ANTIMICROBIAL RESISTANCE IS A GLOBAL HEALTH ISSUE

Antimicrobial resistance (AMR) happens when microbes, e.g. bacteria, develop mechanisms to defend themselves against the medicines (antimicrobials/antibiotics) we use to treat them.

- The more we use antimicrobials, the more opportunity we are giving microbes to develop resistance to them.
- Levels of AMR are increasing, driven by excessive or inappropriate use of antimicrobials.
- We are now seeing some infections, e.g. Tuberculosis, become resistant to most, or all, known antimicrobials.

The World Health Organisation classifies AMR as one of the biggest threats to global health, food security and development. In 2019, 3.57 million human deaths were related to AMR.

We can combat AMR by using antimicrobials responsibly. This means using the right medicine, for the right infection, at the right time.

THE DOGSTAILS PIPELINE

Our new diagnostics pipeline uses nanopore DNA sequencing to identify the bacterial species and potential AMR present in clinical canine urine and skin swab samples, in a fraction of the time taken by the current methods.

1. Culture

   Samples are spread on a growth medium, and the resulting bacterial colonies are inspected.
   
   Bacteria are grown in the presence of an array of antibiotics, to determine which they are resistant/susceptible to.
   
   Minimum time: 48+ hours

2. Antibiotic sensitivity testing

   This will continue to demonstrate that a single, adaptable, sequencing-based diagnostic method can enable the rapid selection of appropriate antimicrobial treatments.

WHAT’S NEXT?

- Continue to optimise the protocol for urine and swab samples, focussing on AMR prediction in samples with high levels of host DNA.
- Test other frequently seen clinical sample types, including blood, tissue, faeces, and various effusions, and samples from other animals.
- Open a new lab on-site at the RDJ/SVS Hospital for Small Animals, where we will offer the Dogstails method as standard.

We will continue to demonstrate that a single, adaptable, sequencing-based diagnostic method can enable the rapid selection of appropriate antimicrobial treatments.

REFERENCES


“Dogs in the Dogstails” was created by Eliza Wolfson for the comic strip Loudest in collaboration with Joanne Allison and the LBEP team at the Roslin Institute. See the whole comic: https://lizawolfson.co.uk/portfolio

CURRENT DIAGNOSTIC METHODS

The current “gold-standard” diagnostic pathway is similar for all sample types. While waiting for results, broad-spectrum antimicrobials are usually started.

HOW WELL DOES IT WORK?

We can detect the top ten species most commonly seen in urine and skin infections.

- We optimised the protocol using the ten most common species, representing 87.5% of diagnoses.
- We have subsequently processed over 50 real clinical samples with the Dogstails pipeline.
- Our lower limit of detection is comparable to current methods.
- Above this limit, we can offer the correct species with 100% sensitivity and specificity.
- Levels of dog DNA in the original samples affect the accuracy of AMR prediction.
- Urine contains fewer dog cells, and allows up to 96% accuracy.
- Skin swabs contain almost entirely dog DNA, and will require an extra dog cell depletion step prior to DNA extraction to enable equally accurate AMR prediction.

This work is available as a preprint on bioRxiv: https://www.biorxiv.org/content/10.1101/2022.01.27.264847v1

ABOUT THE AUTHOR

I am a Postdoctoral Research Fellow at the Roslin Institute and Royal (Dick) School of Veterinary Studies in Edinburgh, where I live with my husband and our toddler, and am originally from Essex.

I am developing ways of applying DNA sequencing to improve animal welfare.

__Notes__

Some figures created with BioRender.com

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