OIE Collaborating Centres Reports Activities

Activities in 2021

This report has been submitted : 2022-01-20 16:10:20

Title of collaborating centre:	Risk Analysis and Modelling
Address of Collaborating Centre:	Royal College Street London NW1 0TU UNITED KINGDOM Animal and Plant Health Agency (APHA) Woodham Lane New Haw Addlestone Surrey KT15 3NB United Kingdom
Tel.:	+44-1707 666 960
Fax:	
E-mail address:	principal@rvc.ac.uk
Website:	https://www.rvc.ac.uk/ https://www.gov.uk/apha https://www.rvc.ac.uk/research/risk-analysis-and-modelling
Name of Director of Institute (Responsible Official):	Professor Stuart Reid (Principal, RVC) Mr. Ian Hewett (Interim Chief Executive, APHA)
Name (including Title and Position) of Head of the Collaborating Centre (formally OIE Contact Point):	Professor Stuart Reid Principal, The Royal Veterinary College (RVC).
Name of writer:	Prof. Emma Snary (APHA), Prof. Javier Guitian (RVC)

ToR: To provide services to the OIE, in particular within the region, in the designated specialty, in support of the implementation of OIE policies and, where required, seek for collaboration with OIE Reference Laboratories

ToR: To identify and maintain existing expertise, in particular within its region

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

Epidemiology, surveillance, risk assessment, modelling	
Title of activity	**Scope**
Member of EFSA working group on atypical scrapie	Fitted models to intensive surveillance data collected across the EU, to investigate whether atypical scrapie is infectious or not.
Member of EFSA working group on antimicrobial resistance	Scientific opinion for listing and categorisation of transmissible animal diseases caused by bacteria resistant to antimicrobials in the framework of the animal health law. Provision of epidemiological expertise.
Member of EFSA working group on high pressure processing (HPP)	EFSA scientific opinion assessing the efficacy and safety of HPP used in food production; particularly as an alternative for pasteurisation and UHT treatment of raw milk and colostrum and for the control of L. monocytogenes in ready-to-eat foods. Risk assessment input.
Member of FAO working group on "Risk profile - Group B Streptococcus (GBS) – Streptococcus agalactiae sequence type (ST) 283 in freshwater fish"	Contribution to a risk profile that documents the current state of knowledge on the presence and transmission of GBS ST283 along the freshwater fish supply chain and to identify relevant data gaps. Risk assessment input.
SARS-CoV-2 risk assessment	Defra risk assessment for submission to the UK Scientific Advisory Group for Emergencies (SAGE) entitled 'A qualitative risk assessment to estimate the likelihood of SARS-CoV-2 infection of rodents from contact with the environment and onward exposure to humans'
Evaluation of effectiveness of medical detection dogs in identifying COVID infections	RVC collaborated with LSHTM / Arctech to model data on the sensitivity and specificity of medical detection dogs identifying people infected with COVID as a potential tool for screening at airports & mass gatherings.
Control and surveillance of SARs-CoV-2 in mustelids	Perspective review of control and surveillance of SARs-CoV-2 in mustelids, particularly farmed mink, and risk of emergence of novel variants.
Animal health import risk assessment	A large qualitative import risk assessment to assess the risk to animals resulting from Prohibitions and Restrictions on animal products arriving from the EU. Hazards assessed were Aujeszky's disease virus (ADV) (porcine herpesvirus 1), Salmonella Gallinarum and Trichinella spp.

Analysis of effects of partial protection against bTB using BCG vaccines	The relative efficacy of full versus partial protection was evaluated using a simulation model, and based on expert opinion of the effects of BCG in badgers.
Analysis of the impact of the Badger Control Project (bTB)	arget trial emulation was used to analyse data on bovine tuberculosis in cattle in over 40 defined areas within which badgers were culled at various times during 2013 - 2020. Comparisons within and between areas allowed estimation of median impacts with confidence intervals after 1 to 3 or more years of badger control.
Investigation of persistent bTB infected herds in England	APHA and RVC collaborated to investigate the recent decline in number of persistent breakdowns in England, including an assessment of performance of various diagnostic tests. The results of this analysis will be used to inform operational management of persistent herds and associated policy development.
Outbreak response – avian influenza	2020/21 and 2021/22 outbreaks of avian influenza in the UK. Provision of multiple risk assessments for tracing, feed and licensed movements during the outbreaks. Collation of epidemiological reports, reports for the OIE.
Modelling global trends in toxoplasmosis	Mathematical modelling of national trends in exposure to T. gondii and projected changes in incidence of congenital toxoplasmosis.
Modelling effectiveness of Test & Treat strategies for controlling livestock schistosomiasis	Mathematical transmission modelling of Test & Treat strategies for controlling livestock schistosomiasis in Africa, with a focus on minimising risk of promoting drug resistance.
Modelling PPR transmission & trading networks	Collaboration between RVC and APHA to contribute modelling insight into the global eradication of PPR.
Modelling spread of pathogens among poultry	Mathematical models of pathogen transmission across networks, regularly updated based on real-time findings, to be used to generate and test hypotheses about pathogen transmission and evolution, as well as to explore the potential impact of possible disease risk mitigation interventions.
Modelling mammal distribution in Europe	EFSA funded citizen science data analysis to produce ungulate and carnivore European distributions (species distribution modelling) for future disease modelling
Update of GB C-TSEMM model	Updated GB version of the Cattle TSE monitoring risk model with 2021 data. Used to assess effectiveness of GB surveillance.
Source attribution for Salmonella in pigs	Comparing different modelling approaches to inferring source attribution of human infection from Salmonella making use of sequence data. Work was done at APHA in collaboration with DTU (Denmark).
Avian influenza surveillance strategy	Design of surveillance strategy to support disease freedom following 2020/21 AI outbreak in the UK.
Training, capacity building	
Title of activity	**Scope**
Training in Feature Manipulation Engine (FME) software	10 APHA staff attended a 3 day intensive training course in FME, to learn how to manipulate large data more effectively using this software
Training in Quantitative Risk assessment	Three APHA members of staff attended a two-week virtual training course organised by epixanalytics called Modeling Food Safety and Animal Health Risks Using R. In Sept 2021

Review of risk assessment processes in outbreak	Throughout the HPAI outbreak in 2020/21 in the UK, the processes for commissioning risk assessments in an outbreak, and the templates and the methods, have been reviewed and improved. This included independent review by EPIC (Scotland) and presentation and discussion at the 5 Nations VRA group.
R course	APHA epidemiologist attended 2 online training courses for the R programming. Courses were Introduction to R with Tidyverse (1 day) and Advanced R (1 day).
Functional data analysis	RVC staff attended training on functional data analysis.
Ongoing seminar series	RVC staff regularly participate on weekly seminars addressing various technical aspects within the designated speciality.

ToR : To propose or develop methods and procedures that facilitate harmonisation of international standards and guidelines applicable to the designated specialty

2. Proposal or development of any procedure that will facilitate harmonisation of international regulations applicable to the surveillance and control of animal diseases, food safety or animal welfare

Proposal title	Scope/Content	Applicable area
One Health European Joint Programme (EJP) project ARDIG - harmonising of AMR breakpoints	APHA has worked with collaborators at the Bundesinstitut für Risikobewertung (BfR) in Germany to analyse AMR surveillance data from UK, France and Germany and harmonise AMR detection methods	☐Surveillance and control of animal diseases ☒Food safety ☐Animal welfare
Member of EFSA panel on animal health and welfare	1. Scientific opinions on the assessment of the control measures of category A diseases of Animal Health Law: Foot and mouth disease; African swine fever; Highly pathogenic avian influenza; African Horse Sickness; African swine fever and outdoor farming of pigs; African swine fever exit strategy. 2. Risk analyses on these topics: Monitoring of SARS-CoV-2 infection in mustelids; African Swine Fever Risk ranking matrices.	☒Surveillance and control of animal diseases ☐Food safety ☐Animal welfare
Maintaining target standard for lead and copper in tissue proficiency tests	Statistical work to support proficiency tests provided and evaluated by APHA to a panel of about 6 institutions at a time. During establishment of a new evaluation process the targets are updated and reports are completed that evaluate the test results.	☒Surveillance and control of animal diseases ☐Food safety ☐Animal welfare
Member of EFSA WG on HPP processing	Contributor to scientific opinion assessing the efficacy and safety of HPP used in food production; particularly as an alternative for pasteurisation and UHT treatment of raw milk and colostrum and for the control of L. monocytogenes in ready-to-eat foods.	☐Surveillance and control of animal diseases ☒Food safety ☐Animal welfare

Member of EFSA working group on organic fertilisers / soil improvers endpoints	Provided expertise on thermo-stability plots representing time/temperature combinations for 3-log or 5 log inactivation of various pathogens.	☐Surveillance and control of animal diseases ☒Food safety ☐Animal welfare
Peste des Petits Ruminants Global Research and Expertise Network (PPR-GREN) which includes OIE and FAO, and researchers from research institutes, universities and national vet services	Annual meeting for researchers and interested stakeholders, to share latest research and future research, with working groups meeting and communicating throughout the year.	☒Surveillance and control of animal diseases ☐Food safety ☐Animal welfare
The relation between different zoonotic pandemics and the livestock sector	RVC staff co-authored this report, upon request from the European Parliament's committee on the Environment, Public Health, and Food Safety	☒Surveillance and control of animal diseases ☐Food safety ☐Animal welfare
Monitoring and surveillance guidelines to complement Progressive Control Pathways.	RVC staff are members of a work group convened by FAO to develop guidelines and standards for operational planning and implementation monitoring and surveillance systems that can complement progressive control pathways (PCP) guidelines.	☒Surveillance and control of animal diseases ☐Food safety ☐Animal welfare
Development of tool to carry out training needs assessment in field epidemiology (frontline and intermediate competencies)	In collaboration with FAO, RVC staff has developed a training needs assessment tool to be used by countries to assess their needs regarding field epidemiology training.	☒Surveillance and control of animal diseases ☐Food safety ☐Animal welfare
Hepatitis E virus detection	Harmonisation of Hepatitis E virus detection in faeces methods across 10 European countries to help standardise evaluation of presence on pig farms.	☒Surveillance and control of animal diseases ☐Food safety ☐Animal welfare

ToR: To establish and maintain a network with other OIE Collaborating Centres designated for the same specialty, and should the need arise, with Collaborating Centres in other disciplines

ToR: To carry out and/or coordinate scientific and technical studies in collaboration with other centres, laboratories or organisations

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

Yes

Name of OIE CC/RL/other organisation(s)	Location	Region of networking Centre	Purpose
University of Melbourne, New Zealand Government (Department of Primary Industries), Azure Quality Assurance (NZ), Canadian Food Inspection Agency, USDA Animal and Plant Health Inspection Service (USA)	Australia, New Zealand, Canada, USA	☐Africa ☒Americas ☒Asia and Pacific ☐Europe ☐Middle East	Collaboration between APHA and groups in USA, Canada, Australia, New Zealand and UK focussing on application of FMD modelling.
One Health European Joint Programme BIOPIGGEE. German Federal Institute for Risk Assessment (BFR), National Veterinary Institute (SVA), National Veterinary Institute (NVI), Estonian Veterinary and Food Laboratory, Robert Koch Institute, Wageningen Bioveterinary Research (WBVR), ANSES, Austrian Agency for Health and Food Safety (AGES), National Veterinary Research Institute of Poland (PIWET), Veterinary Research Institute (CZ), Bulgarian Food Safety Agency, Istituto Superiore di Sanità, Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise, Istituto Zooprofilattico Sperimentale della Lombardia e Dell'Emilia Romagna, RIVM One Health European Joint Programme ARDIG. Various EU institutes including:- German Federal Institute for Risk Assessment (BFR), Robert Koch Institute, ANSES, National Veterinary Institute (SVA), Federal Office of Consumer Protection and Food Safety (BVL).	Germany, France, Sweden	☐Africa ☐Americas ☐Asia and Pacific ☒Europe ☐Middle East	Collaborative, multi-disciplinary project examining the dynamics of AMR in the human, animal, food and environment epidemiological unit from 6 European countries (UK, Norway, France, Netherlands, Germany, Spain). APHA undertaking epidemiological analysis
One Health European Joint Programme COHESIVE. Various EU institutes including:- RIVM, Istituto Zooprofilattico Sperimentale dell'Abruzzo e del Molise, Wageningen Bioveterinary Research (WBVR), Bfr, National Veterinary Institute (SVA).	Netherlands, Italy, Germany, Sweden	☐Africa ☐Americas ☐Asia and Pacific ☒Europe ☐Middle East	Joint integrative project where APHA have lead the development of a user-friendly decision support tool to assist one-health risk assessors.

Wageningen Bioveterinary Research (WBVR), National Veterinary Institute (SVA), University of Copenhagen, Denmark.	Netherlands, Sweden, Denmark	☐Africa ☐Americas ☐Asia and Pacific ☒Europe ☐Middle East	APHA are leading a collaborative project to draft good practices for risk communication from risk assessor to risk manager, including how to communicate uncertainty and the use of user interfaces in communication.
Animal Health Ireland	Ireland	☐Africa ☐Americas ☐Asia and Pacific ☒Europe ☐Middle East	Initial discussions on data sharing and joint analysis/modelling of pig farm biosecurity data being collected in Ireland, as well as that being collected in European partners of the BIOPIGEE project
Universidad de Castilla-La Mancha (IREC) Spain; Office Francais de la Biodiversite (OFB) France; Institute for Terrestrial and Aquatic Wildlife Research (ITAW), Universita' Degli Studi di Sassari (UNISS) and Universita' Degli Studi di Torino (UNITO) Italy; Mammal Research Institute Policy Academy of Sciences (MRI) Poland; University of Wageningen Netherlands.	Various	☐Africa ☐Americas ☐Asia and Pacific ☒Europe ☐Middle East	Data collection and modelling of mammal abundance across Europe
VEO consortium (20 institutes in the EU). Led by Erasmus Medical Centre.	Various	☐Africa ☐Americas ☐Asia and Pacific ☒Europe ☐Middle East	EU Horizon 2020 project in which APHA are providing generic risk assessment tools, data analytic approaches to assess disease incursion into Europe. (https://www.veo-europe.eu/)
OIE Collaborating Centre in Animal Disease Surveillance Systems, Risk Analysis and Epidemiological Modelling Centers for Epidemiology and Animal Health. USDA-APHIS-VS-CEAH. United States of America; OIE Collaborating Centre in Veterinary Epidemiology and Public Health. EpiCentre and mEpiLab Institute of Veterinary and Biomedical Sciences Massey University. New Zealand. China Animal Health and Epidemiology Centre. China (People's Republic of); OIE Collaborating Centre in Veterinary Services Capacity Building (Americas), University of Minnesota. United States of America; OIE Collaborating Centre in Economics of Animal Health. University of Liverpool, Utrecht University, Norwegian Veterinary Institute.	US, China, New Zealand, UK, Netherlands, Norway	☐Africa ☒Americas ☒Asia and Pacific ☒Europe ☐Middle East	Editing an OIE Sci. Tech. Review on Animal Health Data Management. Invited international scientists to collaborate and proposed list of contributions on various aspects of animal health data management including use for risk analysis and modelling.

Pharmacy Directorate of the Ghanaian Ministry of Health	Ghana	☒Africa ☐Americas ☐Asia and Pacific ☐Europe ☐Middle East	APHA epidemiologist mentoring a FAO Fleming Fund fellow on surveillance of AMR. Supporting the development of AMR data collection systems, data analysis and the creation of dashboards.
Texas A&M	USA	☐Africa ☒Americas ☐Asia and Pacific ☐Europe ☐Middle East	Risk assessment of re-introduction of rinderpest 10-years post-eradication.
University of Melbourne	Australia	☐Africa ☐Americas ☒Asia and Pacific ☐Europe ☐Middle East	Modelling the effectiveness of One Health interventions to tackle zoonotic hookworm
National Veterinary Institute (SVA), Wageningen Bioveterinary Research (WBVR), University of Surrey	Sweden, Netherlands, United Kingdom	☐Africa ☐Americas ☐Asia and Pacific ☒Europe ☐Middle East	DACRAH. Systematic review of published literature to gather data on factors such as diagnostic tests and experimental infection for risk assessments on vector borne disease and Animal health law diseases
Centre for Environment, Fisheries and Aquaculture Science (CEFAS) – OIE Reference Laboratory Veterinary Medicines Directorate Food Standards Agency Foods Standards Scotland Health & Safety Executive UK Health Security Agency Business, Energy and Industrial Strategy	UK	☐Africa ☐Americas ☐Asia and Pacific ☒Europe ☐Middle East	Regular correspondence via a cross-Government risk assessment group which discusses, and exchange information on, the current and future practices of risk assessment for Government
Food Standards Agency	UK	☐Africa ☐Americas ☐Asia and Pacific ☒Europe ☐Middle East	Collaborative working with the FSA on a large qualitative import risk assessment. APHA assessed the risk to animals; FSA assessed the public health risk via the food chain.

One Health European Joint Programme ARDIG. Various EU institutes including:- German Federal Institute for Risk Assessment (BFR), Robert Koch Institute, ANSES, National Veterinary Institute (SVA), Federal Office of Consumer Protection and Food Safety (BVL),.	Germany, France, Sweden	☐Africa ☐Americas ☐Asia and Pacific ☒Europe ☐Middle East	Collaborative, multi-disciplinary project examining the dynamics of AMR in the human, animal, food and environment epidemiological unit from 6 European countries (UK, Norway, France, Netherlands, Germany, Spain). APHA undertaking epidemiological analysis

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

Yes

Name of OIE CC/RL/other organisation(s)	Location	Region of networking Centre	Purpose
The Pirbright Institute (OIE reference laboratory)	UK	☐Africa ☐Americas ☐Asia and Pacific ☒Europe ☐Middle East	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.
National Academy of Medicine	UK	☐Africa ☐Americas ☒Asia and Pacific ☐Europe ☐Middle East	Prof. Stuart Reid is a member of the USA National Academy of Medicine.
Department of Veterinary Tropical Diseases Faculty of Veterinary Science University of Pretoria. OIE collaborating centre in Training in Integrated Livestock and Wildlife Health and Management South Africa Africa Collaboration between RVC and University of Pretoria on brucellosis diagnosis, molecular characterization and modelling of control strategies in Rwanda.	South Africa	☒Africa ☐Americas ☐Asia and Pacific ☐Europe ☐Middle East	Collaboration between RVC and University of Pretoria on brucellosis diagnosis, molecular characterization and modelling of control strategies in Rwanda.
Ecole Inter-Etats des Sciences et Médecine Vétérinaires, Dakar. OIE collaborating centre in Training Official Veterinarians (Africa)	Senegal	☒Africa ☐Americas ☐Asia and Pacific ☐Europe ☐Middle East	Collaboration between RVC and EISMV as part of project on brucellosis epidemiology and control in West and Central Africa.

Animal and Plant Health Agency OIE reference laboratory for Brucellosis (Brucella abortus, B. melitensis, B. suis)	Africa, India, UK	☒Africa ☐Americas ☒Asia and Pacific ☒Europe ☐Middle East	Collaboration between RVC and reference centre for brucellosis at APHA to enhance diagnostic and surveillance capacity for brucellosis, including laboratory proficiency testing and assessment of performance of novel diagnostic tests.
Animal and Plant Health Agency OIE reference laboratory for Avian Influenza.	UK	☐Africa ☐Americas ☐Asia and Pacific ☒Europe ☐Middle East	As required, provision of ad hoc consultancy and advice in epidemiology, risk assessment and modelling.
Animal and Plant Health Agency OIE reference laboratory for Bovine Spongiform Encephalopathy (BSE) and Scrapie.	UK	☐Africa ☐Americas ☐Asia and Pacific ☒Europe ☐Middle East	As required, provision of ad hoc consultancy and advice in epidemiology, risk assessment and modelling.

ToR: To place expert consultants at the disposal of the OIE.

5. Did your Collaborating Centre place expert consultants at the disposal of the OIE?

Yes

Name of expert	Kind of consultancy	Subject
Dr Bryony Jones	Epidemiology	Member of OIE expert group on strengthening veterinary para-professional capacity.
Dr Claire Cassar	Secondment. To work on improving the consistency and quality of diagnostic test kits	Surveillance and control of animal and diseases. Food safety

ToR: To provide, within the designated specialty, scientific and technical training to personnel from OIE Member Countries

6. Did your Collaborating Centre provide scientific and technical training, within the remit of the mandate given by the OIE, to personnel from OIE Member Countries?

Yes
a) Technical visits: 0
b) Seminars: 0
c) Hands-on training courses: 7
d) Internships (>1 month): 1

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
c	RVC delivered an online course on risk assessment in food safety, in partnership with ILRI. The course is intended for professionals dealing with food safety issues in low and middle-income countries.	India and Ethiopia	40
c	APHA Lead / co-tutor on EFSA EU-FORA Risk Assessment Fellowship program. Online teaching. 2 day induction course on microbiological risk assessment (January 2021)	EU, China	25
c	APHA Lead / co-tutor on EFSA EU-FORA Risk Assessment Fellowship program. Online teaching. 2 day induction course on microbiological risk assessment (September 2021)	EU, Georgia, Belarus, Azerbaijan	25
c	Lead tutor on EFSA EU-FORA Risk Assessment Fellowship program. Online teaching. 1/2 day course on animal health risk assessment (delivered twice – Cohort 2021, Cohort 2021/22)	EU	50
c	APHA and RVC both provide teaching on risk analysis, risk assessment, risk management, animal health surveillance and risk-based surveillance as part of the RVC's MSc Veterinary epidemiology & MSc One Health programmes	Multiple, majority UK based	40
c	Workshop (face-to-face and online). Decision support tool to assist risk assessors. Output from COHESIVE workpackage within the One Health European Joint Programme. (November 2021)	EU	62
c	APHA delivered a module on epidemiological modelling within an online course "Diseases and the human-animal-environment interface" developed in collaboration with Improve International. The module introduced how the different types of epidemiological models can be used by decision-makers to inform policies.	Ethiopia, Bangladesh, Ghana and Egypt	73
d	RVC hosted a senior academic from Jordan during a sabbatical, to carry out joint collaborative work in the context of OIE educational twinning.	Jordan	1

ToR: To organise and participate in scientific meetings and other activities on behalf of the OIE

7. Did your Collaborating Centre organise or participate in the organisation of scientific meetings on behalf of the OIE?

No

ToR: To collect, process, analyse, publish and disseminate data and information relevant to the designated specialty

8. Publication and dissemination of any information within the remit of the mandate given by the OIE that may be useful to Member Countries of the OIE

a) Articles published in peer-reviewed journals: 64

1. Adedeji, AJ et al. (2021). Household and animal factors associated with sheeppox and goatpox sero-prevalence and identification of high-risk areas in selected States of northern Nigeria. Preventive veterinary medicine 196, 105473

2. Aenishaenslin, C (2021). Evaluating the Integration of One Health in Surveillance Systems for Antimicrobial Use and Resistance: A Conceptual Framework. Frontiers in veterinary science 8, 169

3. Alarcon, P et al. (2021) A review of cleaning and disinfection guidelines and recommendations following an outbreak of classical scrapie. Preventive Veterinary Medicine, 105388

4. Arnold, M et al. (2021). Bayesian Source Attribution of Salmonella Typhimurium Isolates from Human Patients and Farm Animals in England and Wales. Frontiers in microbiology 12, 65

5. Arnold, ME et al. (2021). A Bayesian analysis of a Test and Vaccinate or Remove study to control bovine tuberculosis in badgers (Meles meles). PlosONE 16 (1), e024614

6. Baker, E et al. (2021). The verification of ecological citizen science data: current approaches and future possibilities. Citizen Science: Theory and Practice 6 (1).

7. Bennani, H et al. (2021). Characterisation and mapping of the surveillance system for antimicrobial resistance and antimicrobial use in the United Kingdom. Veterinary Record 188 (7).

8. Bennani, H et al. (2021). Evaluating integrated surveillance for antimicrobial use and resistance in England: a qualitative study. Frontiers in Veterinary Science. 8:743857.

9. Birch et al. (2021). A combined measure of tuberculous lesions for assessing the efficacy of vaccination against tuberculosis (Mycobacterium bovis) in European badgers (Meles meles) supports the 3Rs principle of reduction. Vaccine 39(11): 1661-1666.

10. Buzdugan, SN et al. (2021). Enhancing the value of meat inspection records for broiler health and welfare surveillance: longitudinal detection of relational patterns. BMC Veterinary Research 17 (1), 1-13

11. Chapot, L et al. (2021). A global media analysis of the impact of the COVID-19 pandemic on chicken meat food systems: Key vulnerabilities and opportunities for building resilience. Sustainability 13 (16), 9435

12. Cheke, RA et al. (2021). Taking the strain out of onchocerciasis? A reanalysis of blindness and transmission data does not support the existence of a savannah blinding strain of onchocerciasis in West Africa. Advances in Parasitology 112, 1-50

13. Chiesa, F et al. (2021). A Survey on One Health Perception and Experiences in Europe and Neighboring Areas, Frontiers in public health 9, 92

14. Coffeng, LE et al. (2021). Survey design to monitor drug efficacy for the control of soil-transmitted helminthiasis and schistosomiasis. Clinical Infectious Diseases 72 (Supplement_3), S195-S202

15. Compston, P et al. (2021). Understanding what shapes disease control: an historical analysis of foot-and-mouth disease in Kenya. Preventive Veterinary Medicine, 105315

16. Condoleo, R et al. (2021). A semi-quantitative model for ranking the risk of incursion of exotic animal pathogens into a European Union Member State. Microbial Risk Analysis, 100175

17. Craighead, L et al. (2021). Brucellosis in dairy herds: Farm characteristics and practices in relation to likely adoption of three potential private–public partnership (PPP) vaccination control strategies. Transboundary and

Emerging Diseases. Available at: https://doi.org/10.1111/tbed.14114

18. Craighead, L et al. (2021). “Everything in this world has been given to us from cows”, a qualitative study on farmers’ perceptions of keeping dairy cattle in Senegal and implications for disease control and healthcare delivery. PlosONE 16 (2), e0247644

19. Crotta, M et al. (2021). Viraemic pigs entering the food chain are the most likely source of hepatitis E virus (HEV) in pork meat: Modelling the fate of HEV during slaughtering of pigs. Food Control 121, 107662

20. Croft, S et al. (2021). A spatially explicit population model to compare management using culling and fertility control to reduce numbers of grey squirrels. Ecological Modelling, 440, 109386. https://doi.org/10.1016/j.ecolmodel.2020.109386

21. Cuevas Garcia-Dorado, S et al. (2021). Using Qualitative System Dynamics Analysis to Promote Inclusive Livestock Value Chains: A Case Study of the South African Broiler Value Chain. Frontiers in Sustainable Food Systems, 267

22. Delahay, RJ et al. (2021). Assessing the risks of SARS-CoV-2 in wildlife. One Health Outlook 3 (1), 1-14

23. De Meneghi, D et al. (2021). A survey on One Health collaboration between human, animal and environmental health sectors in Europe and neighboring areas. Frontiers in Public Health 9, 92

24. Desbois, AP et al. (2021). Systems-thinking approach to identify and assess feasibility of potential interventions to reduce antibiotic use in tilapia farming in Egypt. Aquaculture 540, 736735

25. Dewar, R et al. (2021). A user-friendly decision support tool to assist one-health risk assessors. One Health 13, 100266

26. Díaz, AV et al. (2021). Surveillance and control of SARS-CoV-2 in mustelids: an evolutionary perspective. Evolutionary Applications 14 (12), 2715-2725

27. Djomo, PN et al. (2021). 1134 Seroprevalence and Risk Factors of Coxiella burnetti infection in the general population of Senegal. International Journal of Epidemiology 50 (Supplement_1), dyab168. 480

28. Dolo, H et al. (2021). Serological evaluation of onchocerciasis and lymphatic filariasis elimination in the Bakoye and Falémé foci, Mali. Clinical Infectious Diseases 72 (9), 1585-1593

29. Downs et al. (2021). Detection of a local Mycobacterium bovis reservoir using cattle surveillance data. Transboundary and Emerging Diseases: doi 10.1111/tbed.14272

30. Economu, L et al. (2021). Incidence and risk factors for feline lymphoma in UK primary-care practice. Journal of Small Animal Practice 62 (2), 97-106

31. Enticott, G et al. (2021). Mapping the geography of disease: a comparison of epidemiologists' and field-Level experts' disease maps. Applied Geography, 2021. 126: p. 102356.

32. Fall, et al. (2021). Hybridized Zoonotic Schistosoma Infections Result in Hybridized Morbidity Profiles: A Clinical Morbidity Study amongst Co-Infected Human Populations of Senegal. Microorganisms 9 (8), 1776

33. Fielding, HR et al. (2021). Spatial and temporal variation in proximity networks of commercial dairy cattle in Great Britain. Preventive Veterinary Medicine 194. DOI: 10.1016/j.prevetmed.2021.105443

34. Galipo et al. (2021). Spatial distribution and risk factors for human cysticercosis in Colombia. Parasites and Vectors 14 (590). https://doi.org/10.1186/s13071-021-05092-8

35. George, et al. (2021). Towards an integrated animal health surveillance system in Tanzania: making better use of existing and potential data sources for early warning surveillance. BMC veterinary research 17 (1), 1-18

36. Hamley, JID et al. (2021). What does the COVID-19 pandemic mean for the next decade of onchocerciasis control and elimination? Transactions of The Royal Society of Tropical Medicine and Hygiene 115 (3), 269-280.

37. Häsler, B et al. (2021). Cost-benefit and feasibility analysis for establishing a foot-and-mouth disease free

zone in Rukwa region in Tanzania. Preventive veterinary medicine 196, 105494

38. Holloway, P et al. (2021). Risk Factors for Middle East Respiratory Syndrome Coronavirus Infection among Camel Populations, Southern Jordan, 2014–2018. Emerging infectious diseases 27 (9), 2301

39. Holt, H et al. (2021). Epidemiology of brucellosis in cattle and dairy farmers of rural Ludhiana, Punjab. PLoS Neglected Tropical Diseases 15 (3), e0009102

40. Jewell, PD et al. (2021). Neurocysticercosis and HIV/AIDS co-infection: A scoping review. Tropical Medicine & International Health 26 (10), 1140-1152

41. Jolma, ER et al. (2021). Serologic responses correlate with current but not future bacterial shedding in badgers naturally infected with Mycobacterium bovis. Transboundary and Emerging Diseases. Available at: https://doi.org/10.1111/tbed.14181

42. Kock, R et al. (2021). Zoonotic Tuberculosis–The Changing Landscape. International Journal of Infectious Diseases Volume 113, Supplement 1, December 2021, Pages S68-S72

43. Marjamäki, PH et al. (2021). , Genetic, social and maternal contributions to Mycobacterium bovis infection status in European badgers (Meles meles). Journal of Evolutionary Biology. DOI: 10.1111/jeb.13775

44. McCarthy, C et al. (2021). Estimating the likelihood of ESBL-producing E. coli carriage in slaughter-aged pigs following bacterial introduction onto a farm: a multiscale risk assessment. Microbial Risk Analysis, 100185

45. Mesa-Varona et al. (2021). Comparison of phenotypical antimicrobial resistance between clinical and non-clinical E. coli isolates from broilers, turkeys and calves in four European countries. Microorganisms 9(4), 678. https://doi.org/10.3390/microorganisms9040678

46. Neves, MI et al. (2021). Revisiting density-dependent fecundity in schistosomes using sibship reconstruction. PLOS Neglected Tropical Diseases 15 (5), e0009396

47. Onyango, DLA et al. (2021). Brucellosis risk factors and milk hygiene handling practices in pastoral communities in Isiolo county, Kenya. Veterinary Medicine and Science 7 (4), 1254-1262.

48. Packer, R et al. (2021). Pandemic Puppies: Characterising Motivations and Behaviours of UK Owners Who Purchased Puppies during the 2020 COVID-19 Pandemic. Animals 11 (9), 2500

49. Pope, H et al. (2021). Developing a functional food systems literacy for interdisciplinary dynamic learning networks. Frontiers in Sustainable Food Systems. Available at: https://doi.org/10.3389/fsufs.2021.747627

50. Queenan, K et al. (2021). A qualitative analysis of the commercial broiler system, and the links to consumers' nutrition and health, and to environmental sustainability: A South African case study. Frontiers in Sustainable Food Systems 5

51. Romero, MP et al. (2021). A comparison of the value of two machine learning predictive models to support bovine tuberculosis disease control in England. Preventive Veterinary Medicine 188, 105264

52. Rossi, G et al. (2021). Phylodynamic analysis of an emergent Mycobacterium bovis outbreak in an area with no previously known wildlife infections. J. Appl. Ecol., in press. DOI: 10.1111/1365-2664.14046

53. Saidu, AS et al. (2021). Epidemiology of bovine brucellosis in Hisar, India: identification of risk factors and assessment of knowledge, attitudes, and practices among livestock owners. Tropical Animal Health and Production 53 (5), 1-12.

54. Seifert, SN et al. (2021). Limited Genetic Diversity Detected in Middle East Respiratory Syndrome-Related Coronavirus Variants Circulating in Dromedary Camels in Jordan. Viruses 13 (4), 592

55. Smith, GC & Budgey, R (2021). Simulating the next steps in badger control for bovine tuberculosis in England. PlosONE 16 (3), e0248426

56. Stolk, WA et al. (2021). Scaling-Down Mass Ivermectin Treatment for Onchocerciasis Elimination. Clinical Infectious Diseases 72, S165-S171

57. Taylor et al. (2021). Predicting spread and effective control measures for African swine fever—Should we blame the boars? Transboundary and Emerging Diseases 68 (2), 397-416

58. Taylor, C et al. (2021). Spatio-temporal distribution and agroecological factors associated with canine leptospirosis in Great Britain. Preventive Veterinary Medicine, 105407

59. Tewari, A et al. (2021). Development and Validation of Confirmatory Foot-and-Mouth Disease Virus Antibody ELISAs to Identify Infected Animals in Vaccinated Populations. Viruses 13 (5), 914

60. Toor, J et al. (2021). Predicted impact of COVID-19 on neglected tropical disease programs and the opportunity for innovation. Clinical Infectious Diseases 72 (8), 1463-1466

61. Walker, M et al. (2021). Supporting drug development for neglected tropical diseases using mathematical modelling. Clinical Infectious Diseases, 73 (6), e1391–e1396.

62. Walker, M et al. (2021). Individual responses to a single oral dose of albendazole indicate reduced efficacy against soil-transmitted helminths in an area with high drug pressure. PLoS neglected tropical diseases 15 (10), e0009888

b) International conferences: 11
1. Presentation at One Health EJP COHESIVE Annual Meeting. Retrospective analysis of Q fever by systems mapping WP3. Bilthoven, the Netherlands, 8th-10th November. Rob Dewar (APHA).

2. Presentation at One Health EJP COHESIVE Annual Meeting. Systematic cost-benefit analysis, WP3. Bilthoven, the Netherlands, 8th-10th November. Rob Dewar (APHA).

3. Presentation at the Modelling in Animal Health (ModAH2) conference. Using computer simulation models to assess potential impacts of changes to primary bovine tuberculosis surveillance testing of cattle in England. 16th September 2021. Colin Birch (APHA).

4. Presentation at the Med Vet Net workshop “SARS-CoV-2 at the Human-Animal Interface”. A global world: assessing the risk of human travel on the spread of SARS-CoV-2 and preparing for the next Disease X. 1st September 2021. Rachel Taylor (APHA).

5. Presentation at the Med Vet Net workshop “SARS-CoV-2 at the Human-Animal Interface”. Assessing the risks of SARS-CoV-2 in wildlife. 1st September 2021. Richard Delahay (APHA).

6. Presentation at the One Health EJP Virtual Conference. User-Friendly Decision Support Tool to Assist One Health Risk Assessors. 9th June 2021. Rob Dewar (APHA).

7. Poster at the One Health EJP Virtual Conference. BIOPIGEE: Modelling of the cost and effectiveness of biosecurity measures. 9th – 11th June 2021. Catherine McCarthy (APHA)

8. Poster at the One Health EJP Virtual Conference. Preliminary description of biosecurity practices related to importing pig and semen onto European pig farms. 9th – 11th June 2021. Richard Smith (APHA)

9. Presentation at International Conference: "One Health: new insights and challenges of zoonotic diseases", SECTION III - Impact of epidemic/pandemic zoonotic diseases: Keys issues and Lessons to learn. "SARS-CoV-2 and traditional food markets in Bolivia: towards collective, non-stigmatizing, science-based risk mitigation". 1st June 2021. Javier Guitian (RVC).

10. Presentation at Conference of the European College of Veterinary Microbiology. “Integrated surveillance of zoonotic avian influenza viruses in endemic areas”. 17th October 2021. Javier Guitian (RVC).

11. Presentation at International Symposium on ”One Health Concept: Opportunities and Perspectives in Present Scenario”. XVII Annual Conference of Indian Association of Veterinary Public Health Specialists (IAVPHS). “Brucellosis as an evolving zoonotic infection risk”. 28th-29th May 2021. Javier Guitian (RVC).

c) National conferences: 1
Presentation at the Annual Conference of the Mammal Society. Assessing the risks of SARS-CoV-2 in wildlife. 17th April 2021. Richard Delahay

d) Other
(Provide website address or link to appropriate information): 28
EFSA and FAO publications

1. EFSA (2021). Welfare of sheep and goats at slaughter. EFSA Journal 19 (11), e06882

2. ENETWILD-consortium (2021). Update of model for wild boar abundance based on hunting yield and first models based on occurrence for wild ruminants at European scale. EFSA Supporting Publications 18, 6825E. DOI: https://doi.org/10.2903/sp.efsa.2021.EN-6825

3. EFSA (2021). Assessment of the control measures of the category A diseases of Animal Health Law: peste des petits ruminants. EFSA Journal 19 (7), e06708

4. EFSA (2021). Research priorities to fill knowledge gaps in wild boar management measures that could improve the control of African swine fever in wild boar populations. EFSA Journal 19 (7), e06716

5. EFSA (2021). Assessment of the control measures of the category A diseases of Animal Health Law: Classical Swine Fever. EFSA Journal 19 (7), e06707

6. EFSA (2021). Assessment of animal diseases caused by bacteria resistant to antimicrobials: Dogs and cats
7. EFSA Journal 19 (6), e06680

8. EFSA (2021). Research objectives to fill knowledge gaps in African swine fever virus survival in the environment and carcasses, which could improve the control of African swine fever virus. EFSA Journal 19 (6), e06675

9. EFSA (2021). Scientific Opinion on the assessment of the control measures for category A diseases of Animal Health Law: Foot and Mouth Disease. EFSA Journal 19 (6), e06632

10. EFSA (2021). Research priorities to fill knowledge gaps in the control of African swine fever: possible transmission of African swine fever virus by vectors. EFSA Journal 19 (6), e06676

11. EFSA (2021). Ad hoc method for the assessment of animal diseases caused by bacteria resistant to antimicrobials. EFSA Journal 19 (6), e06645

12. EFSA (2021). African swine fever and outdoor farming of pigs. EFSA Journal 19 (6), e06639

13. EFSA (2021). Ability of different matrices to transmit African swine fever virus. EFSA Journal 19 (4), e06558

14. EFSA (2021). Research priorities to fill knowledge gaps on ASF seasonality that could improve the control of ASF, European Food Safety Authority (EFSA). EFSA Journal 19 (4), e06550

15. EFSA (2021). ASF Exit Strategy: Providing cumulative evidence of the absence of African swine fever virus circulation in wild boar populations using standard surveillance measures. EFSA Journal 19 (3), e06419.

16. EFSA (2021). Scientific Opinion on the assessment of the control measures of the category A diseases of Animal Health Law: African Horse Sickness. EFSA Journal 19 (2), e06403

17. EFSA (2021). Scientific Opinion on the assessment of the control measures of the category A diseases of Animal Health Law: Highly Pathogenic Avian Influenza. EFSA Journal 19 (1), e06372

18. EFSA (2021). Scientific Opinion on the assessment of the control measures of the category A diseases of Animal Health Law: African Swine Fever. EFSA Journal 19 (1), e06402

19. ENETWILD-consortium (2021). Analysis of wild boar-domestic pig interface in Europe: spatial overlapping and fine resolution approach in several countries. ENETWILD-consortium. EFSA Supporting Publications 18 (1), 1995E

20. EFSA (2021). Scientific report on the analysis of the 2-year compulsory intensified monitoring of atypical scrapie. EFSA Journal 19 (7):6686

21. FAO. 2021. Risk profile - Group B Streptococcus (GBS) – Streptococcus agalactiae sequence type (ST) 283 in freshwater fish. Bangkok.

Preprints

22. Adeyemo, P et al. (2021). Estimating the Financial Impact of Livestock Schistosomiasis on Traditional Subsistence and Transhumance Farmers Keeping Cattle, Sheep and Goats in Northern Senegal. Available at: https://assets.researchsquare.com/files/rs-757540/v1/0cfd11e5-1cb8-4651-b295-7ccf64df0445.pdf?c=1631887622

Published reports

23. Day, J et al. (2021). Copernicus User Uptake (CUU): Applying Earth Observation (EO) to horizon scanning for Emerging Infectious Diseases (EIDs). JNCC Report No. 676, JNCC,
Peterborough, ISNN 0963-8091.

Book chapters

24. Stevens, KB (2021). Novel Scientific Approaches to Understanding Emerging Infectious Diseases. Routledge Handbook of Biosecurity and Invasive Species, pages 90-101

Website

25. Further development of a website to publicise the work of the OIE Collaborating Centre for Risk Analysis & Modelling: https://www.rvc.ac.uk/research/risk-analysis-and-modelling

Miscellaneous

26. APHA Risk Assessment team were winners of the 2020 UK Civil Service award for the International Travel Risk Assessment (ITRA) for SARS-CoV-2. Further information:
https://civilservice.blog.gov.uk/2021/03/12/civil-service-awards-2020-the-science-award/

27. Creation of a user-interface to allow other countries to perform risk assessment for entry of international travellers with SARS-CoV-2, available here: https://rrls.shinyapps.io/ODA_ITRA/ Disseminated through an ODA project to other countries

28. Animal Health Surveillance Podcast. Conceived and led by RVC as part of a joint RVC-/APHA PhD studentship. Podcast includes news, interviews, information and is released biweekly. Episodes are available here: https://theanimalhealthsurveillancepodcast.buzzsprout.com/

9. Additional comments regarding your report:

COVID-related travel restrictions during the reporting period have reduced opportunities to host visitors and participate at international conferences/events.