The Presence of Antimicrobial Resistance (AMR) in Wild Bird Populations

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Key message: Screening for AMR in wild bird populations revealed significant resistance to some antimicrobials which are of major importance in veterinary and human medicine. The work suggested there may be variations between different populations of wild birds indicating that a range of factors may affect the prevalence of AMR microbes. Increased surveillance of AMR in wild birds and livestock could provide valuable data on AMR trends and the emergence of new patterns of resistance.

Key Points

- This work explored the presence of antimicrobial resistance (AMR) in wild bird populations. This is highly relevant to public health due to wild birds’ unique ability to have direct contact with humans, other vertebrate animals and different environments, and thus the potential to transfer zoonotic AMR organisms or the genes that result in AMR.
- Surveillance for AMR in sentinel species such as certain wild birds could indicate previously identified AMR trends and could also proactively identify new/emerging AMR trends.
- Wild garden bird surveillance demonstrated low or no resistance to most antimicrobial agents tested, with no evidence of multiple AMR (defined as resistance to four or more unrelated classes of antimicrobial agents).
- Surveillance of wild gulls indicated frequent carriage of extended spectrum beta lactamase (ESBL)-producing E. coli, some of which also showed multiple AMR including resistance to other antimicrobials used in both veterinary and human medicine.
- Different methodologies were used when screening garden birds and gulls, and so direct comparisons are not possible. However the trends suggest that within wild bird sub-populations there may be several factors affecting the prevalence of AMR microbes, including the degree of environmental contamination.
- Increased AMR surveillance of wild bird populations could better inform trends in AMR, proactively identify the emergence of new zoonotic AMR trends, and increase knowledge and understanding of the role that environmental contamination plays in the development of AMR.

Introduction

AMR is not a disease but a feature of pathogenic (disease causing) and non-pathogenic microbes (microscopic organisms). Antimicrobial usage results in the selection of such resistant microbes as only those susceptible to the antibacterial are eliminated, ultimately causing antibacterial failure. The occurrence of multiple resistant microbes of human and veterinary origin, capable of transmission between species of vertebrate animals and humans, may result from direct transfer between species or may be acquired from the environment. Recent research has designated wild bird populations as potential sentinels for infectious disease surveillance. The unique interaction that wild birds have with humans, livestock and wild animals in differing environments means...

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http://www.scotland.gov.uk/Publications/2014/02/8714/5
2 Jamie McFadzean, Rural Policy Centre Intern, Summer 2013. For further details regarding this work please contact Tom Pennycott, Veterinary Centre Manager E: tom.pennycott@sac.co.uk or Siân Ringrose, Rural Policy Centre E: sian.ringrose@sruc.ac.uk.
3 A sentinel species in this instance is one whose prevalence of AMR microbes is accepted as indicative of the level of AMR present in the environment more generally.
4 ESBLs are enzymes produced by certain bacteria that prevent penicillins and cephalosporins from being effective. These antibiotics are used in the treatment of severe infections in humans and, to a lesser extent, in veterinary medicine.
5 Policy Briefing (2013): AMR Trends, Impacts and Policy messages
http://www.srsc.ac.uk/info/120483/archive/1207/2013_amr_trends_impacts_and_policy_messages
that AMR surveillance in wild birds not only provides supportive information about identified AMR trends, but may also aid in identifying new/emerging resistance trends as well as exploring the role that specific environmental factors play in the increase of AMR development. This research provides a basic indication of the presence of AMR in wild bird populations and evaluates the benefits of increasing this type of resistance surveillance.

Methodology and Findings

Antimicrobial susceptibility testing was carried out using the Kirby-Bauer disc diffusion test. Samples from garden birds were not screened with selective media that would enhance the detection of AMR bacteria. The gull samples however, were screened using media to select organisms showing extended resistance to the beta lactam group of antimicrobials. Direct comparisons between the results for garden birds and gulls are not therefore possible.

- *Salmonella Typhimurium* from garden bird carcases (January 1995-December 2011): no resistance was found to ampicillin, amoxicillin, apramycin, cefpodoxime, cephalaxin, enrofloxacin, florfenicol, neomycin or trimethoprim-potentiated sulphonamides. Fifty-six of 174 samples (32.2%) were sulphisoxazole resistant and 35 of 299 (11.7%) were resistant to tetracyclines, but no isolates were resistant to more than one class of antimicrobial agent.
- *Escherichia albertii* from garden bird carcases (January 1995-December 2011): no resistance was found to apramycin, cefpodoxime, cephalaxin, florfenicol, sulphisoxazole, tetracyclines or trimethoprim-potentiated sulphonamides. A small number (less than 3% of 117 isolates tested), however, were non-susceptible to ampicillin, amoxicillin plus clavulanic acid, enrofloxacin or neomycin. Only one isolate showed non-susceptibility to more than one class of antimicrobial, and none were multiple antimicrobial resistant (four or more unrelated antimicrobials).
- Meticillin-resistant *Staphylococcus aureus* (MRSA) was isolated from only one out of nearly 1000 garden birds examined between January 1995 and December 2011, but more targeted studies would be required to explore this further.
- In 2012 the carcases of 30 dead gulls (*Larus* species) were screened for ESBL-producing *E. coli*, a group of organisms of potential clinical significance in humans. ESBL-producing *E. coli* were recovered from 13 of the gulls (43.3%). 85% of these isolates were also resistant to tetracyclines, 38% resistant to trimethoprim / sulphonamides, and 15% to enrofloxacin. Twelve of the thirteen isolates were resistant to two different classes of antimicrobial, including four that were multiple antimicrobial resistant (four or more unrelated antimicrobials).
- Direct comparisons between the two populations of wild birds are not possible due to the different methodologies used, but the high recovery rate of potentially zoonotic ESBL-producing *E. coli* from gulls, some with resistance to multiple antimicrobial agents, is concerning, and potential transfer from wild birds to humans and livestock is a significant public health concern.

Policy and Research Implications

- This work has highlighted the existence of AMR organisms in species not directly treated with antimicrobial drugs. Wild birds carrying AMR organisms possess the potential to not only propagate identified resistance trends but also spread new/emerging AMR to humans, vertebrate animals and the environment. The unrestricted movement of wild birds within and beyond national boundaries could transfer new/emerging patterns of AMR into the UK from other parts of the globe.
- AMR policy can only be truly effective when policies include screening bacterial isolates from a wide range of different sources, but this is currently underutilised in existing AMR surveillance schemes.
- Enhanced surveillance of sentinel species such as wild birds could potentially offer a wealth of information about current AMR trends and aid in the identification of emerging resistance trends.
- The demonstration of bacteria in gulls that are resistant to a range of antimicrobial agents, some of which are of major importance in human and veterinary medicine, warrants increased investigation. This finding suggests that environmental contamination may be playing a far greater role than previously thought.

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7 For further details on the disc diffusion test see: 2013: AMR Trends, Impacts and Policy messages