Deliverable JIP1-2.7
Revised OH Knowledge Base - Epi, including lessons learned from the OH pilots
Workpackage 2- Epi

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REVISED OH KNOWLEDGE BASE - EPI, INCLUDING LESSONS LEARNED FROM THE OH PILOTS

Executive Summary

The Joint Integrative Project ORION (One health suRveillance Initiative on harmOnization of data collection and interpretatioN") aims at establishing and strengthening inter-institutional collaboration and transdisciplinary knowledge transfer in the area of One Health Surveillance (OHS). To map out an effective approach to address the aims, initial project requirement analyses were performed. These analyses identified that cross-sectoral and multidisciplinary communication, collaboration and knowledge exchange were significant challenges for the OHS community and required attention. To address this requirement, work package WP2Epi developed a One health knowledge base (OH KNOWLEDGE BASE – EPI) to facilitate not only cross-sectoral and multidisciplinary knowledge exchange, but also to encourage communication and collaboration.

The OH KNOWLEDGE BASE – EPI consists of two inventories: a *Surveillance* inventory and a *Tools and Methods* inventory. Both will become part of an overarching expert system (see WP3). We developed the Surveillance inventory to facilitate information exchange on zoonotic and food borne disease surveillance performed across different sectors and countries. Early during the development of the inventories and analysis of existing databases, we found that definitions for the same term could differ between the public health, animal health and food sectors. Even between countries and languages, definitions for the same term could differ. Thus, we recognised the need to include experts from different sectors and organisations (e.g. EFSA, ECDC) in the development of the inventories, to ensure harmonisation as best as possible. Nevertheless, we could not resolve all the differences in terms and definitions, and therefore, the planned development of a single inventory on surveillance systems for all sectors was not possible. The result was a separate surveillance inventory for each of the sectors. However, ongoing information exchange with other work packages (WP1) and other projects (EJP MATRIX) will help to harmonise these definitions, and perhaps allow for a combined inventory in the future.

The Surveillance inventory (accessible at: https://shiny.fli.de/ife-apps/EJPOrion_WP2Epi/) development process also highlighted the need to establish new resources that supported the interpretation and interoperability of surveillance data (reports). To begin to address that need, we developed a guidance document that clarified the meaning of the data fields.

The Tools and Methods inventory (accessible at: https://shiny.fli.de/ife-apps/toolsdatabase/) was designed to collate information on methods and tools relevant to the correct interpretation and analysis of One health surveillance data. The intention was that this inventory would act as a one-stop-shop for accessing this information easily and conveniently, and thereby encourage improved interpretation and analysis of One health surveillance data in the field.

Both inventories within the knowledge base, have been created as "living" databases. This means that they are not in a fixed state, but rather, are updateable and thereby able to keep pace with developments

in One health surveillance as they occur. Within the pilot studies, the inventories have already been tested and updated on an ad hoc basis, and we expect this to continue on a consistent quarterly basis.

Currently, the OH KNOWLEDGE BASE – EPI is hosted on a publicly available web platform. It is designed in a way that additional resources can easily be added to each inventory. Furthermore, we used open source software (R Statistical software) to develop a user-friendly graphical user interface (GUI) that can also be updated easily.

In order to disseminate the OH KNOWLEDGE BASE – EPI research work, and increase awareness of the inventories, we intend to write a manuscript describing the OH KNOWLEDGE BASE – EPI for submission to a peer reviewed journal.

Lastly, to ensure sustainable use and further development of the OH KNOWLEDGE BASE – EPI, we have collaborated with other EJP projects, specifically MATRIX. MATRIX members have agreed to maintain the OH KNOWLEDGE BASE – EPI as of 1 July 2021, when the ORION project reaches its conclusion. We have provided MATRIX with all the necessary code for the application, the data collection spreadsheets and the guiding documents.

Progress

Development of the inventories

To get an overview on surveillance running at EJP ORION partners, we developed an Excel sheet and asked the partners to list the surveillance systems they are working with. For this purpose, we looked in more detail at the existing tools *SurF*, *RiskSur* and *SERVAL*, to see if they could be used to create a schema for our inventories. Our Excel sheet was inspired by the scheme of the *RiskSur* Tool (https://www.fp7-risksur.eu).

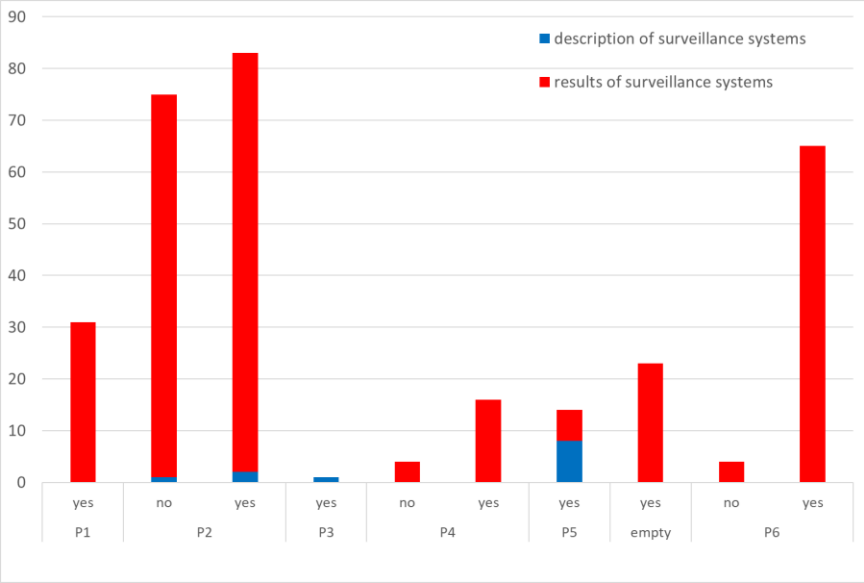

Figure 1: Number of different diseases described by available data sources entered to the Excel sheet in the first screening, ordered by partners and zoonosis (yes or no). Note, one data source (e.g. report) can cover several diseases.

Partners reviewed and answered the preliminary surveys, but pointed out the need to align terminology across sectors before a more complete inventory could be achieved. This is further discussed below.
For the list on Surveillance Systems, we received answers from only 5 partners with 294 entries, 171 reported hazards and 194 established surveillance systems. In total, 75 systems were classified as zoonosis, 63 as "no zoonosis" and the other entries were not classified or uncertain (Figure 2).

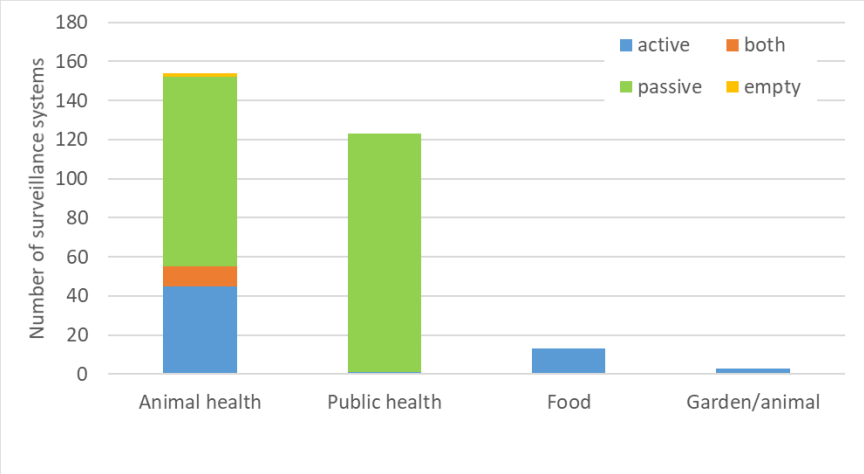

Figure 2: Number of Surveillance Systems identified in the first screening by sector and type of surveillance system.

We presented the results at the first meeting in April and discussed the Excel lists. Two important issues were identified:

not all terms (e.g. hazard") were used by all partners and therefore there wered problems with filling in the tables.

definitions for some terms were interpreted differently between partners, countries and sectors. For example, the terms "active surveillance" and "passive surveillance" were more commonly used in the Veterinary Sector but not in the Public Health sector (Figure 2). For that reason, we decided first to align the terminology before setting up a common database. Hence, we worked closely with WP1 to define the terms that would be used in the knowledge base.

Despite the problems with definitions, the results showed that the *RiskSur* scheme, which originally had been developed for animal health surveillance, would be suitable to inventory public health and food safety surveillance systems as well, especially following modifications for that purpose.

Considering the issues described above we also realised that the inventory on existing data, methods and the description of surveillance systems would need to be developed in a different way. Subsequently, the decision was made to split the scheme design from one inventory into three:

Surveillance systems

Surveillance data sources

Methods and Tools used for surveillance

Despite the need for three rather than one inventory, eventually there will be an option to link between all tables.

Development of these individual inventories is described below.

Surveillance systems

To develop the inventories on surveillance systems, we first worked on defining the terms that would be used in the inventories and comparing these definitions between sectors. Additionally, in an effort to

increase inter-sectoral understanding of surveillance carried out in the different sectors we held a webinar to describe the surveillance systems in each of the sectors.

As this process was quite complex, we decided to create separate lists for each sector and to combine it afterwards. For the subgroup on Surveillance Systems, a **second screening** round was started. Partners were asked to describe their surveillance activities in the appropriate language for their sector. In total, four answers were received for this call. Furthermore, an alignment between RISKSUR, member states annual reports to ECDC, and to EFSA were compared. It became evident that the general structure of the surveillance process is similar across sectors (animal health, public health and food safety), but the terminology used can vary a lot. As a result, we decided that in year 2 we would carry out a more extensive inventory of surveillance programs in all three sectors, circulating spreadsheets that were aligned with the terminology in each domain specifically. Afterwards, however, the results of the inventories would be combined, based on the similarities identified while still ensuring preservation of the dissimilarities. This is possible due to the tight cooperation of WP1 and WP3, which investigated and documented, respectively, how differences in terminologies across sectors could be aligned.

As a follow up of our first survey (see above), we set up a second survey that was then carried out as a part of the ORION M9 survey (Subtask 2Epi1.3). In total there were 11 responses from 6 countries. Five responses were submitted by the sector animal health, four by the public health sector and two from institutes covering all fields (animal health, public health and feed & food). In all countries represented, reports on surveillance systems were available and, for eight cases, they were publicly available. Regarding the tools and methods, we received seven answers with information on tools. The answers were very detailed; some respondents reported the use of the following software: SAS, STATA, Excel and R. For the methods, respondents referred to general methods, e.g. descriptive statistics with several respondents stressing that the method used is purpose driven. Hence, the challenge was to create a list with all purposes in the field of surveillance systems represented (e.g. sample size calculation, early detection, descriptive statistics, prevalence estimation) and to collect the tools according to the purpose.

Due to the small number of replies, we considered if the survey should be revised and distributed to all OHEJP partners again. However, considering the amount of parallel activities and input gathering going on within the project at the same time, rather than push on this EJP survey, we decided to take the time to consolidate all input from project members, and then review results with key stakeholders (EFSA and ECDC). In June 2019, we had a workshop at EFSA (Parma) to discuss the results and improve the inventories. ECDC joined this meeting by Skype conference. As an outcome of this meeting we changed the animal health and feed and food inventories to reflect the existing data structure of EFSA. This lead to a more mature version of the tables for inventory of surveillance systems, and we conducted another round of questions when sending out those inventory tables.

Whenever possible, we used a similar data dictionary to EFSA and ecdc. For the animal health and feed & food inventories, we aligned the data collection framework as closely as possible to that of EFSA (DCF, see https://www.efsa.europa.eu/de/supporting/pub/en-992) and for the public health inventory we aligned to data collection framework as closely as possible to the data structure of Tessy (https://www.ecdc.europa.eu/en/publications-data/european-surveillance-system-tessy).
Tables comparing the fields in the inventories and the respective fields in the ECDC and EFSA databases can be found in Appendix A.

For all fields, we created lists in order to simplify entering data and to have as similar data as possible. Whenever possible we used the lists from EFSA and ECDC.

Data sources

Our preliminary screening showed that there were many reports available but that they were hard to list in a unique way because of their different publication types, e.g. scientific publications, reports, data on websites, databases. Hence, we decided to use a common system, which could list all different data sources and be used to collect relevant information for the repository. It was finally decided to use the Zotero reference management tool (*Zotero,* https://www.zotero.org) to collect available information. The fields of the reference manager would be extended by fields necessary to link the data to the surveillance systems. To collect the data in a unique way, it was decided to collect the data for Methods & Tools with the same reference management tool (*Zotero)*. We created groups in Zotero for Data Sources and Methods & tools and gave access to all partners. The next step was to define the fields that were necessary to link between Data sources, Methods & Tools and Surveillance systems.

Methods & Tools

Another object of this WP was the analysis of methods for planning and analysis of surveillance systems. A web application with a user interface was developed using R statistical software. During the creation of a database with specific statistical methods for One Health surveillance and One Health monitoring it became clear that this database alone was not sufficient to describe the knowledge on the use of One Health procedures in the control of zoonoses. This was especially true due to the poor response to the inventory for statistical tools and methods during project time. Nevertheless, the tool database will continue to be maintained and used by BfR departments.

Additionally, it was decided to present and test the Rasch model and apply it to the specific area of One Health surveillance, as this model could be used to evaluate the different systems implemented in terms of their One Healthness using a questionnaire. The OH-ness of surveillance and monitoring systems represents a latent trait, i.e. it cannot ascertained directly by observation. The Rasch model is regularly used to quantify similar latent traits such as intelligence and quality of life or creativity. In our case, by OH-ness, we mean the willingness of public and private bodies to follow the OH mindset in the planning and implementation of surveillance and monitoring measures to control zoonoses. The applicability of the Rasch model was successfully tested in the pilot project. Testing will be further conducted with international partners.

Platform development

For both the Surveillance inventories and the Tools and methods inventory a platform to make the data publicly available was needed.

Platform requirements

- The agreed requirements for the platform were:
- Free software
- Computer language that is commonly used within the FLI and BfR
- Option to create interactive web applications
- Within the web application search and filtering option
- App can be hosted at FLI

Decision

Based on the requirements to develop a user-friendly platfrom we decided to use the free software R (https://www.r-project.org/) in combination with the package "shiny"[1].
For adding new entries to the knowledge hub, we decided to use Excel sheets. Although Excel is not free software, it is widely used and most people are familiar with how to enter data. Furthermore, it can be used with open software (e.g. LibreOffice).
The code for the app has been made publicly available at https://github.com/JoernGe/EJP-Orion-knowledge-hub and https://github.com/Tsel/EJP-Orion-knowledge-hub---tools . The final apps are available at https://shiny.fli.de/ife-apps/EJPOrion_WP2Epi/ and https://shiny.fli.de/ife-apps/toolsdatabase/. They are accessible with all standard browsers and all mobile devices.

Altogether, the App "Knowledge hub inventories" contains the following parts:

1. *A tab with background information on the project EJP ORION*
2. *A tab with instructions*
   The instructions include standard tables for download to fill in additional entries as well as the pathway to submit new entries to the database. The tab also listsa central email address for questions regarding the app or the inventories. Any new data contributions about surveillance systems should be sent to this address (EJP.Orion@fli.de). Furthermore, a downloadable guidance document is also provided that explains the tables and refers to the data
3. *Three tabs, one each for thepublic health, animal health and feed & food inventories*
   In each tab the inventory for the specific sector can be found. The inventories can be sorted by clicking on the arrow in the column. Furthermore, a global search is included. All rows containing the search term will be presented. It is possible to export the selected datasets (see figures). When pushing the radio button in front of each row, more information for the entry is shown. For most database entries, a link to the data source is also provided.
4. *A tab with a literature collection*

[1] Winston Chang, Joe Cheng, JJ Allaire, Carson Sievert, Barret Schloerke, Yihui Xie, Jeff Allen, Jonathan McPherson, Alan Dipert and Barbara Borges (2021). shiny: Web Application Framework for R. R package version 1.6.0. https://CRAN.R-project.org/package=shiny

In the literature collection, we collected reports, peer reviewed articles, and other publications (websites, databases) that contain information on surveillance systems or studies. It includes a global search as well as sorting and additional information when pushing the radio button in front of each row. It is possible to export the selected datasets (see figures).

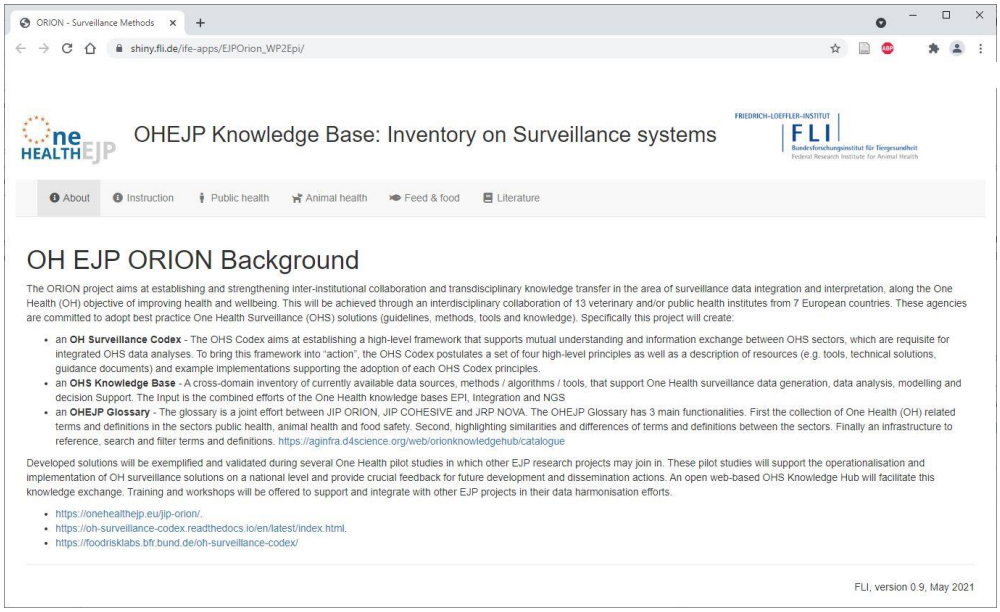

Figure 3: Sreenshot OHEJP Knowledge base – Introduction

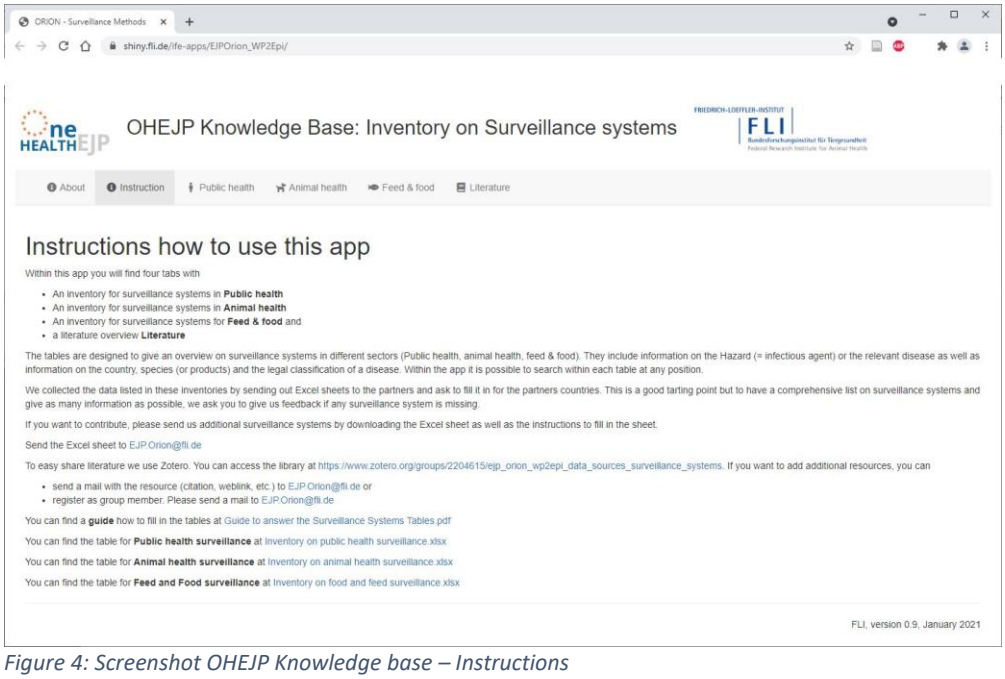

Figure 4: Screenshot OHEJP Knowledge base – Instructions

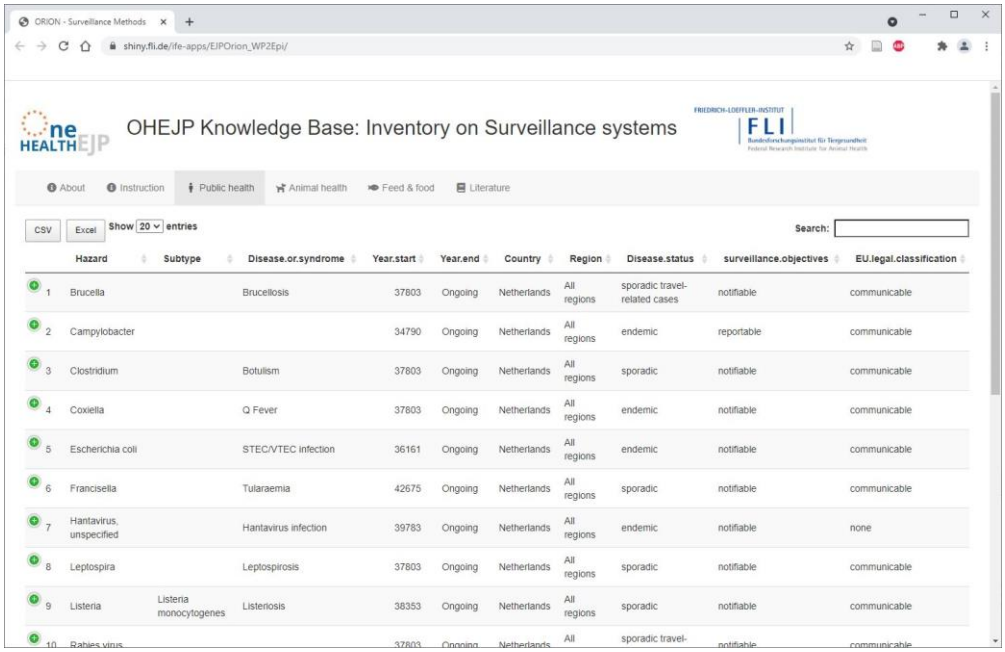

Figure 5: Screenshot OHEJP Knowledge base – Public health 1

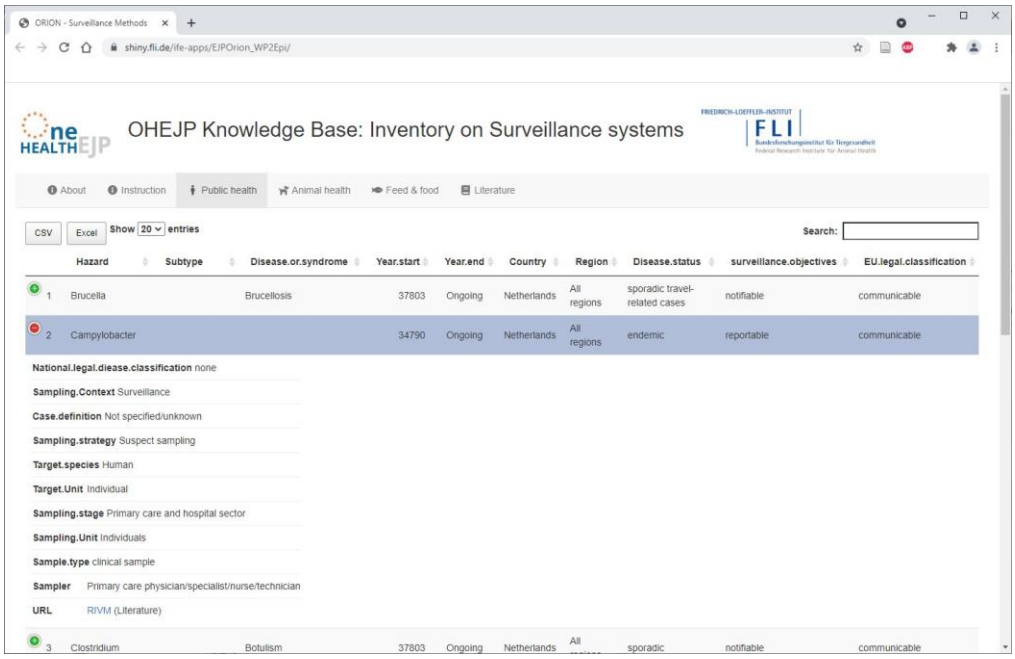

Figure 6: Screenshot OHEJP Knowledge base – Public health 2

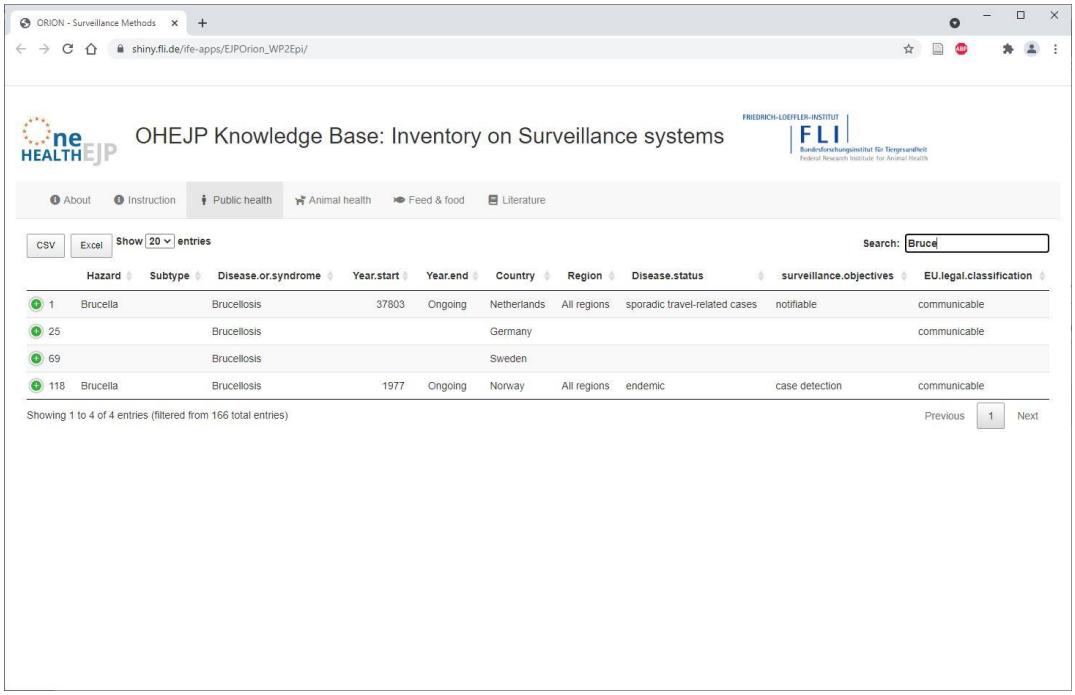

Figure 7: Screenshot OHEJP Knowledge base – Public health 3

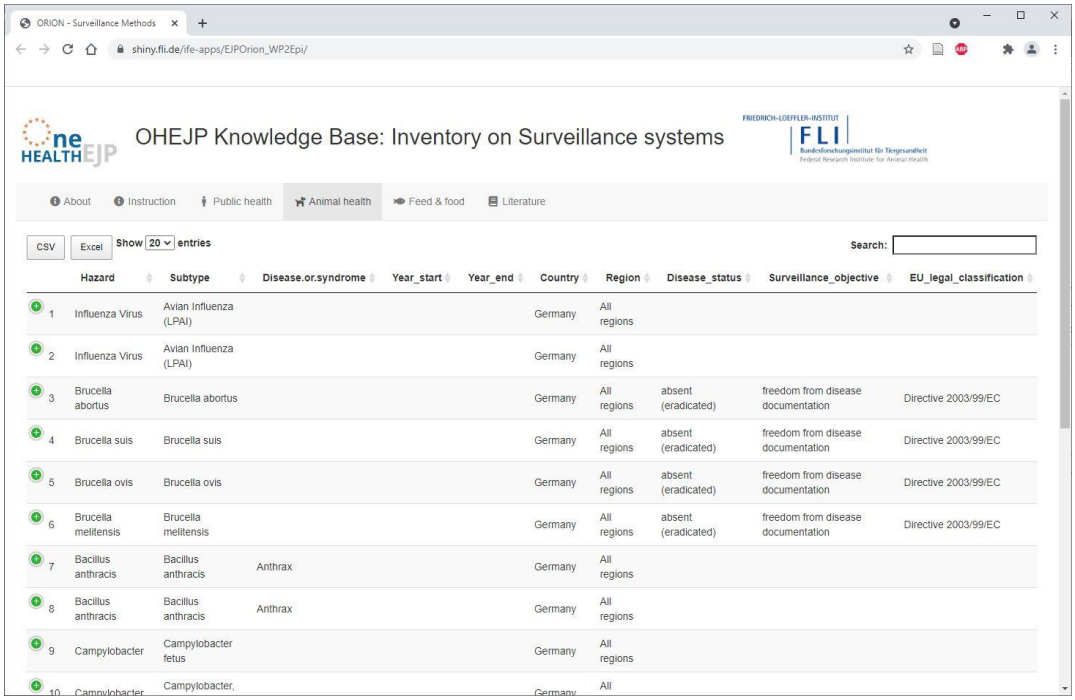

Figure 8: Screenshot OHEJP Knowledge base – Animal health 1

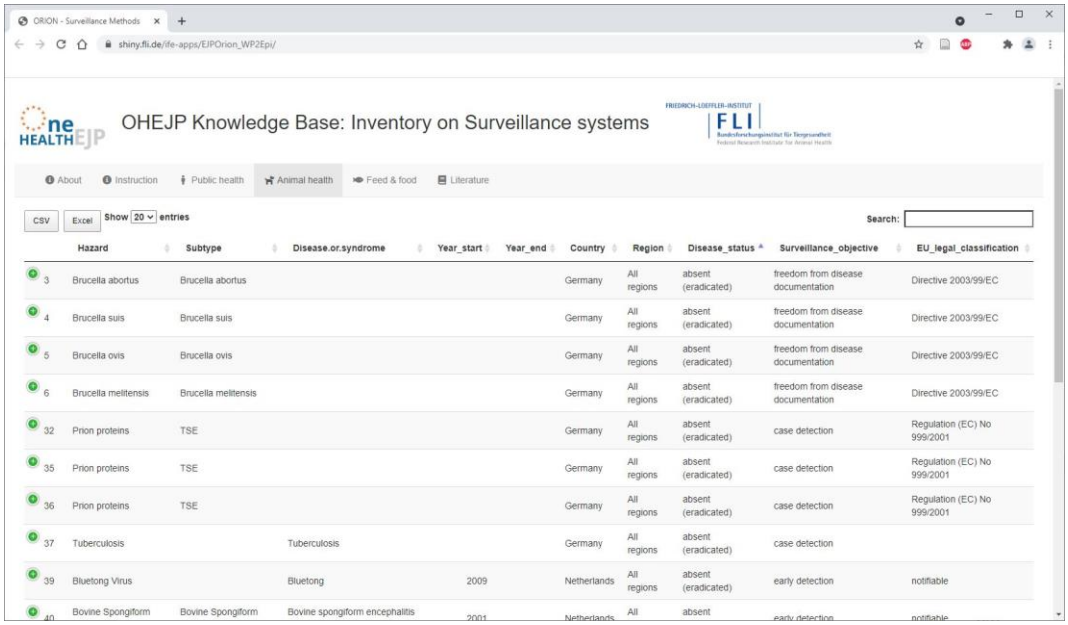

Figure 9: Screenshot OHEJP Knowledge base – Animal health 2

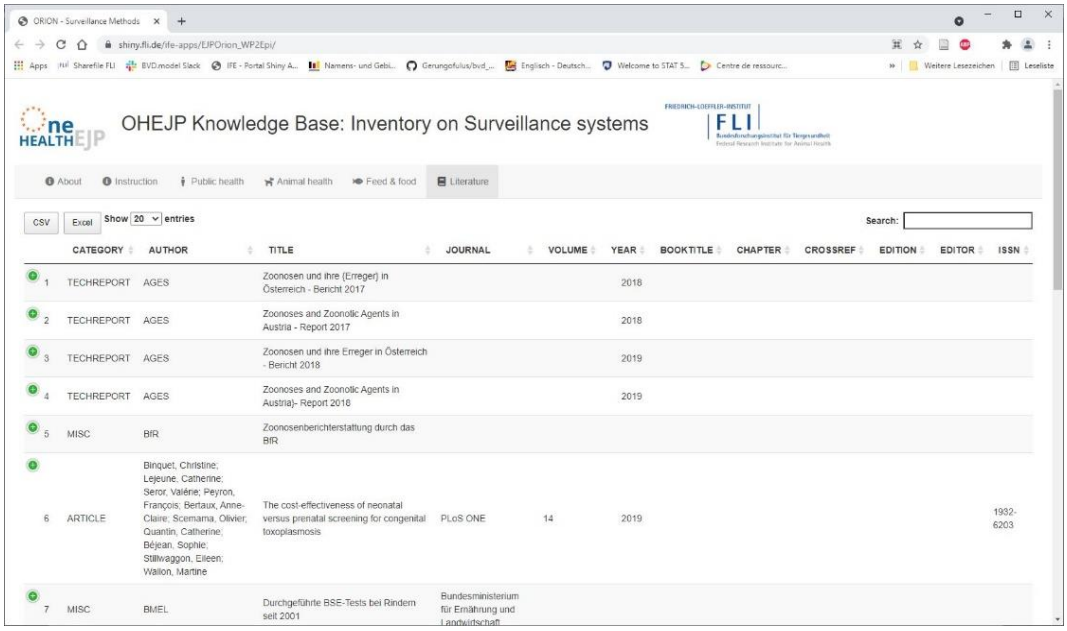

Figure 10: screenshot OHEJP Knowledge base – Literature database

Server

A public shiny server was setup at FLI (M30) and the software was tested. The software was updated several times until it was running stable.

The web application was published in M33 at https://shiny.fli.de/ife-apps/toolsdatabase/.

Results

Through the project period, we evaluated the accessibility of surveillance systems not listed in a European database and identified gaps in the exchange of knowledge between the different sectors. We developed an inventory of surveillance systems for different sectors and agreed on the datasets with EFSA and ECDC. Nevertheless, there were concerns that the inventories may duplicate existing databases and include protected data. We overcame these unfounded concerns and present all steps of the development process. We further developed a web application to present the data collected regarding surveillance systems for foodborne and zoonotic diseases. The code of the web application has been made publicly available.

The inventories are suitable for both surveillance systems and prevalence studies. The pilot studies demonstrated their suitability to different sectors and countries. Another concern was that these inventories would only be a snapshot and would not be updated. In response, we established a collaboration with EJP Matrix to proceed with the inventories at the close of the ORION project and to analyse the data contained within.

Due to a high fluctuation of personnel and the Covid-19 outbreak, the collection of the data was delayed and we were unable to implement a global search in all inventories. These limitations will be addressed within MATRIX. Nevertheless, the inventories provide a useful resource to facilitate use of surveillance in a One-health context by decision makers and scientists. To our knowledge, such a resource has not previously been available.

Pilot studies

To test the suitability of the inventory for adding a diversity of surveillance systems and other scientific studies, we tested the knowledge hub within the pilot studies (T3).

Although the pilot studies were designed to test and support the general aim of WP2Epi, in most cases the actual scope of the study was much broader and gave additional impact in the analysis of surveillance systems in Europe. In pilot study 1 (ST1), carried out by FLI and BfR we analysed in detail the role of *Toxoplasma gondii* as a zoonotic agent through literature research and systematic review. The results of this pilot study were directly added to the knowledge hub.

Other pilot studies analysed the role of Salmonella, Hepatitis E, and AMR. These pilot studies not only supported WP2Epi but other WPs as well.

For example, the pilot study carried out for Salmonella from PHE and APHA tested the flow and sharing of gene sequencing data between different sectors. This pilot was relevant for WP1, WP2Epi, WP2NGS, and WP3. In the pilot study carried out by Sciensano, all aspects of AMR reporting in Belgium were tested. This had strong links to the glossary (WP1), to WP2Int, and also to WP3. Within the pilot carried out by RIVM and WBVR, the surveillance of hepatitis E in the Netherlands was analysed. As all sectors were included, it was a good example of how to map sectors within a specific field and improve the collaboration between sectors. This pilot study informed multiple WPs within EJP ORION.
Further details about the pilot studies can be found in the pilot reports.

Lessons learned

Collaboration

Through this process we learned that a large predictor for successful collaborations stems from trust. In our case, that trust was dependent upon our collaborators feeling confident that their data would be used and presented accurately and in a way that preserved the integrity of the data. To that end, we had to be ablsolutely clear for example about how the data were going to be used, what data we were asking for (eg. only data already publicaly available), and who the audience would be. Without that transparency, the trust could not develop and subsequenlty collaboration would not be successful.

Knowledge

Through the generation of the pilots and the development of the inventories we learned the absolute importance of having an understanding of the surveillance appraoch within each of the sectors. In each sector, surveillance differed due to the different purposes for the output data (detection vs showing disease freedom vs a single study to explore prevalence), how the data were collected and so on. We also learned that vocabulary between the sectors could be different, OR could be similar but have significantly different meanings. Without this understanding it would be impossible to share, integrate, or better yet, harmonise data across the sectors. Through this process, we also learned the value of accepting the data from the different sectors for what they were and working with that. Not all data can be harmonised, but that does not mean it can not be used in a One health context, and open thinking in this area will promote progress.

Data

Through the pilot studies we gained a better understanding of the data collected in the inventories, and more generally, what data is collected for zoonotic diseases and foodborne zoonoses across the sectors. As more data are added to the inventories this understanding will continue to improve.
Our pilots studies confirmed that the inventories are sufficiently flexible to accomodate a range of data from a range of sources, and that data are easily entered and extracted.

Dissemination

It will be important to comprehensively outline and explain the utility of the data captured in the inventories and disseminate this information so that this resource is used to its maximum potential.

One major concern with respect to disseminating the data was that the inventories would only provide a snapshot of the current situation in each inventory. However, the inventories have been developed with the flexibilty for updates, and regular updates to keep the data current are expected. Furthermore, responsibility for the inventores will be assumed by the MATRIX project from 1 July 2021, to ensure the inventories persist beyond the close of the ORION project. The inventories will be used in the future within the institutions that were developing the tools.

Publications

Poster Presentation: Jörn Gethmann , Sandra Stelzer, Thomas Selhorst, Michael Weiß, Christoph Staubach, Fernanda Dorea, Christine Müller-Graf, Tasja Buschhardt, Taran Skjerdal, Karin Lagesen, Franz J. Conraths (2020): "The ORION project – OH knowledge base 'surveillance systems'", One Health EJP annual meeting 2020

Oral presentation: Johanna Dups-Bergmann, et al. (2021): "An Inventory of Zoonotic and Foodborne Disease Surveillance Systems: Expanding the One Health Knowledge Base", One Health EJP annual meeting 2021

Appendix documents

Instructions how to use the app

Within this app you will find four tabs with

- An inventory for surveillance systems in **Public health**
- An inventory for surveillance systems in **Animal health**
- An inventory for surveillance systems for **Feed & food** and
- a literature overview **Literature**

The tables are designed to give an overview on surveillance systems in different sectors (Public health, animal health, feed & food). They include information on the Hazard (= infectious agent) or the relevant disease as well as information on the country, species (or products) and the legal classification of a disease. Within the app it is possible to search within each table at any position.

We collected the data listed in these inventories by sending out Excel sheets to the partners and ask to fill it in for the partners countries. This is a good tarting point but to have a comprehensive list on surveillance systems and give as many information as possible, we ask you to give us feedback if any surveillance system is missing.

If you want to contribute, please send us additional surveillance systems by downloading the Excel sheet as well as the instructions to fill in the sheet.

Send the Excel sheet to EJP.Orion@fli.de

To easy share literature we use Zotero. You can access the library at https://www.zotero.org/groups/2204615/ejp_orion_wp2epi_data_sources_surveillance_systems. If you want to add additional resources, you can

- send a mail with the resource (citation, weblink, etc.) to EJP.Orion@fli.de or
- register as group member. Please send a mail to EJP.Orion@fli.de

You can find a **guide** how to fill in the tables at Guide to answer the Surveillance Systems Tables.pdf

You can find the table for **Public health surveillance** at Inventory on public health surveillance.xlsx

You can find the table for **Animal health surveillance** at Inventory on animal health surveillance.xlsx

You can find the table for **Feed and Food surveillance** at Inventory on food and feed surveillance.xlsx

Guide to answer the Surveillance Systems Table

Guide to answer
the Surveillance Syst

This meeting is part of the European Joint Programme One Health EJP.
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Conversion table efsa ecdc

Table 1: conversion table public health inventory and Tessy

WP2 Epi (PH) Category	ECDC (TESSy) Category	ECDC table	Sheet in Table	Comment/Decision
Hazard	[Various Subjects] Pathogen	MetaDataSet-45-(2020-0404)	Variables	Reports individual agents in 21 instances only. **DECISION: incl disease/syndromes in variable 1.3 and double check that the aetiological agents are present at variables 1.1 and 1.2 (acco to Pathogen where present)**
Subtype	[Various Subjects] Pathogen	MetaDataSet-45-(2020-0404)	Variables	Reports individual agents in 21 instances only. **DECISION: incl disease/syndromes in variable 1.3 and double check that the aetiological agents are present at variables 1.1 and 1.2 (acco to Pathogen where present)**
Disease or syndrome	Subject	MetaDataSet-45-(2020-0404)	Subjects	Include all diseases/syndromes (Subjects) from TESSy at this v
Start Date dd-mm-yyyy	not used			Use the existing variable
End Date dd-mm-yyyy	not used			Use the existing variable
Country	Countries	MetaDataSet-45-(2020-0404)	Coded Values	Currently using the NUTS system to be comparable to other d bases, but restricted to europe. **Compare the countries prese see that all are captured in our system**
Region	not used			Currently using the NUTS system to be comparable to other d bases. Keep as is for continuity with the AH survey.
Disease status	not used			**DECISION: Use existing variable but provide definitions**
Surveillance objective	NA(?)….[DS_CORESET] Comments			This data may be captured in the 'comments' section. Howeve vague variable title, therefore remain with current variable tit **DECISION: Keep current variable title and drop-down option**
EU legal classification	not used			Any disease included in the list of communicable diseases (Commission Implementing Decision (EU) 2018/945) is reporta the EU level.
National legal disease classification	[DS_CORESET] LegalCharacter	MetaDataSet-45-(2020-0404)	Variables	ECDC collects this variable simply to determine if reporting is compulsory or voluntary.
Sampling Context	[DS_CORESET] Active	MetaDataSet-45-(2020-0404)	Variables	The ECDC has a variable called Active. The description is as fol Active: The surveillance system is based on the public health officials' initiative to contact the physicians, laboratory or hos staff or other relevant sources to **report data**. Passive: The surveillance system relies on the physicians, laboratory or hos staff or other relevant sources to take the initiative to **report** the health department. AH definitions are different in that are based on the COLLECTION of data and whether it is a plan system or not, rather than the reporting of data. Discussions t to align the definitions or modify the names indicate that it is possible (JG). Although collecting essentially two different dat types is generally inadvisable, it appears necesssary to keep th different definitions as they are - but clearly state this limitati any publications and presentations of the data. **DECISION: Ke variable and drop-down options but accept that there are tw different definitions. Update the PH guide to reflect the PH definition.**

WP2 Epi (PH) Category	ECDC (TESSy) Category	ECDC table	Sheet in Table	Comment/Decision
Case definition	[DS_CORESET] CaseDefinition	MetaDataSet-45-(2020-0404)	Variables	ECDC variable collects data on whether the case definition use from the list of EU case definitions (Decision #s 2002/253/EC, IV/2008, EU-2012, 2018/945) or a national, regional etc. **DECI modify guide to reflect the EU case definitions (as drop down options) and associated wording in description. Use 'other' c and request that 'other' definition are included in free text.**
Sampling strategy	not used			TESSy does not have an equivalent sampling strategy variable. Currently using sampling strategy list adapted from EFSA for A survey. Need appropriate 'suspect sampling' definition to capt passive surveillance data capture through testing of 'suspecte disease' patients, otherwise, it appears list is appropriate for P well. **DECISION: Continue to use EFSA sampling stratgey list. Update definitions where necessary to make them appropria PH as well.**
Target species	not used			
Target Unit	not used			
Sampling stage	not used			
Sample Unit	not used			
Sample type	[Various Subjects] Specimen	MetaDataSet-45-(2020-0404)	Variables	Specimen is reported for 16 subjects and are specific to each. **DECISION: Look at sepcimen options and consider if frequent used specimen options are not captured in drop-down and s be included.**
Sampler	not used			
Website	not used			

Table 2: conversion table animal health and feed & food inventory versus EFSA DCF

WP2 Epi category	**EFSA category**	**WP2 Epi sector**	**EFSA table**	**sheet in table**	**Comment**
Hazard + Subtype	Zoonosis	AH	ZOO_FACT_DISEASESTATUS_MAN	CAT_PARAM_dst	only Brucella an Mycobacterium
Hazard + Subtype	fboAgent_param	Food	ZOO_FACT_FBO_MAN	CAT_PARAM_fdbrnag	foodborne outb rather outbreak investigation tha surveillance
Hazard + Subtype	zoonosis_param	Feed&Food, AH	ZOO_FACT_PREVALENCE_MAN	CAT_Param_microParam	compared to all Parameter lists, the most extens
Hazard + Subtype	zoonosis_param	Feed&Food, AH	ZOO_FACT_AMR_ISOLATE_AST_MAN ZOO_FACT_AMRESBL_MAN	CAT_PARAM_serovarsamr	
Country	repCountry	Feed&Food, AH	ZOO_FACT_PREVALENCE_MAN	CAT_COUNTRY	
Region	sampArea	Feed&Food, AH	ZOO_FACT_PREVALENCE_MAN	CAT_NUTS_nuts2013	
Disease status	not used				
Surveillance objective	not used				
EU legal classification	not used				
National legal classification	not used				
Initiator	sampContext	Feed&Food, AH	ZOO_FACT_AMR_ISOLATE_AST_MAN ZOO_FACT_AMRESBL_MAN ZOO_FACT_PREVALENCE_MAN	CAT_PRGTYP_zooSampContext	
Selection of units/Sampling design	progSampStrategy	Feed&Food, AH	ZOO_FACT_AMR_ISOLATE_AST_MAN ZOO_FACT_AMRESBL_MAN ZOO_FACT_PREVALENCE_MAN	CAT_SAMPSTR	
Target species	Matrix	Feed&Food, AH	ZOO_FACT_AMR_ISOLATE_AST_MAN ZOO_FACT_AMRESBL_MAN ZOO_FACT_PREVALENCE_MAN	CAT_MATRIX	
Target species	Matrix	AH	ZOO_FACT_ANIMAL_POPULATION_MAN	CAT_MATRIX_pop	compared to "CAT_MATRIX": trout"
Target unit	sampUnitType	Feed&Food, AH	ZOO_FACT_AMR_ISOLATE_AST_MAN ZOO_FACT_AMRESBL_MAN	CAT_UNIT_amrsmpUn	
Target unit	Unit	AH	ZOO_FACT_ANIMAL_POPULATION_MAN	CAT_UNIT_popUn	compared to "CAT_UNIT_amr ": + "Beehives", "slaughter anim batch"

WP2 Epi category	**EFSA category**	**WP2 Epi sector**	**EFSA table**	**sheet in table**	**Comment**
Target unit	sampUnit	AH	ZOO_FACT_PREVALENCE_MAN	CAT_UNIT_smpUn	compared to "CAT_UNIT_amr ": - "slaughter a (heads)"
Sampling point	sampStage	Feed&Food, AH	ZOO_FACT_AMR_ISOLATE_AST _MAN ZOO_FACT_AMRESBL_MAN ZOO_FACT_PREVALENCE_MAN	CAT_SAMPNT_zooss	
Sampling unit	not used				
Sample type	sampType	Feed&Food, AH	ZOO_FACT_AMR_ISOLATE_AST _MAN ZOO_FACT_AMRESBL_MAN ZOO_FACT_PREVALENCE_MAN	CAT_SMPTYP	
Sampler	Sampler	Feed&Food, AH	ZOO_FACT_AMR_ISOLATE_AST _MAN ZOO_FACT_AMRESBL_MAN ZOO_FACT_PREVALENCE_MAN	CAT_SAMPLR	

Pilot Summary – WP2Epi-T3-ST1

Responsible Partner: FLI

Contributing partners: BfR

WP2EPI: *TOXOPLASMA GONDII* PILOT STUDIES

1. Background

Within Work Package 2 of ORION (WP2), which aimed at establishing a One Health Knowledge Hub, the subtask WP2Epi focussed on collecting and describing “classical One Health” and “associated One Health” surveillance data and tools. To do so, WP2Epi developed two cross-domain inventories: the ‘Surveillance Inventory’ and the ‘Tools and Methods Inventory’. The ‘Surveillance’ inventory aimed to collate data on all the One Health associated surveillance systems from public health, animal health and feed/food safety across EU member states in the one platform; and the ‘Tools and Methods Inventory’ aimed to collect data on One Health surveillance tools and methods.

To test the inventories and demonstrate their practical application we chose to use the pathogen *Toxoplasma gondii* as a pilot study test subject. This was a logical choice given that *T. gondii* is a zoonotic hazard, and features in all areas of the One Health concept targeted by ORION.

T. gondii is a zoonotic parasite that uses felids, such as wild and domestic cats, as the definitive host. Following infection, the parasite completes its lifecycle and the definitive host sheds infective oocysts for a short time (sexual cycle). The oocysts are stable, and thus remain viable and infective in the environment for a long time. Environmental oocysts are then ingested by the definitive host to repeat the sexual cycle described above, or ingested by intermediate hosts (necessarily non-felid). Following ingestion by intermediate hosts, the parasite localises to tissues, such as muscle and neuronal tissues, and forms infective cysts (asexual cycle). When these cysts are ingested by either definitive or intermediate hosts the sexual and asexual lifecycles continue respectively.

Logically, the natural prey of cats, such as rodents or birds, are the most common intermediate hosts of the parasite. However, any mammalian species is theoretically susceptible, and infection of livestock species with *T. gondii* is not uncommon. In livestock species, the relevance of the infection is most notable in small ruminants where it is a major cause of abortions.

Humans are another intermediate host of *T. gondii.* Infection in humans most commonly occurs by one of three routes: exposure to oocysts through handling of infected cats and their faeces; exposure to infective oocysts through contact with soil whilst working outdoors; and exposure to infective cysts through the consumption of raw or undercooked meat from infected livestock species.

In humans, infection usually presents as mild, flu-like symptoms and often goes unnoticed. However, in some high-risk patients, such as young, old, pregnant or immune-suppressed persons (commonly referred to as YOPI’s), the outcome of an infection can be more severe. This is particularly true for pregnant women where infection can lead to still birth, miscarriage and congenital/developmental defects in the child.

The relevance of T. gondii not only to public health, but also to animal health and food/feed safety, makes it a well suited subject for a pilot study, to test the ‘Surveillance’ and ‘Tools and Methods’ inventories of the One Health Knowledge Hub. Using *T. gondii* also allowed us to collect useful and clinically relevant data as a natural collateral outcome of testing the inventories.

The overall goals of the pilot studies were to test: our ability to extract information from the inventories, the ease of entering data into the inventories, and the applicability of the inventories using *T. gondii* as the test subject.

To that end, we develop three individual studies to meet those goals:

1. Inventory query
   To analyse and describe the data on *T. gondii* surveillance provided in reports from the different sectors captured in the surveillance inventory. *This study addresses the 'ability to extract data from the inventory' and 'applicability of the inventories' goals.*
2. Systematic review
   To systematically review the literature on seroprevalence data and risk factors for *T. gondii* infection in relevant livestock species and add these data to the surveillance inventory. *This study addresses the 'ease of entering data' goal.*
3. To analyse and compare data on *T. gondii*-seroprevalence in participants of the "Status of Health in Pomerania" (SHiP) study with the national cohort (Wilking et al, 2014) using tools from the developed inventories. *This sutdy addresses the 'ease of entering data' goal.*

By completing these studies, we expected to address the overarching goals and produce three outputs: a paper describing risk factors for T gondii infection in livestock animals, a report describing the data available for T gondii surveillance in the inventories, and lastly produce a paper comparing *T. gondii*-seroprevalence in participants of the "Status of Health in Pomerania" (SHiP) study with the national cohort.

2. The studies

2.1 Inventory query

The objective of this study was to identify, extract and analyse the data on *T. gondii* surveillance provided in reports from the different sectors captured in the surveillance inventory. *This study addresses the 'ability to extract data from the inventory' and 'applicability of the inventories' goals.*

Activities performed

To address the objective, we searched all four sectors, Animal health, Public health, Feed & food and Literature within the inventory (https://shiny.fli.de/ife-apps/EJPOrion_WP2Epi/). We used the search function available and extracted search results into Excel using the Excel extraction option provided within the shiny app. We then analysed the data. The results are summarised below.

Results/Discussion

We used the search function within the inventory to identify any entries related to *Toxoplasma gondii* in each of the sectors. We found that we could not perform one search to interrogate all sectors at the same time, rather, we needed to perform a separate search for each sector, extract the data, and then combine all the results for an overall picture. The results of this process are presented in Table 1.

Table 1 Number of surveillance systems or literature entered for Toxoplasma gondii in the surveillance systems inventory.

Sector	Public health	Animal health	Feed & food	Literature
Number of entries	2	1	0	12

Altogether, two surveillance systems for *Toxoplasma gondii* were reported in Public heatlh, one in Animal health and none in Feed and food safety. There were twelve literature entries associated with *Toxoplasma gondii* in the literature section. All three *Toxoplasma gondii* surveillance systems identified in the inventories were from the same one Member state. Table 2 presents the total number of member states that have provided complete or partial data on zoonotic and food-borne diseases under surveillance, and suggest we should have found more entries for *Toxoplasma gondii* surveillance systems in our search of the inventories. Additionally, Human congenital *Toxoplasma gondii* infections are required to be reported to ECDC, so it is clear that these surveillance systems must exist. However, although *Toxoplasma gondii* is a zoonotic pathogen, in this case transmission occurs from the infected mother to the unborn child and therefore, does not occur within a zoonotic context. For that reason, it is not surprising that these surveillance systems were not reported by the other MS for Public health. Having said that, in some MS, screening programs for *Toxoplasma gondii* infection in pregnant women are in place, and in those instances we would expect these programs to be entered into the inventories as infection would most likely have occured within a zoonotic/foodborne context. At this time, those MS have not contributed data, but we expect to see these data soon.

Table 2 Number of individual Member states that provided data on zoonotic and foodborne diseases under surveillance.

Sector	Complete Responses	Partial Responses
Public Health	3	2
Animal Health	3	2
Food Safety	2	1
Total	8	5

There is no EU regulation that requires the surveillance and monitoring of *Toxoplasma gondii* infection in animals. However, the latest EU One Health Zoonoses report[1] states that fifteen EU MS and non-MS provided *Toxoplasma gondii* monitoring data in livestock. Of these fifteen, four provided Animal health data to our inventories, which suggests that we should have found more surveillance systems for *Toxoplasma gondii* infection in our Animal health inventory. This finding requires further investigation to fully understand the reasons these surveillance systems were omitted. A possible explanation is that they were simply overlooked as a zoonotic or foodborne pathogen due to the fact that *Toxoplasma gondii* is also a legitimate animal health pathogen considering its potential to considerably impact on production.

Although searching within sectors was easy and intuitive, the inability to search for a term across all sectors at once, decreased the efficiency of extracting data from the system, and likely the acceptability of the system to the users. Through this pilot, we have identified, and can rectify, this limitation.

Outlook

The findings of this study have been discussed with members from WP1 of the Matrix project who will assume responsibility for the inventories as of 1 July 2021. A work program is in place to determine the reason why *Toxoplasma gondii* surveillance systems reported to ECDC were not reported to the inventories. This information will shape subsequent modifications to the system to avoid missing these data in the future. It is likely the reason these systems were omitted will apply to other pathogens, and therefore, addressing the cause will result in a more complete inventory.

Programming has already begun to provide a function within the inventories that allows a term to be searched for and extracted across all sectors at once.

2.2 Systematic review

The objective of this study was to systematically review the literature on seroprevalence data and risk factors for *T. gondii* infection in relevant livestock species and add these data to the surveillance inventory. *This objective addresses the 'ease of entering data' goal.*

Activities performed

To address objective 2, we first established the review question: *What is the relationship between on-farm hypothetical risk factors and T. gondii infection in pigs, bovines, sheep, goats, chickens, turkeys, horses and/or ponies?* We then created an *a priori* protocol for: the identification of records potentially relevant to the review question; the screening process; and the final extraction process. Initially three data bases, Embase, Medline and Biosys were systematically searched in two steps covering the periods from 2013 – August 2018 (A) and August 2018- November 2020 (B). Potentially relevant records were identified using purpose specific search strings developed in consultation with library support personnel. The records were combined and de-duplicated.

The final libraries of identified records from periods A and B were then systematically and sequentially screened for relevance to the research question through Title, Abstract, and Full text screenings. At each screening stage, a team of 12 (records A) and 11 (records B) screeners were assigned a proportion of the records, and asked to answer a set of specific questions for each. These questions represented the exclusion and inclusion criteria determined prior (and described in the a priori protocol) to beginning the study. Table 3 describes the questions that were to be answered at each screening round. Records were then excluded or included based on the answers provided by two to three different screeners at each screening stage (see Figure 1). All literature remaining after the full screening process was

completed underwent quality assessment and data extraction according to a prescriptive data extraction form.

Table 3 Screening questions

Screening round	Title and Abstract	Full Text
Inclusion criteria (n=remove)	Is the record a peer-reviewed publication, PhD or doctoral thesis?	Is the record a peer-reviewed publication, PhD or doctoral thesis?
	Does the record present original data?	Does the record present original data?
	Is the record about *Toxoplasma gondii*?	Is the record about *Toxoplasma gondii*?
	Is the record about relevant animal species?	Is the record about relevant animal species?
	Is the record about the assessment of risk/protective factors?	Is the record about the assessment of risk/protective factors?
Exclusion criteria (y=remove)		Is the record a case report only?
		Does the record contain no data driven assessment of on farm risk/protective factors?
		Are risk/protective factors reported based on experimentally infected animals only?
		Is the study not conducted under European husbandry conditions (NB. Not all studies from non-European countries should be excluded, only when the husbandry condition are clearly different e.g. because of incomparable climatic conditions or exotic breeds)?

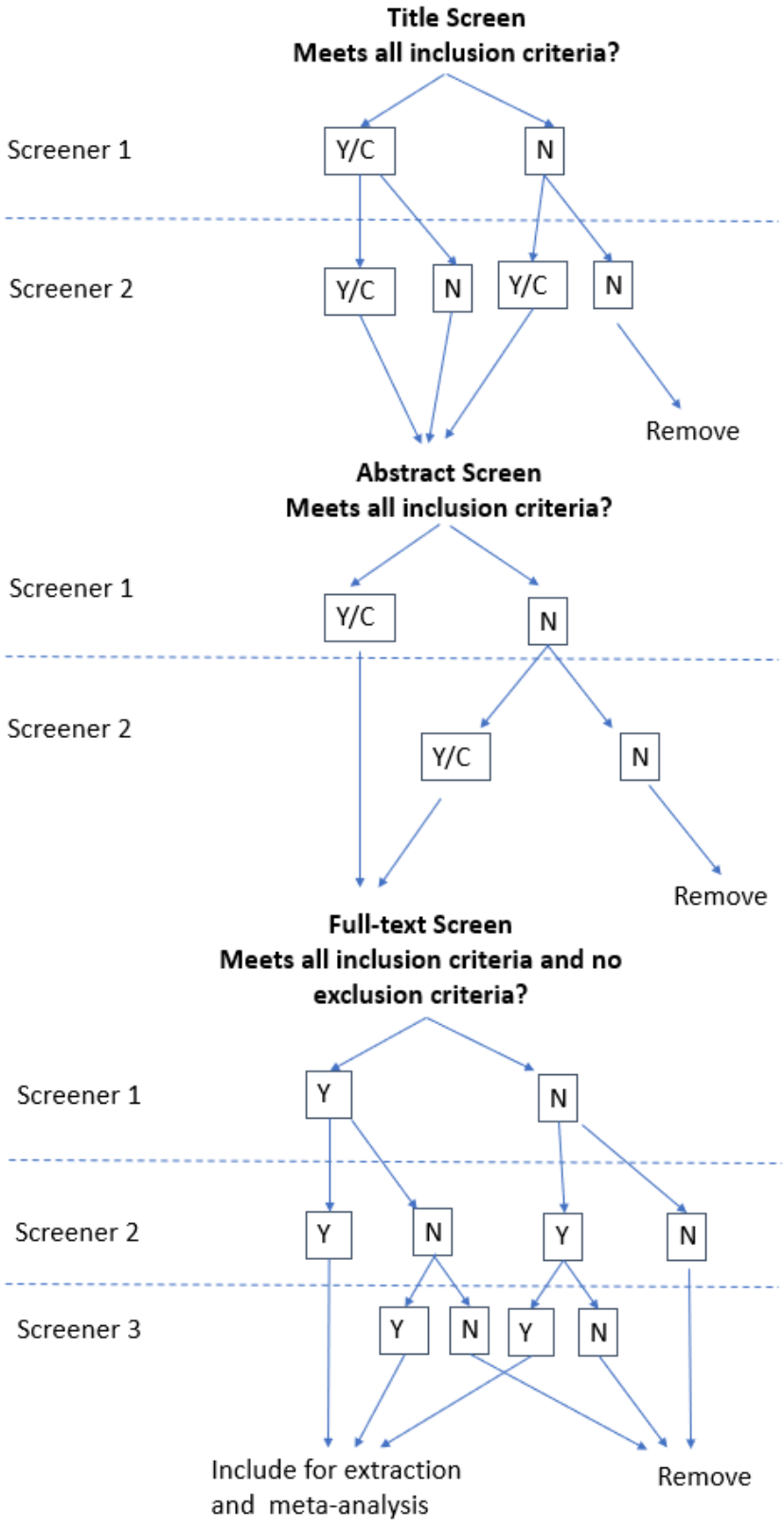

Figure 1 Screening process. A proportion of records were assigned to screeners at each screening stage (bold). Screeners could answer questions related to the inclusion and/or exclusion criteria giving an overall result for each record of Y (yes), N (no) or (C) can't tell. Records progressed through the process as depicted based on the results at each stage of the screeining process.

The extracted data were reviewed, cleaned, categorized and an analysis plan developed to assess the risk factors for *T. gondii* infection in livestock.

In a last step, we included records, identified and screened in an earlier published EFSA study (https://efsa.onlinelibrary.wiley.com/doi/abs/10.2903/sp.efsa.2016.EN-996). This study identified records from 1994-2013 using the same review quesion, databases, search strings, and screening method, meaning that incorporating these records into our library was appropriate. More importantly, including these records was beneficial as it extended the period under investigation.

Results/Discussion

Following de-duplication, 868 references possibly relevant to the research question were identified from period A (January 2013 to August 2018). Following title screening 313 references were excluded, 282 following abstract screening, and 174 following full-text screening, leaving a total of 95 references for data extraction and analysis, see Figure 2.

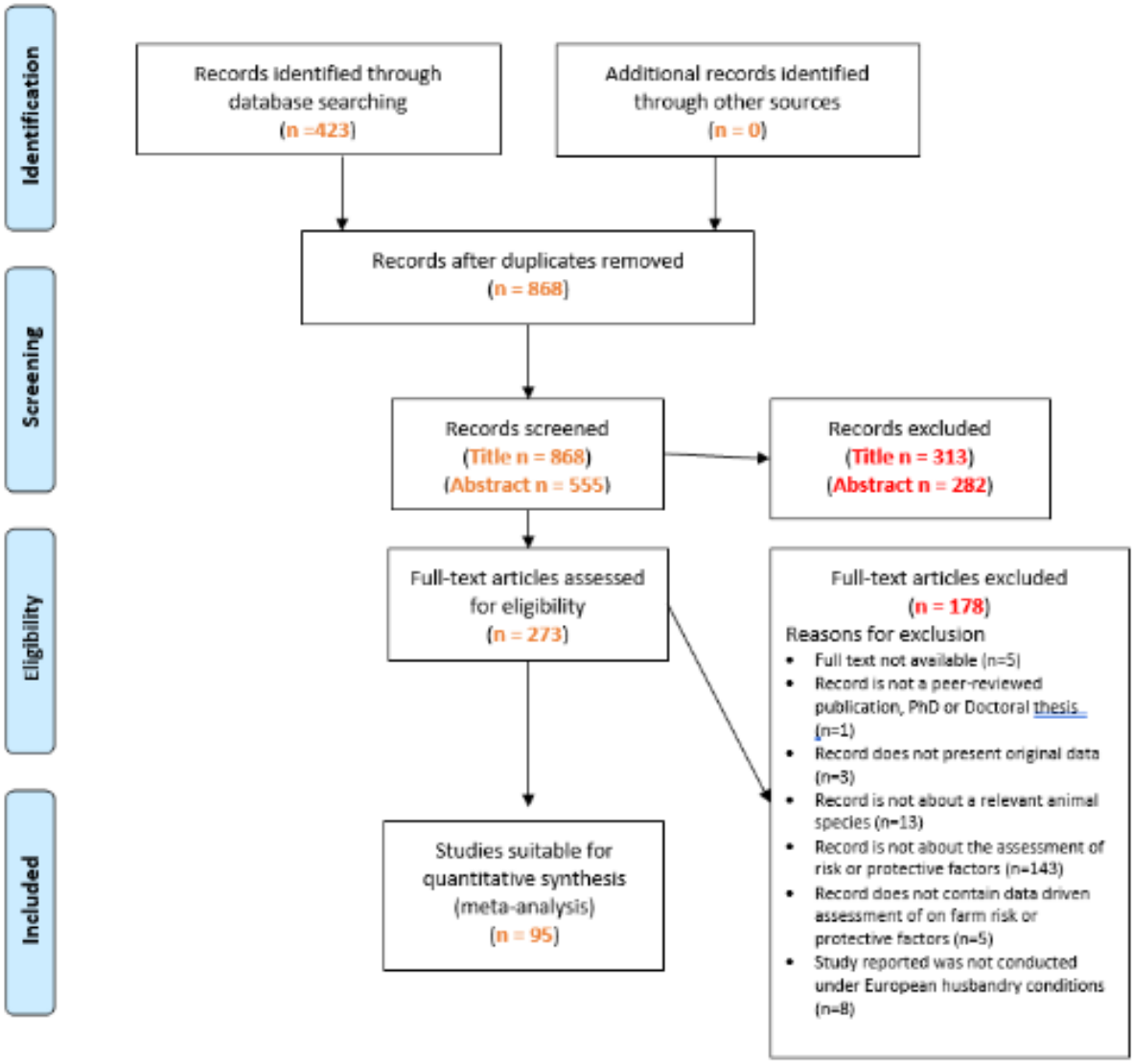

Figure 2 Flow diagram of screening process and results of records identified from 2013 to August 2018

These records formed the basis of a narrative review exploring the risk factors and economic impact for Toxoplasmosis in farm animals [2].

Due to loss of personnel in mid-2019, further work did not progress on the project until a new staff member was recruited mid-2020. Extraction and analysis of initial literature resumed, however, given the considerable period of time since the last search was performed it was decided to update the literature search. The protocol for the original literature search was used to search Embase and Medline from August 2018 to November 2020 and an additional 358 references possibly relevant to the research question were identified. Following title screening 171 references were excluded, 98 following abstract screening, and 56 following full-text screening leaving a total of 33 references for data extraction and analysis, see Figure 3.

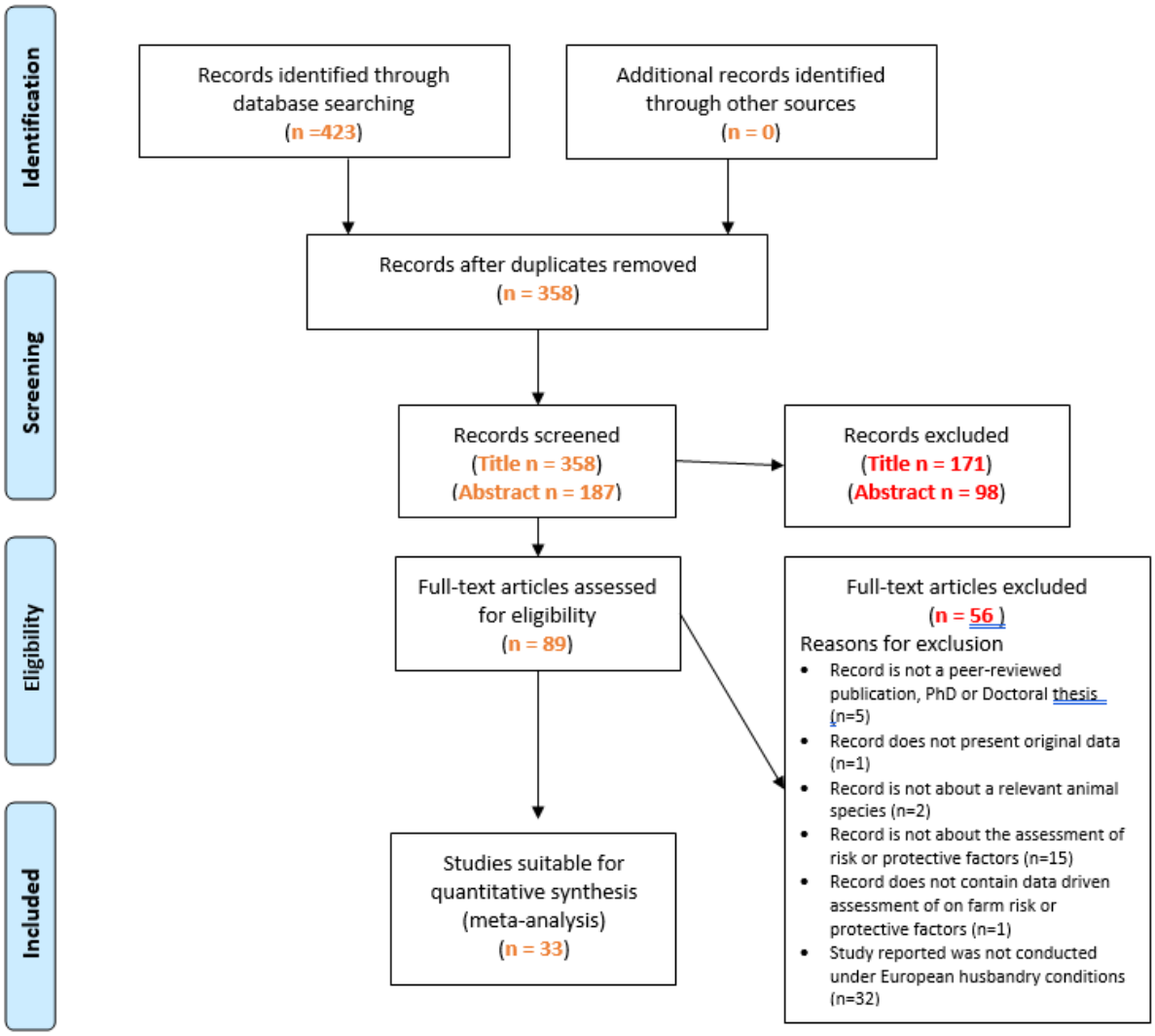

Figure 3 Flow diagram of screening process and results of records identified from August 2018 to November 2020 (records B)

All together our search and screening efforts resulted in 128 records identified as potentially relevant to the systematic review question. When these records were combined with those identified in the EFSA study (n=41), the total number of records rose to 169. We entered all records into the surveillance inventories '*Literature*' section,.

Preliminary descriptive analyses of extracted data

Data extraction is over 70% complete with data extracted from 124 of the 169 records identified as relevent to the review question. Preliminary descriptive analsyses of these data are presented below.

Figure 4 shows the distribution of records identified as relevant to the review question by year of publication. There is a discernable increase in the number of records published over time. This may reflect increasing awareness of the importance of *T. Gondii* as a zoonotic and food-borne pathogen in human health, leading to greater interest in determining risk factors for infection.

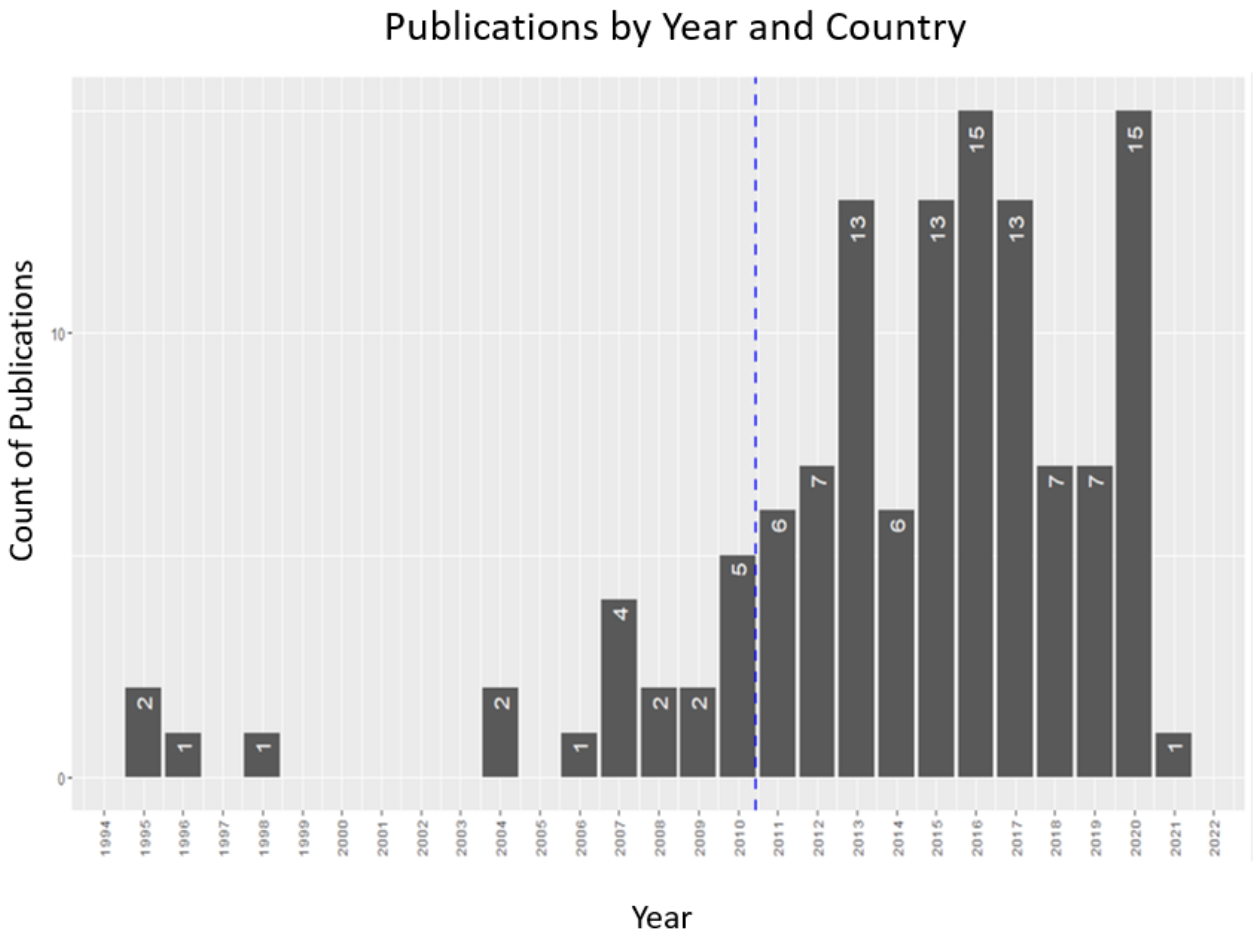

Figure 4 Studies relevant to the review question by year of publication

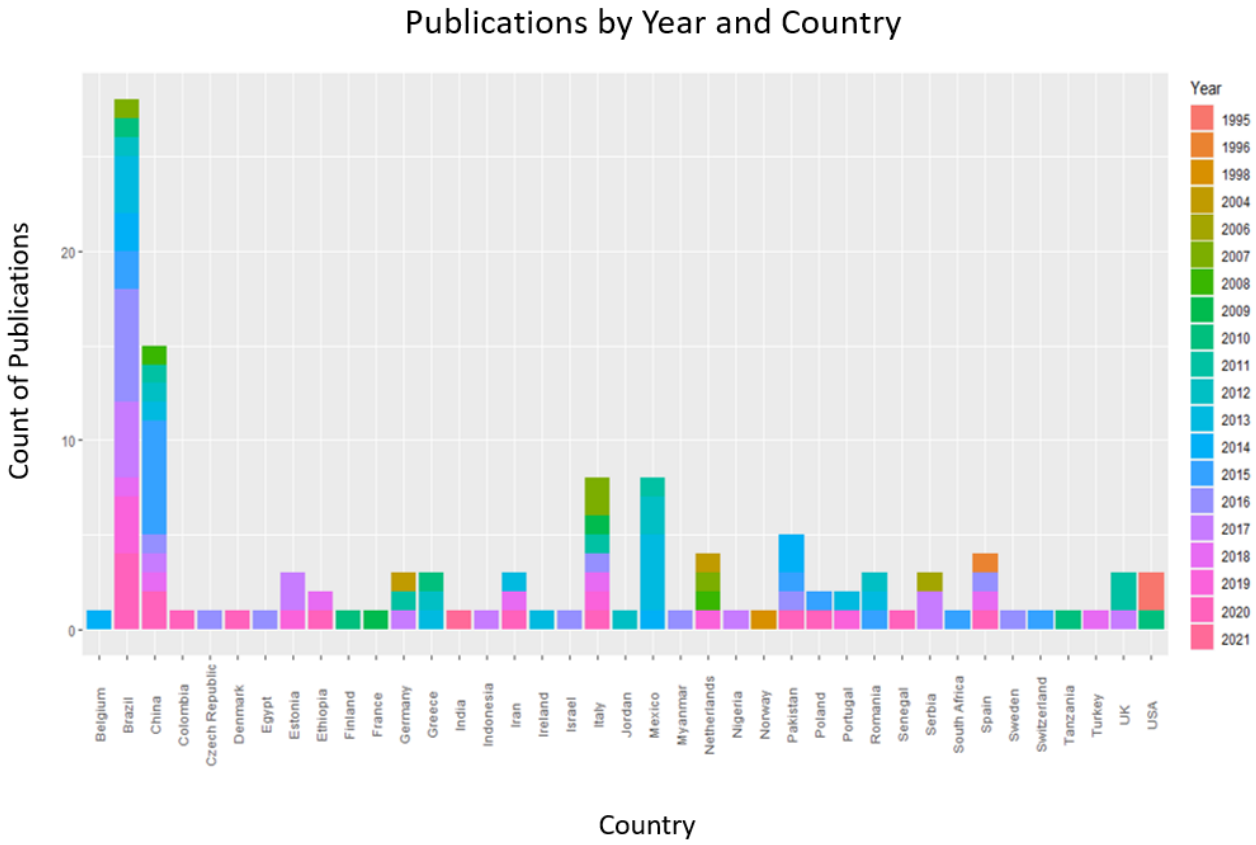

Figure 5 Studies relevant to the review question by year of publication and country where the study was performed

Studies conducted in Brazil were over-represented in our records (Figure 5). However, these data are consistent with the fact that Brazil is described as a 'hot-spot' for *Toxoplasma gondii* outbreaks in humans[3,4] , likely leading to more intense research efforts. The collection of records from Brazil are unlikely to represent all records from this country, as our screening protocol required studies from outside Europe to reflect similar husbandry and climatic conditions to Europe. This requirement will have precluded studies from central to northern areas of Brazil where the climatic conditions are considerably different to any in Europe.

Overall, 35 of the records included for extraction described studies conducted in Europe. Of the 17 European countries represented, the highest number of studies were conducted in Italy (n=4), with most countries only reporting one study (n=10).

For the purpose of the review, only the following livestock species were considered: pigs (domestic only), cattle (Bos taurus taurus breeds only), small ruminants (domestic sheep and goats only), poultry (domsetic chickens and turkeys only) and horses or ponies. In Table 4 we see that small ruminants and pigs were most frequently studied in the records that we identified as relevant to the review question.

Table 4 Number of publications identified as relevant to the review question broken down by species studied

Species	Number of publications*
Pigs	30
Cattle	15
Small ruminants	61
Poultry	18
Horses and Ponies	12
*Note number of publications is greater than 124 as two or more species may be represented in a single publication	

We then looked closely at the risk factors for *T. gondii* infection studied in all the records. For initial analysis and assesment the risk factors were broadly grouped into 34 categories. The categories are listed in Appendix A. Figure 6 describes the number of publications studying factors related to each of the risk factor categories. The three highest studied risk factor categories were age, sex and cat parameters. These were unsurprising considering the life cycle of the pathogen and expected confounders.

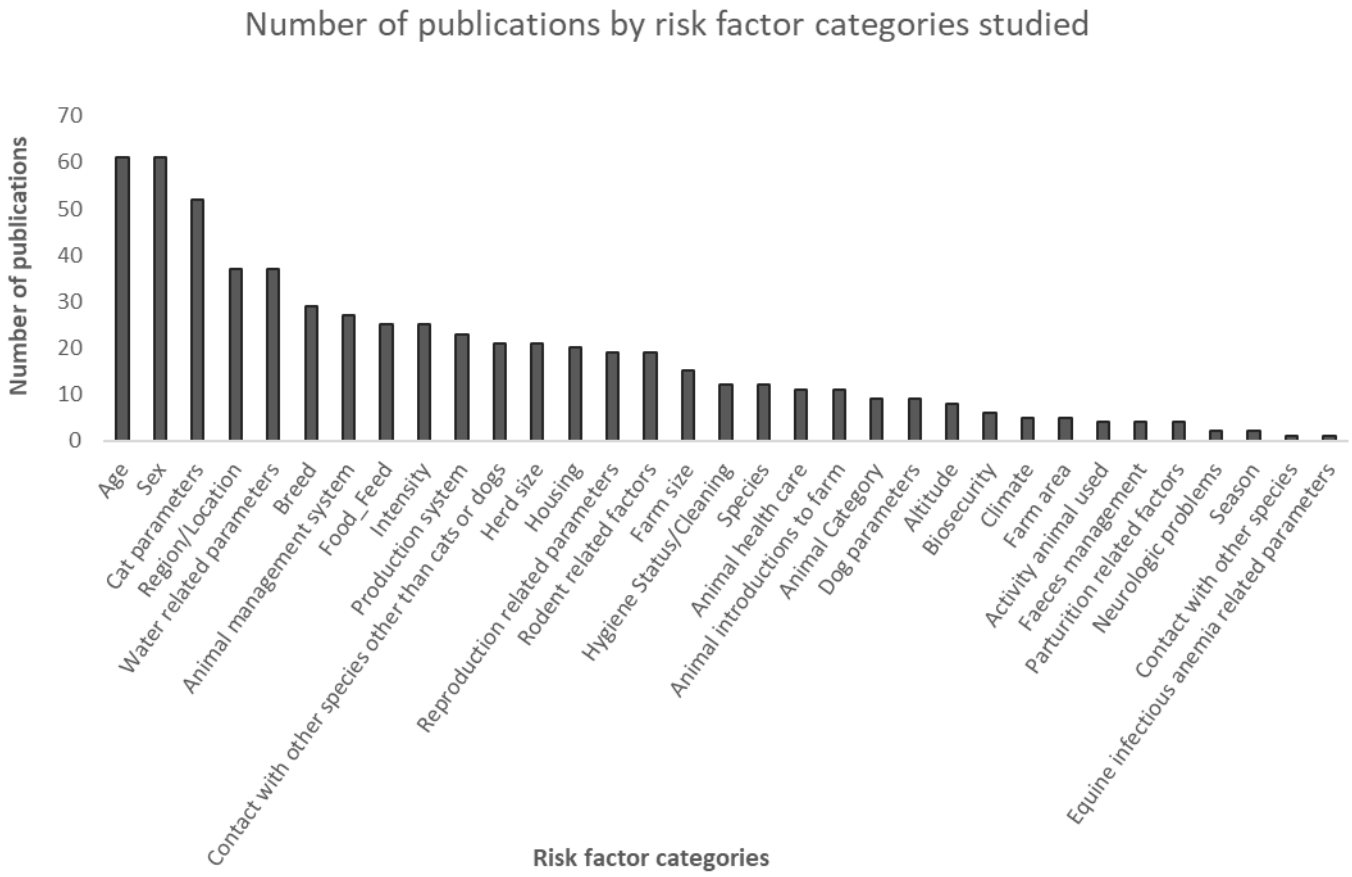

Figure 6 Number of publications by risk factor categories studied

For the purpose of subsequent meta-analysis, we then explored the number of publications that provided complete raw data and/or summary data describing associations between the risk factors studied and infection with *T. Gondii*. We broke these down by species, to understand how best to target our resources for meta-analysis. Table 5 demonstrates, that resources may be best targeted to small ruminants inititally where most publications with complete data-sets exists. Further exploration is needed

to understand whether combinable risk factors are described by these data, nonetheless, these results provide a sensible starting point.

Table 5 Number of publications with complete raw and/or summary data sets broken down by species

Species	Pigs	Cattle	Small Ruminants	Poultry	Equids
Total Publications	30	15	61	18	12
Total Publications with complete data	20	12	50	13	8
Publications with complete raw data only	12	4	26	11	7
Publications with complete summary data only	6	6	15	1	1
Publications with complete raw and summary data	2	2	9	1	-

Summary

Through this objective we were able to test the ease of entering data into the inventories. We entered all 169 records, with little difficulty and were able to demonstrate that the process was intuitive. No improvements could be identified from this activity.

We further provided descriptive anaylses of the data extracted from each record.

Outlook

Although the goal of this pilot study, *to test the ease of entering data into the inventories*, was achieved, we will continue to work with these data to identify important and significant risk factors for *T. gondii* infection in livestock species by meta-analysis. In that way, this pilot will not only have contributed to testing the relevance and operational aspects of the inventories, but will also provide translational information for indirectly protecting humans from *T. gondii* infection through protecting livestock species.

2.3 SHiP study

The objective of this study was to compare *T. gondii*-seroprevalence data in participants of the "Status of Health in Pomerania" (SHiP) study with that of the national cohort (Wilking et al, 2014). *This study addresses the 'ease of entering data' goal.*

Activities performed

To address the objective we approached administrators of the "Status of Health in Pomerania" (SHiP) study and discussed our planned study. We also reviewed sample data to understand the data set we would receive and any limitations that needed consideration.

Results

Agreements were put in place to access *T. gondii*-seroprevalence data on participants of the "Status of Health in Pomerania" (SHiP) study when needed.

Initial review of the data identified a limitation with the testing approach for *Toxoplasma gondii* infection in study participants. Study participants were tested for current or previous *Toxoplasma gondii* infection at study commencement and then again 5, 11 and 17 years later. Although this provided a longitudinal description of *Toxoplasma gondii* infection in participants, the analytical tests used at each sampling timepoint were not necessarily the same. Given inherent differences in test performance, the variability in the tests used, introduced limitations to calculating prevalence over time. Discussions are ongoing to investigate whether bio-samples for each of the study participants (which are available) can be re-tested in a consistent manner, and the strategy for doing so eg. at all sampling times, or only select sampling times.

Outlook

Due to pesronnel movement and subsequent lack of personnel reosurces this study has not progressed further. However, given the potential impact of the results we plan to continue when more resources become available

3. Implementation and impacts

With these pilots we have been able to test the ease of data input into the inventories and extraction from the inventories. The pilots also demonstrated the practical applications of the inventories, and suggests that these inventories should have a considerable impact in easing access to the broad, though sometimes difficult to access, array of surveillance systems and data available for zoonotic and food borne diseases across Europe. Improved access to these data will facilitate One Health approaches to disease management.

Through these pilot projects we have also been able to test the ORION glossary, an outcome of WP1, against the definitions needed for the inventories. The glossary is a living document and adjustments can be made as needed leading to ongoing improvements.

4. Reflections on the OH perspective

4.1 The OH evaluation matrix

To our knowledge, prior to developing the inventories there was no harmonised European union wide platform to search for existing national surveillance systems in foodborne and zoonotic disease, or to enter surveillance data on foodborne and zoonotic diseases. In developing the inventories we hoped to address these issues, amongst others. Through the pilot studies we confirmed that accessing One Health surveillance data through the inventories was easy and intuitive, although it would be improved with an inbuilt extraction option. We also found the data input process efficient and logical.

4.2 Lessons learned under each relevant principle in the OHS Codex:

Collaboration

Within these pilots we collaborated with people from both within ORION, and from MATRIX and TOXOSOURCES. Only through these collaborations were we able to screen all the records, and understand the data accurately within the sectoral framework.

Data

Through the pilot studies we were able to ‘ground truth’ the comprehensiveness of the data contributed to the surveillance inventories. The omission of *Toxoplasma gondii* monitoring systems in the Animal health inventory showed us the possibility of pathogens being overlooked as zoonotic in favour of another categorisation (in this case ‘animal health pathogen’). This was an important lesson, as it highlighted the different ways that pathogens may be percieved within sectors and, therefore, omitted from our inventory, or worse yet, overlooked as a candidate for One heatlh consideration.

Dissemination

Through the first pilot study, we identified that the lack of a search function that allowed the user to query a seach term across all the sectors, affected the acceptability of the system to the user. This lack of acceptability would likely impact on dissemination of the surveillance inventories for two reasons. First, users may be less likely to return and use the inventories again. Second, users may be less likely to encourage or promote the system to other potential users. We learned of this limitation through the pilot studies and have been able to put a work-plan in place to rectify it.

4.3 SWOT-like considerations for

Process	Max 2-3 points in each
Things that worked very well during the study	• Collaboration
Things that were difficult or didn't work well during the pilot study	• Personnel movement
Outcome/product	
Prospects for implementation of the pilot study outcome and further development opportunities	• A a cross-sectoral search and extraction function in the data platform for the inventories has been incorporated
Expectations that were not fulfilled and/or barriers for uptake	

5. References

1. EFSA and ECDC (European Food Safety Authority and European Centre for Disease Prevention and Control), 2021. The European Union One Health 2019 Zoonoses Report. EFSA Journal 2021;19(2):6406, 286 pp. https://doi.org/10.2903/j.efsa.2021.6406
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6. Annex: List of publications, presentations

Publications

1. S. Stelzer, W. Basso, J. Benavides Silván, L.M. Ortega-Mora, P. Maksimov, J. Gethmann, F.J. Conraths, G. Schares. **Toxoplasma gondii infection and toxoplasmosis in farm animals: Risk factors and economic impact.** Food and Waterborne Parasitology, 15 (2019), pp.1-32

Presentations/Posters

1. Dups-Bergmann, Johanna; Opsteegh, Marieke; Gethmann, Jörn; van der Giessen, Joke; Conraths, Franz; Sauter-Louis, Carola; Maksimov, Pavlo; Györke, Adriana; Guitan, Javier; Katzer, Frank; Spano, Furio; Klun, Ivana; Stelzer, Sandra; Jokelainen, Pikka; Schares, Gereon. **Systematic review and meta-analysis of risk factors for Toxoplasma gondii infection in**

livestock species raised for human consumption. One health European Joint Program Annual Scientific Meeting, (Copenhagen) 2021.06.9-11 https://ohejp2021.com/abstracts-1

2. Stelzer, Sandra; Opsteegh, Marieke; Conraths, Franz; Gethmann, Jörn; Maksimov, Pavlo; Sauter-Louis, Carola; Györke, Adriana; Spano, Furio; Guitan, Javier; Katzer, Frank; Klun, Ivana; Schares, Gereon. **Risk factors for Toxoplasma gondii infection in farm animals : A systematic review.** One Health EJP Annual Scientific Meeting , 1 (Dublin) : 2019.05.22-24, https://www.openagrar.de/receive/openagrar_mods_00055332
3. Stelzer, Sandra; Opsteegh, Marieke; Conraths, Franz; Gethmann, Jörn; Maksimov, Pavlo; Sauter-Louis, Carola; Györke, Adriana; Spano, Furio; Guitan, Javier; Katzer, Frank; Klun, Ivana; Schares, Gereon. **Risk factors for Toxoplasma gondii infection in farm animals. A Systematic Review and Meta-Analysis**. 2019. Junior Scientist Symposium ; 8 (Jena) : 2019.09.25-27, Solutions for Future - Upcoming challenges in animal and human health (2019), S. 51, https://www.openagrar.de/servlets/MCRFileNodeServlet/openagrar_derivate_00023422/SD201951448.pdf

WP2 EPI – Pilot project 3

Towards a One Health surveillance of hepatitis E in the Netherlands

Responsible Partner: 31-RIVM, 30-WBVR
Contributing partners: 31-RIVM, 30-WBVR

GENERAL INFORMATION

European Joint Programme full title	**Promoting One Health in Europe through joint actions on foodborne zoonoses, antimicrobial resistance and emerging microbiological hazards**
European Joint Programme acronym	**One Health EJP**
Funding	**This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 773830.**
Grant Agreement	**Grant agreement n° 773830**
Start Date	**01/01/2018**
Duration	**60 Months**

DOCUMENT MANAGEMENT

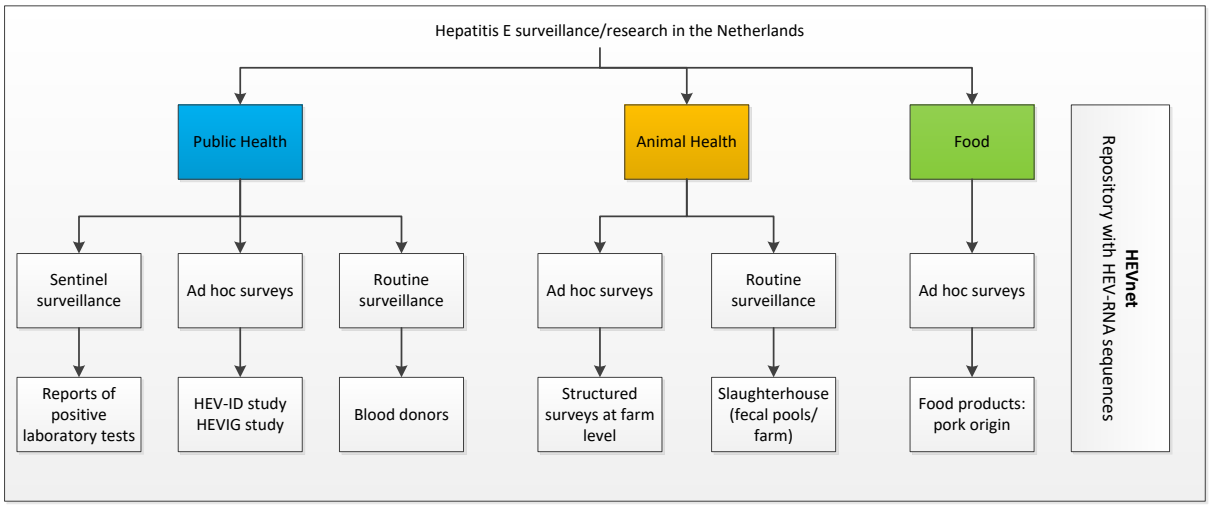
Title OHEJP deliverable	P**ilot study report**
WP and task	W**P2, T-2EPI.3**
Authors	A**nita Dame, WBVR; Ingrid Friesema, RIVM**
Other contributors	José Gonzalez, WBVR
Due month of the deliverable	M42
Actual submission month	M39
Type *R: Document, report* *DEC: Websites, patent filings, videos, etc.; OTHER*	R **Save date**: 24-Mar-21
Dissemination level *PU: Public (default)* *CO: confidential, only for members of the consortium (including the Commission Services).*	PU *See updated Grant Agreement*
Dissemination *Author's suggestion to inform the following possible interested parties.*	OHEJP WP 1 ☒ OHEJP WP 2 ☒ OHEJP WP 3 ☒ OHEJP WP 4 ☒ OHEJP WP 5 ☒ OHEJP WP 6 ☒ OHEJP WP 7 ☒ Project Management Team ☒ Communication Team ☒ Scientific Steering Board ☐ National Stakeholders/Program Owners Committee ☒ EFSA ☒ ECDC ☒ EEA ☐ EMA ☐ FAO ☐ WHO ☐ OIE ☐ Other international stakeholder(s): …… Social Media: ..... **Other recipient(s):** .....

TOWARDS A ONE HEALTH SURVEILLANCE OF HEPATITIS E IN THE NETHERLANDS

1. Background

Incidence of (reported) hepatitis E in humans increased in the Netherlands in 2014 and remained high since then. Five institutes are involved in Dutch surveillance and research of hepatitis E in humans, animals and food: Wageningen Bioveterinary Research (WBVR), National Institute for Public Health and the Environment (RIVM), Sanquin (blood supply), and Dutch Food Safety Authority (NVWA) together with Wageningen Food Safety Research (WFSR). Furthermore, RIVM coordinates and maintains HEVnet with support of the ECDC: a laboratory network of hepatitis E virus (HEV) experts across Europe, collaborating to perform supranational studies and sharing a joint repository containing molecular and epidemiological data of hepatitis E virus. Around 27 institutes in 12 European countries, including the Dutch institutes, working on HEV in public and veterinary health, environment as well as food and blood safety are contributing to this database. The HEVnet database provides access to more than 700 HEV sequences from acute patients, positive human blood donors without clinical signs, and from swine meat as well as feces.

With several institutes working on hepatitis E in different domains of One Health, the opportunity arises to collaborate and integrate data to achieve a One Health approach. HEVnet will be the basis to perform joint analyses on hepatitis E data on national level. Building on the existing and growing collaboration, we would also like to work on integration of the different data flows.



2. Objectives

1) Stimulation of collaboration between the institutes
2) Performing joint analyses of available (WGS) data
3) Integration of the different data flows to a One Health surveillance
4) Evaluation of the obstacles and pitfalls encountered during the process and advantages of a One Health approach

3. Expected outcomes

1) Assessment of the current state of OH collaboration by mapping the institutes, projects, and collaboration. By inspecting the different steps of the surveillance process, areas for improvement of collaboration can be identified. Furthermore, meetings will be organized to discuss and specify topics of collaboration, all to have more and better communication and collaboration between institutes.
2) Set joint goals to add all available WGS-data, including available epidemiological data, into HEV-net. Perform joint analyses to gain more insight in the One Health aspects of hepatitis E.
3) The visualization as made for objective 1 will also help in visualizing the different data flows and with that points suitable for exchange of data and harmonization of these data flows can be determined.
4) Develop a template to systematically monitor obstacles, pitfalls and improvements during the pilot process. By using the template, obstacles and pitfalls encountered and advantages when reaching a OH surveillance will be described.

4. Performed activities

1) An overview of the institutes and their projects was made. Furthermore, WBVR performed an evaluation of the current state of HEV surveillance (animals) within their institute, RIVM will finish the evaluation of their HEV surveillance (humans) end of June 2021. Several meetings between RIVM and WBVR have been arranged in which topics of collaboration and joint analyses were discussed.
2) RIVM will perform analyses on the HEVnet data in 2021, in collaboration with the institutes connected to HEVnet. A start has been made to make a data-template to organize HEV data in a FAIR (findable, accessible, interoperable, reusable) manner, including codebook with names and descriptions of several relevant variables that could be used by several institutes, enabling exchange of data between institutes and joint analysis.
3) A template was made, named Country Map, to describe and visualize institutions, projects and data flows. This template consists of a Visio-document and a Excel-document. This document shows the existing but also currently missing links between institutes, data sources and data streams.
4) Due to the corona crisis, and corresponding lack of staff, this objective was not systematically carried out.

5. Results

5.1. Collaboration

The meetings between RIVM and WBVR were fruitful, and a start in more collaboration and plans for joint analyses were made. However, both institutes have now duties within the coronavirus crisis leading to lack of time or permanent shift in work tasks. Therefore, the execution of most of the plans and ideas within the pilot study have been delayed.

5.2. Country map

To visualize the hepatitis E surveillance in the Netherlands, a template was developed. This Country Map consists of two parts: the visualization with the most important information (made as a Visio-document) and a table (made in Excel) in which more details can be added to get an overview of the different groups within the surveillance and the data flows (see appendix).

5.3. Data-template

The template to ease data exchange has to be finished yet.

5.4. Analyses

The analyses on HEVnet data has not started yet.

5.5. Evaluation surveillance HEV

The surveillance of HEV in animals was evaluated using the SurF tool (Muellner et al 2018). Using this tool the surveillance program is described and weak points/measures for improvement are identified. Based on this recommendations have been written. RIVM will finish their evaluation in June 2021.

6. Implementation and impacts

The communication and collaboration between RIVM and WBVR has already improved, and will be continued although it is partly on hold at the moment due to the corona crisis. When the lack of personnel is resolved collaboration will be continued including other institutes.
The country map proved to be a good tool to visualize the different institutes and data flows, and a quick overview who to contact for specific questions in which collaboration is needed or wanted. Moreover it shows the missing links, and where collaboration could be improved. The template is independent of pathogen, concerned institutes, data flows or level of existing collaboration. Evaluation of the surveillance within an institute helps to critically look into the existing system and determine elements that need improvement, both for internal as well as for (One Health) collaboration purposes.

7. Reflections on the OH perspective

7.1. OH evaluation matrix

The grey shaded cells represent the level of integration in the Netherlands before the pilot. Due to the corona crisis, none of the steps in the surveillance pathways has improved yet. The process, however, will continue, also after the end of the ORION project. It is expected that more communication, cross-sectoral consultation, and joint analyses will be achieved as soon as corona claims less time.

Steps in the surveillance pathway	**Levels of integration**			
Design, adjustment and optimisation	Undertaken separately in each sector	Undertaken by a single sector for all surveillance components	Cross-sectoral consultation but undertaken separately in each sector	Undertaken by a cross-sectoral working group for OH objectives
Sample/data collection	Undertaken separately in each sector	Undertaken by a single sector for OH objectives	Harmonisation across sectors	Joint activities across sectors
Laboratory analysis	Undertaken separately in each sector	Undertaken by a single sector for OH objectives	Harmonisation of methods across sectors	Joint activities across sectors

Data transfer /sharing	No data exchange	Notification of unusual events only or when needed	Data exchange at regular intervals (e.g. yearly)	Ongoing data exchange; joint database and/or open access
Data interoperability	Unstructured data	Internal harmonisation (organization own coding practices)	Structural interoperability* across sectors	Semantic interoperability* across sectors
Data analysis/interpretation – COLLABORATION	Undertaken separately in each sector	Undertaken separately and collated by a single sector	Undertaken separately and then combined by a cross-sectoral working group	Jointly undertaken by multi-sectoral working groups
Data analysis/interpretation – DATA STREAMS	Interpretation of each data stream individually in each individual sector to sector specific objectives	Interpretation of multiple, sector specific data streams in each sector to sector specific objectives	Interpretation of multiple data streams from multiple sectors to sector specific objectives with cross-sector consultation	Interpretation to joint cross-sector objectives of multiple data streams from multiple sectors in cross-sector collaboration
Outcome communication	Undertaken separately in each sector	Joint dissemination in separate sectoral activities	Joint dissemination by a single sector	Joint cross-sectoral dissemination
Prioritization and response	undertaken separately in each sector	undertaken by a single sector for all surveillance components	cross-sectoral consultation but undertaken separately in each sector	undertaken by a cross-sectoral working group

7.2. Lessons learned

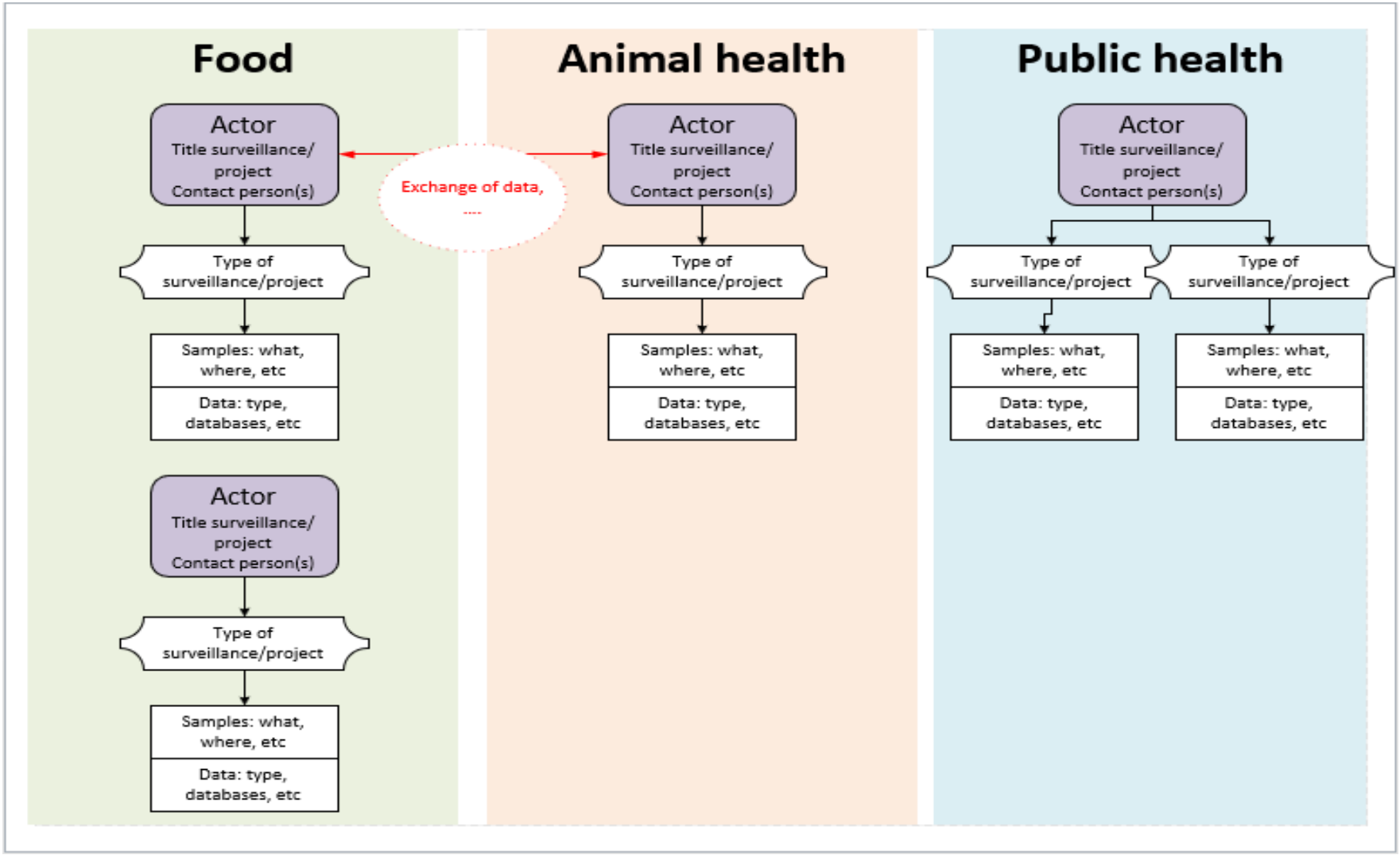
Although the colleagues of RIVM and WBVR working on hepatitis E already knew each other, meeting each other to hear what the other is working on helps a lot to find topics and ways to intensify the collaboration. In the near future, regular meetings (1-4 times a year) will be planned to continue the collaboration.

Making a country map proved to be very informative. It illustrates the OH field of the mapped pathogen/surveillance and shows the existing collaborations as well as the missing links between organizations or data flows. With this in hand, targeted meetings can be planned to improve the OH perspective concerning collaboration, data collection, joint analyses and/or joint dissemination.

7.3. SWOT-like considerations

Process	
Things that worked very well during the study	Collaboration
Things that were difficult or didn't work well during the pilot study	Staff / time lost to corona
Outcome/product	
Prospects for implementation of the pilot study outcome and further development opportunities	Use of the country map to inventory a OH working field (pathogen/surveillance/etc). Continuing of the improved communication and collaboration within the hepatitis E surveillance
Expectations that were not fulfilled and/or barriers for uptake	The delay in collaboration between RIVM and WBVR, and objective 4 that has not been executed, both due to lack of time and leave of staff as a result of the corona crisis

8. Template of country map



9. Template of country map-table

Group	Information gathering:	Description/background	Actor 1	Actor 2	Actor 3
A	OH-area	Food/Feed/Animal Health/Public Health/…			
B	Name actor	Name institute/organization/etc			
B	Title specific surveillance/project	Title of task of possible OH interest			
B	Contact person(s)	Name(s) actual contact person(s)			
C	Type of surveillance/project	Description of surveillance / survey / monitoring			
C	Period of surveillance/project	Description of period in which it is performed (can also be 'continuing' and/or start date only)			
D	Sample description - type of sample	What kind of samples from what/whom			
D	Sample description - where	Where are the samples taken			
E	Data gathering - variables	What are the main variables within the project			
E	Data gathering - tests	What tests are done, what outcomes are available			
E	Data gathering - codebook	Is there a codebook with description of variables and metadata, and where stored			
E	Data gathering - laboratory protocol(s)	Are laboratory protocols available, and where stored			
E	Availability of a database/server to share data - name/location	Details of a possible database/server that is or can be used to share data			
F	Exchange of data / collaboration (1)	With which actor data is exchanged / a collaboration is in place			
F	Exchange of data / collaboration (1)	What data is being exchanged / what kind of collaboration			
F	Exchange of data / collaboration (2)	With which actor data is exchanged / a collaboration is in place			
F	Exchange of data / collaboration (2)	What data is being exchanged / what kind of collaboration			

Pilot report

JIP1 - ORION - IA1 - 1st Call

Responsible Partner: Sciensano

GENERAL INFORMATION

European Joint Programme full title	Promoting One Health in Europe through joint actions on foodborne zoonoses, antimicrobial resistance and emerging microbiological hazards
European Joint Programme acronym	One Health EJP
Funding	This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 773830.
Grant Agreement	Grant agreement n° 773830
Start Date	01/01/2018
Duration	60 Months

DOCUMENT MANAGEMENT

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JIP/JRP Leader	Mickaël Cargnel
Other contributors	Maria-Eleni Filippitzi Géraldine Boseret Marc Dispas Sarah Welby Javiera Rebolledo Gonzalez
Due month of the deliverable	March
Actual submission month	March
Type	Word documents, Excel documents, website (SharePoint)
Dissemination level	Public

Promoting the implementation of One Health collaborative approaches between disciplines in Belgium with a focus on the elaboration of the future national One Health Antimicrobial report using qualitative research methodologies

1. Introduction

Antimicrobial agents, like antibiotics, are substances used to kill microorganisms or to stop their development and multiplication. They are commonly used in human and veterinary medicine to treat a wide variety of infectious diseases. Antimicrobials have been one of the most important life-saving drugs, but their misuse promotes the development of antibiotic-resistance (AMR) in bacteria (Bell *et al.*, 2014; Burow *et al.*,2014; European Food Safety Authority (EFSA), 2015; Graveland *et al.*, 2010; Megha 2014). Result is that today, bacteria which are totally (or almost totally) resistant to antimicrobials are spreading in Europe (European Center for Disease Prevention and Control, 2018). AMR constitutes a serious risk to health worldwide with major economic impacts as it leads to treatment failure and increases morbidity and mortality, both in humans and animals.

One of the major recommendations of the World Health Organization (WHO), is to enhance national multi-disciplinary system to encompass the "One World, One Health" approach to face antimicrobial challenges. Such a system should at least cover human medicine (ambulatory/general practice, hospital and nursing homes sectors) and animal medicine. (Fromm et al., 2014, Megha, 2014, Moodley et al., 2014). This is what is called a "One Health" (OH) approach. Several integrated surveillance strategies exist globally or are attempted in some countries, including Belgium. In Belgium, monitoring systems exist for both the consumption of antimicrobial agents and the occurrence of phenotypic AMR in commensal and pathogenic bacteria from humans, food-producing animals and the food chain. However, the surveillance in the different sectors (i.e. the human, veterinary and environmental sectors) is fragmented and monitored by different stakeholders. There is no aligned strategy for data collection, data analysis and communication, across sectors and across the country. This has led to many individual and independent activities by the different stakeholders and difficulties getting a global overview the AMR and the antimicrobial usage/consumption (AMU) situation

at the national level. For example, in 2020, scientists working for Sciensano, the National Reference Laboratory for Belgium, have collaborated and have drafted, for the first time, an internal OH AMR report, only with the data internally available. In the meantime, to enhance national multi-disciplinarity, the federal and regional Belgian authorities adopted a national OH action plan. One goal sets in this action plan is to develop a yearly national OH AMR report. This report will focus not only on AMR but also on AMU. The development of this report will require collaboration and coordination of the actions taken by the many involved partners (Belgian Health Care Knowledge Centre, 2019). Writing the OH national rapport could face two major challenges. Firstly, due to the fragmentation that exists in the actors involved in AMU and AMR monitoring, all stakeholders' activities are not known and by consequence, some could be not identified and could not be involved in the report. Secondly some stakeholders would be resistant to collaborate and bring data together for this work. To achieve a good participation and to diminish resistances, it is important to identify potential causes of it (Burnes, 2017), to understand and consider the different needs and interests (Raineri, 2011).

The overarching aim of this study is to promote and implement One Health collaborative approaches between disciplines in Belgium with a focus at activities related to AMR surveillance. To do so, this study focused on the elaboration of the future national OH AMR report and aimed to conduct a stakeholder analysis (SA) of the active stakeholders in AMR/AMU within the different sectors to, *in fine*, provide recommendations to policy-makers on how to ensure a balanced consideration of all stakeholder perspectives.

In detail, the specific objectives of this study are the following:

(1) to repertory all stakeholders active and respective activities in AMR, AMU in the veterinarian, human, food and environment sectors in Belgium. Subsequently, to create an online share tool to provide an overview of the collected information. This will help to reduce fragmentation not only by providing an overview of all AMR/AMU activities, as all relevant information regarding this topic will be gathered available on one point. It will also help to set up the process for organizing the stakeholders network for the following participatory stages and to facilitate collaboration between disciplines and sectors.

(2) to list the stakeholders' expectations regarding the OH national report but also to inventory the **strengths (S), weaknesses (W), opportunities (O) and threats (T)** regarding collaboration (SWOT analysis). SWOT analysis can be used to identify favorable and unfavorable factors and conditions, solve current problems in a targeted manner, recognize the challenges and obstacles faced, and formulate strategic plans to guide scientific decisions

(Wang and Wang, 2020). Additionally, to consider the internal Sciensano OH report as a pilot project for the national report. Concretely, the scientists who have taken part in were interviewed, in a **focus group**, to understand what were the general difficulties they have faced but also the concerns for the future national report.

(3) to create an actor map, also called the 'interest-power matrix' or 'Mendelow's matrix' (Mendelow, 1981). This map is a visual depiction of the key organizations and individuals, called 'actors', that influence a topic, allowing insight into the players within a system. The map categorizes stakeholders in the form of a 2 × 2 matrix according to how they should be managed from a project owner's perspective (figure 1). Stakeholders with A) low power and low interest must be monitored and not bored with excessive communication or can be ignored (minimal effort). B) high interest and low power should be kept informed as their needs should be met for the initiative to be successful. They are often very helpful with project details. C) low interest and high power should be continuously considered, informed and monitored, as they could be potentially disruptive for the forming and implementation of the plan. These stakeholders should be kept satisfied. D) high interest and high power need to be considered key players. (Clausen et al., 2020; Moreno *et al.*, 2020).

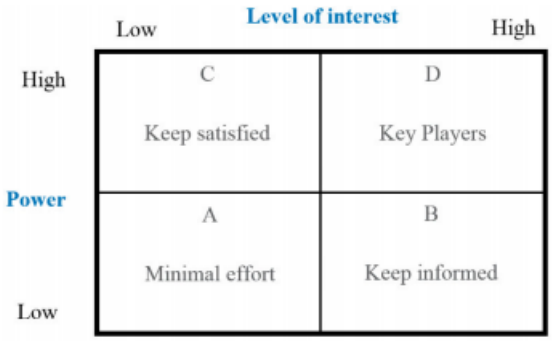


Figure 1. Actor-map (adapted from Mendelow)

Finally, as this project aims to enhance collaboration, it seemed required to improve inter-sector understanding by using common definitions. As another additional objective, the main terms related to AMR used by the different disciplines and sectors in Belgium were identify, evaluated and redefined if necessary.

The principle OHS Codex that is be addressed is the 'Collaboration principle', as results are expected to enable inter-sector communication and help to overcome barriers to collaboration (e.g. resistance to change) and mutual understanding.

2. Materials and Methods

2.1. Stakeholder analysis

Stakeholder analysis (SA) is seen as a useful and constructive approach to support collaboration (Wang and Aenis, 2019) and provide valuable information that can be used to propose or develop future policy-making actions such as new policies or strategies, policy instruments and recommendations (Raum, 2018). It may be used further for the preparation of participatory processes (Herman, 2008; Nordström *et al.*, 2010). By consequent, SA could be a way to overcome the aforementioned potential issues. SA consists in three key steps: (1) Identifying the groups and individuals relevant to the policy issue of focus (**stakeholder identification**); (2) Determining the current position (in terms of support or opposition) of each stakeholder on the issue (**current position of stakeholders**); (3) Determining the relative power of each stakeholder over the issue (**actor mapping**) (Roberts et al. 2008).

2.1.1. Questionnaires

Two questionnaires (Qre 1 and Qre2) were created to collect the requested information for the SA (Annex 1, Annex 2). Both of them provided general objectives of the project, explained the study expectations and included a letter of consent. Tuesday 5 November 2019, Sciensano, the Belgian National Reference laboratory, launched the 'Belgian One Health Network event'. This event with 'One Health' as its theme, was a new initiative to promote One Health and to bring together everyone who works in a One Health context in Belgium. The goal was to discuss the One Health concept in the presence of organizations that are active in this domain in Belgium and also to highlight the cooperation and interactions between the various actors. In this event, 210 participants accepted to give their e-mail address to the Federal Public Health Service (FPHS). These people were contacted by the FPHS to take part at the Qre1 and the Qre2 and a reminder was sent two weeks later. Then the list of the survey participants was send to the FPHS and three experts in AMR for Sciensano They were requested to complete it with other stakeholders they think they should fill Qre1. The mentioned stakeholders were submitted Qre1 afterward.

2.1.2. Stakeholders identification

Qre1 collected information on the AMR and AMU activities that are lead in Belgium. A first step to create the national report is to identify the stakeholders who are active in the domain. To do so, a cross-domain inventory of existing human/veterinary health AMR, AMU reports as well as ongoing research projects and initiatives. In short, respondents were asked if they

publish a report on AMR (Annex 1, section C) or AMC (Section D) and in which sector (e.g. veterinary/human, environment) (C2 and D2), if not (questions C1 and D1), if another service in their institute does (questions C6 and D6) and to provide its name (questions C7 and D7). Extra information on the report, as bacteria targeted, frequency of publication, was searched for in the reports, if publically available (questions C4 and D4) and if not, asked directly (questions C5 and D5).

Duplicate answers were removed (e.g. two identical answers from two scientists from the same unit). The collected information was gathered in an Excel file (one sheet per bacteria). To make the tool more user friendly, in the first sheet, the first line contains a drop-down list where the different bacteria that have been cited can be selected and that role is to look for the requested information up in the different sheets.

2.1.3. Current position of stakeholders

2.1.3.1. Stakeholders' expectations

In the survey, respondents were given a free range to express their expectations regarding the future One Health national antimicrobial report. The question was:' What are your expectations on the future One Health national antimicrobial report?' (Annex 1, question B3). Then, for each participant, the main expectation(s) was/were summarized to identify the main ideas which were grouped together in so-called 'themes'. Relative frequencies for each theme were calculated and presented in form of a word cloud.

2.1.3.2. Strengths Weakness Opportunities Threats analysis

This study used the Strengths (S), Weaknesses (W), Opportunities (O) and Threats (T) (SWOT) analysis method. It comprehensively, systematically, and accurately describes the scenario in which the topic is located. This helps to formulate the corresponding strategies, plans, and countermeasures, which are based on the results of the assessment (Jasiulewicz-Kaczmarek, 2016). This method can be used to identify favorable and unfavorable factors and conditions, solve current problems in a targeted manner, recognize the challenges and obstacles faced, and formulate strategic plans to guide scientific decisions (Wang and Wang, 2020).
Considering all institutions actively involved in this topic should collaborate to write the national OH antimicrobial report, respondents were asked to cite at least one strength, one weakness, one opportunity and one threat related to this project.

2.1.3.3. Focus group interview

An information letter about the study and its voluntary nature was sent to the scientists who took part in the Sciensano internal OH report. A focus group was organized online in January 2021 with the 8 scientists and was video-recorded and transcribed verbatim (Annex 3). There were two epidemiologists, two bacteriologists (human/vet sectors), one mycologist, one expert in genomic and the OH coordinator. Before the interview, oral informed consent was obtained. The semi structured interview consisted, first, to identify the difficulties faced to write the internal report and then, on the expected problems when developing the national OH report. Concerns were identified by the interviewer and sent back to the interviewers asking them their agreement on these concerns.

2.1.4. Actor mapping

An actor map is a visual depiction of the key organizations and individuals, called 'actors', that influence a topic, allowing insight into the players within a system.

In the actor map, different actors were graded in relation to their power and interest relationship with the national OH report implementation. The listed actors were listed by experts elicitation. Experts worked for the Federal Public Service Health, Food Chain Safety and Environment (n=2), and for Sciensano (epidemiologists (n=3), project manager (n=1)). The actors are listed in table 1.

Power was defined as the capacity to influence the decision-making, the ability to decide upon implementing and how to implement the intervention. Interest was defined as the level of importance the intervention has to the particular stakeholder, if the subject is high on the stakeholder's agenda. Respondents were asked to give a score (0 to 10) for each actor listed regarding their respective power and interest.

The grades were compiled and the averages were established for each assorted actor. The actor map was constructed by plotting in a graph the averages of the power (y-axis) & interest (x-axis) grades resulted from the questionnaire. It is possible to split the stakeholders into high and low power and interest categories depending on whether their mean score is above or below the power and interest mean scores for all the stakeholders (Mendelow, 1981).

Table 1. List of the different stakeholders having potential power and interest regarding the One Health national AMR report

Name
Belgian Antibiotic Policy Coordination Committee (BAPCOC)
Belgian Feed Association

Certification/label/sector/professionnal associations
Consumers
Farmers association
Federal agency for medicines and health products
Federal Public Service
Food Agency for the Safety of the Food Chain
Food retailers
Knowledge centre of antibiotic use and resistance in animals (AMCRA)
Medical doctors
Milk sector organisations/labs
Minister of Agriculture
Minister of Health
National Belgian Federation of slaughterhouses (FEBEV)
National Institute for Health and Disability Insurance (INAMI/RISIV)
Pharma industry
Risk assessment group
National reference laboratory (Sciensano)
Universities
Vet association
Vet practitioners
Vet regional laboratory 1 (Association régionale de santé et d'identification animales)
Vet regional laboratory 2 (Dierengezondheidszorg Vlaanderen)

This table displays the different stakeholders that were listed by the experts as there are believed to have power and/or interest regarding the national one health AMR report implementation.

2.2. Glossary

A glossary permits a mutual understanding cross-sector. A One Health European Join Project workpackage has created the 'Glossaryfication-Service'. This tool enables users to automatically retrieve terms and definitions that are contained within several glossaries (CDC, EFSA, OHEJP and WHO glossaries) from any user-provided text document. This project aimed to report the main terms related to AMR used by the different disciplines and sectors, in a view to put forward a common terminology and avoid misunderstanding, which could impede OH collaboration for the development of a national OH strategy and/or a OH surveillance reports. To do so, in Qre1, respondents were asked to cite at least 5 words that they think they are an integral part of the vocabulary dedicated to antimicrobial resistance (Annex 1, question B1). Then, to restrain the list to the most commonly used terms, the following exclusion criteria were applied: number of citation <2, proper names, not in the OHEJP Glossaryfication-Service. The remaining terms were associated with their definitions and sent in Qre2. Respondents were

asked if they agreed with the provided definitions and if not, to give theirs (Annex 2, questions A1 and A2).

3. Results

3.1. Questionnaires

Each questionnaire was sent to 201 stakeholders. The answer rate for the first questionnaire was 23% (n=46) and 14% (n=29) for the second. However, the real participation rates were in reality much higher because some stakeholder were individually contacted but gave common answers for their institute.

3.2. Stakeholders identification

This questionnaire has pinpointed that there are twelve different stakeholders publishing reports on AMU in Belgium and ten of them are publicly available. Two of these reports focus on feed, 6 livestock, 1 in other animals and 4 in humans. However, not all of them publish original data. There are 12 reports dedicated to AMR, published by 8 different stakeholders which almost all of them are public (11/12). One report reports AMR in feed, 3 in food from animal origin, 2 in food not from animal origin, 8 in livestock, 1 in other animals, 1 in the environment and 4 in humans.

A user friendly tool was created to provide the requested information in a row. In brief, selecting a bacteria in a list provides all information collected though the questionnaire (organization name,...) (figure 2). This is available at the moment on a SharePoint by the registered stakeholders who can consult and make modifications and updates.

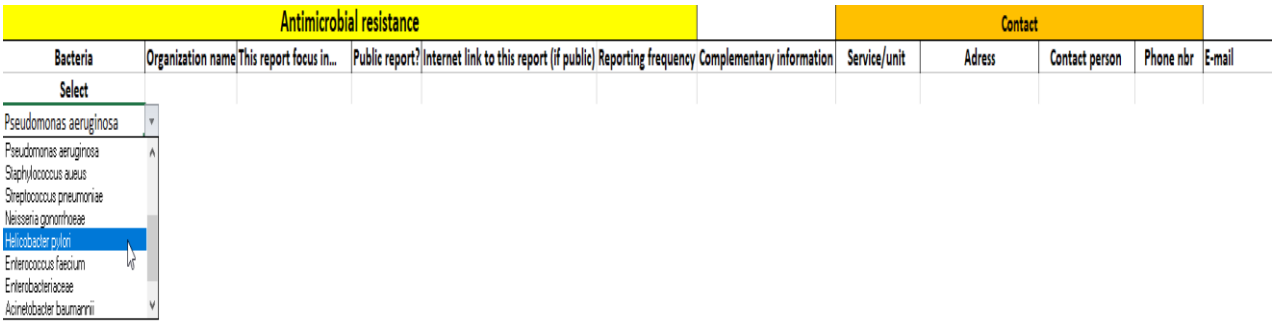


Figure 2. Overview of the online tool for antimicrobial resistance.

3.3. Stakeholders' expectations

Expectations for the national OH AMR report expressed by 41 stakeholders were collected and are available in Annex 4. The most prevalent identified themes are presented in figure 3. Here are discussed the top five most prevalent expectations: (1) The majority of stakeholders expect a 'One health collaboration' in the content of the report. Concretely, data on AMR and AMU from the different sectors (human, veterinary, environment) should be compiled and presented in a centralized report that provides a global picture of the situation in Belgium. It is also required that the different public and private actors, at the national, regional and local levels, actively collaborate at the different stages of the drafting process. (2) The report should not only summarize data but should provide useful conclusions and workable recommendations, guidelines to reduce AMR/AMU that can be practically applicable on the field and support policy. (3) Sufficient (financial) incentives are asked to implement the recommendations. (4) Finally, it seems important for the stakeholders to not just present figures per sector but to make links between sectors (e.g. comparison of human and animal strains) and (5) to make trends analysis.

Figure 3. Words cloud presenting the different stakeholders' expectations for the future OH AMR national report. The police size is proportional to the citation frequency.

3.4. Stakeholders concerns: focus group interview

The *verbatim* transcription is available in Annex 3. Eight scientists took part at the focus group interview but four of them interacted. One veterinary epidemiologist missed half of the discussion because of connection problems. Two major concerns can be highlighted. First, there is not a clear consensus on what is expected (content and aim) in the national OH national report. This is exemplified by the following quote by the scientist working in bacterial diseases (BD), who sees the report as a very brief summary of existing reports: "*the purpose of this report is to have 10 to 15-page document, a very, very short which summarizes all the other reports that we are doing.(...) It will be a very short report which just assembles the relevant data."* whereas one veterinary epidemiologist wants to include a research part to demonstrate the link between AMU and AMR*: "one added value of this report was to follow up in parallel the consumption and resistance both in humans and animals. (...) Yes, but try to have the information to identify causative link. (...). So it goes further than just having the previous report all gathered in the same document*." For the veterinary bacteriologist and the scientist working in food pathogens (FP), Sciensano should draft a first report and, based on a collaborative approach with external stakeholders, to decide what should be added. The veterinary bacteriologist said: '*I think we should draft a first plan based on the previous short report that we did last year and think what we have to add and then to submit it to the other stakeholders and discuss it together*." The veterinary epidemiologist agreed that collaboration is required by saying: '*there must be a debate on the content and on the aim*".

The second concern identified is an absence of a clear overview of the different activities carried out on AMR by the different actors, as exemplified by FP: "*I was thinking Sciensano together with the stakeholders to see what are the data that we have*" and ' *'Maybe it will be useful to us, to the stakeholders, how they do the monitoring. I mean, how they do the monitoring, the collection of the isolates, what is the protocol for them (...)*.'

3.4.1. Collaboration: Strengths Weakness Opportunities Threats analysis

One answer was removed as the answer was out of the score (Annex 5, stakeholder ID 38). Stakeholder ID24 cited a family name which was hidden for confidentiality reasons. The main ideas are summarized afterwards. There is a global consensus that OH collaboration with so

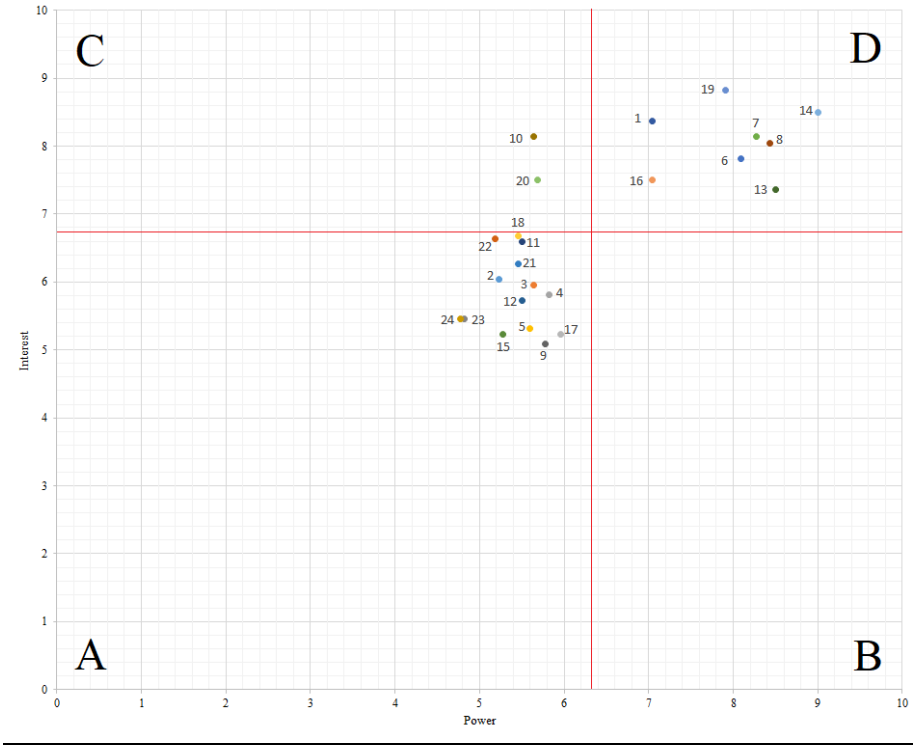
many stakeholders, having data related to humans, animals and environment is a strength for the national report (Annex 5).

The fragmentation in different sectors is seen as a weakness because it could be difficult to create a report with the current lack of harmonization and involving many stakeholders with different interest and competencies. That could be a challenge to find a consensus. The report is seen as a way to harmonize (e.g. procedures, approaches), but also to aware (or communicate, sensitize, highlight) on the problematic of AMR. It is also perceived as a mean to trigger changes, to open the door to new possibilities (e.g. switch to next generation sequencing, new research collaborations). Finally, the main threats are the work load, the lack of resources and a low involvement of the partners.

3.5. Actor mapping

Twenty-two respondents filled entirely the table whereas one stopped after having given a score for 'Sciensano' and 'Food Agency for the Safety of the Food Chain'. The power and interest mean scores for all the stakeholders are 6.32 and 6.74 respectively (Annex 6). Nine stakeholders are considered with a high interest and a high power. These are the Belgian Antibiotic Policy Coordination Committee (BAPCOC), the Federal Agency for Medicines and Health Products, the Federal Public Service, the Food Agency for the Safety of the Food Chain, the Minister of Agriculture, the Minister of Health, the National Institute for Health and Disability Insurance and Sciensano. Two stakeholders were scored with high interest but low power: the Knowledge Centre of Antibiotic Use and Resistance in Animals and universities. The remaining stakeholders were scored with low interest and low power. The Minister of Health, the Minister of Agriculture and the Food Agency for the Safety of the Food Chain are considered to have the highest power whereas the two regional veterinary laboratories and the vet practitioners have the lowest power. Sciensano, the Belgian Antibiotic Policy Coordination Committee and the Minister of Health were scored with the highest interest and the food retailers, the National Belgian Federation of Slaughterhouses (FEBEV) and the pharma industry with the lowest.

There is no stakeholder with high interest and low power (figure 4).



Legend	
Number	**Stakeholders**
1	Belgian Antibiotic Policy Coordination Committee (BAPCOC)
2	Belgian Feed Association
3	Certification/label/ sector/professionnal associations
4	Consumers
5	Farmers association
6	Federal agency for medicines and health products
7	Federal Public Service
8	Food Agency for the Safety of the Food Chain
9	Food retailers
10	Knowledge centre of antibiotic use and resistance in animals (AMCRA)
11	Medical doctors
12	Milk sector organisations/labs
13	Minister of Agriculture
14	Minister of Health
15	National Belgian Federation of slaughterhouses (FEBEV)
16	National Institute for Health and Disability Insurance (INAMI/RISIV)
17	Pharma industry
18	Risk assessment group
19	Sciensano
20	Universities
21	Vet association
22	Vet practitioners
23	Vet regional laboratory 1 (Association régionale de santé et d'identification animales)
24	Vet regional laboratory 2 (Dierengezondheidszorg Vlaanderen)

Figure 4. Actor-map_grading the stakeholders based on their power and interested in publishing a common national one health antimicrobial/antimicrobial usage or consumption report. Legend: In light orange, the stakeholders with

low power, low interest (A); in blue, the stakeholders with high interest but low power (C); in red, the stakeholders with high power and high interest (D).

3.6. Glossary

In total, 190 terms were mentioned by 30 participants as part of the vocabulary dedicated to AMR but 10 of them filled the inclusion criteria. The Glossaryfication-Service provided 18 definitions. Twenty-nine scientists gave their opinion on all the definitions and one respondent stopped after the 4th. The agreement rate is in a range between 56.7% (definition for 'antimicrobial (2)') and 100% (definition for 'Antibiotic (1)') (Annex 7). Reasons of disagreement are given in annex 8. A future step would be to take into account the comments, to reformulate the definitions if necessary, and to send the definitions once more to evaluate if the percentage of agreement increases.

4. Discussion

This study aimed to promote and implement One Health collaborative approaches between disciplines in Belgium. To do so, it focused on the elaboration of the future national OH AMR report and aimed to conduct a stakeholder analysis (SA). The exponential growth in SA reports in the last decades indicates that these analyses are increasingly being recognized as an intrinsic part of health innovation planning processes (Franco-Trigo *et al.*, 2020).

In the first activity conducted in the framework of this study, the 'stakeholder identification', which listed all stakeholder's activities in AMR and AMU, has shown that there are multiple individual reports published by multiple stakeholders. Consequently, at the moment, it is a challenge to get a straightforward overview of the AMR/AMU situation in Belgium. The focus group, which captured stakeholders' expectations and concerns, has supported this affirmation showing that, even for the experts, there is a lack of clarity and transparency in the activities lead by the different laboratories. In that respect, this project has developed an interactive online SharePoint that would help, on one side, to better know each other's activities and to promote inter-sector collaboration; and one the other side, to provide the politicians and the public, an easier way to access to the various information related to this topic. It can also be helpful to reduce the fragmentation, perceived as a weakness in the SWOT analysis. However, a communication campaign should be planned to make the SharePoint known to the stakeholders, who, following, should be convinced on its utility, adopt it and keep it up-to-date.

The stakeholders' expectations showed that there is a strong wiliness for the future national report to be a "One Health' one, therefore, including AMR and AMU data from the human, vet and environmental sides and providing a global picture of the situation in Belgium. What is asked by them is more than a summary of the different already existing reports, but rather a real analysis that can lead to concrete and applicable outputs to reduce AMR/AMU (e.g. guidelines). Some stakeholders mentioned that they would like the report to reflect the link between the different sectors (e.g. AMR transmission from animals to humans). Finally, others would like that the national report has a political message in the sense that it should highlight to the authorities the necessity to provide financial incentives so that the mission against AMR is carried out. This information should be kept in mind when drafting the national report in order to avoid creating a cognitive dissonance leading to resistance, leak a motivation and low involvement by the engaged stakeholders. Cognitive dissonance is a term referring to a situation where requirements are not aligned with concerns and/or values of those effected by them. If not aligned, then resistance is expected to be encountered (Burnes, 2017). In the focus group, the content of the report did not seem clearly defined by the tasks givers and the preferred direction was just to summarize the different existing reports, which will not fit the stakeholders' expectations. As many of them will be also be part of the drafting, this suggestion of a direction may lead to cognitive dissonance, then frustration, leak a motivation and low involvement.

Stakeholder involvement is considered one of the cornerstones of drafting such a report, as it is vital that all relevant stakeholder groups are either involved in the process or at least have been given a chance to participate (Clausen *et al.*, 2020). Low level of involvement and support is an important parameter of potential failures of such endeavors. Failures in the early stages of a process make it difficult or impossible to perform later tasks (Raineri, 2011). This is the reason why participatory leadership through a constructive engagement is required (Burnes, 2017). This request was mentioned during the focus group as experts request that the authority (the tasks givers) clearly defines the content of the report and helps in the process management. The authority should have two major roles: communication and leadership.

The first role would be to communicate and suppress some of the mentioned threats. For example, the authority has to clearly define everyone's tasks, establish a workload and provide budgetary guidelines. Regarding workload, some people may express resistance, not against the change itself, but out of fear of not being able to meet the challenge and/or of not being able to achieve the requested goal. In addition, if the project is successful, it may lead

to new demands and more difficult expectations (Arkowitz, 2002). This uncertainty can be a source of anxiety (Arkowitz, 2002) except if the present and future objectives and individual responsibilities and tasks are clearly defined. Communication can also demonstrate to stakeholders the necessity, legitimacy and justification of the report in order to stimulate their interest but communication should be up to bottom (tasks givers to stakeholders) and bottom up (tasks givers to authority). As Bareil suggests (Bareil, 2004), it is not enough only to demonstrate the advantages and disadvantages, it is necessary to give priority to the stakeholders, because they are the actors who will be actively working on the report. In this regard, they need to be listened to, heard, respected, understood in their concerns and supported (Bareil, 2004). In this study, it was surprising to note that in the actor map, the two regional vet laboratories were categorized as having low interest in the national report although they are key stakeholders. Specifically, they are actively involved in determining AMR in pathogens bacteria in livestock. By consequence, their active collaboration would be of great importance and their output indispensable due to long experience with laboratory testing and monitoring. It will be relevant to understand why they were scored with a so low interest.

The second role of the authority should be to oversee and lead the drafting process, as the high number of stakeholders with different interests participating in the process may pose significant obstacles to cooperation. Different interests do not necessarily lead to conflicts as there might be buffer zones for negotiation (Wang and Aenis, 2019). However, if reaching a consensus is not achieved, then the authority should intervene, set priorities linked to everyone' needs and interests and take decisions. Thus, it is necessary to identify who will contribute to the project, what is the role and contribution of each, who will be in charge of communication between the different parties, who have resources, who has the leadership… (Cunningham and Kempling, 2009). It is about establishing a clear policy where each function has an individual or a group of individuals intelligently attached after studying its strengths and weaknesses.

Finally, it is important to remember that the information captured in the present SA are a snapshot of the present situation and not a static approach. Stakeholders' perceptions of things, their agendas, their interrelations and their importance and influence may change over time (Clausen *et al.*, 2020).

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Annexes

Annex 1. Questionnaire 1

The One Health European Joint Programme (OHEJP) aims to align European countries through a joint priority setting in the domains of foodborne zoonosis, antimicrobial resistance and emerging threats, and joint programming of research agendas. This is a considerable opportunity for harmonization of approaches, methodologies, databases and procedures for the assessment and management offoodborne hazards, emerging threats and antimicrobioresistance across Europe, which will improve the quality and compatibility of information for decision making.

The One health suRveillance Initiative on harmOnization of data collection and interpretation (ORION) is a OHEJP project that aims at establishing and strengthening inter-institutional collaboration and transdisciplinary knowledge transfer in the area of surveillance data integration and interpretation, along the One Health objective of improving health and well-being. This will be achieved through an interdisciplinary collaboration of 13 veterinary and/or public health institutes from 7 European countries.

This survey focuses on the Pilot project for Belgium, part of the "One Health Surveillance Knowledge Hub" (ORION work package 2). In short, this Pilot project takes place in a context the federal and regional Belgian authorities require to developa national One Health antimicrobial resistance (AMR) action plan. In this goal, the first step is to develop a yearly national One Health AMR report. The development of this report will require collaboration and coordination of the actions taken by the many involved partners (Belgian Health Care Knowledge Centre, 2019). The ORION pilot project will help to overcome the possible challenges that could happen during the process.

Section A: Personal data

A1. What is your organization's name?

A2. Where is your organization located?

A3. What is your function?

A4. Can you cite at least 5 words that you think they are an integral partof the vocabulary dedicated to antimicrobial resistance

Section B: Glossary

B2. Belgium is about to write a national One Health antimicrobial report.

Considering all institutions actively involved in this topic should collaborate, cite at least one strength, one weakness, one opportunityand one threat related to this project

Strengths: characteristics of the project that give it an advantage over others. Weaknesses: characteristics of the project that place it at adisadvantage relative to others. Opportunities: elements in the environment that the project could exploit to its advantage. Threats: elements in the environment that could cause trouble for the project

B3. What are your expectations on the future One Health national antimicrobial report?

Section C: Antimicrobial report

C1. Does your service publish a report on antimicrobial resistance? Yes/No

C2. This report focuses on antimicrobio resistance in feed/ Food (from animal origin)/ Food (not from animal origin)/ Live animals (livestock)/ Other live animals (e.i. pets)/ Environment/Humans/ Other (give precisions….)

C3. Is the report public? Yes/No

C4. Can you provide the internet link where the report can be found?

C5. Can you give more details on the frequency the report is published (e.i 1 x/year), on the bacteria and on the antimicrobials tested? If this information is available on a public report and you have already provided the link, just write: see report.

C6. Does at least one other service in your institute publish a report on antimicrobial resistance? Yes/No
C7. Can you cite the name(s) of these service(s)?

Section D: Antimicrobial usage or consumption report

D1. Does your service publish a report on antimicrobial usage or consumption? Yes/No
D2. This report focuses on antimicrobial usage or consumption in feed/ Food (from animal origin)/ Food (not from animal origin)/ Live animals (livestock)/ Other live animals (e.i. pets)/ Environment/Humans/ Other (give precisions….)
D3. Is the report public? Yes/No
D4. Can you provide the internet link where the report can be found?
D5. Can you give more details on the frequency the report is published (e.i 1x/year), on the bacteria and on the antimicrobials tested? If this information is available on a public report and you have already provided the link, just write: see report.
D6. Does at least one other service in your institute publish a report antimicrobial on usage or consumption? Yes/No
D7. Can you cite the name(s) of these service(s)?

Annex 2. Questionnaire 2.

Study expectations

You are expected to fill this online questionnaire The time required to fill the first questionnaire is 10-20 minutes. If you face any difficulty or have a question, you are free to contact the investigator.

Rights for refusal, access to personal information

Your decision to participate in this study is complete voluntary. You may withdraw from your participation at any time for free.

Benefits Associated with Study Enrollment

People will be informed on the final results of the pilot project by sending their e-mail address at mickael.cargnel@sciensano.be.

Use of results; individual return or not

By signing this form, you authorize the use and disclosure of your data and findings during the course of this study for publication and presentation.

Confidentiality / privacy

We guarantee that absolute confidentiality and anonymity. No IP addresses will be collected.
Only the scientists in Veterinary Epidemiology unit (Sciensano) have access to the data.
Each participant will be identified on the questionnaires by an individual ID in order

Section A. Glossary

A.1. Do you agree with these definitions?

Defintions	Yes	No
Antibiotic (1): A drug that kills or stops the growth of bacteria. Antibiotics are a type of antimicrobial. Penicillin and ciprofloxacin are examples of antibiotics.		
Antibiotic (2): A substance produced by or derived from a microorganism, which destroys or inhibits the growth of other microorganisms.		
Antimicrobial (1): A substance, such as an antibiotic, that kills or stops the growth of microbes, including bacteria, fungi, or viruses. Antimicrobials are grouped according to the microbes they act against (antibiotics, antifungals, and antivirals). Also referred to as drugs		
Antimicrobial (2): A drug which, at low concentrations, exerts an action against microbial pathogens and exhibits selective toxicity towards them. Antimicrobials typically include antibiotics but also antivirals and other drugs effective against microorganisms		
Data: Facts, measurements, recordings, records, or observations about the world collected by scientists and others, with a minimum of contextual interpretation. Data may be in any format or medium taking the form of writings, notes, numbers, symbols, text, images, films, video, sound		

recordings, pictorial reproductions, drawings, designs or other graphical representations, procedural manuals, forms, diagrams, work flow charts, equipment descriptions, data files, data processing algorithms, or statistical records.

Disease: a situation in which infection has elicited signs and symptoms in the infected individual; the infection has become clinically apparent.

Environment: All that which is external to the individual, including physical, biological, social, cultural and other factors.

Health (1): A state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity.

Health (2): "The state of complete physical, mental, and social well: being and not merely the absence of disease or infirmity. Health has many dimensions (anatomical, physiological and mental) and is largely culturally

Infection: The invasion of the body or a part of the body by a pathogenic agent, such as a microorganism or virus. Under favorable conditions the agent develops or multiplies, the results of which may produce injurious effects. Infection should not be confused with disease.

Mutation: A permanent, typically negative, change in the genetic material in a cell which, in most cases, can be passed onto any offspring.

One health (1): One Health is an approach to designing and implementing programmes, policies, legislation and research in which multiple sectors communicate and work together to achieve better public health outcomes. The areas of work in which a One Health approach is particularly relevant include food safety, the control of zoonoses and combatting antibiotic resistance

One health (2): a concept that recognizes the optimal health of people as being connected to the health of animals and the environment. The collaborative effort of multiple disciplines working locally, nationally, and globally to attain optimal health for people, animals, and our environment. A concept that became an approach and then a movement.

Suveillance (1): A careful observation of one or more food or feed businesses, food or feed business operators or their activities (in the context of the food and feed control Regulation (EC) No 882/2004). In general, it means a close and continuous observation for the purpose of control. As opposed to monitoring active control measures are frequently taken when positive cases are detected. This type of programme does not necessarily have a defined target for reducing the occurrence of diseases.

Surveillance (2): Consists of procedures developed in response to a risk and carried out to support subsequent actions. Data collection and record keeping to track the emergence and spread of disease: causing organisms (incl. antibiotic: resistant bacteria).

Surveillance (3): The continuous, systematic collection, analysis and interpretation of data needed for planning, implementation, and evaluation related to zoonotic diseases.

Surveillance (4): The systematic continuous or repeated measurement collection collation analysis interpretation and timely dissemination of animal health and welfare related data from defined populations. These data are then used to describe health hazard occurrence and to contribute to the planning implementation and evaluation of risk mitigation actions

Surveillance (5): The systematic ongoing collection, collation and analysis of data for public health purposes and the timely dissemination of public health information for assessment and public health response as necessary.

A2. As you do not agree with the definition(s), please give yours.

Antibiotic (1):
Antibiotic (2):
Antimicrobial (1):
Antimicrobial (2):
Data:
Disease:
Environment:
Health (1):
Health (2):
Infection:
Mutation:
One health (1):
One health (2):

Suveillance (1):

Surveillance (2):

Surveillance (3):

Surveillance (4):

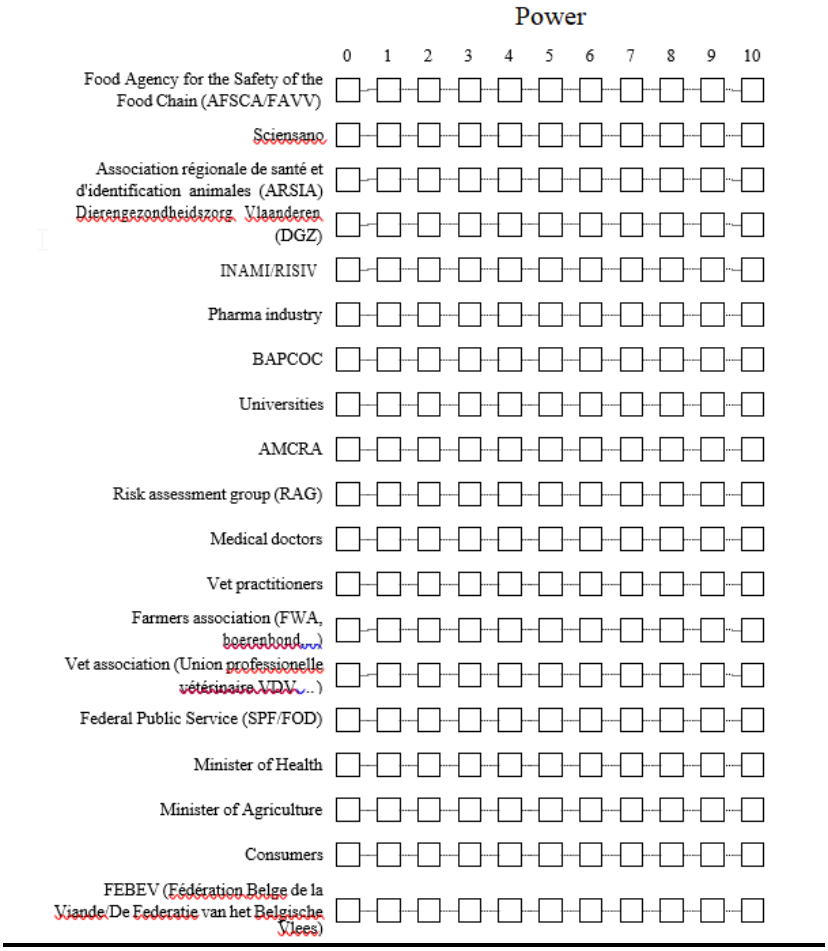
Surveillance (5):

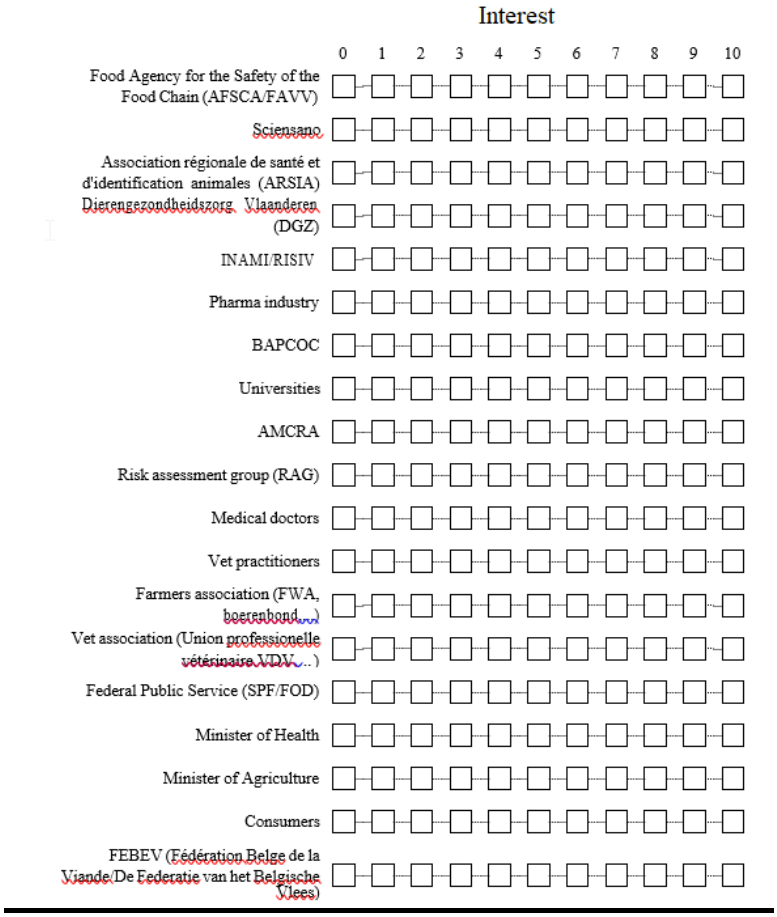
Section B. Actor map.

B1. Can you grade these stakeholders based on their power and interested in publishing a common national one health antimicrobial/antimicrobial usage or consumption report?

Power= the capacity to influence the decision-making, the ability to decide upon implementing and how to implement the intervention. 0= no power and 10= the maximum power

Interest=the level of importance the intervention has to the particular stakeholder, if the subject is high on the stakeholder's agenda. 0= no interest and 10= the maximum interest





Annex 3: Focus group

Introduction to the project

Mail sent to the participants before the meeting

Dear colleagues,

Sciensano is involved in a One Heath European Joint Programme (ORION, pilot project for BE). One goal is to help Belgium to better implement its national OH AMR report. Last year, we wrote a OH Sciensano report. It would be interesting for the project but also for the future report, to highlight the difficulties that we have faced when we wrote it and to anticipate the (potential) upcoming one.

To do so, we propose a virtual focus group (10 minutes) to talk about. Please note that the discussion will be recorded (more information on confidentiality below). We consider that if you participate in the focus group, you have read the information and agree.

The One Health European Joint Programme (OHEJP) aims to align European countries through a joint priority setting in the domains of foodborne zoonoses, antimicrobial resistance and emerging threats, and joint programming of research agendas. This is a considerable opportunity for harmonisation of approaches, methodologies, databases and procedures for the assessment and management of foodborne hazards, emerging threats and antimicrobioresistance across Europe, which will improve the quality and compatibility of information for decision making. The One health suRveillance Initiative on harmOnization of data collection and interpretation (ORION) is a OHEJP project that aims at establishing and strengthening inter-institutional collaboration and transdisciplinary knowledge transfer in the area of surveillance data integration and interpretation, along the One Health objective of improving health and well-being. This will be achieved through an interdisciplinary collaboration of 13 veterinary and/or public health institutes from 7 European countries. This survey focuses on the Pilot project for Belgium, part of the "One Health Surveillance Knowledge Hub" (ORION work package 2). In short, this Pilot project takes place in a context the federal and regional Belgian authorities require to develop a

national One Health antimicrobial resistance (AMR) action plan. In this goal, the first step is to develop a yearly national One Health AMR report. The development of this report will require collaboration and coordination of the actions taken by the many involved partners (Belgian Health Care Knowledge Centre, 2019). The ORION pilot project will help to overcome the possible challenges that could happen during the process.

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Rights for refusal, access to personal information

Your decision to participate in this study is complete voluntary. You may withdraw from your participation at any time for free.

Benefits Associated with Study Enrollment

People will be informed on the final results of the pilot project.

Use of results; individual return or not

You authorize the use and disclosure of your data and findings during the course of this study for publication and presentation.

Confidentiality / privacy

We guarantee confidentiality and anonymity. Your name will not be cited, but we can cite the name of your service in the introduction to define the different profiles that took part in the focus group. The discussion will be recorded and will be transcribed verbatim.

Only the scientists in Veterinary Epidemiology unit (Sciensano) have access to the data. Record and data will never be transmitted to anyone else.

Each participant will be identified by an individual ID in order it will be impossible for anyone to identify them. Only the primary investigator will know what your ID is. We will not be sharing any information to anyone outside of the research team.

Long-term storage

During and after the study, all information collected will be securely stored on a secure internet server. Data will be store during a period of 10 years but you have the right to have all information collected about you modified or deleted at any moment for free. After this period of time, the data will be destroyed

Declaration of Competing Interest

The positions and opinions presented reflect the interviewees' opinions and are not intended to represent the views or scientific works and opinions of Sciensano.

Participants

VE1: Veterinary epidemiology 1
VE2: Veterinary epidemiology 2
SMD: Services of the managing direction
FP: Food pathogens
BD: Bacterial diseases
VB: Veterinary bacteriology
MA: Mycology and aerobiology
OH: One health coordinator
I: Interviewer

Glossary

NRC: national reference center

Transcript

I: This is an open discussion. There is no specific question. I would like to give you a free space to discuss, first, the Sciensano report and especially the problems we have faced.

BD: Ok.

I: I don't know if you can begin, BD?

BD: I have started recording.

I: So who would like to begin? I don't know, for example, for example, I know it was very difficult to involve …to involve people. So perhaps, do you think it would have been more relevant to create a Doodle for a better participation, for example?

BD: You mean for this working group for this…

I: For the last Sciensano report. As you know it was quite difficult. It was written in a hurry in the last week because everyone was involved in different tasks. So do you think it would be a better solution to organize the work between us?

BD: Uh. Yeah. Uh, depending on how many people you are, I think it is a good idea, no?

VE1: Yes, but I think that to do so, we need some visibility in the population of people who has to answer the questions. So we need a mandate first and a clear mission. And with that authority, we can contact the people and a long time before they have to submit something, just to tell them what we expect and what is the… submit them a list of questions. So indeed, it's necessary to organize the conversations, define the contents and ask specific questions because the… the whole project will work on iterations. So a first general report and then more precise information collected and more precise back information shared with the stakeholders. So indeed, we need a first deeper thinking about what we want to collect as information and what we want to have in the report and so we can organize the whole project on a very long time.

BD: But I don't think that this should be only decided by us. It should be in conversation with all people…with all the people involved. So, um, because we have some data also at Sciensano, but we don't have many other data that we'd like to include. So I think we should be, uh, should reach out also to as many people as possible. This was not possible, of course, the last year because of the COVID and the lack of time but I think this will be possible this year.

I: So do you think the authority should be more present to address, to say what to do?

VE1: Yes, I suppose so. We are wanting to do this report that, uh, um, yeah for uh, for Belgium but if we don't have an official mission, why would people think we are serious and wanting to do something useful? So I think, yes, we need a mandate from an authority. What we're seeing on the goodwill of person and what is the representatively of goodwill?

BD: This mandate is defined in the National Action Plan, which will be approved, hopefully… So this will be approved. So the mandate will be given and there will be financing coupled with this also.

VE1: It's still not clear who will receive this money and which team will lead the project. So we asked for money and people, but there is no official document at that stage that we will receive these resources.

BD: No. No, because the action plan has not yet been approved. Hmm.

I: So, first the stakeholders should be clearly defined and then to clearly defined who will receive the money. That's what you are saying? At the moment, the stakeholders are not clearly defined?

VE1: We have our imagination and we imagine the content that should be answering the questions these stakeholders are asking themselves or asking us, but indeed there must be a debate on the content and on the aim.

I: VB and FP, do you want to add something in this discussion?

VB: Yes, I agree with the others. The first thing is to officially have a leader and we have to propose to all the stakeholders, the aims that we think about and the.. (*audio was interrupted*) …the first listed aims. I don't think we should begin with all the stakeholders without having a plan to present. I think we should draft a first plan based on the previous short report that we did last year and think what we have to add and then to submit it to the other stakeholders and discuss it together.

VE1: An ask them what they want to see in the report and how we can improve it.

FP: I think I agree with you, both, and I think we have to predefine the content of this report based on what we have… on what we have done before and the problems that we had. It was very difficult to find the target bacteria

that we wanted to include and to have to data from the different sectors. So we have first to predefine what is possible to report in a One Health perspective because I think there were a lot of gaps this year and it was difficult to compare the data. So we need maybe first to predefine the content and to see what is the most feasible to do.

I: But who has to do that? Sciensano or the authority?

FP: I was thinking Sciensano together with the stakeholders to see what are the data that we have and what we can do with these data. Because (*noise*) national control plan, there are very well regulated and we have very constant data yearly. But the data that we have from to compare with the human part is very difficult. And it was like to do something this year to propose a one health report, but it was… we had a very little points of comparison to do and there was a lot of data that were not included because it was impossible to compare.

VB: Yes, indeed. There are lots of differences between the monitoring in different sectors and for the moment with the current monitoring it is difficult to compare and so it's difficult to have a real one health report.

BD: But if you… it's… it's not so difficult to define what you don't want to include from the veterinarian and food side, right? Because you monitor indicators. That's all data you have. I would not consider it very difficult. I would only consider that the most difficult part is indeed how to link the *staph aureus* and the *campylobacter* with what you see at the human side. But that is something which needs to be discussed not with us, because we don't have the data. That needs to be discussed with the CNR of *campylobacter* and the CNR of *staph aureus*. So that cannot be decided by us and I think this should be discussed

FP: Or maybe the lead has to be taken by the NRC, not from us, because we have a very small amount of data compared to them.

BD: We should not forget that the purpose of this report is to have 10 to 15-page document, a very, very short which summarizes all the other reports that we are doing, which can have a large reference section. But the goal is to have a policy guiding small, small document. Right. So we should not be looking at the hundred page documents. It will be a very short report which just assembles the relevant data. So. Yeah, yeah, that is the goal. So all the other reporting will still be going on. This will just be some kind of summary. So I do believe that the stakeholder meetings with the externals are of crucial importance, because in these meetings, we just have to decide what is relevant and what's not to have policy guiding.

VE1: Ok, but for me, one added value of this report was to follow up in parallel the consumption and resistance both in humans and animals.

BD: Yes, this will be included, hopefully.

VE1: Yes, but try to have the information to identify causative link. And that would be done over time, and that makes necessary to harmonize the data collection and defining a way of analyzing data. So it goes further than just having the previous report all gathered in the same document.

BD: No, I think this will be the purpose of the EVARESIT project, no? This is what the personal work on?

VE1: The EVARIST project focuses on the way of describing the events of antimicrobio resistance in Belgium and to provide guidelines. I would say it's just guidelines and not the definition of the content of the common report. So if you want to define a causative link between consumption and resistance, we need extra data collected. It's not the same as surveillance.

BD: So, but it's really done at the European level, no? There have already two reports doing this. What about these reports again? Where they collect trends and resistance in rapport to consumption. So we just have to adjust, of course, we need to apply the same statistical methods, I think, that are used in these reports. It's not the purpose of this report to organize a new surveillance system, to organize new data collection. That is really not the purpose. There is also no new funding or no personnel or whatever to do this.

VB: Yes, but then we will be limited in the scope that we can discuss because, for example, for *staphylococci*, the context of the bacterial collection is very different between the NRC humans and our team. So it was really difficult to compare because the context is not the same. And you cannot compare.

BD: No, but we just have to acknowledge them. Yeah. Yeah.

VB: So it's the first step to list what is comparable, what is not. And we did this exercise last year, but we will not be able to go deeper because if the monitoring doesn't change, we will not be able to do a more complete report.

BD: No, no. Yeah, that's true. It's not the purpose of this support to change the monitoring. It is just to compare what is possible and to acknowledge the limits if needed. But this needs to be in discussion with all the stakeholders, of course.

FP: Maybe it will be useful to us, to the stakeholders, how they do the monitoring. I mean, how they do the monitoring, the collection of the isolates, what is the protocol for them and to see if there is a possibility to compare or we just we don't take care about these collection methods and we take care about the outcome of the resistance profiles. Because it is impossible to compare in our case the surveillance and in the case of humans, I don't know. Is there also a surveillance or only clinical cases?

BD: Well, I don't know. Maybe there are, for example, maybe there are surveillance studies for staph aureus with healthy volunteers. I don't know. That would be comparable I think. We have to be able to ask the people from the NRC.

VB: Last year it was not the case.

BD: I don't know their plans (*laughs*).

VB: I don't know for the future but last year it was not the case.

BD: We have to ask.

FP: I think there is a surveillance one year every two years or something like this but… I don't know…

I: Ok, so if I summarize the ideas. The first thing is to ask the authority on what they expect and then to have a good discussion with all the stakeholders to know what is available and then to come back to the authority to see if they agree on to the plan we are writing based on the what the pathogens and the bacteria availabilities. Is it is it right?

VE1: Yes, yes. Yes for me…

I. Time is running out. I don't want to be too long. So do you want to add something else?

VE2: I want to say something. I was disconnected for 10 minutes because there was no I have really bad connection today. So in case you talk to me, I didn't reply. It was because I was trying to reconnect. So I'm sorry for that.

I: And have you heard the conversation?

VE2: I think I've heard half of the discussion.

I: Do you want to add something else? Something to close the debate?

BD: I agree with the conclusion: first to contact the authority and then after I see the feasibility for the stakeholders.

I: Ok. I would like to thank you for your participation and the time you have given to me.

Annex 4. Stakeholders' expectations

ID	Answers	Theme 1	Theme 2	Theme 3	Theme 4	Theme 5
1	Initially to provide a yearly or two-yearly (depending on the feasibility) report on : - antimicrobial use in **three main sectors** (human, animal and environment) - antimicrobial resistance in **three main sectors** (human, animal and environment) On a later stage to provide also **analyses** on the links existing among the three sectors. The report should have a large **visibility** in order to provide a clear communication and information to the scientific community on the subject.	One health collaboration	Link between sectors	Large visibility		
2	reach useful and **workable conclusions on the field** to improve AMR and to convince the field to participate actively by using more diagnostic and prevention => **practical** and not theory	Recommendations				
3	I have no particular expectations. I hope it will contain good **recommendations** but only if there **are also sufficient financial means to implement** the recommendations will it also lead to change.	Recommendations	Incentives required			
4	Reporting of baseline figures on antibiotic use and resistance in the **outpatient and inpatient setting, pet and vet sector, environment** and it's relation or association with AMR. This would require **statistical analysis**.	Statistical analysis	One health collaboration			
5	**Clear strategy** and **goal setting** **realistic plan** clear **description of responsibilities** clear **demand for finance** towards government	Clear strategy	Goal setting	Realism	Clear agreements at the start	Incentives required
6	**Prevention of contamination, prevention of worsening** On time **reducing unnecessary antibiotic use** by the use of point of care tests, reducing antibiotic resistance on the long term, starting with antibiotics when really needed	Prevention of contamination	Prevention of worsening	Impact on AMU		
7	**joint data** about human and veterinarian sector **recommendations** for different stakeholders	One health collaboration	Recommendations			
8	**Scientific** based report, but with simple and correct '**take home messages**'	Scientific	Recommendations			
9	"Awareness raising in both veterinary and human medicine" **only antibiotics and it must be**" Reduce resistance **through responsible** antibiotic use Strong **incentive** to adjust management in livestock farming and **find alternatives to antibiotics** Need to finish group treatments and over go to individual treatments"	Recommendations	Incentives required	Find alternatives to antibiotics		

10	It is important to **have clear agreements at the start** of the project. Maybe focus selection of bacteria and the molecules studied. The report should give a **benefit to the people who share data** (PT organization) but most import it should give a **clear messag**e to the people in the field. Raising **awareness** of the right target groups in the field by explaining the results in various forums. The collection and analysis of the data should be performed by one institute but data should be discussed before publication by different experts of the different disciplines involved (use of AB, lab testing, statistical, ...) It should be not a report only for scientist but also **for people involved in the global goal** "lower use of AB and lowering the resistance in general	Clear agreements at the start	Benefice for the participants	Clear message	Increase awareness	Large visibility
11	The report should **compile the AMU and AMR data** for as well the animal health sector as the human health sector. This as well on **national level, regional level as on more local level** (cities or areas).	One health collaboration				
12	Monitoring and results	Monitoring and results				
13	the **collaboration of different institutions** to achieve the defined goals	One health collaboration				
14	**Guidance document** on how to reduce the use of antibiotics, supported and endorsed by the national authorities	Recommendations				
15	Data available to **support policy** **Scientific conclusions** can be taken	Recommendations	Scientific			
16	**one health approach**, we should not be confined to the use of antibiotics in breeding. the unreasonable use of antibiotics is known in pets who are in close contact with their owner.	One health collaboration				
17	To obtain **insights** in how antibiotic use in humans or in animals influence antibiotic resistance in animals and humans, respectively To see the **evolution of the resistance** for different strains To get an **update on alternatives**	New insight	Trends	Updates		
18	that it is **concise**, interesting, no more than 30 pages, with a good summary and most important it should be **ready within 6 months** after the end of the year	Concise	Ready early in the year			
19	I have no real expectations of the report. I hope it contains some concrete **recommendations** but if there are insufficient **means to implement** these recommendations it will change nothing.	Recommendations	Incentives required			

20	Propose an all-integrated plan to attack AMR. In that plan, we would like to consider the possibility and encourage the **research for alternative solutions** to lower the overuse of antibiotics	New insight				
21	**Tools to change** what is necessary. Full dedication of government. Time/money dedicated. Follow up on rules. Timeframe of plans.	Recommendations				
22	**one reference plan** for the whole country with **enforceable measures**	One reference plan	Enforceable measures			
23	It should **increase awareness** around AMR for every stakeholder in order to also allocate **more budget** for this problem It should **enhance private and public partnership and dialogue**	One health collaboration	Increase awareness	Incentives required		
24	it will have an **impact on the use** and prescription of antibiotics but will need perseverance in implementation	Impact on AMU				
25	That all data that are collected in different Institutions can be merged and different domains of expertise can work together in order to come to one strategic **'One Heath' projec**t, tackling the rise of emerging pathogens.	One health collaboration				
26	My expectations on the report: Should be a **priority** for the group working on it. (sufficient time should be awarded) Report ready on time so that measures can be taken rapidly. Ideally not a static report but dynamic eg on website with regular updates. Should be an integrated report, not just figures per sector but **links between sector** should be integrated.	Priority	Dynamic	Link between sectors		
27	The hope that more will be invested i**n NGS-based surveillance**	Incentives required				
28	A global picture of the AMR situation **in all the environmental** settings and possible **interactions**.	One health collaboration	Link between sectors			
29	Get a better insight in the putative **impact** of AMU in one sector on AMR in this sector or on AMR in other sectors. If associated with **a funding** of whole genome analyses, the comparison of human and animal strains could highlight AMR genes or AMR bacterial clones circulating in **and between the different sectors**.	Link between sectors	Incentives required	One health collaboration		
30	**Guidelines** in order to assist health specialists to manage antibioresistance and to adapt to new methods	Recommendations				
31	I hope it will show the **participation of all partners** involved in the AMR action plan. Above all, the **cross-sector interpretation of the data** should be possible (encouraged). Therefore, the support of the authorities is needed (to overcome barriers)	One health collaboration	Support of the authorities			

32	Providing recurrent harmonized presentations of the results allowing for - **follow-up over time**, - **detection of increased use** of critical antibiotics - identify **causative** link consumption/resistance - **readable also for non-experts** => facilitate communication	Trends	Highlight causes	Easy to read		
33	at a first step, an **overview of the currently available data** of resistance in different species and a description of what is missing or what could be added in the future. I hope this work will help in harmonizing further the approaches and methods used in surveillance of AMR in different sectors, as much as this is realistically feasible. In this way, **links between different sectors** could be made based on a sufficient body of knowledge	Overview of the currently available data	Link between sectors			
34	to have an overview of the situation in Belgium concerning AMR and its **evolution**, to know if the levels defined for the different indicators are reached or not, to have **a global picture**, from different fields/domains/approaches of the issue	Trends	One health collaboration			
35	to have a **centralized report** that allow **everyone to get easier access to the results**	Centralized report	Large visibility			
36	Clear **Guidelines** destined to all professionals and general public alike	Recommendations				
37	**wide circulation of the report** to make policies aware of the existing threat	Large visibility				
38	**competence and realism**, therefore confrontation and listening to actors in the field	Competence	Realism			
39	It should **question the model of industrial farming** and the **conditions of emergence of AMR** issues (lack of genetic diversity, intensification of production and overpressure on farm animals), including when such policies are going against strongly instituted interests such as the one of farming unions.	Question the model of industrial	Highlight causes			
40	**Description of successes** in animal use of antibiotics	Description of successes				
41	That it will start from a **shared responsibility of both human and veterinary medicine.** Too often it seems that only animal production is designated as the sector in which further efforts must be made, whereby I believe that also in human medicine, there is much progress that can be made. Furthermore the different government levels **have to be involved** and achievable targets have to be preceded.	Increase awareness	Policy support			

This table displays for each respondent (ID), the raw answer (column 'answer'). For each participant, the main expectation(s) was/were summarized to identify the main ideas which were grouped together in so-called 'themes'.

Annex 5. Strengths Weakness Opportunities Threats analysis.

Stakeholder ID	Strengths	Weaknesses	Opportunities	Threats
1	Complementarity	Fragmentation Of Competencies	Human Resources	Work Load
2	Collaboration , Expertise In Various Aspects	Drown Up The Message Because Too Large		Not Enough Involvement Of The Practitioners
3	Data Harmonization	In Belgium, No Prior Harmonization Work	Harmonization Of Procedures And Standards	Data Ownership, Collegiality, Harmonization Of Procedures And Standards
4	Broad Involvement Of Different Institutions	Slow Decision Processes	Increasing Awareness Of Resistance Problem	Underfinancing, Insufficient Timely And Representative Data On Prescribing And Resistance
5	Support Base And Implementation	Disagreements Between Federal And Regional Partners Or Stakeholders	Involvement Of More Partners - Communication On A Larger Scale	Lost Of Important Partners Such As Infectiologists Due To Their Time Constraints
6	Know How To Reduce The Use Of Ab Is Available	Too Many Actors Involved , Fight For The Data , Takes A Lot Of Time	Better Collaboration Between Institutions	Lack Of Resources (Money)
7	All Stakeholders Stand Behind The Implementation Of One Health Antimicrobial Approach If We Are All Involved Upfront	No Legal Framework To Implement Ivd Testing At Primary Care Level, Many Different Stakeholders Involved	The Role Of Diagnostic Biomarkers, The Role Of Prevention, Financing For Health Care Organisations In Proven Infection Rate	Silo Approach In Healthcare Budget
8	Collaboration Between Human, Veterinarian And Environmental Health	Less Involvement Of Non-Governmental Organizations		
9	Uniform And Clear Report	Commercial Interests / Economy	Awareness	Too Complicated - Too High Level
10	Veterinary And Human Problems Ab Resistance Are Inextricably Linked	Many Different Interests	Unique Opportunity To Improve Both Animal Health And Public Health	Veterinary Medicine Threatens To Reach The Second Place (Danger To Animal Welfare And Animal Health)
11	See Relationships Between Resistance In Different Sectors, Network, Global View Of Data, All Work Towards The Same Goal	Careful With Global Conclusions, Time Needed From The Experts To Invest In This Project, How To Deliver The Data	Open A Discussion Between Actors, Harmonization Between Methods, Good Translation To The Field	Data Protection, Gdpr, Global Conclusions
12	Well Elaborated Plan	Smart Objectives For Reduction Of Am Use Are Required	New Government	Budgetary Situation, To Much Focus On The Covid-19 Crisis/Resources Redirected To Covid-19
13	Collaboration	Many Involved Competence	Knowledge	
14		Alignment With European Initiatives?	Possibility Of Aligning Regional Approaches In A National Plan	
15	Coordinated Approach		Broad View Of The Problematic	Too Patchy (Or Non Harmonized) For Making Scientific Conclusions

16	AMCRA Brings Stakeholders Together	Companies Influence The Topics	Innovative Therapies Have To Be Developed	Innovative Therapies Fail Or Are Too Expensive
17	A Lot Of Data Available	Slow, Fragmented	Possibilities For Good Analysis	Make It So Complete That It Becomes Too Complex And Will Take Too Long Before It Appears
18	Broad Collaboration	Slow Decision Processes,	Increasing Awareness Of The Problem	Underfinancing, Lack Of Representative Data On Prescribing/Resistance
19	Inclusion Of Human, Animal And Environmental Aspects	Too Big Ambitions	Change The Pharmacy System So That Only The Prescribed Amount Of Treatment Is Given, And Not Quantity Per Box	Not Enough Time Given To Infectiologists/Specialists To Make A Good Plan
20	Enthusiasm Of Participants	Splitting Up Of (Legal) Competences And Authority	Actual worldwide Interest In Infectious Diseases	Defederalisation Of Belgium
21	Multi-Stakeholder, Broad Picture, Evidence Of Inter-Relationship, Increased Representativeness	Static Report, Frequent Updates Needed (Real Time Monitoring Of The Amr),	Awareness Around Inter-Relationship, Awareness On Problematic, More Available Information (Regional/National Differences), Communication Between All Stakeholders Aiming At The Same Goal	Not Detailed Enough (High Level), Representativeness, Lack Of Resources, Low Inter institutional Partnership
22	Collaboration In All Policies	Dispersed Competence Levels	Global Plan	Difficult Implementation - Need For Mind Shift
23	Strong Expertise Embedded In Different Institutions	Lack Of Data (And Information) About Antifungal Resistance	Lack Of Data (And Information) About Antifungal Resistance - All Data Will Be Interesting (Even The Negative Ones)	Expertise Is Not Shared
24	Animal, Food And Human Ref Labs In The Same Institution; Small Country	Not Enough Dialogue Between Researchers	OH AMR workgroup In Sciensano Lead by (name)	The Danger Exists That It Is Not Considered A Priority During Covid 19
25	All Eu Surveillances Up And Running	No Environmental Monitoring	Switch To One Health Amr Monitoring Using New generation sequencing	Budget Limitations
26	Historical Data Collection	Lack Of Harmonization In The Data Collection	Show Gaps And Weakness In The Actual Antimicrobial Resistance Surveillance System	Manpower Resources
27	Gather All Information In A Single Report To Highlight Common Trends And Differences In The Monitoring Conducted In The Different Sectors (Ideas To Improve Harmonization To Ensure Comparison Between The Different Sectors) And Highlight Missing Information In Some Sectors	Currently The Context Of Collection Of Amr Data Is Very Different Between The Human Sector (Mainly Clinical Cases) And Animal Sector (Monitoring In Healthy Animals) Which Makes Comparison Difficult.	Get A Better Insight In The Putative Impact Of Amu In One Sector On Amr In This Sector Or On Amr In Other Sectors. If Associated With A Funding Of Whole Genome Analyses, The Comparison Of Human And Animal Strains Could Highlight Amr Genes Or Amr Bacterial Clones Circulating In And Between The Different Sectors (Humans And Animals).	Work Overload Of The Different Persons Involved In Data Supply For The Report Could Slow Down The Writing Of The Report And Could Lead To Less In-Depth Reflection In The Discussion Of The Report
28	Awareness	Lack Of Communication	Existing Systems Of Amu Notification	Competition Between Different Services
29	To Showcase The Cooperation Between Institutions Involved In Amr / Amu	Delay Between Draft And Publish; Variability In Partners And Their Participation	One Health Era, Much Attention Goes To Cross-Sector Collaboration Nowadays	Competition: The Belgian Document (And Plan) Will Be Compared To Others
30	Multidisciplinary	Summarizing Different Opinions	New Research Collaborations	Overload Of Information, Determine The Role Of Each Collaborator

31	Holistic	Representatively	Harmonization	Heterogeneity In Data Available
32	Bringing All Data Together And Potentially Identify Links Between Different Sectors	Different Types Of Data From Different Sectors, Lack Of Harmonization At This Stage	Add New Types Of Data (Eg New generation sequencing)	Lack Of Budget ; Lack Of Participation Of Private Labs
33	Reinforcement Of The One Heath Approach Of This Issue	Difficulties To Obtain Some Data On Time From Some Partners-Fields	National Action Plan For Amr	Ressources Dedicated For This Report
34	Better Communication Hence Better Action At Large Level			
35	Good Monitoring Already In Place	Need Funding	Better Highlight Of Belgium Abroad	Belgium Is A Difficult Country (Federal, Regional), With Different Interest Between Animals/Humans
36	Direct Collaboration Of All Users/Prescribers Will Provide A More Accurate And Overall Picture	When Different Interest Groups Are Involved There Might Be A Risk Of Accepting Concessions	Open Discussions About Each's Sentiment On The One Goal : Public Health	Without Deadlines Endless Discussions Might Halt The Momentum.
37	First One Health Amr Initiative		Integration Of Environment Domain	
39	Wealth	Weight Of Pharmaceutical Industry, Distribution Of Political Competences	Small Country (Possibility Of Coordinated Action)	Open Wide To The Winds Of Globalization And Logistics Fluxes
40	Collaborative Approach		Going Further With The Legislation For Alternative Such As Bacteriophages	
41	Collaboration Human And Animal Use Of Antibiotics	Report Of Use In Animal S Under Control; Not The Case In Human Ambulatory Medicine	Can Only Increase Common Actions Human And Veterinary Medicine	
42	Collaboration Of Different Institutions	Many Institutions And Actors Involved	Implementation Of A One-Health Principle With Equally Shared Goals	It Would Stay A Written Report, With Limited Action In The Field

This table presents the raw results of the Strengths Weakness Opportunities Threats analysis regarding collaboration in the Belgian national one health report. Colours underline similar ideas.

Annex 6. Actors mapping

	power	interest	score
Belgian Antibiotic Policy Coordination Committee (BAPCOC)	7.05	8.36	7.70
Belgian Feed Association	5.23	6.05	5.64
Certification/label/ sector/professional associations	5.64	5.95	5.80
Consumers	5.82	5.82	5.82
Farmers association	5.59	5.32	5.45
Federal agency for medicines and health products	8.09	7.82	7.95
Federal Public Service	8.27	8.14	8.20
Food Agency for the Safety of the Food Chain	8.43	8.04	8.24
Food retailers	5.77	5.09	5.43
Knowledge centre of antibiotic use and resistance in animals (AMCRA)	5.64	8.14	6.89

Medical doctors	5.50	6.59	6.05
Milk sector organisations/labs	5.50	5.73	5.61
Minister of Agriculture	8.50	7.36	7.93
Minister of Health	9.00	8.50	8.75
National Belgian Federation of slaughterhouses (FEBEV)	5.27	5.23	5.25
National Institute for Health and Disability Insurance (INAMI/RISIV)	7.05	7.50	7.27
Pharma industry	5.95	5.23	5.59
Risk assessment group	5.45	6.68	6.07
Sciensano	7.91	8.83	8.37
Universities	5.68	7.50	6.59
Vet association	5.45	6.27	5.86
Vet practitioners	5.18	6.64	5.91
Vet regional laboratory 1 (Association régionale de santé et d'identification animales)	4.82	5.45	5.14
Vet regional laboratory 2 (Dierengezondheidszorg Vlaanderen)	4.77	5.45	5.11

This table shows, for each stakeholder, the mean attributed score for power and interest. The column 'score' is the averages of the power & interest scores. Power was defined as the capacity to influence the decision-making, the ability to decide upon implementing and how to implement the intervention. Interest was defined as the level of importance the intervention has to the particular stakeholder, if the subject is high on the stakeholder's agenda.

Annex 7: Percentage of agreement for a selection a terms related to the vocabulary of antimicrobio-resistance

Term	Definitions	% agreement
Antibiotic (1)	A drug that kills or stops the growth of bacteria. Antibiotics are a type of antimicrobial. Penicillin and ciprofloxacin are examples of antibiotics.	100% (30/30)
Antibiotic (2)	A substance produced by or derived from a microorganism, which destroys or inhibits the growth of other microorganisms.	60% (18/30)
Antimicrobial (1)	A substance, such as an antibiotic, that kills or stops the growth of microbes, including bacteria, fungi, or viruses. Antimicrobials are grouped according to the microbes they act against (antibiotics, antifungals, and antivirals). Also referred to as drugs.	90% (27/30)
Antimicrobial (2)	A drug which, at low concentrations, exerts an action against microbial pathogens and exhibits selective toxicity towards them. Antimicrobials typically include antibiotics but also antivirals and other drugs effective against microorganisms.	56.7% (17/30)
Data	Facts, measurements, recordings, records, or observations about the world collected by scientists and others, with a minimum of contextual interpretation. Data may be in any format or medium taking the form of writings, notes, numbers, symbols, text, images, films, video, sound recordings, pictorial reproductions, drawings, designs or other graphical representations, procedural manuals, forms, diagrams, work flow charts, equipment descriptions, data files, data processing algorithms, or statistical records.	93.1% (27/29)

Disease	A situation in which infection has elicited signs and symptoms in the infected individual; the infection has become clinically apparent.	72.4% (21/29)
Environment	All that which is external to the individual, including physical, biological, social, cultural and other factors.	96.6% (28/29)
Health (1)	A state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity.	96.6% (28/29)
Health (2)	The state of complete physical, mental, and social well: being and not merely the absence of disease or infirmity. Health has many dimensions (anatomical, physiological and mental) and is largely culturally	72.4% (21/29)
Infection	The state of complete physical, mental, and social well: being and not merely the absence of disease or infirmity. Health has many dimensions (anatomical, physiological and mental) and is largely culturally	96.6% (28/29)
Mutation	A permanent, typically negative, change in the genetic material in a cell which, in most cases, can be passed onto any offspring.	58.6% (17/29)
One health (1)	One Health is an approach to designing and implementing programmes, policies, legislation and research in which multiple sectors communicate and work together to achieve better public health outcomes. The areas of work in which a One Health approach is particularly relevant include food safety, the control of zoonoses and combatting antibiotic resistance	86.2% (25/29)
One health (2)	One Health is an approach to designing and implementing programmes, policies, legislation and research in which multiple sectors communicate and work together to achieve better public health outcomes. The areas of work in which a One Health approach is particularly relevant include food safety, the control of zoonoses and combatting antibiotic resistance	82.8% (24/29)
Suveillance (1)	A careful observation of one or more food or feed businesses, food or feed business operators or their activities (in the context of the food and feed control Regulation (EC) No 882/2004). In general, it means a close and continuous observation for the purpose of control. As opposed to monitoring active control measures are frequently taken when positive cases are detected. This type of programme does not necessarily have a defined target for reducing the occurrence of diseases	71.4% (21/29)
Surveillance (2)	Consists of procedures developed in response to a risk and carried out to support subsequent actions. Data collection and record keeping to track the emergence and spread of disease: causing organisms (incl. antibiotic: resistant bacteria).	89.7% (26/29)
Surveillance (3)	The continuous, systematic collection, analysis and interpretation of data needed for planning, implementation, and evaluation related to zoonotic diseases.	71.4% (21/29)
Surveillance (4)	The systematic continuous or repeated measurement collection collation analysis interpretation and timely dissemination of animal health and welfare related data from defined populations. These data are then used to describe health hazard	79.3% (23/29)

	occurrence and to contribute to the planning implementation and evaluation of risk mitigation actions	
Surveillance (5)	The systematic ongoing collection, collation and analysis of data for public health purposes and the timely dissemination of public health information for assessment and public health response as necessary.	79.3% (23/29)

This tables shows the mean proportion of respondent who agreed with the proposed definitions for the selected terms part of the vocabulary dedicated to antimicrobial resistance (see Annex 2, question A.1). The terms were numerated if several definitions were provided by the 'Glossaryfication-Service'.

Annex 8. Comments on the terms related to the vocabulary of antimicrobio-resistance in case of disagreement

Term	Remarks
Antibiotic (2)	I prefer definition of 'Antibiotic (1) A substance, which destroys or inhibits the growth of microorganisms in living organisms. (disinfectants also kill or inhibit growth but are not necessarily antibiotics). I prefer definition of 'Antibiotic (1) An antibiotic can be produced by chemical synthesis. A substance produced by or derived from a microorganism, which destroys or inhibits the growth of bacteria Most antibiotics are derived from microorganisms, but not all. Exceptions are, e.g. Quinolones and sulfamthoxazole. Not all are produced or derived from microrganism Small molecule drugs that either kill bacteria outright (bactericidal) or halt their growth (bacteriostatic) to enable the host immune system to overcome the bacteria that are causing the illness. From : Antibiotics : Challenges, Mechanisms, Opportunities. Walsh C. and Wencewicz T., ASM Press 2016, Washington, DC, ISBN 9781555819316 A substance produced by or derived from a microorganism or synthetically produced, which destroys or inhibits the growth of other bacteria
Antimicrobial (1)	No virus "as some antibiotics are active together against bacteria and protozoans the grouping mode you propose is not accurate! Do not forget protozoans! Antimicrobials -including antibiotics, antivirals, antifungals and antiparasitics- are medicines used to prevent and treat infections in humans, animals and plants,"
Antimicrobial (2)	I prefer definition of Antimicrobial (1) Not necessarily at low concentrations I prefer definition of Antimicrobial (1) Concentration is irrelevant in this definition. The concentration at which it exerts its action is molecule- and target-specific. Suppression at low concentrations A drug which exerts an action against microbial pathogens and exhibits selective toxicity towards them. Antimicrobials typically include antibiotics but also antivirals and other drugs effective against microorganisms Microbe=bacteria Concentration must not be a part of definition, I think A drug or chemical which exerts an action against micro-organisms. Antimicrobials typically include antibiotics but also antivirals and other drugs and disinfectants effective against microorganisms. I prefer definition of Antimicrobial (1)
Data	Collected and validated by scientists, not all information collected should be considered as data in the framework of AMR/AMU surveillance. "recorded information that can be accessed and shared, about "" events, measurements, recordings, observations…."". Format is a property but should not appear in the def. Meta data description should always accompany data, as they describe the used formats, references (i.e: units, time), and internal codes (i.e. categorical data)."
Disease	A situation in which the functioning of one or more organs is disturbed (whether or not by an infection…)

	Disease: a situation in which infection or other condition (eg cancerous tissue, auto-immunity reaction) has elicited signs and symptoms in the infected or affected individual; the infection (or other condition) has become clinically apparent. Disease includes clinical as well as sub-clinical presentations. Not necessary infection - mental disease is possible without an infection A disorder of structure or function in a human, animal, or plant, especially one that produces specific symptoms or that affects a specific location and is not simply a direct result of physical injury. the definitions stays for infectious disease and not disease "You seem to forget non infectious diseases… ""Disease: Literally, dis-ease, the opposite of ease or comfort, a general word descriptive of any departure from good health. Best applied to a physiological and/or psychological departure from normal function, as contrasted with illness, which is the subjective state of the diseased person. A disease is a conceptual entity defined by clinical, pathological, and epidemiological criteria that enable it to be studied systematically"" (From Dictionary of public health, Oxford University Press(Oxford Quick Reference Series), 2nd Ed, 2018)"
Environment	"you should precise the field (ecology, social, market, biophysical)… as even a cell modifies its productions in function of its environment. "
Health (1)	
Health (2)	The perception of health is partly cultural. I prefer definition of 'Health (1)' I do not agree with "largely culturally". "cultural" do not agree The state of complete physical, mental, and social well: being and not merely the absence of disease or infirmity. Health has many dimensions (anatomical, physiological and mental) "please refer to WHO standard,, why do we need the one of Iowa Government ? https://idph.iowa.gov/Portals/1/Files/LPHS/LBOH%2010_glossary.pdf" I prefer definition of 'Health (1)'. I do not see the cultural aspect of health
Infection	Agree with the definition except that virus should be omitted since included in microorganisms
Mutation	Not typically negative A mutation is not typically negative but negative mutations stand out more. 'Negative' also depends on the point of view. What is positive for a bacterium (more resistant to antibiotics) may be negative for the infected organism. Not necessarily permanent and not necessarily negative. Suppression in most cases A permanent, typically negative, change in the genetic material in a cell or microorganism which, in most cases, can be passed onto any offspring. Not necessarily negative not all are negative Mutation: A permanent change in the genetic material in a cell which, in most cases, can be passed onto any offspring A change in the genetic material in a cell which, in most cases, can be passed onto any offspring. Remove "typically negative" from your definition and it will be OK "A change in the genetic material in a cell which, in most cases, can be passed onto any offspring." My comment: another mutation could occur at the same place, then it is not permanent.
One health (1)	One-health is not an approach but a fact that the health of people, animals, plants and environment is related. The summed up particulars are only focusing on animal based risk factors while it should be a much broader concept. Illustration of the bias to focus on perceived high risk from animal origin pathogens. I hate this one : not a word about animals or environment… check here under
One health (2)	I prefer definition of One Health (1) One health should not recognize that the optimal health of people is connected to many things but also that the health of animals, plants and the environment is important and depends for a great deal on human actions. In other words, human health should not in all instances be the primary goal. Similar faulty reasoning as definition above. One health movement focusses on and clearly lays priority on human health. One Health is the concept that drives the collaborative effort of multiple disciplines-working locally, nationally, and globally – to attain optimal health for people, animals and our environment (in blue : from American

	Veterinary Medical Association, One Health : A New Professional Imperative, One Health Initiative Task Force : Final Report, July 15, 2008)
Suveillance (1)	Not limited to food See surveillance 3. Surveillance is more than a careful observation of one or more food or feed businesses, food or feed business operators or their activities but comprise companion animals and human activities. REG 882/2004 is no longer in force. I prefer definition of 'Surveillance (3)' surveillance usually includes targets which in turn leads to actions. The systematic ongoing collection, collation and analysis of data for public health purposes and the timely dissemination of public health information for assessment and public health response as necessary. Not specific of food business Surveillance is the systematic, ongoing collection, collation and analysis of information related to animal health, and the timely dissemination of information to those who need to know, so that action can be taken (OIE Terrestrial Animal Health Code).
Surveillance (2)	I prefer definition of 'Surveillance (3)' I prefer definition of 'Surveillance (3)' see Surveillance (1) alternative definition
Surveillance (3)	Not limited to zoonotic diseases This seems like the best definition if 'zoonotic disease' is replaced by 'the targeted issue'. Broader than just zoonotic diseases. The systematic ongoing collection, collation and analysis of data for public health purposes and the timely dissemination of public health information for assessment and public health response as necessary. Can be systematic or repeated I prefer definition of 'Surveillance (1)'
Surveillance (4)	not limited to animal health and welfare see surveillance 3 Definition of 'Surveillance (3)' The systematic ongoing collection, collation and analysis of data for public health purposes and the timely dissemination of public health information for assessment and public health response as necessary. see Surveillance (1) alternative definition
Surveillance (5)	I prefer definition of 'Surveillance (3)' I prefer definition of 'Surveillance (3)' privacy Can be systematic or repeated I prefer definition of 'Surveillance (1)'

This table displays the comments given by the respondants if they disagreed with the proposed definition(s) for the selected terms part of the vocabulary dedicated to antimicrobial resistance (see Annex 2, question A.2). The terms were numerated if several definitions were provided by the 'Glossaryfication-Service'.

Pilot Summary – WP2Epi-T3-ST5

JIP1 - ORION - IA1 - 1st Call

Responsible Partner: BfR
Contributing partners: FLI

GENERAL INFORMATION

European Joint Programme full title	Promoting One Health in Europe through joint actions on foodborne zoonoses, antimicrobial resistance and emerging microbiological hazards
European Joint Programme acronym	One Health EJP
Funding	This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 773830.
Grant Agreement	Grant agreement n° 773830
Start Date	01/01/2018
Duration	60 Months

DOCUMENT MANAGEMENT

JIP/JRP Deliverable	JIP1-WP2-T3-ST5
Joint Integrative/Research Project	JIP1 - ORION - AI1 - 1st Call
JIP/JRP Leader	Thomas Selhorst (BfR), Robert Opitz (BfR)
Other contributors	Jörn Gethmann (FLI), Johanna Dups-Bergmann (FLI)
Due month of the deliverable	42
Actual submission month	42
Type *R: Document, report* *DEC: Websites, patent filings, videos, etc.* *OTHER*	R
Dissemination level *PU: Public* *CO: confidential, only for members of the consortium (including the Commission Services)*	PU

WP2EPI: RASCH MODEL

1. Background

Within Work Package 2 of ORION (WP2-T3-ST5) we aimed at developing a tool to quantify the extent to which actors follow OH ideas in zoonosis control, i.e. to quantify the OH-ness of their approaches.

The Rasch model[1] belongs to the class of latent trait models that investigate how to quantify underlying latent variables using observable categorical data (the so-called items).
Here, we are concerned with the One Health idea, specifically the extent to which actors involved in zoonotic disease control, for example, follow this idea. The quantification is important because it will be shown that by applying the One Health approach one achieves better results in the prevention, detection and control of zoonoses.

We define a new term here and refer to the extent to which actors follow the on Health idea as One Health-ness (OHn). Further, the actors in the context considered here represent countries, e.g. EU member states or also federal states (such as in Germany). Finally, we assume that it is possible to quantify outcomes of zoonotic disease control measures. Then it is possible to numerically assess the relationship between OHn and success in controlling zoonoses.

For example, the observed data, the items, come from the OneHealth item universe that can be derived from the Tripartite Zoonosis Guide (TZG)[2] and from other publications[3,4]. Considering then TZG for example, for the item multisectoral approach it is stated:
„*In the TZG, taking a multisectoral, One Health approach means that all relevant sectors and disciplines across the human – animal – environment interface are involved to address health in a way that is more effective, efficient, or sustainable than might be achieved if not all relevant sectors were engaged. Taking a multisectoral, One Health approach includes ensuring balance and equity among all the partners.*“

Above it was stated that the items are categorical data. The item mutlisectoral approach is categorical and dichotomous when answering the question whether a multisectoral approach is followed. The answer can only be yes or no, dichotomous. In the type of Rasch model used here, all items are formulated dichotomously, yes(1) and no(0)

Since the item catalog has not yet been agreed upon, it is important to know that the Rasch model claims to generate specifically objective, i.e. item independent test results. This means that regardless of which items from an item universe are used, the test results are always the same for the actors.

[1] Rasch, G. (1961). *On general laws and the meaning of measurement in Psychology*. Berkeley. University of California Press.
[2] https://www.oie.int/fileadmin/Home/eng/Media_Center/docs/EN_TripartiteZoonosesGuide_webversion.pdf
[3] Bordier M, Uea-Anuwong T, Binot A, Hendrikx P, Goutard FL. Characteristics of One Health surveillance systems: A systematic literature review. Prev Vet Med. 2020 Aug;181:104560. doi: 10.1016/j.prevetmed.2018.10.005. Epub 2018 Oct 13. PMID: 30528937.
[4] Bordier Marion, Delavenne Camille, Nguyen Dung Thuy Thi, Goutard Flavie Luce, Hendrikx Pascal (2019). One Health Surveillance: A Matrix to Evaluate Multisectoral Collaboration. Frontiers in Veterinary Science, (6) p.106ff. DOI=10.3389/fvets.2019.00109. ISSN=2297-1769.

2. Objectives & expected outcome

The goal of this pilot is to provide a tool supports to quantitatively assess the OHness of activities of different actors in the context of zoonoses control.

We have developed three objectives to meet the described goal

1. formulation of the underlying model using actual literature,
2. implementation and documentation of the model using dynamic report generation and a bayesaion appraoch from actual literature,
3. functional testing of the tool using a toy dataset,
4. content testing of the Rasch model using data collected by Bordier et., 2019 (The data has been submitted by June 24, 2021, a publication is planned in 2021)
5. formulation of conditions that must be met in order to use the tool.

With the achievement of these sub-objectives, a functionally and content tested tool should be available, with the help of which the ohness of activities of different actors in the context of animal disease control can be quantitatively evaluated. Furhermore documents describing a) the bayesian foundations of the Rasch model, b) the implemation of the model using dynamic reporting, c) the implemenation of the model as pyton script are provided.

3. Performed activities

Objective 1

In order to address objective one, an extensive literature review was conducted regarding Bayesian methods for latent class models. Initially, the implementation of these models in the programming environment R was targeted. After personnel changes, the programming environment was switched to python. It is expected that R programming environment offers similar functionalities as the python.

Objective 2

In order to be able to present the program-technical implementation clearly, the model was created in an environment for dynamic reporting. Here program and description are mixed so that the reader can follow the programming approach more easily. The current literature review on the program environment *Jupyter notebook* was reviewed.

Objective 3

Functional testing of the program was performed by applying the program to various test data sets.

Objective 4

Content testing of the Rasch model using surveillance data fom M. Bordier is scheduled for the remainder of the project.

Objective 5

Here we deal with the item catalog used to quantify the willingness of actors to implement OH measures. Literature on item catalogs and on the item sensitivity of the model was reviewed.

4. Results

Objective 1

It was already pointed out in the introduction that the probability of fulfilling an item depends on two latent variables: on the one hand, on the willingness of an actor to implement the OH idea and, on the other hand, on the demand that the item makes on the actor.

This will be explained by an example: The demand an item makes on an actor can be high or low. An item with a low demand could be, for example, that one drafts a document in which one declares the will to follow the One Health Thought. An item with a high demand could be one that requires financial and human resources to be made available over several years so that the One Health idea can be strengthened in zoonosis control.

If an actor has a certain willingness to implement the One Health concept and the items make different demands on the actor, then the actor will either fulfill the demand or not, depending on the demand (Figure 1).

In the Bayesian approach, both the endpoints of item claims and the actor's willingness to perform One Health measures are not fixed values but are represented by distribution. The posterior distributions for both distributions are derived from prior distributions and the responses taken from the questionnaire (the data). For each actor and for each item, such a distribution is determined from the prior distributions and the data.

The relationship between OHness and item requirement can be described according to Farshad Lavassani Miraftab[5]:

$$P(x = 1|\alpha, \delta) = \frac{\alpha - \delta}{1 - \exp(\alpha - \delta)}$$

with α and δ being the actor's OHness and the requirement of the item respectively.

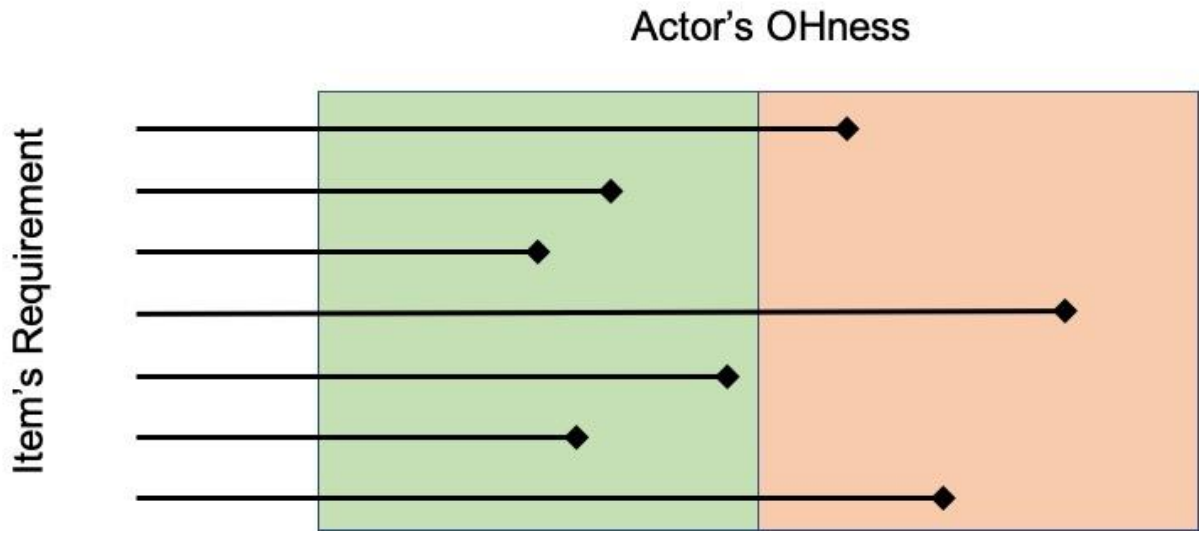

Figure 1 Grapical representation of the Model

[5] https://towardsdatascience.com/a-bayesian-approach-to-rasch-models-item-response-theory-cc08805cbb37 last visited March 29, 2021

Objective 2

The tool is implemented in the programming language Python[6] and in order to realize dynamic reporting a notebook was generated using the interactive computing platform Jupyter[7]. The implementation was adapted from actual literature[8].
The result of the implementation is presented in Annex 1. In this document all steps of the implementation are described.

Objective 3

The tool is also implemented as a python script (with minimal system requirements), which can be started from the console via program name and a data file name:

```
% python OHntool.py -f example.csv
```

The data file must have a certain form and shape so that the program can process the data.
The rows in the file represent the different actors and the columns represent the different items. Rows and columns form the response matrix (m,n) of the actors to the items. Where m is the number of actors and n is the number of items. The entries in the matrix are separated by commas. The file contains only zeros and ones representing the responses to the item requirements. 0 means that the request was not fulfilled and 1 means that the requirement was fulfilled.

Python is executable on all operating systems. Yout have to install all required libraries before you can run the program (required libraries are given at the end of Annex 1). Python source code will be make available (UTF-8 file)

Objective 4

Will be worked on during the remainder of the project in conjunction with Objective 5 of ST-1

Objective 5

The application of the Rasch model consists of two parts. On the one hand we have the model, with which the results from a questionnaire for OHness can be processed. The design of this questionnaire has not yet been agreed upon. It has to be set up in cooperation with scientists with domain knowledge, because it has to be judged which questions should be taken from the item universe One Health. It will be further processed in connection with the processing of objective four.
Nevertheless, the creation of a questionnaire will probably remain preliminary. In this context it is important to remember that the Rasch model claims to generate specifically objective, i.e. item independent test results. This means that regardless of which items from an item universe are used, the test results are always the same for the actors. It must therefore be ensured that the questions originate from the general item universe One Health.
In any case, the questionnaire will take into account the information from the TZG[9] and, in addition, the results of the work of Bordier et al. 2019[10].

[6] https://www.python.org
[7] https://jupyter.org
[8] https://towardsdatascience.com/a-bayesian-approach-to-rasch-models-item-response-theory-cc08805cbb37 last visited March 29, 2021
[9] https://www.oie.int/fileadmin/Home/eng/Media_Center/docs/EN_TripartiteZoonosesGuide_webversion.pdf
[10] Bordier Marion, Delavenne Camille, Nguyen Dung Thuy Thi, Goutard Flavie Luce, Hendrikx Pascal (2019). *One Health Surveillance: A Matrix to Evaluate Multisectoral Collaboration.* Frontiers in Veterinary Science,(6), pp109

5. Implementation and impacts

With the pilot we successfully implemented the Rash model in python. As output, the distributions of Actor's OHn and item requirements were realized. This makes it possible to objectively evaluate the OHn of actors. If this evaluation is available, then a knowledge transfer can happen, where the implementation of successfully handled item requirements can be learned. This will also help to promote impartial collaboration between actors of the One Health community.

The presented model is not a static model but can be adapted to changing conditions and requirements at any time. Also, it can create deeper insights into the dependencies of latent variable actor OHn and item requirement by further developing the statistical analysis.
The program and the code itself are open source, so that further developments can build on these building blocks.

6. Reflections on the OH perspective

The model aims directly at the promotion of the OH idea through the objective evaluation of different implementations and the exchange between actors stimulated by it.

6.2 Lessons learned under each relevant principle in the OHS Codex:

Collaboration
The application of the model created here is only possible through collaboration between scientists from different disciplines.

Knowledge
Here the principle applies: Knowledge increases through interchange. The model can support the generation of this knowledge by stimulating and promoting the exchange between the actors in the field of zoonosis control.

Data
In the course of the Bayesian analysis, a lot of data is generated that can be further analyzed subsequently (posteriori predictive checks) to generate deeper insights.

Dissemination
As mentioned under knowledge, it will be important to demonstrate the benefits from using the model. This is necessary to maintain acceptance and to derive necessary adaptations of the model from the discussion with the users.

6.3 SWOT-like considerations for

Process	Max 2-3 points in each
Things that worked very well during the study	• Collaboration
Things that were difficult or didn't work well during the pilot study	• Personnel movement • Extraction of data from the inventories
Outcome/product	
Prospects for implementation of the pilot study outcome and further development opportunities	• the dissemination activities after the end of the project must be financed.
Expectations that were not fulfilled and/or barriers for uptake	• We did not expect the slow completion of questionnaires

7. Annex: List of publications, presentations

Presentation

1. Michael Weiß. **Surveillance – Erkenntnisse aus der Modellierung von Fragebogendaten.** 26. DACh-Epidemiologietagung „Epidemiologie in der ökologischen Landwirtschaft“. Tagung der DVG-Fachgruppe „Epidemiologie und Dokumentation“, der Sektion Epidemiologie der Österreichischen Gesellschaft der Tierärzte, des Forums für Epidemiologie und Tiergesundheit Schweiz. Freising, 4. bis 6. September 2019
2. Tool to evaluate OH surveillance and monitoring systems. The Rasch model. Presentation at the EJP Full consortium meeting 21-03-09.