



**D4.10 1st periodic report on
ongoing JIP:s**

WP4 Joint Integrative Projects

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Contributing partners: INSA



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1. Introduction

The joint core mission of partners in the One Health EJP is to provide expertise and services to appropriately prevent, detect and respond to societal challenges such as foodborne zoonoses, antimicrobial resistance and emerging threats shared by people and animals. The chain of actions from prevention via detection to response defines a series of capacities that need to be maintained and kept up-to-date by these expert institutes. These pertain to their capacity to design and implement surveillance activities, develop high quality laboratory methods, access relevant reference materials and data, as well as to their ability to interpret and communicate surveillance information in a timely and appropriate manner, as well as to provide guidance to risk managers about relevant actions, both for prevention and response.

Similarly, the purpose of integrative activities and projects within the OHEJP is to strengthen the joint preparedness of partners to prevent, detect and respond to hazards within their joint remit, both nationally and in collaboration within other EU institutes and -agencies. Due to the legislated landscape in which OHEJP partners operate, and due to the close relationship and collaboration with EFSA and ECDC, there are already many strategies, initiatives, activities and systems in place to develop the capacity to respond to joint hazards within the field of foodborne zoonoses, antimicrobial resistance and emerging threats. The objective of Joint Integrative Projects (JIP) is not to replicate, but to strengthen existing, well-functioning systems. The guidance and insight of EFSA and ECDC is of major importance to help such alignment. The objective of JIPs is also to bridge the gap between the sectors by successively focusing on the inter-sectoral mechanisms along the chain from preparedness to response, and to investigate and improve how the work processes of microbiologists, epidemiologists and information specialists function across the Med-Vet interface at the national level. Strengthening of inter-sectoral mechanisms at the national level will subsequently benefit the supra-national level.

Consequently, the ambition of the integrative activities of the One Health EJP is to develop structures, work processes and platforms that bridge inter-sectoral division within the domains defined by the OHEJP scope, resulting in ONE single European surveillance community. This integrative development should be aligned with European priorities, accommodate and be adapted to existing EU initiatives and support long-term sustainability in the improved joint capacity.

Operational integration is promoted by means of several different instruments, the primary instrument being the implementation of Joint Integrative Projects (JIP :s). Prioritised needs regarding joint collaborative resources were identified in the strategic research agenda (SRA) for 2018-2019, developed during 2016 in the context of the EJP proposal. These priorities are reflected by the first two JIP :s - ORION and COHESIVE. COHESIVE focuses on the ability to pick up, share and communicate signals as well as the ability to conduct joint risk assessments. ORION focuses on the semantic and technical interoperability between the sectors, with focus on surveillance information.

Clearly, since the joint EU capacity is a function of each member state's capacity, the JIP :s are expected to make their developments accessible to all partners, and ensure there is transfer of skills and knowledge and promote harmonised approaches wherever it is relevant. In this way, the JIP :s will serve to strengthen both the scientific capacity within the EJP and also future prevention,

preparedness, detection and response of the EU to foodborne and other emerging threats across human-animal-environmental sectors.

WP4 is responsible for supervision and evaluation of the JIP :s. The body of this report is based on the 12-month reports provided by the two projects, with an initial chapter summarising their operational performance in the first year.

2. Summary of the performance of the Joint Integrative Projects

2.1. Milestones and deliverables

During the first year, the two joint integrative projects (JIP:s) COHESIVE and ORION had listed 5 milestones. Three have been achieved and one is partly delayed, but with no critical dependencies. One of COHESIVE’s milestones (M-JIP2-2) was considered redundant in the light of the development OHEJP website, and has not been considered further.

The JIP’s had planned to submit a total of 13 deliverables at the end of Y1. Eight of the 13 expected deliverables have been finalised by the end of the year (62%, see Table below) and reported to the OHEJP WP4 management. However, upload to the private area of the OHEJP website is still pending. This can partly be attributed to a need to get more acquainted with the private space of the website, which was relaunched at the end of 2018. Also, four of the deliverables are meetings or workshops; non-physical deliverables that will not result in a written document, and should perhaps be considered milestones (NA category). Also, one deliverable linked to the launch of a website for COHESIVE (D-JIP-1.2) was considered redundant. It has not been included further below.

	Total	Finalized and submitted on OHEJP website	Finalized but not yet submitted on OHEJP website	Delayed to 2019	NA
Number of Deliverables	13	0	4	5	4
Percentage	100	0	32	36	32

Actions resulting from the follow up of milestones and deliverables:

- The expectations on the continuous reporting of milestones and deliverables, including where to place them, will be more explicitly communicated in an updated version of the reporting guidelines (D3.1 and D4.1).
- The difference between milestones and deliverables will be better communicated for 2nd call proposals.
- The WP4 team has also identified a need to define whether deliverables are to be regarded as public (PU) or confidential (CO). While this is implicit for projects such as the OHEJP itself, where this information is specified in conjunction with the submission of project proposals, this was not the case for the projects funded in the first call of the OHEJP (JRP:s as well as JIP:s). This has been taken care of in the 2nd call to ensure, as far as possible, a timely and open dissemination of deliverables.

Of the 8 deliverables reported in the first year, one was late (3 months). This delay was reported to be due to a late launch of an online survey. It is reported as not having an impact on the project (COHESIVE), but indicates that the time and effort needed to prepare the questionnaire was underestimated.

Five of the expected deliverables have been postponed to the second year. The delays are mainly due to staff issues: recruitment and departure of staff, and underestimation of workload. There are also delays in the collection of questionnaire data, with the delay being related to a late launch. These delays are reported as being under control, and risks of further delays mitigated. See further assessment under 2.4 Critical risks.

	Total	Finalized and submitted on OHEJP website	Finalized but not yet submitted on OHEJP website	Delayed to 2019	NA
ORION	6	0	3	2	1
COHESIVE	7	0	1	3	3

2.2. Publications

The two JIP:s have not produced any scientific publications during Y1; instead their focus has been requirement analyses and interactions both internally (with other JRP:s and with each other) as well as externally (with EFSA, ECDC and other EU and national projects. This is fully in line with the expectations on integrative projects, as they are more development-oriented, and also a natural part of the alignment process. Nevertheless, the projects are also planning contributions to the scientific community, based on Y1 work, with anticipated submission in Y2.

2.3. Interactions with other JRP/JIPs, European and national projects

The two JIP:s are thematically close as one deals with how to work with data and translate it to surveillance information together (data interoperability, including semantic interoperability) and the other deals with how to communicate it, share it between the respective sectors and assess risks together. Therefore, they have had a lot of interaction during the first year. Some partners' staff members are in fact also involved in both projects.

Both ORION and COHESIVE have established operational collaborations with the JRP NOVA. ORION is also collaborating with ARDIG, and has been in contact with LISTADAPT.

Both JIP:s interacted actively with ECDC and EFSA through telephone calls, meetings at ECDC, and with presence of EFSA and ECDC at kick-off meetings and workshops. ORION has also interacted with EFSA's SIGMA initiative.

In order to identify possible synergies and avoid overlap, the OHEJP WP4 (Joint Integrative Activities) organized two cogwheel workshops in 2018: one with EFFORT project and one with COMPARE, where the JIP:s took part in both workshops.

There were also interactions with other EU- and international initiatives, such as the COST Action NEOH (<http://neoh.onehealthglobal.net/>), a Canadian initiative to evaluate integrated AMR surveillance, China National Center for Food Safety Risk Assessment (CFSA) and the Public Health Agency in Hong Kong providing advice and inspiration for their novel integrated surveillance systems. Active exchange is in place with the Canadian initiative to construct a genetic epidemiology ontology (<http://genepio.org>), a highly complementary activity, as they are focused on molecular epidemiology in outbreaks, and ORION focuses on regular surveillance and epidemiological data.

National initiatives engaged by the JIP's the German One Health Initiative (GOHI), and AHSO, a Swedish project, funded by the Swedish Innovation Agency, which aims to develop and animal health surveillance ontology.

ORION provides a general overview of its activities in their continuously evolving ORION Stakeholder Involvement and Dissemination Plan, which is publicly available:

<https://docs.google.com/document/d/1nDCx7KVxdi2RJSoa8uf-zOfcm34cX9rWCr-CoiKaLB8/edit#>

2.4. Critical risks

The risks identified in the projects' 12-month report are summarised in the table below. The colour code categorisation is based both on what the projects report themselves, and on an overall assessment of WP4.

	ORION	COHESIVE
Loss of key-persons (staff and / or leaders)	X	X
Delay in work plan execution	X	X
Conflicts within the consortium		
Lack of commitment of partners		X
Delay in duties, tasks or reporting	X	X
Poor intra-project (JRP) relationship		
Potential entry/exit of partners		
Other risks (please describe)		X

Green: Minor delays, other risks (conflicts, loss of key persons, ...) have been sorted out

Yellow: Delays and other risks don't have an impact on the project but should be followed up

Orange: Delays and other risks might have an impact on the project

Red: Delays and other risks will have a significant impact on the project

Both ORION and COHESIVE report some delays associated with either recruitment of staff, or loss of staff, but they report that overall this is under control and should not lead to problems with the final results/products.

Due to the nature of OHEJP partners and their role in crisis management, unforeseen events and outbreaks is a reality that both projects face. This inherent risk, and the associated work load, was reported by COHESIVE as a possibility that some key persons has been unable to engage sufficiently in the project.

For the coming years, the projects foresee a challenge to get partners external to the project involved in the integrative missions. WP4 will address this risk by investigating how this mechanism can be further strengthened.

GDPR is not a problem for the projects from the ethical perspective, but it is highlighted that GDPR, and the variability in interpreting this joint legislation is in itself a risk, making it difficult (among other things) to associate relevant metadata to WGS data. The topic of data sharing was included in one of COHESIVE:s workshop, where experiences were shared with COMPARE. OHEJP WP4 has taken an internal initiative to explore the possibilities to launch an integrative activity aimed at finding a common standpoint regarding data sharing among partner countries, in particular with regards to interpretation and implementation of GDPR within the remit of our respective institutions.

2.5. Ethical Assessment

Based on the screening by the ethical reviewers, and the responses from projects to their requirements, it can be concluded that the contents of the JIP:s have limited ethical implications, and that those that have been identified are being managed.

3. JIP1 – ORION

3.1. Summary of the work carried out

The ORION project started on January 1st, 2018 and performed its work according to the planned “Inventories and requirement analysis” phase. This included literature reviews, online surveys and individual interviews with experts from the animal, food and public health sector. In WP1 a requirement analysis has been conducted to identify best practices and current needs for the harmonization of One Health Surveillance metadata. As part of this research existing methodological frameworks, that were developed and applied by the UNECE and leading statistical offices, were identified as promising concepts to be adopted for the One Health Surveillance domain. Further WP1 identified the need for the establishment of an ORION Glossary facilitating the joint understanding on One Health Surveillance terminology between the different ORION partner and OHS disciplines. WP2-Epi performed their requirements analysis and knowledge gathering towards the creation of a thorough surveillance data inventory for a One Health Knowledge Base. This included a literature review on existing surveillance systems and data that focussed on surveillance systems, surveillance data sources and methods and tools used for surveillance. WP2-NGS reviewed the use of sequencing for either clinical, surveillance or genomic epidemiology purposes. Work also addressed the question which NGS-based methods are actually in use in public and veterinary institutions in Europe, and what the barriers to take up NextGen technology for surveillance purposes are. This included extensive discussions with the COHESIVE and COMPARE projects and with EFSA/ECDC. WP2-Integration organized and facilitated several workshops 2018 to ensure a coherent project start and continuous synchronization. As a key outcome WP2 Integration facilitated a common way of looking at surveillance and the different steps in the pathway.

In April the ORION project achieved its first milestone when holding the joint “ORION requirement Analysis” workshop. During this event ORION partners took important organizational decisions and synchronized their research and development work for the first project year. All WPs presented and discussed the status of their research accomplished so far. For example, WP1 presented their finding on GSBPM as a potential basis for the envisaged One Health Surveillance Codex. WP3 illustrated the concept of ontology-based linked open data and synchronized with all involved partners on the development steps. This included the development of a shared strategy towards the development of an ontology for OH surveillance data exchange. All work plans of all WPs were reviewed and further detailed. This allowed the ORION project to perform a synchronized online survey during the 3 quarter 2018 and perform numerous individual expert interviews. As a first visible outcome of these joint efforts the project were able to set up a first version of the ORION Glossary. This community resource was created by joint efforts from ORION domain experts and will be improved continuously over the full duration of the ORION project together with experts from other EJP Projects and stakeholders.

Finally, all ORION WPs started discussions on the selection of their WP-specific One Health pilot projects. The aim of these pilots is to illustrate and validate the usefulness and added value of various ORION results in year 2 and 3 of the project.

The project coordination established shared project management resources including a shared space for documents, a shared calendar, an online mailing list and several other features. The project held monthly web meetings for the whole ORION consortium and monthly call for the WP leaders & deputy leaders. The project organized and performed joint web meetings with EFSA and ECDC, contributed to the EJP DMP and initiated collaborations and information exchange with other EJP projects. Members of the project presented ORION and its work at several international conferences.

3.2. Work carried out in the JIP, scientific results

3.2.1. WP1: OH Surveillance Codex

JIP1-WP1-T1: Inventories and requirement analysis for “OH Surveillance Codex”

Subtask 1.1.1: Literature review, drafting a first questionnaire

A literature review was carried out to identify currently available best practice solutions for harmonization of One Health Surveillance data and metadata. As a result of this research WP1 identified frameworks developed by the United Nations Economic Commission for Europe (UNECE) as a promising solution for the OH domain. Specifically, the Generic Statistical Business Process Model (GSBPM) and related standards (e.g. DDI, SDMX) were explored in detail. First explorative research was carried out to assess if these frameworks can be adapted/implemented as a high-level harmonization framework for the One Health Surveillance domain.

WP1 further performed extensive literature search to identify definitions for core terminology relevant for the three domains: Animal Health, Food and Public Health. The terms that were included in this work (and later in the ORION Glossary) were selected by ORION domain experts. If available, existing definitions from EFSA and ECDC were incorporated. The list of terms was continuously extended to include also terms required for the ORION Knowledge Hub (WP2) and the ontological framework developed in WP3. The first version of the ORION Glossary was presented and discussed during an online webinar.

Subtask 1.1.2: Joint ORION “Requirement Analysis” workshop (hosted by WP4) to synchronize questionnaires within ORION

During the workshop, we took organizational decisions for the requirement analysis on the OHS Codex and the procedures to establish the ORION Glossary. It was decided to create first domain specific glossaries that were compared and merged in a second step. The workshop also helped to shape the online ORION survey jointly issued by all WPs in September.

Subtask 1.1.3: Survey and/or interviews with internal / external experts

WP1 created together with WP3 a joint questionnaire within the ORION online survey to gather knowledge from EJP domain experts on OHS data harmonization. The received survey answers were integrated into the WP1 requirement analysis.

Further WP1 used several opportunities to collect feedback from domain experts on the proposed approach towards the OH Surveillance Codex. WP1 presented the GSBPM concept during a dedicated WP1 webinar (June 2018), the ORION Pilot Study Workshop in Copenhagen (November 2018) and a web meeting between EFSA and WP1 (December 2018). The feedback provided from the ORION consortium and ECDC and EFSA was considered for the WP1 requirement analysis. Also, in the revision process of the ORION Glossary interviews and direct contributions from domain experts were used. A first version of the ORION glossary was presented to the EJP consortium and stakeholders from EFSA and ECDC during a dedicated glossary webinar in November 2018 (<https://goo.gl/sUWj2c>). The approach of the ORION glossary was further discussed with EFSA during a dedicated web meeting in December 2018.

WP1 used also input from ORION experts and EFSA & ECDC to identify so called “user stories”. User stories are valuable tool to describe the end users perspective on problems that a new solution should solve.

Subtask 1.1.4: Gap analysis and prioritization of aspects to be considered in the first version of the “OH Surveillance Codex”

Results from workshops, meetings, the ORION survey, interviews, and user stories were used to outline the current limitations and frustrations within the OHS community. Requirements and needs were elicited on that basis. One of the main identified limitations of current OHS is the lack of harmonized OHS metadata. This limitation will primary be addressed through the OH Surveillance Codex in WP1. The conceptual development of the OH Surveillance Codex was further concretized based on the collected results and the scope and envisioned benefits were defined. The need to provide definitions for OHS terms relevant in the different domains was also identified during the requirement analysis phase.

JIP1-WP1-T3: One Health pilot

Subtask 1.3.1: Selection of the OH pilot study topic

WP1 plans to perform two pilots. One pilot will be performed in collaboration with the EJP project “Antibiotic Resistance Dynamics” ([ARDIG¹](#)) and the second pilot will be performed in collaboration with the “German One Health Initiative” ([GOHI²](#)). Both projects (ARDIG and GOHI) thematize OH surveillance of antimicrobial resistance (AMR) in zoonotic and indicator bacteria. The ARDIG project also covers surveillance on antimicrobial use (AMU). The pilot study will be executed by mapping these metadata to the proposed OH Surveillance Codex.

3.2.2. WP2: OH Knowledge Base - Epi

JIP1-WP2-T1: Inventories and requirement analysis for OH Knowledge Base Epi

Subtask 2.1.1: Requirement analysis

Our first task was to carry out a requirement analysis and lay the outline for the creation of the inventories. To reach this goal, we started with a literature review on existing surveillance systems and data.

This resulted in the decision to divide this into three parts, which are

1. Surveillance systems
2. Surveillance data sources and
3. Methods and Tools used for surveillance,

to make it most comprehensible throughout the sectors Public Health, Animal Health and Food Safety. We looked in more detail at the existing tools SurF, RiskSur and SERVVAL, to see if they could be used to create a schema for our inventories. The decision was made that the schema of the RiskSur Tool (<https://www.fp7-risksur.eu>) could serve as a foundation for our inventories.

Subsequently, we drafted a first survey in M3 and 4, where we asked partners to fill in our preliminary schema.

This resulted in 171 reported hazards, 194 established surveillance systems and 322 data sources. These outcomes display the great diversity in which surveillance is carried out within the partner countries. Again, this stresses the need to harmonize data collection and interpretation. Additionally, it showed that the RiskSur schema, which originally had been developed for animal health surveillance, could be suitable to inventory not only animal health, but also public health and food safety surveillance systems, but would need some adjustments for that purpose.

¹ <https://onehealthejp.eu/structure/jrp2-ardig/>

² https://www.gohi.online/GOHI/EN/Home/Homepage_node.html

Another obstacle we encountered in this process were the different semantics the individual sectors used for the surveillance they carried out.

To lay the foundation for a common understanding, we carried out a Webinar on Surveillance in the different sectors in M8.

To work more in detail on the outlines for the individual inventories, we created subgroups within our work-package, which would then focus on the assigned tasks.

The working group on Surveillance Systems worked on revising the schema we used for the original survey and make it suitable for the three sectors. For this, it was crucial to work in line with the Glossary group located in WP1, because the terms used for the inventory have to be defined uniquely to prevent misunderstandings, as we had encountered definition discrepancies in our first surveys.

A thorough analysis of established systems from the three sectors was carried out, which also included information from EFSA and ECDC. This information was compiled, and the original schema was revised, which subsequently resulted in three tables describing the surveillance systems in each sector. These tables will use the same dropdown lists to enter data, hence it is possible to combine the three tables into one schema suitable for all three sectors, which we now will use to inventory existing surveillance systems in a One Health context.

The working group on Surveillance Data Sources revised tools that could potentially be used to collect relevant information for the repository. It was finally decided, that we use a reference management tool (Zotero, <https://www.zotero.org>) to collect available information. The fields of the reference manager will be extended by fields necessary to link the data to the surveillance systems.

The working group on Methods and Tools used for surveillance also decided to initially utilize Zotero. An additional objective of this work package is to optimise the gain of information by the application of up-to-date statistical methods on data collected within the ORION project.

The work in progress currently focusses on the evaluation of surveillance projects by the use of Information theory models on questionnaire data collections. With a Rasch model (<https://www.mailman.columbia.edu/research/population-health-methods/item-response-theory>) the results of several questionnaires are translated into a quality score reflecting the underlying quality of the different surveillance projects. This score is suitable for a ranking of the projects. Additionally, to the quality score, the Rasch model provides feedback on the questions used in the questionnaire to describe the characteristics of the surveillance projects in terms of discriminative power and difficulty. These results on the survey project characteristics are elaborated in more detail by the use of latent class analysis and structural equation models. Here the analysis aims to detect structural dependencies and characteristics that can be combined into classes with specific shared properties.

On the basis of the ECDC technical document: *'Data quality monitoring and surveillance system evaluation. A handbook of methods and applications'* we are developing a programming framework, which ensures an appropriate handling of uncertainty in statistical models. Here we use the explicit incorporation of uncertainty in Bayesian models and embed Bayesian models accounting for sensitivity and specificity into more comprehensive models.

In a combination of the results obtained by the analyses described above with information about the costs associated with surveillance projects, we perform a cost-effectiveness analysis within a Bayesian framework and address decision theory questions.

The list of statistical models applied in this work package will be continuously complemented. For a full reproducibility of the analyses the programming of all models is carried out by using the open source software R (R Core Team (2018). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL [https://www.R-project.org/.](https://www.R-project.org/)) and, in case

of Bayesian analyses, JAGS (<http://mcmc-jags.sourceforge.net>). It is planned to share the complete programming code and executable files developed in the work package with the ORION project partners and to contribute with it to harmonised model collections.

Subtask 1.2.1: WP2Epi contributed actively to the ORION “Requirement Analysis” workshop hosted by WP4 in April 2018.

Subtask 1.2.3: 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. This resulted in 7 complete answers involving institutions from all except the environmental sector. Due to the small number of replies, it will have to be decided if the survey will be revised and send out to all OHEJP partners again. The response should preferably be higher so that the optimization algorithms will give reliable results.

JIP1-WP2-T3: Epi - OH pilot studies

Within this task, the pilot studies within this WP had to be determined. To finalize this and to potentially align our pilot studies with those of other WPs, we took part in the “ORION Pilot Study Workshop” in M11.

Subtask 3.3.1: One Health Pilot 1: Toxoplasma gondii (carried out by FLI and BfR, Germany)

In this pilot study, the first step will be an analysis of currently available data on *T. gondii* surveillance from reports of the different sectors. This will be followed by a literature review on seroprevalence data and risk factors for the infection with *T. gondii* in the relevant livestock species. Additionally, an analysis of the data on *T. gondii*-seroprevalence in participants of the study on the “Status of Health in Pomerania” (SHiP) and comparison with the national cohort (Wilking et al, 2014) will be conducted, as well as a literature analysis on seroprevalence and source attribution of *T. gondii* in humans.

With this Pilot Study, we will be able to test the inventory and show its practical applications. Additionally, we will be able to make a gap analysis and show opportunities and challenges for stakeholders.

We will also be able to test the ORION Glossary of WP1, as well as to provide data from different sectors to involve in the analysis of data interoperability in WP3.

Subtask 2.3.2: One Health Pilot 2: Salmonella

A pilot study will be carried out by PHE and APHA on Salmonella surveillance using the OH surveillance framework. Within the study both partners will harmonise data transfer including data format, frequency, resolution and time. The partners will provide data to WP1 to be able to share data on early detection systems (EDS), methodology and application to salmonella datasets within the OH surveillance framework.

Subtask 2.3.3: One Health Pilot 3: Hepatitis E (carried out by WBVR and RIVM, the Netherlands)

This pilot study will involve a detailed description of the surveillance system according to the schema established in this WP. This will be followed by an analysis on how to make better use of surveillance data. Subsequently, an evaluation of the value of an OH strategy will be carried out.

3.2.3. WP2: OH Knowledge Base - NGS

JIP1-WP2-T4: Inventories and requirement analysis for OH Knowledge Base - NGS

The work done in 2018 has consisted of literature review, survey work, discussion meetings, discussions with other EJP projects as well as ECDC and EFSA. The literature review has focused on papers which describe the use of sequencing for either clinical, surveillance or genomic epidemiology purposes. It is our aim to provide a curated list of papers that can work as a resource within the Knowledge Hub. Based on accrued experience as well as the literature review, we created a survey that was sent out to all EJP participating institutions. The aim of this survey was to discover what is actually in use in public and veterinary institutions in Europe, and also to discover potential barriers to update of NextGen technology for surveillance purposes. Only six of the institutions participating in the EJP chose to participate. As a consequence, we are likely to conduct interviews in cooperation with the COHESIVE project and WP2-Integration based on the survey structure with selected institutions during Q1 of 2019. Throughout 2018, we also conducted several meetings, both within the work package and with stakeholders. The work package meetings mainly focused on defining the scope of this work package, as well as resource and knowledge discovery. We also had discussions with representatives from EFSA and ECDC. These discussions helped us be aware of the resources that these institutions have developed that we can integrate into the Knowledge Hub.

The work done throughout 2018 helped us refine the problem definition for this WP. We discovered that the problem can to a large extent be broken down into four components, all of which have interactions with each other.

- C1 - Infrastructure considerations: this part concerns itself with the infrastructure that is needed for performing such analysis, from sequencers to compute resources, to analysis platforms. We will here catalogue and describe available solutions, with references to where more information can be found. Included is also the question of what personnel is needed.
- C2 - Pipelines: this part concerns itself with the analysis pipelines that are needed to run such analysis. We will here catalogue and discuss available pipelines, detail the requirements needed for usage, and describe results.
- C3 - In silico WGS characterization schemes: the pipelines described above frequently need to use some external information to be able to type a bacterium, or to detect virulence or AMR. This section discusses the various typing schemes available for the species in question, as well as the AMR and virulence databases available.
- C4 - Use of NGS data for surveillance purposes: this component describes how to use NGS data for surveillance. This component will focus on distance measures within various typing methodologies, as well as various clustering methods including phylogeny.

JIP1-WP2-T6: NGS OH pilot studies

During 2019, a pilot will be run within this WP to help explore and develop the knowledge needed to fill the inventory in a satisfactory manner. Based on preliminary analyses, we have discovered that there is quite a bit done already regarding components 2 and 3, thus we will for the main part focus on components 1 and 4. To accomplish this, we will proceed along three different tracks: Infrastructure track: we will explore what is needed with regards to infrastructure for using sequencing for bacterial typing as well as virulence and AMR detection by literature reviews, interviewing other institutions, and by setting up a joint infrastructure between the NIPH and the NVI in Oslo. Pipeline track: we will explore a subset of available workflow systems and pipelines by implementing them on the aforementioned infrastructure.

Surveillance track: we will explore and test out various analyses that are available for doing surveillance based on NextGen data.

3.2.4. WP2: OH Knowledge Base - Integration

JIP1-WP2-T7: Inventories and requirement analysis for OH Knowledge Base – Integration

We initially did some work on defining what type of OH and Surveillance integration was relevant to describe and what would complement rather than overlap with tasks and work carried out in ORION, other EJP projects and in general in the EU.

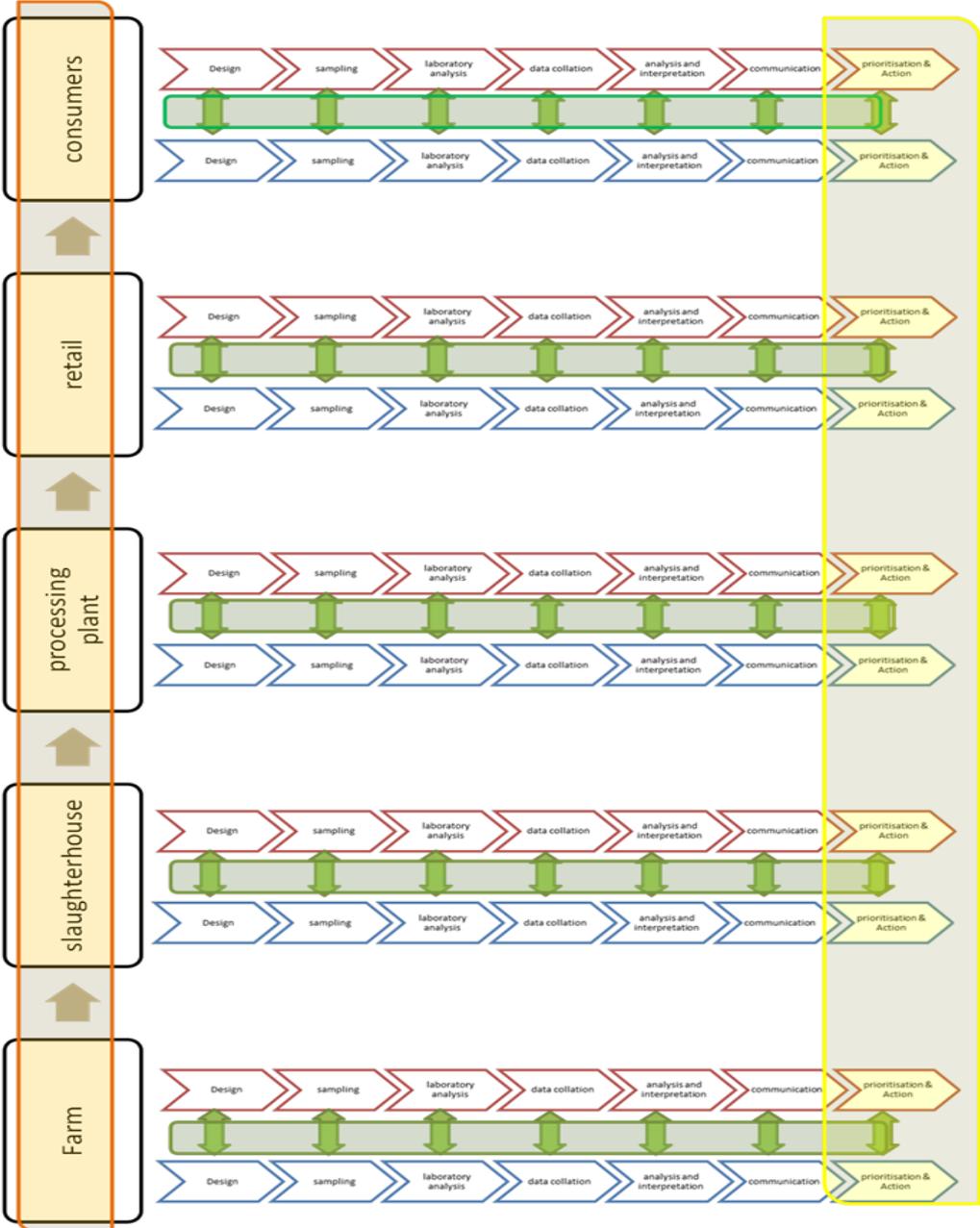


Figure 1. Illustration of the focus areas within the surveillance landscape of the three EJP projects: NOVA, COHESIVE and ORION, when gathering information for a knowledge hub. (Orange=NOVA, Green= ORION; Yellow=COHESIVE)

We used face-to-face meetings, literature and people contacts identified by a snowball approach. Initially, we had to face-to-face meetings within the ORION project to understand the objectives of the other WPs. A meeting with representatives from COHESIVE and NOVA took place to map out the plans for the knowledge hub data collection in the three projects to avoid overlaps, identify gaps and make best use synergies (Fig 1.)

Through the Network for Evaluation of One Health (NEOH)³, we identified individuals at University of Montreal, Canada and University of Montpellier, CIRAD, France working on gathering information on OH surveillance. The French project carried out a large literature review and survey on integrated surveillance systems, not limited to zoonoses. Both ORION WP2epi and University of Montpellier were collecting and analysing data on full surveillance systems with slightly different focus areas. This led to the decision that our WP would focus on less comprehensive One Health surveillance initiatives, where One Health does need to be integrated in the full system. We wanted to illustrate examples of initiatives and small components that countries are implementing in their systems to obtain a more One Health perspective and enhance collaboration between the sectors. To define an OH surveillance initiative, we developed a figure to illustrate the full surveillance pathway and how the term ‘initiative’ fits (Fig. 2).

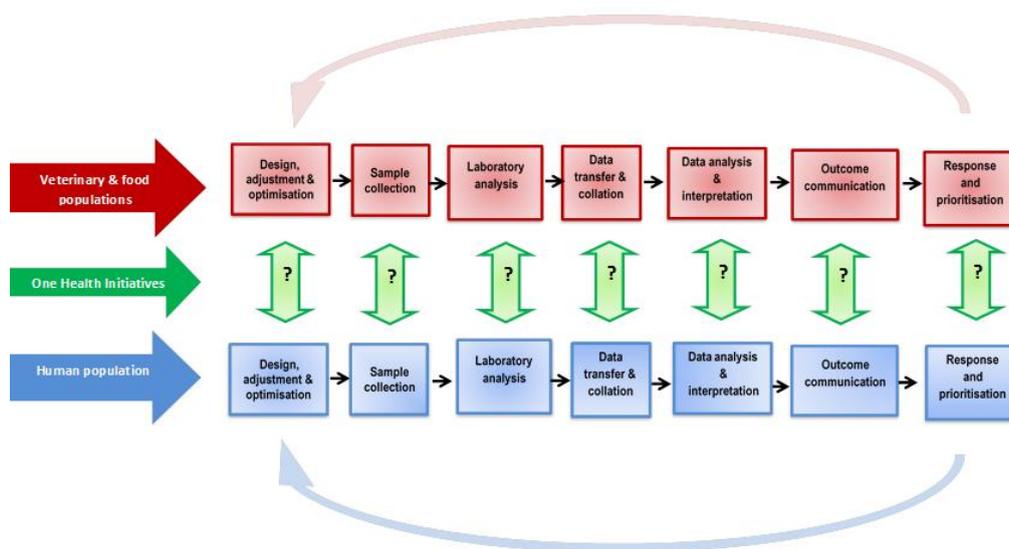


Figure 2. The surveillance pathway used to illustrate what an OH surveillance initiative could be. (Reference: Ellis-Iversen & Dorea, 2018)

A screening questionnaire to identify existing One Health surveillance initiatives in foodborne diseases in the EU was distributed through the network of Focal Points of EFSA and through the Food- and Waterborne Disease and Zoonoses Network of the (FWD-Net) of ECDC. Furthermore, the screening questionnaire was distributed as part of the ORION survey to all partners. Members of known OH surveillance initiatives in Kenya, Singapore, Brazil and the United Kingdom were contacted personally for participation. The screening identified 55OH surveillance initiatives in 20 countries. Of these, 22 initiatives were invited for an interview to provide details of the initiatives. To date 17 interviews have been conducted, and the remainder declined.

³ COST Action TD1404, http://www.cost.eu/COST_Actions/TDP/Actions/TD1404

The results will be presented as short descriptions of each OH initiative and collated in an 'Idea Catalogue' (after agreement with interviewees) to inspire other member states to implement initiatives to enhance OH in their surveillance systems. We aim to publish the catalogue by the end of February.

JIP1-WP2-T9: Integration OH pilot studies

The Danish Institutes SSI and DTU have had several meetings and decided to carry out a pilot study to trial enhancement of OH collaboration within the Danish Campylobacter Surveillance System. The pilot will be exploring the benefits of including a new OHS initiative in the current Campylobacter Surveillance System. The unit will be mainly epidemiological, but should draw on other disciplines in the two institutes (SSI and DTU), like microbiology and molecular biology. The epidemiologists will work very closely together, initially describing the full system and then querying data on both the Public Health and the food/Veterinary Surveillance side, in order to find the best analytical approaches to enhance the Campylobacter surveillance system. The detailed planning of the pilot will continue in 2019.

3.2.5. WP3: OH Surveillance Harmonisation Infrastructure

JIP1-WP3-T1: Inventories and requirement analysis for OH Harmonisation Infrastructure

Subtask 3.1.1: Literature review, drafting a first questionnaire

The WP leaders have carried out a literature review on the subject of data integration and interoperability in health surveillance, and a detailed review of available ontologies which could be reused for data interoperability within the surveillance domain.

Subtask 3.1.2: joint ORION "Requirement Analysis" workshop (hosted by WP4) to synchronize questionnaires within ORION

A decision was made to focus this WP on the development of an ontology for surveillance, plus a surveillance dataset instantiated following the ontology model (all definitions used were added to the glossary built by WP1). An ontology is a model of the domain knowledge that allows data to be published in machine-interpretable format, and it will allow us to apply in practice the surveillance harmonization results accomplished in WP1 and WP2. We will also propose an architecture that allows its implementation in practice, using the one-health pilot as a proof-of-concept case (read below). During this workshop, we reviewed the plan for year 1, and reviewed knowledge themes that will allow partners to contribute within specific knowledge domain areas.

Subtask 3.1.3: Survey and/or interviews with internal / external experts

ORION conducted a joint survey that was broadly disseminated. That survey showed that many institutions already publish public surveillance reports. We followed that up with more in-depth interviews. We interviewed surveillance officials familiar with the process of data collation and reporting to EFSA/ECDC in all of the 13 institutions in the ORION consortium. The results informed the gap analysis, described below.

Subtask 3.1.4: Generation of an OH Harmonisation Infrastructure Hub, Gap analysis

Once we decided, in the requirement analysis workshop, to focus this WP on the development of a knowledge base, the WP was split into 3 main tracks: the *ontology* track, which will develop the

ontology to be used; the *practice of surveillance* track, which will identify how this ontology can enter current data analysis and publication workflows; and a technical track, which will build the technical architecture needed to achieve this use of an ontology in the practice of surveillance. The vision of an Harmonisation Hub, therefore, will be delivered through 3 main outputs: 1) the ontology itself, which is already available (but will be more fully developed next year) at the biomedical ontologies bioportal (<http://bioportal.bioontology.org/ontologies/AHSO>); 2) a dataset of public surveillance data published as linked-open data (LOD), marked up following the ontological model developed; 3) a proof-of-concept workflow to adopt the ontology in practice, which can be used by any other country to expose, as LOD, their surveillance data already shared with other MS, or within countries to support inter-agency OH collaboration. The two latter will be available at the end of the OH-pilot, as planned, and the work in the first year was focused on setting the requirement analysis for their construction through all tasks listed above.

JIP1-WP3-T3: One Health pilot

Subtask 3.3.1: Selection of the OH pilot study topic

The detailed interviews showed that most countries already publish surveillance reports. In Sweden, leader of WP3, this surveillance report is a collaboration among AH, PH and food surveillance agencies. We identified this public report as the most suitable target to apply technologies that can transform data into FAIR data, in order to empower cross-agency collaboration on data analysis and publication. A OH pilot which can prove the value of the technologies, when coupled with institutional collaboration, and can be adopted by other countries, was define as the work to:

- 1) Improve coordination and cooperation among the 3 agencies (AH, PH and food surveillance) in the production of 3 main bacterial foodborne chapters of the report: Salmonella, Campylobacter and STEC. This aims for the production of the surveillance report to become a true one health initiative, with communication and data sharing starting as soon as we start analysing the data.
- 2) End up with a one dataset of epidemiologically analysed and validated surveillance data across the 3 agencies, which is made public in a human and computer readable format, and in time will be a source for historical data (plus metadata).

3.2.6. WP4: Coordination, Communication, Training and Sustainability

JIP1-WP4-T1: Internal project coordination

The project coordination established shared project management resources on Google and on a Virtual Research Environment. This included a shared space for documents, a shared calendar and an online mailing list. On the VRE several other features (tickets, messaging board, wiki, data analytics tools etc.) were made available. The coordination holds monthly web meetings for the whole ORION consortium and monthly calls for the WP leaders & deputy leaders. EFSA & ECDC representatives as well as the leads of EJP WP 4 and 5 and the coordinator of the COHESIVE project were invited to join these calls. A physical full consortium kick-off meeting was organized and held in Berlin in April that also served as joint ORION “Requirement Analysis” workshop.

JIP1-WP4-T2 : External project integration (synchronized with EJP WP5)

The project coordination organized and performed several web-meetings with EFSA and ECDC, e.g. on June 5th, 2018, and June 28th, 2018. It also contributed to all communication and dissemination activities performed by EJP WPs, e.g. the EJP survey, the Cogwheel workshops or the requests to

provide short term missions. All ORION WPs initiated collaborations and information exchange with other EJP projects, e.g. NOVA, COHESIVE, ARDIG and RaDAR.

JIP1-WP4-T3 : Sustainability roadmap

ORION initiated the evaluation of Virtual Research Environment infrastructure which might potentially serve as OHS Knowledge Hub. In case the evaluation is successful the developed ORION resources can become an integral component of the envisaged European Open Science Cloud. As an alternative option ORION has engaged with EJP WP1 to explore if the EJP website could be used as OHS Knowledge Hub as well.

JIP1-WP4-T4 : Training and Dissemination

Subtask 4.4.1: Internal training (sharing knowledge on currently available national solutions)

The ORION project performed several training activities, some of them also open for EFSA / ECDC and selected other EJP projects. For a detailed list see point “9 - List of dissemination and communication activities” of this report.

Subtask 4.4.1: Knowledge integration (web portal, Wiki, curricula, tutorials, videos, sample data)

The ORION coordination established with support from the EU-funded project AGINFRA+ a Virtual Research Environment (VRE) as knowledge integration platform. This ORION VRE also serves as project-specific web portal with Wiki functionality, shared workspace, messaging and data publishing features. It is one of ORION’s research questions to explore if a VRE can serve as knowledge integration platform and technical foundation of the envisaged OHS Knowledge Hub. In addition, each WPs explored additional web-based resources to facilitate knowledge integration, as e.g. GoogleDocs, GitBook, Zotero.

Subtask 4.4.3: Training and support for other EJP projects & partners

The ORION project contributed actively to all dissemination events organized by the overarching EJP project, e.g. the EJP Kick-of meeting from 30th - 31st January in Paris, the EJP project website, the web-meetings with the COMPARE and EFFORT projects. ORION further initiated direct collaboration with a number of other EJP projects, as e.g. COHESIVE, RaDAR and NOVA. The ORION project has further carried out online webinars that could be attended by other EJP projects & stakeholders (see point 9 of this report). Finally, in response to a request from EFSA/ECDC all ORION WPs created a detailed WP description that was shared with EFSA / ECDC to support their internal dissemination and communication processes.

3.3. Progress of the research project: milestones and deliverables

3.3.1. Deliverables

JIP name	Project deliverable number	Deliverable name	Delivery date from AWP	Actual delivery date	If deliverable not submitted on time: Forecast delivery date	Comments
ORION	D-JIP1-1.1	Report on requirement analysis for "OH Surveillance Codex"	12	31-12-2018	Delivered on time	
ORION	D-JIP1-2.1	Report on requirement analysis for an "OH Knowledge Base – Epi"	12	14-01-2019	Delivered on time	
ORION	D-JIP1-2.2	Report on requirement analysis for an "OH Knowledge Base - NGS"	12		28-02-2018	Due to administrative delays in the hiring process, this WP was delayed due to lack of manpower. We have been able to add manpower to be able to ensure that this delay does not propagate.
ORION	D-JIP1-2.3	Report on requirement analysis for an "OH Knowledge Base – Integration"	12		28-02-2018	The DTU ORION post doc is leaving his post before completing the work. The work will be delivered, just a little later than planned.
ORION	D-JIP1-3.1	Report on requirement analysis for an "OH Harmonisation Infrastructure Hub"	12	29-12-2018	Delivered on time	The deliverable will detail our literature review on interoperability in health surveillance, the results of our interview of partners; and requirement analysis on the technical architecture for adoption of ontologies in practice.

JIP name	Project deliverable number	Deliverable name	Delivery date from AWP	Actual delivery date	If deliverable not submitted on time: Forecast delivery date	Comments
ORION	D-JIP1-4.1	Two internal training workshops for ORION partners	12	09-2018	Delivered on time	

3.3.2. Milestones

JIP name	Milestone number	Milestone name	Delivery date from AWP	Achieved (Yes / No)	If not achieved: Forecast achievement date	Comments
ORION	M-JIP1-1	Requirement analysis synchronization workshop	4	Yes		

3.4. Publications and patents

There have been no peer reviewed publications published in 2018 by any ORION WP.

3.5. Impact and relevance

ORION's main objective during the first year was to perform an in-depth requirement analysis in each work package and to identify current best practices, resources and needs. The outcome of this work will become visible in the 2nd year of the project when the elements of the ORION Knowledge Hub will be established, and newly developed resources will be evaluated in WP specific pilot trials.

Based on the feedback ORION received from EFSA / ECDC and other EJP projects it can be stated, that results generated by the ORION project will create impact on the addressed research questions. This became evident for example from the received feedback to several webinars ORION carried out, e.g. the ORION Glossary webinar and the WP3 webinar on ontology based linked open data. In their work ORION partners build on best practice solutions developed in other research projects or communities, as e.g. the RISKSUR project, the UNECE working group, and on EFSA's and ECDC's efforts to harmonize the reporting of food-borne outbreaks throughout the European Union. The requirement analysis carried out by each ORION WP clearly helped to identify significant gaps in various fields relevant for true One Health Surveillance data harmonization. These gaps range from different meanings and interpretation of terms (see ORION glossary), differences in formats and terminology used to encode data up to differences caused by diverse levels of harmonization for analytical and data processing technologies, e.g. in the area of NGS. It is therefore very likely that the research outcome generated by ORION in the two upcoming project years will contribute to the objective of closing harmonization gaps between Vet, Food and Public health sector, specifically for those areas where ORION pilots will support the generation of national OHS reports on selected zoonoses or AMR.

3.6. Follow-up of the recommendations and comments in previous review(s) by the Ethics Advisors

Requirements (from ethical reviewers)	Measures and actions taken
<p>The applicants must confirm the compliance with GDPR.</p>	<p>In WP1, no data from individuals will be collected or used. We see no risk of infringing the GDPR. In WP2Epi, no data from individuals will be collected or used. We see no risk of infringing the GDPR. In WP2-NGS, we might utilize some human related pseudonymized metadata for sequences that we might seek to analyze in collaboration with other EJP projects, however, if so these will be stored on an e-infrastructure approved for use for human sensitive data set up in Norway. For WP2int 2.3 - Requirement analysis for an “OH Knowledge Base – Integration”, professional email addresses of individuals were volunteered in the screening questionnaires. Interviews with volunteering key personnel of some initiatives was recorded and the original sound files will be kept in a restricted folder complying with ORION data management plans, DTU data management plans, DTUs Policy of the Retention of Primary Materials and Data, GDPR, until deletion on the last day of the ORION project.</p> <p>In WP3, no data from individual cases or laboratory tests will be used, only data already aggregated at the surveillance level, and already made public by the owner institution. We see no risk of infringing the GDPR.</p>
<p>The applicants must specify whether human genome will also be sequenced in the pilot study. In case of whole genome analysis, a procedure to address any incidental / adverse findings must be prepared and available.</p>	<p>The human genome will not be sequenced in any of ORION’s pilot studies.</p>

3.7. Critical risks

Description of risk	Yes/No
Loss of key-persons (staff and / or leaders)	Yes
Delay in work plan execution	Yes
Conflicts within the consortium	No
Lack of commitment of partners	No
Delay in duties, tasks or reporting	Yes
Poor intra-project (JRP) relationship	No
Potential entry/exit of partners	No
Other risks (please describe)	No

There is always the risk of losing key personnel during project execution. Due to the strong involvement of senior level experts from each of the ORION partners it seems possible to compensate in cases where these events happen.

Linked to this risk might be some delays in work plan execution. However, at the current point in the project it is guaranteed that these delays can be compensated.

3.8. Interactions with other JRPs/JIPs or with external (EU or national) relevant project

A general overview on all overarching ORION activities is available within the continuously evolving ORION Stakeholder Involvement and Dissemination Plan:

<https://docs.google.com/document/d/1nDCx7KVxdi2RJSoa8uf-zOfcm34cX9rWCr-CoiKaLB8/edit#>

In addition, the following WP collaboration activities were performed:

WP1:

- Established collaboration with NOVA (<https://onehealthjp.eu/projects/jrp6-nova/>) regarding the ORION glossary. Project partners from NOVA will review and extend the ORION glossary.
- Established collaboration with ARDIG (described in detail in section 2.1 under Task T-1.3 One Health Pilot)
- Established collaboration with GOHI (described in detail in section 2.1 under Task T-1.3 One Health Pilot)

WP2-EPI major collaborations:

- Collaborating with EJP-JIP COHESIVE, to avoid double work and to ensure good use of resources

WP2-Integration:

- Network for Evaluation of One Health (NEOH) - COST Action TD1404 <http://neoh.onehealthglobal.net/>
- COHESIVE discussing synergies in knowledge hub objective and providing input to their yr1 workshop.
- NOVA discussing synergies in knowledge hub objective
- Canadian initiative to evaluate integrated AMR surveillance
- China National Center for Food Safety Risk Assessment (CFSA) as workshop contributor on methodologies in integrated surveillance
- Public Health Agency in Hong Kong providing advice and inspiration for their novel integrated

surveillance systems via workshops and speaking at Regional Symposium on AMR 2018: Fighting AMR – Partnerships in Action <http://www.amr.gov.hk/EN/>

- 27-28 September 2018: Visit to SVA to discuss surveillance data storage, flow and WP3 pilot

WP2-NGS:

- Collaborating with EJP-JIP COHESIVE, to ensure good use of resources
- Collaborating with EJP-JRP LISTADAPT with respect to use and analysis of sequencing data

WP3:

- The Swedish project, funded by the Swedish Innovation Agency, which aims to develop and animal health surveillance ontology, and has greatly contributed to the ontological and technical tracks of this WP.
- The Canadian initiative to construct a genetic epidemiology ontology (<http://genepio.org>). This is a highly complementary initiative, as they are focused on molecular epidemiology in outbreaks, and we started focusing on regular surveillance and epidemiological data. We have regular meetings with this consortium, as we agreed to continue developing orthogonal solutions aimed at complementing, rather than duplicating, each other.
- We have contacted the SIGMA project, an EFSA initiative which is also concerned with facilitating data reuse, to make sure that we develop solutions compatible with theirs.

3.9. Dissemination and communication activities

A general overview on all overarching ORION activities is available within the continuously evolving ORION Stakeholder Involvement and Dissemination Plan:

<https://docs.google.com/document/d/1nDCx7KVxdi2RJSoa8uf-zOfcm34cX9rWCr-CoiKaLB8/edit#>

3.10. List of planned tele- or video conferences, face to face meetings in the next year

Tele- or video conferences:

- To facilitate communication with EJP stakeholders and other EJP projects ORION will perform a monthly WP leader call that allows aforementioned externals to get informed and contribute to the decision making of the ORION project.
- To engage a community of surveillance experts, ORION plans to broadcast and record 4-8 webinars in 2019.

Face-to-face meetings:

- From 16th - 18th January there will be a full consortium meeting in Uppsala.

Also, a general overview on all overarching ORION activities is available within the continuously evolving ORION Stakeholder Involvement and Dissemination Plan:

<https://docs.google.com/document/d/1nDCx7KVxdi2RJSoa8uf-zOfcm34cX9rWCr-CoiKaLB8/edit#>

3.11. Key performance indicators

Key performance indicators (KPI:s) to be followed-up in Y2 are tentatively those suggested by ORION in its project proposal:

1. Provision of Trainings for ORION and EJP partner institutes - Number of trainings provided, number of participants, and number of countries reached.
2. Access rate to the OHS Knowledge Hub - number of new and returning visitors, monthly.
3. Interoperability of the „OH Surveillance Codex“ - qualitative comparison of the results of the OH pilots across domains and across institutions.

4. Timeliness of ORION work - delivery of outputs on time.
5. Rate of adoption of „OH Surveillance Codex“ - Qualitative assessment of the potential to retain adoption past the OH pilots, and adoption by other countries after the conclusion of the project.

4. JIP2 - COHESIVE

4.1. Summary of the work carried out

The main start of the COHESIVE project was with the kick-off meeting in March 2018, in Amsterdam. The approaches of the different WPs were discussed with the participants. Also representatives of the ORION project, EFSA and the EU were present and took part in the discussions. It was decided to have several workshops in parallel in November, in order to prevent too much travel. Also connecting to EFSA and ECDC was again emphasized. A meeting was held at ECDC in June as well as direct contact with EFSA specifically for WP4.

On November 26/27 two workshops were held at APHA, England, which were partly combined. One workshop was dedicated to WP2 and WP3, '*One Health collaboration dealing with new and (re)emerging zoonoses*'. The other workshop '*Workshop on data platform to facilitate risk analysis and outbreak control*' was dedicated to WP4.

For WP2 the main goal is to develop guidelines for **national** One Health structures (such as present in for instance The Netherlands and UK) or other ways to strengthen human-veterinary collaborations, with the aim to improve signaling, risk assessment and response by better communication, (early) exchange of information, sharing of knowledge and joint forces. In preparation of the inventory workshop in November, a questionnaire was sent out to gather general and specific information of the different member states (MS) and was used as input for discussions during the workshop. During the workshop, experiences were exchanged, insight was obtained in existing barriers and it was discussed how to shape the guidelines.

Within WP2 another goal is to develop a tool (possibly a decision tree) to help decide which tool/model best to use for risk assessment for the specific situations in which it is needed. Information was gathered, amongst other means, via a literature review and a questionnaire. During an interactive session at the workshop, it was discussed how to continue with the decision tree (or other tool), in which the above- mentioned information was used as input.

WP3 has started by exploring current ways of exchanging signals between countries by contacting them directly. Also, some questions on this topic were included in the questionnaire mentioned under WP2 and were used as input for the workshop. For the task on horizon scanning, information was collected in the same questionnaire and will be used for further steps together with the information gathered via a performed literature review.

The first activities of WP4.1 were to coordinate the activities with those of other EU projects (especially IA-1-ORION and COMPARE) to avoid duplications, and to build a strong interconnection with EFSA and ECDC. In reaction to requests for clarification, a clearer new task description was made for WP4.1. During the workshop, the architecture of the COHESIVE information system was described in detail. The round table discussion was mainly aimed at the practical implementation of this information system at the national levels, the possible constraints that could be faced and possible solutions. In WP4.2 the physical setup of the tracing platform with initial features was realised, which will be filled step-by step with further identified relevant features. Therefore, a list of available tracing tools was compiled and evaluated and prepared to be published as an own web service that can be updated in the future by partners. During the November workshop, further potential partners and interfaces were identified.

4.2. Work carried out in the JIP, scientific results

4.2.1. WP1: Coordination, communication and sustainability

JIP2-WP1-T1: Coordination

A steering group has been formed, consisting of the WP leaders, deputy WP leaders and a secretary. Teleconferences are organized every 6 weeks to discuss the progression of the project as well as management issues.

Activities to connect to other organizations and ongoing work (including projects) has started. During the kick-off meeting ECDC and EFSA were invited and EFSA was present. On June 26th, 2018, representatives of the steering group have visited ECDC with participation of EFSA, to look for further collaboration between COHESIVE and ECDC/EFSA. In this meeting the contact persons for Cohesive, Karin Johansson (ECDC) and Valentina Rizzi (EFSA), were taken part. Most likely, regular telephone conferences will be organized with ECDC/EFSA and the project coordinator. COHESIVE took part in the cogwheel meeting with COMPARE to look for possible connections. A separate video conference will be organized to exchange goals in more detail at the WP level and find these possible collaborations. ORION and NOVA were identified as other OH EJP projects to which COHESIVE could relate. Both were invited to the COHESIVE kick-off meeting and ORION was present. The coordinator of COHESIVE was present at the kick-off of ORION together with several people involved in both projects. Clear links were identified, and it was agreed to keep each other informed on the progress within the projects and collaborate where fruitful, in first instance mainly within WP4.

JIP2-WP1-T2: Communication/dissemination

Since a website has been built for the overarching OH EJP level, most likely no separate website will be built solely for COHESIVE since it seems to meet our requirements. However, the website is not used to its potential as of now. A group named COHESIVE, open for all OH EJP members is made, as well as separate groups for COHESIVE members and one only for the steering group. On the open COHESIVE website general information on COHESIVE can be found as well as the programs of the workshops, the summary and the presentations. A factsheet about COHESIVE was made and is also available via the website.

At the workshops held in November at APHA, 58 people were attending. This included one invited speaker from the Swiss confederation and our contact person from ECDC. The workshop was open for all OH EJP members, which led to participation from five additional partners, not originally part of COHESIVE; INIAV (Portugal), VRI (Czech Republic), PIWET (Poland), Surrey University (UK) and Swiss Federal Veterinary Office (Denmark). Possibilities to keep these institutes involved in COHESIVE are being investigated.

During the kick-off meeting it became clear that the language between the human-vet-food domains differs. For instance, the same terms can mean different things in different domains. It was concluded that a glossary would be important to have. First steps were made to achieve this. During the kick-off meeting of ORION, it turned out that they have a task making a glossary. It was agreed to work synergistically on this.

4.2.2. WP2. Integrated risk-analysis at the national level

JIP2-WP2-T1: Development of guidelines for national One Health structures

For WP2 the main goal is to develop guidelines for **national** One Health structures (such as present in for instance The Netherlands and UK) or other ways to strengthen human-veterinary collaborations, with the aim to improve signaling, risk assessment and response by better communication, (early) exchange of information, sharing of knowledge and joint forces. This is most important for (re)emerging pathogens, but also the response to notifiable pathogens will profit from better collaboration. Since countries are very different in many aspects, no blue-print can be made for such One Health structures. During the workshop held on November 26/27 at APHA, the participants were shown those differences between countries in various presentations, including one from EFSA. Next, the results of a questionnaire, filled in by participants before the workshop, were presented. The questionnaire focused on the organization of the public health, food and animal sectors, already existing contacts and collaborations between the public health and veterinary public health domain as well as barriers for collaboration. The four most mentioned barriers were further discussed in an interactive session (existing structures/regulations/bureaucracy; conflict of interests; communication/sharing of information; geographical barriers). The results of the discussions will be used when drafting the guidelines. Sharing (molecular) data is one of these topics. In an interactive session organized by members of COMPARE, the participants were taken into the dilemmas around data sharing. In another interactive session it was discussed how to shape the guidelines. It was concluded that added value of the guidelines can be found when they would build upon existing guidelines (i.e. Tripartite Zoonoses Guide) and focus on implementation. In addition, also contact has been made with the University of Minnesota to further discuss what can be learned from their OH-SMART programme and whether the toolkit can be of use to us.

JIP2-WP2-T2: Development of structured decision making

This task has some similarities with objectives in ORION and in the EU project COMPARE and connections were made with both of these projects to identify synergies and complimentary activities. There were no specific overlaps identified between the two projects, however the glossary of terms developed within ORION has potential to reduce some of the effort required in COHESIVE. As we are not able to wait until the glossary is completed by ORION, cross checking on progress is an ongoing task.

A single questionnaire was sent out to attendees of the workshop held in APHA 26/27th Nov. This included specific questions that were aimed at supporting the deliverables of this task. The questions gathered information and references to risk assessment tools that are currently in use by attendees. In addition to the inventory of existing tools a breakout session was held at the workshop to gather user stories on what the wider context of why they are being used and also information of how comfortable users are working with them.

A literature review of “one health rapid risk assessment” search results was conducted and previously reported (9-month Summary Progress Report). Combined with the results of the questionnaire this will become the content for the decision support tool to work with. As publication of risk assessments and risk assessment methodologies is a constant process, the work package will continue to allow new items to be added throughout the period of the project, however the formal information collection is now complete.

The next immediate task will be to produce a specification for the decision support tool, based on the workshop break out session results. This specification will guide development in how the tool should look and be navigated.

4.2.3. WP3.Towards an EU zoonoses structure

JIP2-WP3-T1: "Explore current ways for exchanging signals between countries and cross disciplines – pathway analysis"

Within this task is started with exploring current ways of exchanging signals between countries by contacting them directly. Also, some questions on this topic were included in the questionnaire mentioned under WP2 and were used as input for the inventory workshop in November. The continuing work within this task will build upon the results of the group discussions at the inventory workshop held at APHA in November 2018. During the interactive sessions of the workshop, information was gathered on ways of exchanging signals and on barriers and obstacles for sharing information. Examples on functioning pathways on exchanging information on signals were given, such as some EURL/NRL networks. Also, examples on agents with no networks or disciplines were given. Further work within this task will proceed with the information gathered during the workshop as well as from the questionnaire. Next step will be, together with the participants, provide a report on the current ways of exchanging signals cross disciplines and between countries. This report will illustrate these exchanges using examples of regulated and less regulated zoonoses.

JIP2-WP3-T2: Select tools for horizon scanning and signal detection

Horizon scanning is defined as a specific foresight methodology that utilizes various steps to identify issues at the edge of current thinking that may have significant impact in the medium to long-term future. Horizon scanning has been identified as a promising sense making tool prior to decision making. The multisectoral nature of horizon scanning provide opportunities for successful out-reach to disseminate key trends for one health applications. This task has started to get insight on how horizon scanning is designed to foster engagement between academics and policy makers. In order to achieve that, the work in this task started with a literature review concerning horizon scanning methods applied to One Health. Various horizon scanning methods have been identified and for instance, it turned out that there are different definitions in place. For the participants on the COHESIVE workshop at APHA in November 2018, a couple of questions on this topic were added to the questionnaire. The outcome of the questionnaire together with the information gathered via the performed literature review will be used for further steps in the task. Currently, various expert and analysis teams are being established and fostered in a collaborative culture to reach a holistic approach.

JIP2-WP3-T3: Retrospective systems analysis of detection of outbreaks

This task started in month 6 of the project. During the kick off meeting potential partners were identified as wanting to contribute to varying degrees depending on the level of data available within individual countries.

The immediate task involved selecting potential pathogens that could be used as case studies. As there was not one single pathogen that each country has experienced an incident with, a list of potential candidates was created. These pathogens were mostly focused on 'orphan zoonoses', defined as zoonoses for which no specific animal-health derived legislation exists. These present a challenge to

One Health detection systems as they may not trigger formal intelligence gathering channels, but may still pose a threat to human health.

In order to structure the analysis in a way that all partners could participate (also with limited amount of time) while still producing outputs that are comparable between countries and maximizing the advantage of having several different points of view. For this various different systems analysis and operational research frameworks have been investigated, however no simple technical solution could be identified. Currently a bespoke systems analysis template is under preparation to guide individual countries in completing it to one of several geographical levels of resolution in an attempt to stratify the analysis to enable cross-country comparisons to be made in at least the highest stratification. This task will be performed in co-operation with task WP3-T1.

4.2.4. WP4: Data platform to facilitate risk-analysis and outbreak control

JIP2-WP4-T1: Molecular typing data and metadata – database creation

A new description of task 4.1 has been made with a more extensive explanation of the National Information Systems we are aiming to develop, and their placement in the general picture. This new, more detailed description is incorporated in the Annual Workplan for Year 2.

Subtask 4.1.1: Workshop on data and DBs

The WP4 workshop has been held at APHA, Weybridge, on 26-27 November 2018, partly combined with the workshops for WP2 and WP3. In the meantime, for the purpose of this sub-task, teleconferences have been held with COMPARE and ORION projects and a meeting has been held with EFSA (April 2018). A further meeting has been conducted on June 26 with ECDC to harmonize our activities and outputs with the future EU Joint Database EFSA/ECDC. Harmonization with EFSA has been discussed through repeated telephone calls and a face-to-face meeting with EFSA officers. Refinement of Task 4.1 output is ongoing.

During the workshop, the idea of the COHESIVE prototype Information System has been presented. Comments and suggestions have been raised during the workshop. In particular, ECDC representative has proposed to use the EFSA and ECDC coding system for metadata as well as the scheme of data access rights used by the Molecular Typing Data Collection. A representative of the COMPARE project suggested to have a new meeting COHESIVE-COMPARE in order to use COMPARE solutions in COHESIVE prototype Information System.

To investigate the availability and implementation status of NGS methods for FBD surveillance and outbreak investigations, data gathered by ORION will be used. Moreover, the discussion during the roundtable highlighted the need to collect new information from COHESIVE partners with the aim of identifying examples of One Health surveillance systems as well as some details about the level of interoperability between different databases. So, a new Questionnaire has been prepared and sent to all EJP participants in the COHESIVE workshop of November 26-27.

Subtask 4.1.2: Design and implementation of DBs

So far, a preliminary logical Entity-Relationships diagram has been designed, taking into consideration comments from the EFSA side during the kick-off meeting. An architecture of foreseen interactions among the information systems and information flows has been developed and discussed during EFSA/ECDC meeting of June 26.

Subtask 4.1.4: Analysis of the systems in involved countries

Analysis of the systems in involved countries will be the next step. At current, a study of the systems in Italy is in progress.

JIP2-WP4-T2: Development of a platform-independent tracing framework

Subtask 4.2.1: Evaluation of all available approaches, algorithms and tools for tracing, epidemiological analysis and visualization combined with WGS data

Additional to already known tracing tools found by an EFSA working group (DEMOS), a web search was done to find software systems with tracing capabilities along complete feed or food supply chains. The tools found were evaluated according to their functionalities regarding food traceability like one step forward and one step backward, compliance with the EU regulation 18/2002 and its visualization and analyses features. The result is a web-based interactive table-like compilation that compares the functionalities of the software tools found and that will be published for the other project members together with a report about it in the first half of 2019.

The subtask will not be finished at the end of this year. We elongated in agreement with the project coordination in order to be able to integrate even more available tools together with project partners, especially tools focusing on WGS are pending. We underestimated this part a bit and additionally put much effort on the other subtask, which is the development of the tracing platform, see below. No other task or subtask in this project depends on this work. Therefore, the upcoming continual improvement of the tracing tool analysis will not affect the work on any other tasks or subtasks.

Subtask 4.2.2: Programming a software and developing an algorithm

Server for platform is designed and set up. A restricted area is designed and developed. A data model for data collection form and database are defined. First analyses and visualizations are realized and performance needs are identified.

The overall status and progress of the whole project FoodChain-Lab can be inspected at <https://foodrisklabs.bfr.bund.de/foodchain-lab> .

There are several pieces that at the end will come together within this platform. Planned are:

- A data collection module
- An interactive analysis module
- A WGS-data integration module
- A reporting module
- A synchronization module with the desktop version of FoodChain-Lab

A continuous deployment pipeline for the portal was established. New software versions are deployed automatically to a test server accessible at <https://fcl-portal-dev.bfr.berlin> where new features of the tool can be evaluated.

To collect and exchange data in a standardized manner a data structure in a JSON format was developed. The data structure can store supply chain data that are gathered during foodborn outbreak investigations. The data collection mask providing immediate feedback to the data collectors about their data quality is under development.

It is planned to have regular web conferences on a three-month basis with project partners and further interested parties, e.g. EFSA.

JIP2-WP4-T3: Development of a platform-independent risk modeling framework

Subtask 4.3.1: Requirement analysis

Typical components have been identified that support quantitative microbiological risk assessment, advanced simulation techniques, documentation and extended usability. Selection of minimal models for testing and development is ongoing and will be completed in Q2 2019, as well as the prioritization of building blocks for implementation in web application of rrisk. Risk is an R-package and a prototype of a program that supports the risk assessor in the development and documentation of quantitative risk models. Currently, also the search of models and data suitable as case study (ideally with input from project partners) is ongoing.

Subtask 4.3.2: Implementation

Various minimal models from the literature and from project partners were tested and defined. Risk questions and scenarios as well as quantitative risk models were provided by partners in COHESIVE and other EJP projects. As part of the implementation of standards, we were also provided with data sets and use-cases in cooperation with the FLI. Furthermore, in cooperation with project partners we have prioritized different building blocks. For the web application of rrisk we developed various mocks to define the workflow and the individual steps of the user interface in R shiny (this subtask will be finished in Q3 2019).

In cooperation with EFSA and OpenAnalytics⁴, we want to work towards integrating rrisk (web-based version) into a European platform-independent framework for risk modelling.

⁴ <https://www.openanalytics.eu/>

4.3. Progress of the research project: milestones and deliverables

4.3.1. Deliverables

JIP name	Project deliverable number	Deliverable name	Delivery date from AWP	Actual delivery date	If deliverable not submitted on time: Forecast delivery date	Comments
COHESIVE	D-JIP2-1.1	Kick-off meeting	3	3		Meeting in Amsterdam
COHESIVE	D-JIP2-1.2	Website/platform operational	6	Does not apply		As the website of the overarching One Health EJP seems to fulfil our needs we will not develop our own website
COHESIVE	D-JIP2-2.1	Inventory of tools for systematic risk-assessment via questionnaire	8	11		Initial questionnaire sent out by month 8, it took longer to allow respondents to return answers. The inventory will be an 'open' record that we can add to as more partners respond
COHESIVE	D-JIP2-2.2	Inventory and ambition workshop	12	11		Combined workshop of WP2, WP3 and WP4. A summary is placed on the OH EJP website
COHESIVE	D-JIP2-3.1	Inventory and ambition workshop	12	11		Combined workshop of WP2, WP3 and WP4. A summary is placed on the OH EJP website
COHESIVE	D-JIP2-3.3	Pathway analysis of exchanging signals	10		18	The pathway analysis of exchanging signals has been initiated but not finalised due to workload and person circumstances of key staff. This has been solved enabling finalisation of the deliverable in month 18
COHESIVE	D-JIP2-4.5	Report of available tools and algorithms and ranking of most valuable features	12		18	Tools focusing on WGS are not finished yet. The workload of this subtask was underestimated. No other task or subtask in this project depends on this work.

JIP name	Project deliverable number	Deliverable name	Delivery date from AWP	Actual delivery date	If deliverable not submitted on time: Forecast delivery date	Comments
COHESIVE	D-JIP2-4.8	Report section about user requirements, relevant modelling modules and final specification for a modelling tool	10		18	Contact with EFSA and a private company as potential cooperation partners has been established. Identification of synergies is ongoing in 2019.

4.3.2. Milestones

JIP name	Milestone number	Milestone name	Delivery date from AWP	Achieved (Yes / No)	If not achieved: Forecast achievement date	Comments
COHESIVE	M-JIP2-1	Initial workshop	2	Yes		Decided to postpone the workshop so it could be held together with the workshops of WP2 and WP3. Held in November 2018. Summary is placed on the website of OH EJP
COHESIVE	M-JIP2-2	Website/platform operational	6	Does not apply		As the website of the overarching One Health EJP seems to fulfil our needs we will not develop our own website
COHESIVE	M-JIP2-3	Prioritization of requirements for risk modeling framework	6	Yes		Typical components have been identified that support quantitative microbiological risk assessment, advanced simulation techniques, documentation and extended usability.
COHESIVE	M-JIP2-4	Prioritization of most valuable features of available tracing tools	12	No	18	For tracing of supply chains this is sufficiently done. Tracing focusing on WGS is not yet complete, see Deliverable above. It will be finished within the first half of 2019. There is no critical dependency due to this delay

4.4. Publications and patents

Not applicable during this period.

4.5. Impact and relevance

A major aim of this project is to close the gap between public health, food safety and veterinary domains, mainly in the area of risk-analysis. The aim of COHESIVE is to enhance collaboration on all zoonotic threats, irrespective of the regulatory status. Earlier warning of potential zoonotic threats in a structured and integrated way, will facilitate risk management, between the human, food and veterinary domains making use of the tools to be developed in this project (implementation guideline for integrated risk-analysis, decision-tree help selecting the proper risk assessment tool). In the workshop held at APHA in November, important steps were made to develop the foreseen tools, including attracting people to participate. In addition, the workshop was a good opportunity for networking over domains but also over countries. Also, people were informed on the goals of the project, the importance of hum-vet collaboration, but they also had the ability to share and discuss i.e. barriers of collaboration and learn from that. Currently, co-operation and collaboration on cross-bordering threats functions better on regulated than on non-regulated diseases. Collaboration with EFSA, ECDC and EU-Commission in this respect is crucial. In this first year, contacts have been made with the EU-commission, EFSA and ECDC. With EFSA and ECDC, also general agreements were made on further involvement of both organisations, although they have to be further refined. The integration of One-Health surveillance systems with pathogen WGS data will further close the gap between Med and Vet. In this first year, several meetings were organized, including the November workshop, in which was discussed how to work together and get a functional One-Health surveillance system. Also, information about the actual situation on surveillance systems which differs between countries and domains was exchanged. The evaluation of the status of tracing tools and the development of a tracing platform applicable for administrations in EU are one of the urgently necessary and overdue steps for pushing forward digitalization of One Health needs within the EU. Within the different meetings new contacts were made with people from other domains and expertise, bringing the related tasks to a more One Health approach.

4.6. Follow-up of the recommendations and comments in previous review(s) by the Ethics Advisors

Requirements (from ethical reviewers)	Measures and actions taken
None	Not applicable

4.7. Critical risks

Description of risk	Yes/No
Loss of key-persons (staff and / or leaders)	Yes
Delay in work plan execution	Yes
Conflicts within the consortium	No
Lack of commitment of partners	Yes
Delay in duties, tasks or reporting	Yes
Poor intra-project (JRP) relationship	No
Potential entry/exit of partners	No
Other risks (please describe)	Yes

Comments to Other risks:

- At APHA there might be some risk with respect to recruitment and succession planning
- There is some delay in the work plan execution, which will lead to not making all deliverables in time. However, up to this point, this does not seem to lead to problems in the final results/products.
- It appears to be very difficult to engage people with the right expertise into WP2 and WP3. The workshop of November has provided new contacts and hopefully will solve this problem.
- Partners and key persons loaded with other tasks. In addition, unforeseen crises and outbreaks in partnering countries may lead to delays in achieving the milestones.
- Challenge to get countries involved in the STMs in year 3
- Concerning WP4 we anticipate the possibility of "political" problems, such as a very strict interpretation of the GDPR by some institutions or countries, making difficult a proper connection between WGS data and some metadata crucial for the epidemiological analyses.

Most likely, some of the risks emphasized above will be corrected during 2019, according to the progress of the project. However, a contingency plan is anticipated to prepare for mainly with respect to the involvement of countries in the STMs in year 3, and the problems around a very strict interpretation of the GDPR by some institutions or countries.

4.8. Interactions with other JRPs/JIPs or with external (EU or national) relevant project

- Contacts with EFSA and ECDC: telephone calls, meeting at ECDC, EFSA present at kick-off meeting, ECDC present at workshop at APHA, ECDC and EFSA gave presentation during that workshop (EFSA via skype connection)
- Cogwheel meeting with COMPARE
- OH EJP JIP ORION: people from ORION present at kick-off meeting and workshop, several COHESIVE members present at kick-off of ORION, several people involved in both COHESIVE and ORION.
- EJP JRP NOVA: people from COHESIVE present at kick-off meeting of NOVA and vice versa
- EU representative present at kick-off meeting

4.9. Dissemination and communication activities

<i>Name of the activity:</i>	<i>Workshop Cohesive</i>		
<i>Date:</i>	<i>November 26-27</i>		
<i>Place:</i>	<i>APHA, New Haw, England</i>		
<i>Flyer</i>	<i>Yes</i>	<i>Website</i>	<i>Yes</i>
<i>Social Media</i>	<i>Yes</i>		
<i>Estimated number of persons reached</i>			
	<i>Number</i>		<i>Number</i>
<i>Scientific Community (Higher Education, Research)</i>	<i>~50</i>	<i>Other</i>	<i>~5</i>

4.10. List of planned tele- or video conferences, face to face meetings in the next year

Every 6 weeks a teleconference is planned for the steering group. The annual meeting for all members of the project will be scheduled for Spring 2019. In Autumn, a workshop will be organized. Regular teleconferences will be organized with ECDC/EFSA with project coordinator or steering group. Frequency not yet determined.

4.11. Key performance indicators

Key performance indicators (KPI:s) to be followed-up in Y2 are tentatively those suggested by COHESIVE in its project proposal:

1. Number of partners in workshops (within whole EJP consortium)
2. Number of human-veterinary pairs per country involved in the various activities
3. Access rate to, usage of the data platform and institutional implementations of the platform
4. Participation/Interest of partners in the development – number of active participants in monthly web discussion conference
5. Number of countries contributing to the platform, number of strains sequences stored in the WGS database by country, pathogen species and source, number of strains for which complete metadata information (or minimal acceptable metadata information) has been stored in the metadata database.