
Epidemiology, surveillance, risk assessment (true)	One Health living risk assessment tool, L'ORA	Co-development of a spatial risk assessment to assess the incursion risk for zoonotic and animal diseases using a One Health approach and allowing for automatic updates of the risk assessment.
Epidemiology, surveillance, risk assessment (true)	Evaluation of disease control interventions using difference in differences analysis	The Badger Control Policy in England was evaluated by a regression applying the method of difference in differences. This analysis was supported by study of online courses and textbooks on econometrics of programme evaluation and difference in differences analysis.
Epidemiology, surveillance, risk assessment (true)	Support to UK Department for Environment, Food & Rural Affairs (Defra) stakeholder group - bTB partnership (academic, industry, other stakeholders)	Sharing of knowledge and expertise, advice, provision of data and epidemiological analysis in the area of bovine Tuberculosis (bTB).

Epidemiology, surveillance, risk assessment (true)	Risk assessment contributions to the EU-project "Versatile emerging infectious disease observatory" (VEO)	Continuing activity to assess the risk of disease spread via mosquitoes, birds and humans. Geospatial horizon scanning to identify global areas of increased risk of disease emergence.
Epidemiology, surveillance, risk assessment (true)	BTV and HPAI response	Risk, data and epidemiological support for UK's bluetongue (BTV) and Highly pathogenicity Avian Influenza (HPAI) outbreak response
Epidemiology, surveillance, risk assessment (true)	Cattle vaccine for bTB	Epidemiological and data management support for a rollout of a cattle vaccine for bovine Tuberculosis (bTB)
Epidemiology, surveillance, risk assessment (true)	Disease surveillance systems (Ghana)	Evaluation of surveillance systems for a number of exotic diseases in Ghana
Epidemiology, surveillance, risk assessment (true)	Membership of expert group to the WOAH observatory	Review and input to WOAH observatory theme and annual reports.
Epidemiology, surveillance, risk assessment (true)	AMR epidemiological analysis	Delivery of projects understanding occurrence of antimicrobial resistance (AMR) to support AMR National Action Plan
Epidemiology, surveillance, risk assessment (true)	EU-PAHW partnership projects	18 organisations across Europe collaborating on (i) Biosecurity measures to prevent and control animal infectious diseases (AID) on farm and during transport, taking into account effects on animal welfare (ii) Reinforcement of animal resilience. Application of risk assessment methodology and epidemiological analysis.
Epidemiology, surveillance, risk assessment (true)	Analysis of atypical scrapie intensified surveillance	A report predicting the number of atypical scrapie cases missed as a result ending the intensified monitoring of atypical scrapie cases in GB, using a back-calculation modelling approach (link to paper: Impact of Removing the Monitoring Requirements for Holdings

		with Atypical Scrapie in Great Britain)
Epidemiology, surveillance, risk assessment (true)	Report and presentation to inform Defra policy on Salmonella	Calculating the impact on the number of contaminated eggs entering the food chain should a change in testing policy be adopted (for confirming operator sample positive laying flocks).
Epidemiology, surveillance, risk assessment (true)	Modelling timeframes to safe cessation of interventions against Guinea worm in Chad using epidemiological and genomic data	A new project has been initiated in partnership with the Carter Centre to support the eradication of Guinea Worm following the identification of the parasite in dogs, cats and wildlife.
Epidemiology, surveillance, risk assessment (true)	Brucellosis surveillance in Rwanda	Supported Rwanda Agriculture and Animal Resources Development Board designing a strategy for active surveillance of cattle brucellosis including simulation of various sampling strategies.
Epidemiology, surveillance, risk assessment (true)	Campylobacter exposure through poultry consumption in Peru	In collaboration with Peruvian researchers, carried out quantitative assessment of Campylobacter exposure through poultry in Peru.
Wildlife (true)	ASF risk analysis	Analysis of risk factors for African swine fever (ASF) occurrence and persistence in eastern Europe. EFSA funded project ENETWILD
Wildlife (true)	Density and distribution of wild boar	First estimates of population size of wild boar in all European countries using a single approach. EFSA funded project ENETWILD
Wildlife (true)	Distribution of mammals and mosquitoes with climate change	Predicting changes in distribution of wild mammals and mosquitoes in 2100 due to climate and habitat change. EUP funded.
Training, capacity building (true)	Ongoing seminar series	RVC staff regularly participate in weekly seminars addressing various technical topics. Likewise, APHA hold bi-weekly seminars.
Training, capacity building (true)	AI meeting series	Avian Influenza (AI) technical meeting series for RVC and APHA staff members.

Training, capacity building (true)	Postgraduate academic qualifications	Completion of PhD "Working towards the global eradication of peste des petits ruminants: a mathematical modelling approach". RVC, APHA and ANSES supervision. Ongoing postgraduate studies by APHA staff on assessing the effectiveness of gamma testing policies in English cattle herds (PhD) and on the epidemiological analysis and investigation of HPAI (MRes).
Training, capacity building (true)	European College of Veterinary Public Health (ECVPH).	APHA are an Approved Residency Training Institute for the European College of Veterinary Public Health (ECVPH). Currently 5 Residents are doing their programme as part of the APHA Residency Training Institute and 1 APHA colleague, and ECVPH Resident, is undertaking their programme with a different Residency Training Institute.
Training, capacity building (true)	Residency in wildlife epidemiology	Partnership between RVC and Zoological Society of London (ZSL) to deliver 3-year residency training in wildlife epidemiology.
Training, capacity building (true)	APHA and RVC attendance at specialist training courses	Staff attended seminars and courses on a variety of topics, including: - 2 day training course run by MRC Biostatistics Unit in Cambridge exploring the use of agent based models to improve epidemic preparedness - Difference-in-differences seminar - Scenario tree modelling - SQL (multiple courses) - Bayesian modelling (multiple courses) - Digital Epidemiology

TOR 3: HARMONISATION OF STANDARDS

2. Proposal or development of any procedure that will facilitate harmonisation of international regulations applicable to the main fucus area for which you were designated

Proposal title	Scope/Content	Applicable Area
Practical surveillance guidelines for the progressive	Co-authors and contributors to a major new guideline document published in September by FAO. The report provides	

control of Foot-and-Mouth Disease and other transboundary animal diseases.	a 'how to' guide for designing, applying, and evaluating surveillance to the different stages of animal disease control. Link to report: https://openknowledge.fao.org/handle/20.500.14283/cd2138en	Health Management
Vaccination of poultry against highly pathogenic avian influenza–Part 2. Surveillance and mitigation measures.	Epidemiological input to an EFSA scientific opinion recommending several schemes to enable the safe movement of vaccinated poultry following preventive vaccination. Vaccination of poultry against highly pathogenic avian influenza – Part 2. Surveillance and mitigation measures - - 2024 - EFSA Journal - Wiley Online Library	Health Management
Two Scientific Opinions relating to animal welfare during slaughter and depopulation	Input to opinions on the use of high expansion foam for stunning and killing pigs and poultry, and hazards and welfare consequences associated with the on-farm killing of sheep and goats.	Animal Production
WOAH Guidelines for Addressing Disease Risks in Wildlife Trade	Contribution to WOAH guidelines that provide a framework to support those undertaking risk analysis of a wildlife trade system, and to help users determine appropriate risk reduction measures for the system they are assessing. Guidelines for Addressing Disease Risks in Wildlife Trade - WOAH - World Organisation for Animal Health	Wildlife Health and Biodiversity
Guidelines for surveillance of selected endemic zoonoses in their animal reservoirs	Supported FAO in development of guidelines for surveillance of endemic zoonoses in their animal reservoirs, currently under review.	Health Management

3. In exercising your activities, have you identified any regulatory research needs* relevant for WOAH?

No

4. Did your Collaborating Centre maintain a network with other WOAH Collaborating Centres (CC), Reference Laboratories (RL), or organisations designated for the same specialty, to coordinate scientific and technical studies?

Yes

Name of WOAH CC/RL/other organisation(s)	Location	Region of networking Centre	Purpose
QUADS EpiTeam (consisting of the University of Melbourne (Australia), New Zealand			Ongoing collaboration between APHA and groups in USA, Canada, Australia, and

Government (Department of Primary Industries), Azure Quality Assurance (NZ), Canadian Food Inspection Agency, USDA Animal and Plant Health Inspection Service (USA))	Australia, Canada, New Zealand, USA, UK	América Asia y el Pacífico Europa	New Zealand, focussing on the application of mathematical modelling for use in decision making, to exchange best practice and build confidence in independently built models.
IZS Teramo: WOAH Collaborating Centre for Epidemiology, Modelling and Surveillance	Italy	Europa	Collaborating centre initiated a teleconference and 1 day meeting between APHA / RVC and Teramo to discuss synergies between the centres and collaboration opportunities.
EPIC consortium Scotland (The Roslin Institute, Biomathematics and Statistics Scotland, Glasgow Uni, Scotland's Rural College)	UK	Europa	Ongoing collaboration between Defra, APHA and EPIC, in the areas of risk assessment and modelling. Consortium for networking/sharing recent risk analysis and modelling work.
Multiple partners as part of European Partnership on Animal Health and Welfare (PAHW) - including Swedish Veterinary Agency, Wageningen Bioveterinary Research and L'Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise "Giuseppe Caporale" (IZS)	Multiple countries in Europe	Europa	Member of a large consortium for the European Partnership on Animal Health & Welfare (PAHW). Scientific contributions include a mathematical model for outdoor-reared pigs, use of rapid risk assessment and risk assessment in the area of climate change.
Wageningen Bioveterinary Research (WBVR), Swedish Veterinary Agency (SVA), University of Copenhagen (KU)	Netherlands, Sweden, Denmark	Europa	Collaboration with European partners to coordinate developing guidelines for a 'light' Expert Knowledge Elicitation process for use when there is limited resource.
			EU Horizon 2020 project in which APHA are providing

Multiple partners as part of VEO project (Versatile Emerging infectious disease Observatory)	Multiple countries in Europe	Europa	generic risk assessment tools, data analytic approaches to assess disease incursion into Europe. (https://www.veo-europe.eu/). Attendance at annual meeting to discuss quantitative risk assessments projects. APHA presented on development of generic risk assessment tools.
Universidad de Castilla-La Mancha (IREC), Office Francais de la Biodiversite (OFB), Institute for Terrestrial and Aquatic Wildlife Research (ITAW), Universita' Degli Studi di Sassari (UNISS), Universita' Degli Studi di Torino (UNITO), Mammal Research Institute Policy Academy of Sciences (MRI), University of Wageningen	Spain, France, Germany, Italy, Poland, Netherlands	Europa	Data collection and modelling of mammal abundance across Europe
Centre for Environment, Fisheries and Aquaculture Science (CEFAS) – WOAH Reference Laboratory, Veterinary Medicines Directorate, Defra, Food Standards Agency, Foods Standards Scotland, Health & Safety Executive, UK Health Security Agency, Public Health Scotland, Business, Energy and Industrial Strategy, Marine Scotland Science	UK	Europa	Regular correspondence via a cross-Government risk assessment group which discusses, and exchanges information on the current and future practices of risk assessment for the UK Government
Instituto Zooprofilacttico Sperimentale Venezie (IZSVe) Diseases at the Animal/Human Interface; Epidemiology, Training and Control of Emerging Avian Diseases	Italy	Europa	Collaborators as part of EU Horizon project "Ecology and biology of HPAIV H5 (Kappa-Flu)" working with IZSVe on epidemiology of HPAI.
China Animal Health and Epidemiology			Collaboration summarizing

Centre (CAHEC). WOAH collaborating centre in Veterinary epidemiology and Public Health.	China	Asia y el Pacífico	experience in building a self-sustained in-service field epidemiology capacity building program.
Centre d'Estudis Avancats de Blanes (CEAB)	Spain	Europa	Collaboration on building mosquito models to assess invasive spread of mosquitoes (for spreading West Nile Virus and other vector-borne diseases) throughout Europe
Modelling of Diseases Infecting Livestock (MoDIL) consortium	UK	Europa	Rapid response consortium for future DEFRA request for modelling support
Swedish Veterinary Agency (SVA), University of Copenhagen (KU), ANSES, Wageningen Bioveterinary Research (WBVR)	Sweden, Denmark, France, The Netherlands, UK	Europa	Collaboration on latent class models for evaluation of diagnostic tests using continuous outcomes
Centre for Environment, Fisheries and Aquaculture Sciences (CEFAS	UK	Europa	Meeting with risk analysts to discuss how an animal health entry assessment that utilises WAHIS data can be adapted to work for aquatic diseases

TOR 4 AND 5: NETWORKING AND COLLABORATION

5. Did your Collaborating Centre maintain a network with other WOAH Collaborating Centres, Reference laboratories, or organisations in other disciplines, to coordinate scientific and technical studies?

Yes

Name of WOAH CC/RL/other organisation(s)	Location	Region of networking Centre	Purpose
Multiple partners within the European Partnership for Animal Health and Welfare (EU-PAHW) Centre for Environment, Fisheries and Aquaculture Sciences (CEFAS)	Europe-wide	Europe	Collaborations across multiple work packages with disease specialists across Europe.

Friedrich-Loeffler-Institut (FLI)	Germany	Europe	Collaborators as part of EU Horizon project "Ecology and biology of HPAIV H5 (Kappa-Flu)"
The Pirbright Institute – TPI (WOAH reference laboratory)	UK	Europe	Continuing collaboration between RVC and TPI researchers as part of research projects on lumpy skin disease, sheep and goat pox and foot and mouth disease and in capacity building and knowledge exchange in Nigeria. TPI have 10 WOAH reference laboratories
National Academy of Medicine	USA	Americas	Prof. Stuart Reid (Head of Centre) is a member of the USA National Academy of Medicine
Animal and Plant Health Agency WOAH reference laboratory for Avian Influenza	UK	Europe	As required, provision of ad hoc consultancy and advice in epidemiology, risk assessment and modelling.
Animal and Plant Health Agency WOAH reference laboratory for Bovine Spongiform Encephalopathy (BSE) and Scrapie.	UK	Europe	As required, provision of ad hoc consultancy and advice in epidemiology, risk assessment and modelling.
Animal and Plant Health Agency WOAH reference laboratory for brucellosis	UK	Europe	Collaboration on brucellosis surveillance in endemic settings.
UK Heath Security Agency (UKHSA)	UK	Europe	Meeting with UKHSA Public Heath Rapid Support Team (Dec 2024). Discussion, among other topics, on risk assessment as applied in animal health and potential collaboration in the area of public health, particularly as part of outbreak response in

			low and middle income settings. 16 participants

TOR 6: EXPERT CONSULTANTS

6. Did your Collaborating Centre place expert consultants at the disposal of WOAH?

Yes

Name of expert	Kind of consultancy	Subject
Lucy Brunton	AMR expertise	Lucy Brunton has been asked to serve as a subject expert for review of the Terms of Reference for the Competency Package on "Prudent Use of Antimicrobials and Other Veterinary Products", part of the Competency-Based Training Framework (CBTF).
Jon Ellerbeck / Andy Mitchell / Robin Simons / Emma Snary / Javier Guitian	SQL expertise	Meeting to discuss best practice for dealing with WOAH's WAHIS data on the webpage, to allow end users to utilise the data most effectively
Julian Drewe	Improving wildlife health surveillance	Address given to WOAH's Wildlife Expert Group on emerging diseases and drivers of disease emergence. To inform rapid scan of emerging disease issues that WOAH should have on their radar.
Jessica Parry / Kim Stevens	WOAH Observatory	Review and input to WOAH Observatory theme and annual reports.
Samantha Rivers, Claire Cobbold, Sebastian Dohne, Helen Roberts, Emma Snary	Risk Assessment	Contribution to the development of WOAH Guidelines for Addressing Disease Risks in Wildlife Trade

TOR 7: SCIENTIFIC AND TECHNICAL TRAINING

7. Did your Collaborating Centre provide advice/services to requests from Members in your main focus area?

Yes

Multiple contributions to the UK Government's scientific evidence base for policy development.

Participated in 2 workshops organised by Defra to provide input on disease risks and opportunities for regenerative farming practices.

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Presented research to inform Salmonella policy in a meeting with Defra, APHAFSA and representatives from the poultry industry. Research presented included calculations of the impact on the number of contaminated eggs entering the food chain should a change in testing policy be adopted (for confirming operator sample positive laying flocks).

Provided risk assessments, data and epidemiological input to support GB's application for WOAH negligible risk status for Bovine spongiform encephalopathy (BSE).

8. Did your Collaborating Centre provide scientific and technical training, within the remit of the mandate given by WOAH, to personnel from WOAH Members?

Yes

a) Technical visit : 0

b) Seminars : 20

c) Hands-on training courses: 90

d) Internships (>1 month) : 0

Type of technical training provided (a, b, c or d)	Content	Country of origin of the expert(s) provided with training	No. participants from the corresponding country
B	Provided training to Fleming Fellows on One Health and interdisciplinary approaches to tackle Antimicrobial Resistance.	Ghana, Zimbabwe	20
C	EFSA EUFORA Programme, Induction course. Food safety risk assessment. 2 days teaching. Parma Italy. Sept 2024	Multiple countries within Europe	15
C	EFSA EUFORA Programme, module 1. 1/2 day online. Animal Health Risk Assessment and Modelling. November 2024	Multiple countries within Europe	15
C	MSc Vet Epi. Quantitative risk assessment, 1 day. (June 2024)	UK	10
C	MSc Vet Epi, One Health, Wildlife. Qualitative risk assessment, 1 day. (Nov 2024)	UK	35
C	Training on outbreak investigation and applied epidemiology for control of African Swine Fever	Albania, Bosnia-Herzegovina, North Macedonia, Montenegro, Serbia	15

TOR 8: SCIENTIFIC MEETINGS

9. Did your Collaborating Centre organise or participate in the organisation of scientific meetings related to your main focus area on behalf of WOAH?

No

TOR 9: DATA AND INFORMATION DISSEMINATION

10. Publication and dissemination of any information within the remit of the mandate given by WOAH that may be useful to Members of WOAH

a) Articles published in peer-reviewed journals:

26

Arnold J-C, Onono J, Ballesteros C, Aboge G and Alarcon P (2024) Modeling the economic performance of small ruminant pastoralist flocks and financial impact of changes in reproductive performance and mortalities in Kajiado county, Kenya. Front. Sustain. Food Syst. 8:1406864. doi: 10.3389/fsufs.2024.1406864

Arnold, M., Jones, B., Horigan, V., Simons, R., & Rajanayagam, B. (2024). Impact of Removing the Monitoring Requirements for Holdings with Atypical Scrapie in Great Britain. Animals, 14(24), 3607.

Aslam, H. B., Häsler, B., Iqbal, M., Yaqub, T., & Alarcon, P. (2024). Financial impact of low pathogenic avian influenza virus subtype H9N2 on commercial broiler chicken and egg layer production systems in Pakistan. Preventive Veterinary Medicine, 233, 106346.

Auplish, A., Raj, E., Booijink, Y., de Balogh, K., Peyre, M., Taylor, K., ... & Häsler, B. (2024). Current evidence of the economic value of One Health initiatives: A systematic literature review. One Health, 100755.

Bennani, H., Whatford, L., Myers, J., Mays, N., Glover, R., & Häsler, B. (2024). Progress and Challenges: Implementation of the UK Antimicrobial Resistance National Action Plan 2019–2024 within the Beef Cattle Sub-Sector. Antibiotics, 13(9), 839.

Birch, C. P. D., et al. (2024). Difference in differences analysis evaluates the effects of the badger control policy on bovine tuberculosis in England. Scientific Reports 14(1): 4849. DOI: 10.1038/s41598-024-54062-4

Brunton, L., & Enticott, G. (2024). Is badger culling associated with risk compensation behaviour among cattle farmers?. Veterinary Record, e4152.

Crotta, M., Chinchio, E., Tranquillo, V., Ferrari, N., & Guitian, J. (2024).
Pairwise summation as a method for the additive combination of probabilities in qualitative risk assessments. Risk Analysis.

Evans, D., Horigan, V., Taylor, R. A., & Kelly, L. (2024). A qualitative risk assessment of imports of animal feed as a potential pathway for Aujeszky's disease virus incursion. Microbial Risk Analysis, 27, 100314.

Gold, S., Croft, S., Budgey, R. & Aegerter, J. (2024). Selection of movement rules to simulate species dispersal in a mosaic landscape model. Ecological Complexity, 58, 101081. https://doi.org/10.1016/j.ecocom.2024.101081

Guzinski, J., Arnold, M., Whiteley, T., Tang, Y., Patel, V., Trew, J., ... & Petrovska, L. (2024). Comparison of three source attribution methods applied to whole genome sequencing data of monophasic and biphasic Salmonella Typhimurium isolates from the British Isles and Denmark. Frontiers in Microbiology, 15, 1393824.

Holloway, P. M., Gibson, M. D., Holloway, T. T., van Doremalen, N., Munster, V. J., Al-Omari, B., ... & Guitian, J. (2024). MERS-CoV exposure and risk factors for MERS-CoV ELISA seropositivity among members of livestock-owning households in southern Jordan: a population based cross-sectional study. The Lancet Microbe, 5(9).

Ho-Palma, A. C., Gonzales-Gustavson, E., Quispe, E., Crotta, M., Nunney, E., Limon, G., ... & Guitian, J. (2024). Salmonella in Chicken and Pork Meat as a Likely Major Contributor to Foodborne Illness in Peru. The American Journal of Tropical Medicine and Hygiene, 1(aop).

Huber, N., Meester, M., Sassu, E. L., Waller, E. S., Krumova-Valcheva, G., Aprea, G., ... & Carreira, G. C. (2024). Biosecurity measures reducing Salmonella spp. and hepatitis E virus prevalence in pig farms—a systematic review and meta-analysis. Frontiers in Veterinary Science, 11, 1494870.

Kuye, A., Dauda, M., Ameh, A. O., Danladi, M. I., Atuman, Y. J., Kia, G. S. N., & Häsler, B. (2024). An assessment of the operationality and factors influencing the effectiveness of rabies surveillance in Gombe State, Nigeria. PLOS Neglected Tropical Diseases, 18(5), e0012154.

Ludi, A. B., Baker, H., Sanki, R., De Jong, R. M., Maryan, J., Walker, M., ... & Officer, K. (2024). Epidemiological investigation of foot-and-mouth disease outbreaks in a Vietnamese bear rescue centre. Frontiers in Veterinary Science, 11, 1389029.

McIntyre, K. M., Khan, M., Betson, M., Brunton, L., Degiovanni, H. B., Desbois, A. P., ... & Cole, J. (2024). Understanding the interests of academics from diverse disciplines to identify the prospective focus for a UK-based transdisciplinary network involving farm-to-fork stakeholders on antimicrobial resistance in agrifood systems: An online survey. One Health, 19, 100884.

Merrick, R., Pulford, C., Rubeshkumar, P., Seyan, P., Fina, L., Sawyer, C., ... & Thomas, D. (2024). A genetically related cluster of Salmonella Typhimurium cases in humans associated with ruminant livestock and related food chains, United Kingdom, August 2021-December 2022. Epidemiology & Infection, 1-22.

Olorunleke, S. O., Kirchner, M., Duggett, N., Stevens, K., Chah, K. F., Nwanta, J. A., ... & Anjum, M. F. (2024). Rapid detection and molecular epidemiology of β-lactamase producing Enterobacteriaceae isolated from food animals and in-contact humans in Nigeria. Plos one, 19(4), e0289190.

O'Neill, D. G., Komutrattananon, R., Church, D. B., Hartley, A. N., & Brodbelt, D. C. (2024). The epidemiology of tick infestation in dog breeds in the UK. The Journal of small animal practice, 65(7), 569–581. https://doi.org/10.1111/jsap.13727

Osman, A. Y., Saidouni, A., Wambua, L. W., Mahrous, H., Malik, S. M. M. R., Lubogo, M., ... & Mor, S. M. (2024). IHR-PVS National Bridging Workshop for Somalia: An interactive and participatory approach for operationalizing the One Health roadmap. One Health, 19, 100858.

Reid, S. M., Coward, V. J., James, J., Hansen, R. D., Birch, C., Bakrania, M., ... & Banyard, A. C. (2024). Validation of a reduction in time for avian influenza virus isolation using specific pathogen-free embryonated chicken eggs. Veterinary Record, e4842.

Sama, D. J., Haider, N., Guitian, J., Osman, A. Y., Ntoumi, F., Zumla, A., Kock, R., & Ansumana, R. (2024). Identifying risk factors for clinical Lassa fever in Sierra Leone, 2019-2021. Epidemiology and infection, 152, e177. https://doi.org/10.1017/S095026882400164X

Thomas, C. M., Salamat, M. K. F., Almela, F., Cooper, J. K., Ladhani, K., Arnold, M. E., ... & Houston, E. F. (2024). Longitudinal detection of prion infection in preclinical sheep blood samples compared using 3 assays. Blood, 144(18), 1962-1973.

van Winden, S., Nunney, E., Guitian, J., Caldow, G., Swift, B., Burr, P., & Cutler, K. (2024). 44. Johnes Disease control in dairy cattle; a critical approach to the use of diagnostic results. Animal-science proceedings, 15(1), 46-47.

Warren, C. J., Brookes, S. M., Arnold, M. E., Irvine, R. M., Hansen, R. D., Brown, I. H., ... & Slomka, M. J. (2024). Assessment of Survival Kinetics for Emergent Highly Pathogenic Clade 2.3. 4.4 H5Nx Avian Influenza Viruses. Viruses, 16(6), 889.

b) International conferences:
15
Oral presentations at International Society for Veterinary Epidemiology and Economics conference (ISVEE), Sydney, Nov 11-15 2024:
- *"Exploring an apparent reduction in persistent bovine tuberculosis breakdowns among cattle herds in England". Lucy Brunton, RVC*
- *"Predicting the emergence of the next pandemic- a geospatial horizon scanning tool". Robin Denley Bowers, APHA*
- *"Health without borders: an approach to international disease monitoring". Laura Gonzalez Villeta, APHA*
- *"Visualising the risk of disease incursion for multiple diseases in Europe". Harvey Gillard, APHA*
- *"Nowcasting: machine learning to predict current disease outbreak reports". Harvey Gillard, APHA*
- *"Modelling vaccination of cattle against tuberculosis in England and Wales: assessing the impact of different strategies" Gerardo Aquino, APHA*
- *"Designing a study to evaluate the effects of badger vaccination on bovine tuberculosis in cattle in England and Wales" Susan Withenshaw, APHA*

Poster presentations at International Society for Veterinary Epidemiology and Economics conference (ISVEE), Sydney, Nov 11-15 2024:
- *"Assessing existing skills and interest in training on risk analysis and modelling among countries in the WOAH European region". Lucy Brunton, RVC*
- *"A Review Of Epidemiology Career Pathways Within Government Veterinary Services In Great Britain" Rachelle Avigad, APHA*

Oral presentation at European Wildlife Disease Association (EWDA) Conference 2024: One Health
- *"Challenges and Opportunities for the Surveillance and Management of Wildlife." Julian Drewe, RVC*

Oral presentation at Society for Veterinary Epidemiology and Preventive Medicine (SVEPM) conference, Uppsala, 2024:
- *"The impact of flock demographics on post-vaccination immunity levels against peste des petits ruminants virus in heterogeneous Small ruminant populations." Beth Savagar, RVC*

Poster presentations at Society for Veterinary Epidemiology and Preventive Medicine (SVEPM) Annual Meeting, Uppsala, 2024:
- *"Echinococcus multilocularis surveillance in Great Britain: an assessment of the costs and effectiveness of different diagnostic tests" Sebastian Dohne, APHA*
- *"Optimising the value of bovine tuberculosis homerange maps" Lauren Lambert, APHA*
- *"Data visualisation for real-time communication of highly pathogenic avian influenza surveillance in Great Britain" Stephanie Meyer, APHA*
- *"Surveillance of Transmissible Spongiform Encephalopathy in Great Britain" Suzanne Stone, APHA*

c) National conferences:
8
Royal Statistical Society 2024 International Conference (Brighton, UK)
- *"Evaluating the effects of policy in econometrics and epidemiology by assuming parallel trends." Colin Birch, APHA*

UK Stata Conference 2024 (London, UK):
- *"Difference in differences using constraints in Stata." Colin Birch, APHA*

APHA/EPIC meeting 2024 (York, UK):
- *"Modelling within-flock Avian Influenza" Matthew Baister, APHA*
- *"Modelling African Swine Fever in Wild Boar" Simon Croft, APHA*
- *"GEM Pigs ASF – A Model To Simulate Spread of African Swine Fever in Great Britain" Matthew Coleman, APHA*

- *"The Risk of African Swine Fever Infection in European Swine" Robin Denley Bowers, APHA*
- *"An overview of wildlife modelling at APHA" Richard Budgey, APHA*
- *"Quality Assurance in the APHA wildlife modelling team" Simon Croft, APHA*

d) Other (Provide website address or link to appropriate information):
12
EFSA PUBLICATIONS

EFSA Panel on Animal Health and Welfare (AHAW), Nielsen, S. S., Alvarez, J., Bicout, D. J., Calistri, P., Canali, E., Drewe, J.A., ... & Michel, V. (2024). The use of high expansion foam for stunning and killing pigs and poultry. EFSA Journal, 22(7), e8855.

EFSA AHAW Panel (EFSA Panel on Animal Health and Welfare), Nielsen, S. S., Alvarez, J., Bicout, D. J., Calistri, P., Canali, E., Drewe, J.A., ... & Michel, V. (2024). Welfare of sheep and goats during killing for purposes other than slaughter. EFSA Journal, 22(6), e8835.

EFSA Panel on Animal Health and Animal Welfare (AHAW), European Union Reference Laboratory for Avian Influenza, Nielsen, S. S., Alvarez, J., Bicout, D. J., Calistri, P., Canali, E., Drewe, J.A., ... & Gonzales Rojas, J. L. (2024). Vaccination of poultry against highly pathogenic avian influenza–Part 2. Surveillance and mitigation measures. EFSA Journal, 22(4), e8755.

PUBLISHED REPORTS

ENETWILD-consortium, Croft, S., Blanco-Aguiar, J.A., Acevedo, P., Illanas, S., Vicente, J., Warren, D.A. & Smith, G.C. (2024). Modelling wild boar abundance at high resolution. EFSA Supporting Publications, 21, 8965E. https://doi.org/10.2903/sp.efsa.2024.EN-8965

Metwally, S., Drewe, J.A., Ferrari, G., Gonzales, J.L., Mclaws, M., Salman, M. & Wagner, B. 2024. Practical surveillance guidelines for the progressive control of foot-and-mouth disease and other transboundary animal diseases. FAO Animal Production and Health Guidelines, No. 36. Rome, FAO. https://doi.org/10.4060/cd2138en

World Organisation for Animal Health (2024). – Guidelines for Addressing Disease Risks in Wildlife Trade. Paris, 93 pp. https://doi.org/10.20506/woah.3368. Licence: CC BY-SA 3.0 IG

PREPRINTS

Albery, G.F., Becker, D.J., Firth, J.A., et al. (2024). Density-dependent network structuring within and across wild animal systems. bioRxiv, 2024.2006.2028.601262. https://doi.org/10.1101/2024.06.28.601262

Kerr, C., Patassi, A., Pato, P.S., Guitian, J., Diop, S.A., Mangtani, P., Nguipdop-Djomo, P. (2024). The epidemiology of Brucellosis and Q fever in a cross-sectional serosurvey of occupationally exposed groups in peri-urban Lomé, Togo. medRxiv, 2024.10. 28.24316261.

Konzen, E., Delahay, R.J., Hodgson, D.J., McDonald, R.A., Pollock, E.B., Spencer, S.E.F. & McKinley, T.J. (2024). Efficient modelling of infectious diseases in wildlife: a case study of bovine tuberculosis in wild badgers. bioRxiv, 2024.2001.2026.576600. 10.1101/2024.01.26.576600

Konzen, E., Delahay, R.J., Hodgson, D.J., McDonald, R.A., Brooks Pollock, E., Spencer, S.E.F. & McKinley, T.J. (2024). Detecting superspreaders in wildlife reservoirs of disease. bioRxiv, 2024.2001.2026.576600. https://doi.org/10.1101/2024.01.26.576600

Wood, A.J., Benton, C.H., Delahay, R.J., Marion, G., Palkopoulou, E., Pooley, C.M., Smith, G.C. & Kao, R.R. (2024). The utility of whole-genome sequencing to identify likely transmission pairs for pathogens with slow and variable evolution. bioRxiv, 2024.2005.2006.592672. https://doi.org/10.1101/2024.05.06.592672

WEBSITE

Further development of a website to publicise the work of the WOAH Collaborating Centre for Risk Analysis & Modelling: https://www.rvc.ac.uk/research/risk-analysis-and-modelling. Includes the publication of news articles that summarises the work of the Collaborating Centre

11. What have you done in the past year to advance your area of focus, e.g. updated technology?
The WOAH Collaborating Centre for Risk Analysis & Modelling will host the Society for Veterinary Epidemiology and Preventive Medicine (SVEPM) 2026 Annual Meeting in London, UK. Planning occurred in 2024.

The WOAH Collaborating Centre is supporting the organisation of an international modelling conference focussing on wildlife (in early stages of planning for 2026/2027).

12. Additional comments regarding your report:
2024 OUTREACH STATISTICS

Website: Unique page views (URL: https://www.rvc.ac.uk/research/risk-analysis-and-modelling. Includes the publication of news articles and a short video that summarises the work of the Collaborating Centre): 526

Social media: 6 social media posts with 31,031 impressions and leading to 232 engagements (e.g. liking, sharing or commenting)*
** Impressions are the total number of times social media content has been displayed*