Monitoring of antimicrobial resistance in the interface between domestic animals, wildlife, and the environment

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Background and Objectives

The establishment of the Quadripartite partnership in March 2022, has reaffirmed the importance of the environmental sector in One Health [1]. The Quadripartite considers One Health as the main approach for addressing complex health challenges such as antimicrobial resistance (AMR). In its latest call to action, the Quadripartite urged stakeholders to focus on a number of priority actions, among which to strengthen and sustain prevention of health threats at source, in order to reduce the risk of zoonotic spillover. The Quadripartite's One Health Joint Plan of Action extensively addresses the possible spillover of AMR between food-producing animals, humans and the environment, and recognizes the role of the interface between domestic animals and wildlife in the emergence of zoonotic epidemics [1].

Denmark is internationally recognized for a long-lasting successful intersectoral collaboration for the monitoring of AMR in animals, food and humans – the DANMAP program. In a recent evaluation of its One Health scope, DANMAP scored lowest in the target of coverage/transdisciplinary, due to the lack of representation of the environmental sector in its program [2]. The monitoring of AMR in the environment is crucial to understand the dynamics of AMR dissemination outside of clinical, veterinary and farm-to-fork settings [3]. It can serve both the purposes of assessing the dissemination of already resistant bacteria, and of studying how the environment acts as a source of new AMR hazards [3]

Research on the environmental monitoring of AMR of anthropogenic origin is in its infancy, with the majority of the existing studies having focused on farm waste or wastewater. However, wildlife is known to have a role in the spread of AMR and has been increasingly hypothesized as a useful marker for environmental pollution with antimicrobial resistance [4].

Hypothesis

Terrestrial animals participate in the spread of resistance between food producing animals and the surrounding ecosystem. Mussels are successful bioindicators for environmental spread of AMR from the terrestrial to the aquatic environment. *E. coli* can be used as indicator for future environmental surveillance of AMR.

Methods

Fecal samples were collected from septic tanks from pig farms selected within a 5 km radius of the Limfjord straight in western Denmark. Fecal content from wildlife and whole mussels were collected from the surrounding area. *E. coli*was isolated from all samples on selective media (MacConkey) and DNA was isolated followed by whole genome sequencing and phenotypic testing (broth microdilution). All samples had geolocation. Phylogenetic analysis will be performed to investigate the genomic relationship between the *E. coli*isolates, and the pathway of AMR environmental spread will be modelledutilizing GIS software.

Results

Preliminary results will be available at the conference.

Keywords: One Health surveillance, antimicrobial resistance (AMR), environmental surveillance, wildlife–livestock interface, Escherichia coli (E. coli).

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