Designing an Antimicrobial Resistance Surveillance System for Healthy Pet Dogs and Cats

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Introduction

Antimicrobial Resistance (AMR) is a global One Health challenge. Surveillance is an essential tool for addressing this challenge, as it is only with regular collection and interrogation of high-quality data that we can obtain a clear picture of baseline AMR levels in different populations, trends or changes over time, and the effects of interventions designed to mitigate risk.

Close contact between people and animals, as occurs in households with pets, is an opportunity for cross species AMR transmission. Understanding AMR in dogs and cats, the most common UK pets, is essential for understanding the risk of AMR transmission to the health of dogs and cats, their owners, other human contacts and the environment. In the UK the information needed to fully understand and mitigate these risks is lacking. Although AMR surveillance of clinical samples from dogs and cats occurs (1), AMR surveillance of healthy UK dogs and cats is absent.

Surveillance capable of providing AMR prevalence estimates that are generalizable to populations of dogs and cats requires collection of representative samples, ideally through random sampling of the population under surveillance. Collecting a random sample from a population requires that all animals in the population are a) identifiable and b) accessible for sampling. Neither of these are straightforward for all dogs and cats in the UK because there are no single, authoritative registries of all UK dogs or cats, sampling locations where the entire populations can be accessed are few, and there are few studies reporting the structure and distribution of the UK dog and cat populations in their entirety. While there are surveys of AMR in healthy pets (2), there are no operational national healthy pet AMR surveillance systems (3).

There are other methods for collecting samples that are considered acceptable by the surveillance community for making valid inferences about populations or their subpopulations (hereafter referred to as compartments). Examples for animals include random surveys of carcasses at abattoirs (e.g. the PATH-SAFE funded survey of AMR in prime cattle at slaughter in GB), the approach used for Bovine Spongiform Encephalopathy (BSE) surveillance where the population is divided into compartments and different approaches for selecting animals are used in each compartment (WOAH), and risk-based surveillance (4). Compartments or high-risk areas are often not representative of the entire population. However, if individuals within compartments can be selected using randomization methods, surveillance samples can be collected that are representative of the compartment, and parameters can be estimated that are representative of the subpopulation within that compartment.

This project aims to provide sufficient information to design surveillance to produce representative estimates of AMR in commensal *Escherichia coli* (*E. coli*) in healthy UK dog and cat populations. When operational, the surveillance is expected to produce information about emerging AMR issues, changes in AMR trends, and to have the ability to estimate changes in AMR trends following interventions aimed at reducing AMR. The key challenges are 1) the characterisation of the UK dog and cat populations at sufficient resolution to design a strategy for collecting representative samples from the populations, and 2) the collection and delivery to the laboratory of faecal samples of sufficient quality to allow the use of European Committee on Antimicrobial Susceptibility Testing (EUCAST) methods to produce AMR surveillance information that is consistent with that routinely reported by the UK Veterinary Antimicrobial Resistance and Sales Surveillance (VARSS) livestock programme.

This paper outlines our overall approach for designing a surveillance system for AMR in healthy UK dog and cat populations and describes the outcomes of two activities completed to date – a representative survey of UK dog or cat-owning households and collection for AMR testing of faecal samples submitted from dogs and cats owned by a subset of respondents to that survey.

Materials and Methods

Defining information needs from an operational pet dog and cat AMR surveillance system.

A workshop with participation from the project team and members of the Veterinary Medicines Directorate (VMD) an executive agency of the UK Department for Rural, Environment, Food & Rural Affairs (DEFRA) was held to define surveillance objectives and identify information needed from an operational surveillance system. To ensure that an operational surveillance system will be useful, the outputs of the workshop will be used to guide the design of the new surveillance system.

Identification and characterisation of the UK dog and cat populations and their compartments.

We divide UK dog and cat populations into compartments based on available information about size and degree of human control over that compartment which influences the accessibility of animals for sampling. We then explore different approaches for collecting representative samples from each compartment. This approach will allow monitoring of each compartment independently over time, estimating the current and changing AMR prevalence in compartments, estimating the AMR risk to the health of people and animals from each compartment, targeting higher risk compartments for more intensive surveillance, and estimating overall AMR prevalence or risk by weighting the estimates from each compartment by size and precision, and combining them.

Three population compartments have been adopted for our surveillance system design: 1) owned and ontrolled (**O&C**) dogs and cats, which are those that are owned and live in people's homes, 2) unowned and controlled (**U&C**) dogs and cats, which are those that are temporarily in local authorities or shelters before being returned or re-homed, and 3) unowned and uncontrolled (**U&U**) dogs and cats, such as stray or free-ranging dogs and cats (5). There is empirical evidence that the uncontrolled compartment of cats in the UK is larger than the equivalent dog compartment, as the UK has negligible free-roaming dogs, but stray and feral cats are considered relatively numerous.

We reviewed scientific and grey literature to produce updated estimates for the size and distribution of the UK dog and cat populations across the compartments described above. Where feasible, we will use random selection of dogs and cats proportional to the subpopulation size in each compartment to allow the surveillance samples to be as representative as possible of the subpopulation in each compartment.

For **O&C dogs and cats**, we explore 3 sampling approaches: 1) a nationally representative survey of a minimum of 1000 dog or cat-owning households; 2) a national veterinary survey, where veterinary surgeries are randomly selected proportional to the human population density and asked to provide samples from a number of dogs and cats that is proportionate to the human population density and national statistics on dog/cat ownership; and 3) a national dog/cat survey, where owners and their dogs/cats are randomly selected from pet identification registries, proportional to regional dog and cat population densities found within those registries, and asked to provide samples. The household survey has been completed in collaboration with an external provider – IPSOS. We have used the IPSOS Knowledge Panel to screen UK households and recruit those owning dogs and/or cats to complete an online questionnaire. The questionnaire gathered information about respondents' dogs/cats, their feeding practices, lifestyle, and interaction with owners and vets. We were provided with the background demographic household data IPSOS used to ensure their UK panel was representative of the UK population.

For**U&C dogs and cats,** we will create lists of local authorities, shelters and other locations that care for found dogs and cats and explore possibilities for randomly selecting locations to request samples for a national U&C survey.

For **U&U cats (and to a lesser extent, dogs)** it will be a greater challenge, since little is known about their demographics, and easily accessing them to collect samples may be difficult or impossible. To identify sampling opportunities, we propose consultation and a workshop with people who interact with U&U pets such as community members, workers from shelters, feral cat wardens and others.

The results of all these sampling components will be analysed to estimate potential biases, compliance to requests for samples, ease of sample collection, sample quality at the lab, cost, scalability and whether or not the information produced meets the information requirements defined for the surveillance system.

Collection of faecal samples of appropriate quality for laboratory testing for AMR

Through consultation with colleagues experienced in acquiring samples from cattle for AMR surveillance activities we refined sampling protocols and defined minimum standards for samples, including types of sample vessel, sample volume, transport media, conditions of transport and mechanism of transport, to optimise capacity to culture generic *E. coli* from the sample on receipt at the laboratory. We compiled sampling kits to be sent out along with instructions, such that samples could be collected by participants and posted back to our laboratory.

The sample collection process was piloted with 10 “friends and family” testers, who were asked for feedback regarding ease of sample collection and submission. Following this pilot, we invited 100 respondents from the completed household questionnaire to submit a faecal sample from their dog or cat for laboratory AMR testing.

Laboratory processing of samples obtained
We culture all samples received for this project, following standardised protocols, to isolate generic *E. coli*. A single generic *E. coli* isolate per sample will undergo Whole-Genome Sequencing (WGS) and Antibiotic Sensitivity Testing (AST) against a defined panel of antibiotics as specified in Table 2, Annex 1 of the Commission Implementing Decision (EU) 2020/1729, plus three additional antibiotics selected in consultation with the VMD due to their importance as veterinary treatments for dogs and cats. The AST approach will be the Minimum Inhibitory Concentration (MIC) method, using commercially available MIC plates for the defined panel of antibiotics and bespoke MIC plates for the three additional antibiotics. Each sample obtained will also be cultured on selective agar to identify the presence of presumptive Extended-Spectrum Beta-lactamase (ESBL)-producing, AmpC-producing or Carbapenemase (CP)-producing *E. coli*. Any isolates identified from selective agar will subsequently be submitted for WGS to confirm that they are ESBL/AmpC/CP-producing and for bioinformatics analyses.

Results
Workshop participants identified three areas of importance in terms of useful information that should be created by the surveillance system:
-baselines for AMR carriage in healthy cats and dogs.
-changes in the AMR carriage over time.
-patterns of AMR carriage in space and time.

Workshop participants suggested potential uses for this surveillance information including:
-making comparisons of AMR carriage in pets with humans and other species and across health sectors, regions and nations.
-understanding transmission patterns among pets and across species.
-identifying risk factors and opportunities for intervention.
-informing estimates of AMR risk for humans and other species.
-informing policy development.
-leading to new research directions

Other outputs from the workshop included the metadata that should be collected with samples, and data about AMR generated from laboratory analyses.

Sample collection kits were designed and pilot tested with ten friends and family member in November 2025. Feedback received was used to clarify the instructions provided with the sampling kits. Faecal samples collected during the pilot were processed in the laboratory following the planned protocol for the household survey and the testing components will be done later in the project, when other subpopulations have been sampled.

The household survey was available online from February 5th to 11th, 2026 and 1,085 pet-owning UK adults participated. Overall, 48% of respondents owned at least one dog or cat, with 29% owning a dog, and 24% owning a cat. Most respondents had only one dog (80% of dog owners) or cat (60% of cat owners). Over half or respondents (52%) agreed to provide a faecal sample from their pet – 62% for dog owners and 40% for cat owners. We invited 56 dog owners and 44 cat owners to submit a faecal sample from their dog/cat.

At the time of writing, we have received 75 samples in total from the 100 respondents invited to submit a sample and have processed 69% of these. Fifty samples (67%) reached the laboratory within 3 days of sample collection; for the remaining samples it ranged from 4-10 days or is unknown. We isolated generic *E. coli* from 67 samples so far and will carry out AST on these isolates. To date, from the selective agar, we have identified presumptive ESBL/AmpC-producing *E. coli*in eight samples and have not identified any presumptive CP-producing *E. coli*.

Discussion
Preliminary findings suggest that AMR is present in healthy pets, which supports the need for AMR surveillance and the continued conscientious stewardship of antibiotic use in pets. The household survey has been an effective way to access faecal samples from one cohort within the O&C dog/cat subpopulation. Our next steps will be to trial the sampling approach for each of the remaining compartments of UK dogs and cats, beginning with those accessing veterinary clinics and moving on to those living in shelters, before addressing the uncontrolled subpopulations. All this information will feed into a workshop, to be held with the VMD and an expert advisory group, to select the population sampling and animal sampling methods that will form the

operational surveillance system. The operational system will be tested at in a national scale pilot with a sample size that will be comparable with the EU and VARSS surveillance of other animals.

Conclusion

For an AMR surveillance system for healthy UK dogs and cats to be sustainable, it is prudent to make use of existing routes of communication with and access to the target populations – where appropriate – to optimise the use of resources in the collection of surveillance samples and data. At this point, we have found that part of the O&C subpopulation can be successfully accessed for sampling purposes through targeted recruitment and a self-directed sampling process, when the necessary materials and instructions are provided. This is a positive finding as the active sampling component of a surveillance system can be resource-intensive, in terms of time and money. We have also demonstrated that the samples returned meet the quality required for AMR testing, making this an effective approach for gathering surveillance data from this important and largest compartment of the UK dog and cat populations. Finally, although laboratory processing is not yet complete, we have identified evidence that the sampled cohort contains bacteria of importance for public health, confirming that this work is a necessary component of national efforts to address the challenge of AMR.

Keywords: Antimicrobial Resistance, Antimicrobial Resistance Surveillance, Dogs and Cats.

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