WORLD HEALTH ORGANIZATION   COLLABORATING CENTRE

FOR RESEARCH AND TRAINING FOR HEALTH AT THE HUMAN-
ANIMAL-ENVIRONMENT INTERFACE
AT THE UNIVERSITY OF VETERINARY MEDICINE HANNOVER

Annual Report
2019

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for Health at the Human-Animal-Environment Interface
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Contents

1   State of the WHO Collaboration Centre for Research and Training for Health at the Human-Animal-Environment Interface

1.1   Personnel and re-designation

The work on the scientific tasks of the WHO Collaboration Centre for Research and Training for Health at the Human-Animal-Environment Interface (WHO CC HAEI) was carried out by the employees of the Institute for Biometry, Epidemiology and Information Processing.

The Department of Food Safety and Zoonoses of the WHO headquarters was responsible for the cooperation between WHO and our institute in 2019. This changed with the internal reorganisation of WHO that took place throughout the year 2019. Since the re-designation at the end of 2019, the Antimicrobial Resistance Division (AMR Division) is responsible for collaboration with WHO CC HAEI. The contact person is Dr. Jorge R. Matheu Alvarez.

After intensive consultation during the year 2019, an application for re-designation as WHO CC HAEI was submitted at the beginning of November 2019, which was approved in a letter dated November 20, 2019. The current period of re-designation started on December 17, 2019 and ends on December 17, 2021.

1.2   Terms of reference

With the previous re-designation requested in spring 2015, the terms of reference (TOR) for basic, advanced and follow-up training as well as research at the human-animal-environment interface were redesigned in coordination with the WHO and structured as follows:

1.   **Studying antibiotics use and resistance in animal populations to assess its impact on resistance in humans**

2.   **Studying animal health and animal welfare as the basis for improving human health (with a focus on food-borne infections in humans)**

3.   **Methods for regional, national and global strategies for surveillance, prevention and control of zoonoses and food-borne infections.**

The reporting period from 01.01. until 17.12. 2019 falls under these ToR.

With the recent re-designation requested in November 2019, the terms of reference were redesigned in coordination with the AMR Division of WHO and concentrated in one central term of reference:

To support WHO and its member states in the development and implementation of GLASS under the leadership of WHO.

With this, WHO CC HAEI is also related to the WHO AMR Surveillance and Quality Assessment Collaborating Centres Network.

1.3   Highlights of work

Within the reporting period 2019 WHO CC HAEI was supporting a lot of projects. In the light of the given TOR the following highlights were addressed:

–   Different international calculation methods for the treatment frequency in antimicrobial usage were evaluated in the context of the benchmarking of farms.

–   WHO CC HAEI provided training for project partners from Zambia, India and Japan for one week each in Hannover on the VetCAb-ID data collection protocol and data base to set up surveillance on antibiotics use in these WHO member states.

–   First results on antimicrobial usage in dairy cows in Chilean farms were presented.

–   The German data base on antibiotic use in farm animals was enlarged significantly, thus enabling in-depth analyses of specialised niche farms to pilot these analyses for international use.

–   Regarding the usage of veterinary medicinal products with withdrawal periods greater than zero, the "treatment-free period" and the "withdrawal free period before slaughter" have proved to be particularly meaningful for answering the question of a species specific adaptation of the "relevant period" within the food chain information according to Reg. (EU) No. 853/2004. Recommendations for the definition of an EU-wide uniform "relevant period per animal species" were developed on the basis of data representative for Germany.

–   A project on antimicrobial usage in individual animals was started. The project is the first to describe the use of antibiotics in pets and horses in Germany and could act as a pilot for other WHO member states.

–   In the frame of a stakeholder analysis, two workshops were conducted at WHO CC HAEI with participants from human and veterinary medicine on knowledge gaps in both fields regarding Q-fever, and how these could be filled best.

–   A framework of multivariate consolidation of hygiene measures and health outcome was developed and multivariate health scores were defined as a model for human-animal-environment studies.

–   A new projects was started to set up a genome-based surveillance of transmissible Colistin and Carbapenem resistances of Gram-negative infectious agents (GÜCCI) and compare these at the human-animal interface

    A new project was started for the development of a working framework for the design of sampling plans for the evaluation of food potentially contaminated with zoonotic agents.

2   Research

The WHO CC HAEI conducts interdisciplinary research activities in several areas. Research and training in the field of animal health, zoonoses and antibiotic resistance represent the core of our work. These activities were directly linked to the work of the former WHO Advisory Group on Integrated Surveillance of Antimicrobial Resistance (AGISAR). It is intended to continue supporting WHO in its activities following AGISAR.

The following short report summarizes work done as WHO CC HAEI and those projects performed by the institute that have a direct link to the WHO CC work.

2.1   The "*Tricycle*" Project

The "Advisory Group on Integrated Surveillance on Antimicrobial Resistance" (AGISAR) and the Food Safety and Zoonoses Department of the WHO coordinate a project for global surveillance of ESBL-producing *E.coli* (ESBL-EC) whose aim is to introduce a simplified, integrated, trans-sectoral surveillance system for antibiotic resistance in bacteria on a global level. In doing so, the occurrence of ESBL-EC should be detected and compared annually on the basis of a uniform protocol in humans, animals/food as well as in the environment, where *E.coli* serves as an indicator for antibiotic resistance. The aim is to obtain robust, comparable and valid results from the three areas. In parallel, data on antibiotic consumption should also be collected. In addition to information about the occurrence of ESBL-EC, the data should also serve to show the effect of interventions as well as to investigate country-specific factors for the occurrence of ESBL-EC.

The protocol for the integrated surveillance of ESBL-EC in all three areas has to be highly standardized, and at the same time, the realization has to be feasible also in developing and threshold countries. Thus, the aim of the projects is to implement the One Health approach and to support these countries in the development of their National Action Plans on Antimicrobial Resistance.

In 2019 the WHO CC HAEI was in touch with groups from Zambia, India, Japan, Chile, and St.Kitts / Nevis to discuss and support the countries to introduce components of the project.

2.2   VetCAb-Sentinel: Longitudinal capture of consumption quantities of antibiotics in food-producing animals at selected representative veterinary practices and holdings (participants - sentinel)

On behalf of the Federal Institute for Risk Assessment (BfR), the project "Veterinary Consumption of Antibiotics" (VetCAb) has been carried out in Germany since 2006. An initial feasibility study showed that the consumption of antibiotics could be captured in livestock farming. The results of this feasibility study and the subsequent pilot study, carried out in 2011, have shown that it is possible to quantify the use of antibiotics on the basis of a representative sample and formed the basis for the development of a continuous monitoring

system. Since 2013, this monitoring system has been continued as a sentinel study (VetCAb-S).

Participating veterinarians and farmers voluntarily provide information in the form of application and delivery forms (ADF) on the use of antibiotics on farm level which is entered into the VetCAb data base. In addition to yearly and half-yearly comparisons on the antibiotic use of the farms since 2011, the dosing behaviour of the veterinarians can be observed as well as the changes in frequency of use of different active substances or active substance classes.

Furthermore, different international calculation methods for the treatment frequency were evaluated in the context of the benchmarking of farms. In 2019, the VetCAb collective was enlarged significantly, thus enabling in-depth analyses of specialised niche farms. Detailed data search facilitated analyses of antibiotic use per flock in broiler farms.

2.3   VetCAb International Documentation

WHO CC HAEI continued to work on the project "Veterinary Consumption of Antibiotics - International Documentation (VetCAb-ID)", which was supported by the WHO FOS Department and is seen as a possibility to gain important data on antimicrobial usage in member states of WHO. These data can provide complementary information to the results of the Tricycle project.

As outside of Europe only few countries collect data on usage of antimicrobials in animals, VetCab-ID was started as a pilot at the end of 2018. WHO CC HAEI developed a data base that can be used worldwide and is open for project partners to record the use of antibiotics in animal populations in their countries. The concept is based on VetCAb-S and had to be adapted to international conditions.

The VetCAb-ID data base was developed in English language and complemented with a catalogue for veterinary medicinal products. This catalogue has to be filled with certain information by each project partner. It is foreseen that each project partner has access only to his/her data, although partners from one country can share the same catalogue.

End of 2018, the new data base was tested by project partners from two different Chilean universities (University de Chile, Santiago, and University Austral de Chile, Valdivia) who visited WHO CC HAEI in November and December, respectively. Experience from this pilot was used to further optimize the structure of the data base.

During 2019, more retrospective data was entered by project partners from Chile and first analyses on antimicrobial usage in dairy cows of three Chilean farms could be done. These results were presented at a conference in autumn 2019.

In June 2019, project partners from Zambia, India and Japan took part in a training activity for one week each at the WHO CC HAEI to get familiar with the VetCAb-ID data collection protocol and data base. Additional funding for this and the pilot project at the end of 2018 was raised by the WHO CC from the MoH/Germany. Partners from Uganda showed strong interest in joining the project in 2020 (see 4.4).

2.4 Survey on the treatment of certain farm animals (turkeys, pigs, beef cattle, veal calves) with veterinary drugs concerning the food chain information

The objective of this project that was finalised in 2019 was to collect representative data on the usage of veterinary medicinal products with withdrawal periods greater than zero in relation to respective slaughtering dates by means of a sample including turkey, pig, beef cattle and veal calf holdings representative for Germany. This data was used to determine proposals for a reasonable "safety-relevant period" from epidemiological and meat hygiene points of view for any evaluated livestock species. This was done with regard to the elaboration of a unified determination of the "safety-relevant period" at EU level. In addition, the project involved an analysis of the connection between veterinary drug use during the rearing and fattening periods of the corresponding lots delivered and the occurrence of carcass and organ findings at official meat inspections.

Within the project, data were collected and analysed from 19 fattening turkeys, 5 runners, 43 fattening pigs, 57 fattening calves and 60 fattening bulls farms over a period of at least two consecutive fattening periods.

The "treatment-free period" and the "withdrawal free period before slaughter" proved to be particularly meaningful for answering the question of a species specific adaptation of the "relevant period" within the food chain information according to Reg. (EU) No. 853/2004. The median for the shortest withdrawal period before slaughtering is for turkeys 27, for fattening pigs 71, for fattening calves 28, for fattening bulls (calves) 389 and for fattening bulls (eaters) 311 days. The 5% percentile of this shortest waiting time before slaughter is 5 days for turkeys, 24 for fattening pigs, 1 for fattening calves, 111 for fattening bulls (introduced as calves) and 63 days for fattening bulls (introduced as elder calves).

On the basis of these data, for fattening pigs as well as for the fattening bulls (calves and elder calves) it is recommended to maintain the "relevant period" at seven days. However, the results of the turkey and calf fattening show that extension of the "relevant period" has to be taken into account under special considerations. To decide for this, further studies are needed. Because of the very low number of acquired weaner farms, a statistically reliable statement in this project was not possible.

The presented recommendations are an essential part of the political discourse on the definition of an EU-wide uniform "relevant period per animal species" as they were derived on the basis of data representative for Germany and other countries with comparable agricultural structures. The data may be used as pilot information for other WHO-member states as well.

2.5 Antimicrobial usage in individual animals

Up to now, data on antimicrobial usage on an international or national level are systematically collected and analysed mainly for food producing animals. With this, possible connections to human health via the food consumption route are supported. On the other hand,

the contact route gets more and more attention regarding resistance transfer from animals to humans. Therefore, usage data for pets and horses are important.

So far, approved systems that mirror the usage close to reality exist neither for horses, nor for pets. Only in a few countries like Great Britain, the Netherlands and Australia results of single investigations were published.

Therefore, a pilot project on antimicrobial usage in individual animals was started at the WHO CC HAEI in 2018 in order to collect data on application of antibiotics in pets and horses. The project is the first to describe the use of antibiotics in pets and horses in Germany and could act as a pilot for other WHO member states.

As data are analysed using the same methodology, independent from the animal species, results can be compared between these species, e.g. dogs, cats and horses. By looking at the real use data, a practical analysis is feasible. Moreover, also off-label use and use of veterinary and human medical preparations in the frame of the cascade are involved in the analyses.

2.6   Health indicators and scoring in research studies and surveillance systems

Antibiotic-resistant pathogens represent a serious problem for animal and human health and consumer protection and are thus in the focus of the public. In the framework of this problem, data is sampled within specialised research studies and on a more general level in surveillance programmes. For both data sources detailed data is useful, especially to take care on confounding aspects of population study data. On the other hand, often some data enrolled is "super-detailed", which causes the need to condense data into easy indicators and scores.

Within several studies in animal populations usage of antibiotics could be minimized by targeted diagnostic measures, optimisation of the treatment strategy and comprehensive, intensive management consultations on farmers For this, samples and findings were recorded at the beginning and the end of the treatment with antibiotics. A lot of additional information was gathered as well and methods for condensing these into specialised scores were developed and evaluated. The measures were grouped into different hygiene sections and questions asked were summarised into these groups. By applying this method, consultation becomes more obvious, and changes in the field of hygiene and management in the farm can be displayed also graphically. This system can be applied in the developed practice management software and is useful both for veterinary and human health consulting.

2.7   Genome-based surveillance of transmissible Colistin and Carbapenem resistances of Gram-negative infectious agents (GÜCCI)

The aim of the project is the trans-sectoral harmonisation of methods for analysis and evaluation of a genome-based surveillance of selected multiresistant bacteria in Germany. For this, data from hospitals and random samples from the human population, data from food and animal health surveillance is integrated into one entire system. The project focuses on the scientific-based assessment of the potential of Colistin and Carbapenem resistance to be transmitted between humans and animals or by isolates thereof, and shall also support decisions on necessary measures in disease prevention and consumers` protection. Through involvement of associated partners on federal state level, a transfer of knowledge and capabilities from federal and research institutions towards the level of federal states, regional institutions and regional laboratories will be reached.

So far, existing sequencing techniques of the participating laboratories were inventoried and evaluated. Comparison of calculations of NGS data showed a good comparability of results. This means that for harmonization of analytical methods and thus comparability of data standards for raw data quality are more relevant than unification of equipment platforms or analytical software.

Furthermore, a relevant collection of bacterial strains was compiled containing Colistin resistant enterobacteria (*E. coli, K. pneumoniae*) and selected Carbapenemase-producing enterobacteria. The consortium focusses on the analysis of VIM-1-producing *E. coli* isolates (human/animal), analysis of VIM-1-producing, clinical *Enterobacter cloaceae* and *Klebsiella oxytoca* isolates in a temporal and regional context (human) as well as analysis of mcr-mediated and mcr-independent Colistin resistance in *E. coli* and *K. pneumonia* isolates (human/animal).

2.8   Q fever - GermAn interdisciplinary Program for reSearch (Q-GAPS)

Q-fever is a zoonotic disease caused by the bacterium *Coxiella burnetii (C. burnetii)*. In the sense of the One Health approach, the national consortium Q-GAPS deals with open questions on epidemiology and pathogenesis of *C. burnetii* and wants to explore new methods for the surveillance, control and therapy of this disease in small ruminants (sheep/goats) and the human population. The aim of this project is to collect important information on *C. burnetii* and to pass it to people who deal with diagnosis and control of the disease. Besides a collection of existing information that is available online, guidelines for handling infections with Q-fever will be developed. The close collaboration and exchange between partners of this interdisciplinary consortium form the basis for a successful research on the topic Q-fever.

The WHO CC HAEI works on questions on the interaction of human and veterinary medicine like the establishment of an active monitoring and surveillance system for the detection and characterization of *C. burnetii* in herds of small ruminants and the occurrence of Q-fever Fatigue Syndrome in Germany

Investigation of the occurrence of QFS will help to better understand the course of Q-fever infections in humans. Results will be integrated into the guidelines that will be developed for practitioners and public health authorities. An extension to other WHO-member states is intended.

2.9   Development of a working framework for the design of sampling plans for the evaluation of food potentially contaminated with zoonotic agents (StiproZoo)

Specific problems in food law require the elaboration and application of appropriate plans to draw random samples. This need for random sampling results besides others from cases of food-borne outbreaks of zoonotic diseases and from assessment of food safety regarding the contamination with zoonotic agents. Both the chosen method for sampling and the laboratory method have to give representative and robust results to facilitate a statement on the presence of a zoonotic agent. The choice of appropriate methods regularly displays a challenge for the responsible authorities. Many different factors play an important role in this complex question: characteristics of the agent, time and way of contamination, homogeneity of distribution, matrix and the laboratory method applied.

A special focus lies in the precise and targeted investigation of food-borne zoonotic outbreaks that is performed along the food chain by the veterinary services. The aim of these outbreak investigations is to define the degree of hazard, to identify the cause of infection and to eliminate it, and to avoid similar outbreaks in the future through targeted control measures or adaption of hygiene measures.

Within this project, the research question will be answered, if it is possible to develop a robust, feasible and at the same time biometrically correct sampling scenario, taking into account very diverse factors like infectiology, production technology and logistics. Because of the complexity, the project will start with a few selected, practical use-cases and with this will develop a generic concept for all zoonotic agents.

In a long term, this project aims at developing a user-oriented tool (Shiny-Appin R) for sampling calculation by combining scientific knowledge about the agents, technological knowledge in food production and epidemiological-scientific knowledge with the information gained in different outbreak investigations. The application with a modular conception will thereby illustrate the different levels that have to be taken into account in sampling and sample analysis. This helpful tool and related perceptions will be provided to the responsible authorities.

3   Training events

The WHO CC HAEI holds training events and scientific colloquia or supports these activities on a regular basis. In 2019, the following events were prepared or organised:

3.1   Seminar on Veterinary Public Health 2019: "Antimicobial Resistance at the Human-Animal-Environment Interface"

The Seminar Veterinary Public Health, organised annually by the WHO-CC Hannover, took place on 8 February 2019 on and was perceived as a very sucessful event by speakers and participants. Eleven invited international experts covered topics like AMR as a One Health paradigm, AMR in humans in the EU and in Germany (healthcare-aquired and community-aquired infections), AMR in animals in the EU and in Germany regarding food-producing animals and food itself, global monitoring of AMR in waste water and faecal samples, AMR in surface waters, plants and soil. The WHO Tricycle Project was also presented.

Since May 2019 we worked already on the upcoming seminar which was held on 7 February 2020. The topic of this seminar was Q-fever and it focussed on active discussions and exchange between human and veterinary medicine. Please find an extra short report on this event attached.

This seminar addresses physicians and veterinarians from public health and veterinary services, microbiologists, practitioners, and is a well established conference at local level. More information can be found on our website: www.tiho-hannover.de/vph2020.

3.2   Course program: Epidemiology - Biometry 2019

The courses were held in February 2019 in collaboration with the WHO CC HAEI. The courses were intended for anyone who deals with the planning, analysis and evaluation of empirical studies within the scope of their work.

Four courses were offered, each consisting of three days training: Descriptive Epidemiological Methods, Analytical Epidemiological Methods, Application of Dynamic Models for Epidemiological Considerations and Evaluation of Diagnostic Tests.

The "Descriptive" and "Analytical Epidemiology" courses imparted the methodical knowledge necessary for epidemiological studies and explained them by means of examples. Concepts for the construction and collection of epidemiological measured values, the most important collection methods, evaluation and correction of error sources and basic evaluation methods for epidemiological studies were described.

During the course "Application of Dynamic Models for Epidemiological Considerations – a practical introduction", participants were taught both background knowledge and practical experience in the development and application of models. Here, compartment models on infectious diseases in certain host groups were introduced, developed and tested in

NetLogo. Afterwards, a model for the dissemination of an infectious disease based on individuals was developed and variegated depending on different practical questions. In a practical exercise, participants were given the possibility to apply disease modelling to solve real problems in decision making.

The "Evaluation of Diagnostic Tests" course imparted knowledge on study planning, sample collection, evaluation and critical interpretation of the different study types for the evaluation of diagnostic tests. The required statistical and epidemiological concepts were explained.

All courses received positive evaluations from participants.

4 Cooperation and ongoing activities

4.1 Preparation of the re-designation

WHO CC HAEI was re-designated by December 17th, 2019. Throughout the year 2019, additional efforts were made to develop proposals for a new work plan. This included, in cooperation with WHO, development of several trainings, workshops and concepts in the field of epidemiology as well as the elaboration of proposals for new fields of collaboration.

4.2 Antimicrobial Resistance Cooperative Network (ARCONE)

The ARCONE project will be integrating two major universities in Chile, such as Universidad Austral de Chile (UACh, Valdivia) and Universidad de Chile (UChile, Santiago) with WHO CC HAEI.

The aim of this network is to improve the coordination, cooperation, standardization and validation of the diagnostic methods and control of bacteria that express antimicrobial resistance between the participating labs from Germany and Chile. This will be achieved by (1) standardization and validation of the direct and indirect diagnostic techniques of resistant bacteria in different animal species and humans, (2) coordination and cooperation between labs from Germany and Chile to develop the molecular characterization techniques of the isolated pathogens, and (3) establishment and standardization of protocols and to use them in pathogen studies, risk assessment studies or future pharmacological studies. Therefore, ARCONE is directly taking the Tricycle approach.

Preparative work was done in 2019: During a visit of one project partner at WHO CC HAEI, several meetings were organised in Hannover and Berlin to elaborate whether the project ideas can be extended to other institutes and project partners. A concept was developed on how to proceed with ARCONE and a visit of representatives from WHO CC HAEI to both Chilean universities was planned and prepared for December 2019 in order to introduce ideas and give workshops in the frame of ARCONE.

Unfortunately, due to the political situation in Chile at the end of 2019, the visit had to be cancelled. Collaboration within the project will be continued in 2020.

4.3 Collaboration with partners from Uganda

Soon after first results of the VetCAb-ID project were presented in autumn 2019, interest was raised in colleagues from Switzerland who have a collaboration with partners from Uganda. After a first meeting within a scientific conference, a videoconference was organized in October with participants from the Makerere University, different levels of the veterinary administration (including the Ministry of Agriculture, Animal Industry and Fisheries), a fellow at Fleming fund on AMR attached to NADDEC, and the respective colleague from

the University of Zurich. The VetCAb-ID data base was introduced and standards of data collection as well as functionality of the data base were explained.

This videoconference was followed by further communication on how to develop a collaboration and how Uganda could get involved in the project. A visit in Uganda is planned for the second half of 2020.

4.4   WAAW 2019: One Health lecture at the Hannover Medical School

At 21 November 2019, during the World Antibiotic Awareness Week, a lecture on Antimicrobial Resistance as THE One Health challenge was held by Dr. Nicole Werner at the Hannover Medical School in the frame of an elective course on Global Health. The audience was compiled of students from the Hannover Medical School and the University of Veterinary Medicine Hannover. Following the lecture, possible ways of integrating One Health topics into the curricula at both universities, maybe even in a joint course, were discussed.

4.5   AACTING conference 2020

AACTING represents a network of professionals involved in the quantification of veterinary Antimicrobial usage at herd level and Analysis, CommunicaTion and benchmarkING to improve responsible use. In 2019, WHO CC HAEI started to organise the third AACTING conference that will take place in Hannover at the beginning of December 2020 with presumably around 150 participants. The focus of the conference is (quantification of) antimicrobial usage in veterinary medicine and antimicrobial stewardship, benchmarking and action plans.

5   Collaborations

5.1   International cooperation partners

At the international level, the WHO CC HAEI collaborates within the scope of its research and training activities with the following institutions:

− Department of Experimental and Applied Psychology, University of Amsterdam, The Netherlands
− Ross University School of Veterinary Medicine, Basseterre, St. Kitts and Nevis
− Veterinary Public Health Institute, Bern, Switzerland
− Bundesamt für Lebensmittelsicherheit und Veterinärwesen, Bern, Switzerland
− Department of Biomathematics and Informatics, University of Veterinary Science, Budapest, Hungary
− Department of Population Medicine, Ontario Veterinary College, University of Guelph, Guelph, Canada
− Makerere University, Kampala, Uganda
− College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati, India
− Institute of Infection and Global Health, University of Liverpool, UK
− Royal Veterinary College, London, UK
− Department of Disease Control, University of Zambia, Lusaka, Zambia
− Faculty of Veterinary Medicine, University of Chile, Santiago de Chile, Chile
− The University of Tokyo, Tokyo, Japan
− Faculty of Veterinary Medicine, Universidad Austral de Chile, Valdivia, Chile
− Agentur für Gesundheit und Ernährungssicherheit Wien, Austria
− Veterinärmedizinische Universität Wien, Austria
− Vetsuisse-Fakultät der Universität Zürich, Switzerland

5.2   National cooperation partners

On national level, the WHO CC HAEI collaborates within the scope of its research and trainings activities with the following institutions:

− Veterinärmedizinische Fakultät der Freien Universität Berlin
− Charité, Berlin
− Bundesinstitut für Risikobewertung, Berlin
− Bundesamt für Verbraucherschutz und Lebensmittelsicherheit, Berlin
− Nationales Forschungsnetz zoonotische Infektionskrankheiten, Berlin
− Robert Koch-Institut, Berlin und Wernigerode
− QS Qualität und Sicherheit GmbH, Bonn
− Helmholtz-Forschungszentrum für Infektionsmedizin, Braunschweig
− Johann Heinrich von Thünen-Institut, Bundesforschungsinstitut für Ländliche Räume, Wald und Fischerei, Braunschweig
− Leibniz-Institut für Präventionsforschung und Epidemiologie - BIPS GmbH, Bremen
− Friedrich Loeffler-Institut, Celle, Jena, Mariensee und Insel Riems

- Max Rubner-Institut, Detmold
- Fakultät für Statistik der Technischen Universität, Dortmund
- Bayerisches Landesamt für Gesundheit und Lebensmittelsicherheit, Erlangen
- Universitätsklinikum Erlangen
- Bayerische Landesanstalt für Landwirtschaft, Freising
- Marketing Service Gerhardy, Garbsen
- Tierärztliche und medizinische Fakultät der Justus-Liebig-Universität Gießen
- Lebensmittel- und Veterinärinstitut Braunschweig/Hannover
- Medizinische Hochschule Hannover
- Niedersächsisches Landesgesundheitsamt, Hannover (NLGA)
- Niedersächsische Tierseuchenkasse, Hannover (NTSK)
- Universitätsklinikum Jena
- Tierseuchen- und Zoonosendiagnostik, Abteilung A –Veterinärmedizin, ZInstSanBw Kiel
- Veterinärmedizinische Fakultät der Universität Leipzig
- Fraunhofer Institut für Zelltherapie und Immunologie, Leipzig
- Helmholtz-Forschungszentrum für Umweltfoschung, Leipzig/Halle
- BALVI GmbH, Lübeck
- Tierärztliche und medizinische Fakultät, Institut für Statistik der Ludwig-Maximilians-Universität München
- Helmholtz-Forschungszentrum München
- Institut für Mikrobiologie der Bundeswehr, München
- Medizinische Fakultät der Westfälischen Wilhelms-Universität Münster
- Landwirtschaftskammer Niedersachsen, Oldenburg
- Niedersächsisches Landesamt für Verbraucherschutz und Lebensmittelsicherheit (LAVES), Hannover und Oldenburg
- Veterinärdienst des Landkreises, Osnabrück
- Tierärztliche Gemeinschaftspraxis, Vet Team Reken, Reken
- Landwirtschaftskammer Schleswig-Holstein, Rendsburg
- Fakultät für Agrarwissenschaften der Universität Hohenheim, Stuttgart
- Landesgesundheitsamt Baden-Württemberg, Stuttgart
- Verein zur Förderung der bäuerlichen Veredlungswirtschaft, Uelzen
- Missionsärztliches Institut, Würzburg

6   Publications

The following scientific writings were published by the WHO CC HAEI during 2019:

6.1   Scientific publications in journals

Adler F, Christley R, Campe A.
>   Invited review: Examining farmers' personalities and attitudes as possible risk factors for dairy cattle health, welfare, productivity, and farm management: A systematic scoping review. J Dairy Sci. 2019 May;102(5):3805-3824. doi: 10.3168/jds.2018-15037. Epub 2019 Mar 7.

Echelmeyer J, Taylor PM, Hopster K, Rohn K, Delarocque J, Kästner SBR.
>   Effect of fentanyl on thermal and mechanical nociceptive thresholds in horses and estimation of anti-nociceptive plasma concentration. Vet J. 2019 Jul;249:82-88. doi: 10.1016/j.tvjl.2019.05.012. Epub 2019 May 31.

große Beilage E, Meyer D, Hewicker-Trautwein M, Kreienbrock L, Hartmann M, Vogel C.
>   Schulterulzera bei Sauen – tierschutzfachliche Bewertung und Prävention. Amtstierärztlicher Dienst und Lebensmittelkontrolle. 26. Jahrgang – 4 / 2019, 196-199.

Hilke J, Strobel H, Woelke S, Stoeter M, Voigt K, Grimm L, Meilwes J, Punsmann T, Blaha I, Salditt A, Rohn K, Bastian M, Ganter M.
>   A comparison of different vaccination schemes used in sheep combining inactivated bluetongue vaccines against serotypes 4 and 8. Vaccine. 2019;37:5844-5853. pii: S0264-410X(19)31050-3. doi: 10.1016/j.vaccine.2019.08.011.

Hommerich K, Ruddat I, Hartmann M, Werner N, Käsbohrer A, Kreienbrock L.
>   Monitoring Antibiotic Usage in German Dairy and Beef Cattle Farms—A Longitudinal Analysis. Frontiers in Veterinary Science. 2019;6(244). doi: 10.3389/fvets.2019.00244.

Iwanuk N, Wall L, Nolte I, Raue J, Rumstedt K, Pilgram A, Sehn M, Rohn K, Bach JP.
>   Effect of pimobendan on physical fitness, lactate and echocardiographic parameters in dogs with preclinical mitral valve disease without cardiomegaly. PLoS One. 2019 Oct 3;14(10):e0223164. doi: 10.1371/journal.pone.0223164. eCollection 2019.

Jensen KC, Frömke C, Schneider B, Do Duc P, Gundling F, Birnstiel K, Schönherr F, Scheu T, Kaiser-Wichern A, Woudstra S, Seyboldt C, Hoedemaker M, Campe A.
>   Case-control study on factors associated with a decreased milk yield and a depressed health status of dairy herds in northern Germany. BMC Veterinary Research. 2019;15(1):442. doi: 10.1186/s12917-019-2190-4.

Jung K, Vogel C, Zapf A, Frömke C.
>   Reproduzierbare Forschungsergebnisse: Anforderungen und Herausforderungen durch Data Science. MDI : medizin://dokumentation/informatik/informationsmanagement/. 2019;21(2):45-48. ISSN 1438-0900

Kaesbohrer A, Bakran-Lebl K, Irrgang A, Fischer J, Kämpf P, Schiffmann A, Werckenthin C, Busch M, Kreienbrock L, Hille K.
>   Diversity in prevalence and characteristics of ESBL/pAmpC producing E. coli in food in Germany. Vet Microbiol. 2019 Jun;233:52-60. doi: 10.1016/j.vetmic.2019.03.025. Epub 2019 Apr 7.

Kasabova S, Hartmann M, Werner N, Käsbohrer A, Kreienbrock L.

Used Daily Dose vs. Defined Daily Dose—Contrasting Two Different Methods to Measure Antibiotic Consumption at the Farm Level. Frontiers in Veterinary Science. 2019;6(116). doi: 10.3389/fvets.2019.00116.

Konze SA, Abraham WR, Goethe E, Surges E, Kuypers MMM, Hoeltig D, Meens J, Vogel C, Stiesch M, Valentin-Weigand P, Gerlach GF, Buettner FFR.
Link between Heterotrophic Carbon Fixation and Virulence in the Porcine Lung Pathogen Actinobacillus pleuropneumoniae. Infect Immun. 2019 Aug 21;87(9). pii: e00768-18. doi: 10.1128/IAI.00768-18. Print 2019 Sep.

Kostic D, Carlson R, Henke D, Rohn K, Tipold A.
Evaluation of IL-1β levels in epilepsy and traumatic brain injury in dogs. BMC Neurosci. 2019 Jun 17;20(1):29. doi: 10.1186/s12868-019-0509-5.

Mathes KA, Radelof K, Engelke E, Rohn K, Pfarrer C, Fehr M.
Specific anatomy and radiographic illustration of the digestive tract and transit time of two orally administered contrast media in Inland bearded dragons (Pogona vitticeps). PLoS One. 2019 Aug 22;14(8):e0221050. doi: 10.1371/journal.pone.0221050. eCollection 2019.

Meyer D, Hewicker-Trautwein M, Hartmann M, Kreienbrock L, Grosse Beilage E.
Scoring shoulder ulcers in breeding sows - is a distinction between substantial and insubstantial animal welfare-related lesions possible on clinical examination?
Porcine Health Manag. 2019 Jan 22;5:3. doi: 10.1186/s40813-018-0108-3. eCollection 2019.

Meyer D, Vogel C, Kreienbrock K, große Beilage E.
How effective are clinical pre-farrowing risk assessment and the use of soft rubber mats in preventing shoulder ulcers in at-risk sows? Porcine Health Manag. 2019 Jul 12;5:16. doi: 10.1186/s40813-019-0123-z.

Meyerhoff N, Rohn K, Carlson R, Tipold A.
Measurement of Neutrophil Gelatinase-Associated Lipocalin Concentration in Canine Cerebrospinal Fluid and Serum and Its Involvement in Neuroinflammation. Frontiers in Veterinary Science. 2019;6(315). doi: 10.3389/fvets.2019.00315.

Mühlhause F, Tipold A, Rohn K, Lepori V, Leeb T, Sewell AC, Kornberg, M.
Verlaufsuntersuchungen bei Deutschen Jagdterriern mit belastungsabhängiger metabolischer Myopathie: Tierarztl Prax Ausg K 2019; 47(06): 402-410 DOI: 10.1055/a-1027-2533

Nicolaisen T, Lühken E, Volkmann N, Rohn K, Kemper N, Fels M.
The Effect of Sows' and Piglets' Behaviour on Piglet Crushing Patterns in Two Different Farrowing Pen Systems. Animals (Basel). 2019 Aug 7;9(8). pii: E538. doi: 10.3390/ani9080538.

Niemann L, Eichhorn I, Müller P, Brauns J, Nathaus R, Schäkel F, Höltig D, Wendt M, Kadlec K, Schwarz S.
Draft Genome Sequences of Three Porcine Streptococcus suis Isolates Which Differ in Their Susceptibility to Penicillin. Microbiol Resour Announc. 2019 Feb 28;8(9). pii: e01711-18. doi: 10.1128/MRA.01711-18. eCollection 2019 Feb.

Niemann L, Feudi C, Eichhorn I, Hanke D, Müller P, Brauns J, Nathaus R, Schäkel F, Höltig D, Wendt M, Kadlec K, Schwarz S.
Plasmid-located dfrA14 gene in Pasteurella multocida isolates from three different pig-producing farms in Germany. Vet Microbiol. 2019 Mar;230:235-240. doi: 10.1016/j.vetmic.2019.01.016. Epub 2019 Jan 16.

Ruddat I, Adler F, Hartmann M, Wendt A, Werner N, Blume K, Lindtner O, Lüth A, Nölke T, Greiner M, Campe A.
Stichprobenplanung in der Lebensmittelüberwachung: Reduktion des notwendigen Stichprobenumfangs durch Pooling. J Consum Prot Food Saf (2019) 14(4):409-414 DOI 10.1007/s00003-019-01227-3.

Schnier S, Middendorf L, Janssen H, Brüning C, Rohn K, Visscher C.
Immunocrit, serum amino acid concentrations and growth performance in light and heavy piglets depending on sow's farrowing system. Porcine Health Manag. 2019 Jun 14;5:14. doi: 10.1186/s40813-019-0121-1. eCollection 2019.

Ullrich C, Langeheine M, Brehm R, Taube V, Rosillo Galera M, Rohn K, Popp J, Visscher C.
Influence of Different Methionine Sources on Performance and Slaughter Characteristics of Broilers. Animals (Basel). 2019 Nov 19;9(11). pii: E984. doi: 10.3390/ani9110984.

Waberski D, Luther A-M, Grünther B, Jäkel H, Henning H, Vogel C, Peralta W, Weitze KF.
Sperm function in vitro and fertility after antibiotic-free, hypothermic storage of liquid preserved boar semen. Scientific Reports. 2019;9(1):14748. doi: 10.1038/s41598-019-51319-1.

Wegner B, Spiekermeier I, Nienhoff H, Große-Kleimann J, Rohn K, Meyer H, Plate H, Gerhardy H, Kreienbrock L, grosse Beilage E, Kemper N, Fels M.
Status quo analysis of noise levels in pig fattening units in Germany. Livestock Science 230 (2019) 103847 doi:10.1016/j.livsci.2019.103847