

## **SHORT TERM SCIENTIFIC MISSION (STSM) – SCIENTIFIC REPORT**

The STSM applicant submits this report for approval to the STSM coordinator

**Action number:** TD1404-39356

**STSM title:** Application of system and interdisciplinary approach to Antimicrobial Drug Resistance in Portugal

**STSM start and end date:** 15-01-2018 to 19-01-2018

**Grantee name:** Patricia Alexandra Curado Quintas Dinis Poeta

### **BACKGROUND**

Several strategies and approaches have been attempted to deal with anti-microbial resistance. The term "control" seems inappropriate because true control of antimicrobial-resistant organisms and their effects seems biologically and historically impossible. However, statements from professional societies, independent review groups, and governmental agencies stress several measures to minimize the detrimental effects of resistance. These include professional educational programs, enhanced microbiologic surveillance, enhanced surveillance of patients, implementation of infection control procedures, development of vaccines against resistant organisms, and prudent use of antimicrobial agents for treatment and prophylaxis. These measures can be evaluated in terms of their success in reducing antimicrobial-drug resistance and its associated costs. However, costs associated with each of the strategies must also be included in the calculation of overall economic impact. These costs appear more or less important, depending on the perspective from which the analysis is being conducted. The few analyses of this type conducted to date focus on costs of infection control. Determining the true economic impact of antimicrobial-drug resistance is a challenge because so many variables and perspectives are involved. Better methods are needed to assess the practical implications from all perspectives, whether prescriber, patient, health-care business, pharmaceutical company, or the public. Because studies completed to date have been hampered by their small size and lack of uniformity, validity of the information provided is unclear and extrapolating the studies to regional or national or international levels is questionable. Population-based studies of the true impact of resistance would require large multi-centre study groups and would be valuable to help address the different perspectives. Relevant studies will require sufficient size to describe baseline antimicrobial-drug resistance, deal with limits of random variation, and control for variables. Multi-centre study groups will likely have to be assembled to provide enough observations, as well as sufficient resources. Only when this is done, the true magnitude of the economic impact of antimicrobial-drug resistance will be clear and evaluation can be started.

The procedure elaborated by NEOH with the Handbook delivers conceptual means to approach complex evaluation problems, in particular the application of system thinking, as described in NEOH handbook, and the interdisciplinary co-operation. Despite the diffused claim for economic evaluation of health initiatives and in particular of the OH initiatives, this activity is still embryonal and suffer for the complexity of evaluation methodology. NEOH case studies are providing examples of OH evaluation especially applied to develop OH-ness evaluation. Less attention has been paid to show how system thinking and interdisciplinary work routine can be applied to the elaboration of epidemiologic models and evaluation problems, including in particular economic evaluation. And how this can be done in a sustainable way.

## **OBJECTIVE**

As mentioned in the proposal, the objective of this STSM was identified in the opportunity to strengthen interdisciplinary cooperation between the Department of Agricultural and Food Sciences of the University of Bologna (I) and the Department of Veterinary Sciences in Portugal to develop the economic evaluation of the ongoing “Prospective Case Study: After the first study how evaluate Methicillin Resistant Staphylococcus aureus from the One-Health perspective?” project, following the general methodological framework developed NEOH. The above-mentioned project is one of the case study presented at the NEOH Malta meeting in January 2017, which is the subject of a paper that one of the Applicants (Prof. P. Poeta) is co-authoring in view of its publication on Frontiers in Microbiology.

My participation in NEOH COST action TD1404 has started at 2015 mainly in the WG2 activities. In this sense, I'm leader of a case study "First report on MRSA recovered from wild boars in the north of Portugal. Omic tools to characterize methicillin resistant Staphylococcus aureus recovered from wild animals. A one health perspective". The goal of this STSM was to perform the application of NEOH framework to our case-study but furthermore to look into the economic assessments and factors needed for that kind of evaluation to be done with the objective to integrated One Health approach. This occurs because the case studies, as recommended by the WG1 of NEOH during 2016, must to be evaluated by using the evaluation framework developed.

## **DEVELOPMENT**

We developed a conceptual exercise to apply system approach to the identification of economic outcomes related to AMR starting from epidemiologic models, where epidemiologic models include not only biological aspects related to humans, animals and the environment but also social practices and situations relevant for the understanding of the AMR problem. Beside scientific justifications, the STSM provided useful methodological result because of the interdisciplinary collaboration between the applicants. In fact, in this STSM we took advantage of the mix of competences of applicant institution (applicants are veterinarians which are active in AMR research and in NEOH activities, in particular through the development of case studies) and the host institution (whose representatives are agro-food economists skilled in economic evaluation, actively participating in the development of NEOH methodology and in NEOH case studies). Both parties performed STSM's activities that provided methodological development for the advancement of NEOH approach to OH evaluation, in particular in view of its simplification and practical sustainability. This experience allowed me to cooperatively work

with the Italian supervisors in applying the outfits for assessment of One Health from the NEOH Handbook for evaluation to my case study. This STSM was definitely a huge chance for both to begin teamwork among our teams in Portugal and Italy.

At my arrival, on the first day, Prof. Maurizio Aragrande, Dr. Massimo Canali and myself had a meeting to inform them about my case study and the improvements that are need to input. So, they start explaining me the economic evaluation techniques and application in different contexts and perspectives as well the application in other case studies. Also, the relevant aspects of AMR epidemiologic model, in particular in Portugal, based on current knowledge, were analysed. We discussed tools for evaluation from NEOH Handbook and the procedure of OH thinking, planning, evaluation of learning and sharing, related to the above-mentioned MRSA project. Furthermore we spend some time to the discussion on the future publication that should come out of the evaluation work. A detailed description of how the time was spent, what exactly was done and outcomes obtained are shown in the Table 1 below. Normal time work was 9.30-13 and 14.30-18.00

## **OUTCOMES**

Main STSM outcomes can be summarized as below:

- i. Reciprocal training about the focus in relation to the case study (i.e. epidemiology, economics, health and economic evaluation techniques) by presentation and discussion sessions.
- ii. Draft epidemiologic model of the case study on the basis of the existing knowledge
- iii. Identification of gaps and needs to develop OH-sound evaluation of the “Application of system and interdisciplinary approach to Antimicrobial Drug Resistance in Portugal”
- iv. Strategy and plan to implement effective scientific cooperation among participants institutions on practical objectives

Details about the time schedule and time use are displayed in the table below.

<b>Table 1 – Details of the activities performed during the STSM</b>	
Day 1	<p><b>Activities</b></p> <ul style="list-style-type: none"> <li>- Prof. Patricia Poeta (PP) introduces the main features of her activities on AMR and in particular in the context of the on-going “Prospective Case Study: After the first study how evaluate Methicillin Resistant Staphylococcus aureus from the One-Health perspective? Project. She stresses the analytical methodologies and the general strategy of data collection and sharing of the project.</li> <li>- Based on specific questions of Prof. Maurizio Aragrande (MA) and Prof. Massimo Canali (MC), PP provides information about the existing knowledge about AMR epidemiology and related scientific problems and grey areas.</li> <li>- A first essay to draw and epidemiologic model is attempted, as a basis for common discussion the next days</li> </ul> <p><b>Outcomes</b></p> <ul style="list-style-type: none"> <li>- Knowledge transfer among participants</li> </ul>
Day 2	<p><b>Activities</b></p> <ul style="list-style-type: none"> <li>- Based on MA and MC, PP explains former and current measures and policies to fight AMR in Portugal. Further specifications are provided to focus the role of the Application of system and interdisciplinary approach to Antimicrobial Drug Resistance in Portugal in the above-mentioned context and the general Theory of change behind the project.</li> <li>- A discussion is started in view of identifying the potential focus of an economic evaluation in the project context.</li> <li>- PP provides information about the current availability of statistical data concerning AMR in Portugal</li> <li>- In the afternoon, a preliminary session about system thinking and its application to the case study is developed. Reference is made to the draft epidemiological model</li> </ul> <p><b>Outcomes</b></p> <ul style="list-style-type: none"> <li>- Knowledge transfer among participants</li> <li>- Refining of the AMR epidemiologic model</li> <li>- Role of the Application of system and interdisciplinary approach to Antimicrobial Drug Resistance in Portugal in the epidemiologic model</li> </ul>
Day 3	<p><b>Activities</b></p> <ul style="list-style-type: none"> <li>- Second and final session about system thinking</li> <li>- MA and MC provide general information about economic evaluation, focusing in particular available methods, time-frame of the evaluation, relevant definitions and</li> </ul>

	<p>concepts (input, output, outcomes; market and non-market goods, ex-ante and ex-post comparison, financial aspects of evaluation)</p> <ul style="list-style-type: none"> <li>- Based on specific questions of PP, and on the consequences of AMR in humans as resulting from the tentative AMR epidemiologic model, a common discussion is started to identify relevant economic inputs, outputs and outcomes of the Application of system and interdisciplinary approach to Antimicrobial Drug Resistance in Portugal project in view of an economic evaluation.</li> </ul> <p><b>Outcomes</b></p> <ul style="list-style-type: none"> <li>- Knowledge transfer among participants</li> <li>- Integration of participants' knowledge</li> <li>- Conceptualization of the economic evaluation</li> </ul>
Day 4	<p><b>Activities</b></p> <ul style="list-style-type: none"> <li>- MA and MC go in depth with limits and possibilities of the economic evaluation, providing in particular highlights about the methods allowing for the evaluation in a trans-sectoral and social perspective (CBA, WTP, contingent evaluation etc.)</li> <li>- Data need to apply such evaluation methods to the case study are discussed. PP provides information about the sustainability of the economic evaluation based on the existing data. The need of additional data is discussed, as well as the possible strategies and resources to get them</li> <li>- The potential long-term outcomes of the project at institutional level are discussed according to the standards set by NHOH methodology concerning the evaluation of OH-ness</li> <li>- In view of an effective cooperation to reach practical objectives, PP suggest the participation of MA and MC in the paper " Prospective Case Study: After the first study how evaluate Methicillin Resistant Staphylococcus aureus from the One-Health perspective?" (current draft) in view of its publication on Frontiers in Microbiology.</li> </ul> <p><b>Outcomes</b></p> <ul style="list-style-type: none"> <li>- Knowledge transfer among participants</li> <li>- Structure and contents of the economic section of the ongoing publication on AMR</li> <li>- Data need to refine epidemiological model and related research strategies in a time, long-term perspective</li> </ul>
Day 5	<p><b>Activities</b></p> <ul style="list-style-type: none"> <li>- All the participants discuss the way of revising the on-going paper in view of including the economic evaluation, stressing in particular the interdisciplinary approach and the way to implement it. This is set as a primary, short term objective, in view of the next deadline for submission (April 2018). To this aim, a regular discussion will start since February, based on the exchange and the mutual revision of paper drafts.</li> <li>- Further possibility of co-operation between the two institutions are discussed, looking at the long term. The contribution to the development of an economic evaluation of the</li> </ul>

	<p>ongoing Portuguese project on AMR is agreed as credible practical objective of the cooperation.</p> <ul style="list-style-type: none"> <li>- During the afternoon participants developed a debriefing session and the lines for the self-evaluation of the STSM outcomes. The general lines for STSM report are discussed and agreed</li> </ul> <p><b>Outcomes</b></p> <ul style="list-style-type: none"> <li>- Draft plan of future cooperation in the short and long term and related deadlines</li> <li>- STSM report structure and content</li> </ul>
<p><b>Outcomes overview</b></p> <ul style="list-style-type: none"> <li>- Reciprocal training about the focus in relation to the case study (i.e. epidemiology, economics, health and economic evaluation techniques) by presentation and discussion sessions.</li> <li>- Draft epidemiologic model of the case study on the basis of the existing knowledge</li> <li>- Identification of gaps and needs to develop OH-sound evaluation of the "Prospective Case Study: After the first study how evaluate Methicillin Resistant Staphylococcus aureus from the One-Health perspective?"</li> <li>- Strategy and plan to implement effective scientific cooperation among participants institutions on practical objectives</li> </ul>	

## FUTURE COLLABORATIONS

In the future we plan continued this collaboration with the objective to finish a manuscript related with the social and economic skills applied to Antibiotic resistance in the perspective of the One Health approach. We are planned also to coordinated together a PhD thesis into the economic impact of an antibiotic resistance in bacteria form humans and animal production in Portugal and, depending on this results, a European project related with this area could be a chance of development more knowledge, international collaborations and financial support to continue this kind of research.

## CONFIRMATION BY THE HOST OF THE SUCCESSFUL EXECUTION OF THE MISSION

According to the proposal, I have carried out the STSM successfully. The data increased during the discussions and meetings are a valuable material for the continuation of evaluation. All the planed steps of evaluation of the case study were done according to the 5-day plan. The work done together was not only fruitful for the evaluation process but it was also a pleasure for all the researchers involved.

Signatures

Grantee



Host

