

**Introduction to Animal Antimicrobial Use Data Collection in the United States:
Methodological Options**

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Antimicrobial agents (antimicrobials) can be broadly defined as substances that kill or inhibit the growth of microorganisms. It has long been recognized, however, that exposure to antimicrobial agents can exert a selective pressure for the emergence and dissemination of genes or genetic elements that enable bacteria to “resist” the lethal or inhibitory effects of the drugs. Ironically, therefore, antimicrobial use may ultimately render antimicrobials ineffective against their target populations (Levy, 2002).

Over the past fifty years, antimicrobials have been used in a variety of settings including human medicine, veterinary medicine, plant agriculture, and even cosmetics and antibacterial household products. All of these uses of antimicrobials potentially contribute to the emergence and spread of antimicrobial resistance, but antimicrobial use in animals, particularly in food animals, has recently come under particularly intense scrutiny. In large part, concern stems from evidence for direct transfer of resistant pathogens from animals to humans through the food supply (e.g. Spika et al., 1987). The prospect that resistance may be amplified through more indirect, ecological mechanisms is also potentially alarming from a public health standpoint. For example, exposure to antimicrobials in the gastrointestinal tract of a food animal may select for resistance genes in non-pathogenic bacterial populations. While not necessarily harmful to the animal, these bacterial populations could theoretically serve as reservoirs for mobile resistance determinants such as plasmids, which may subsequently be transferred to other bacteria (including human or animal pathogens) through a variety of ecological mechanisms (e.g. Summers, 2002). Various pathways for potential flow of resistance genes or genetic determinants through the ecosystem are illustrated in Figure 1. The

relative importance of these ecological mechanisms in disseminating and amplifying antimicrobial resistance remains poorly understood.

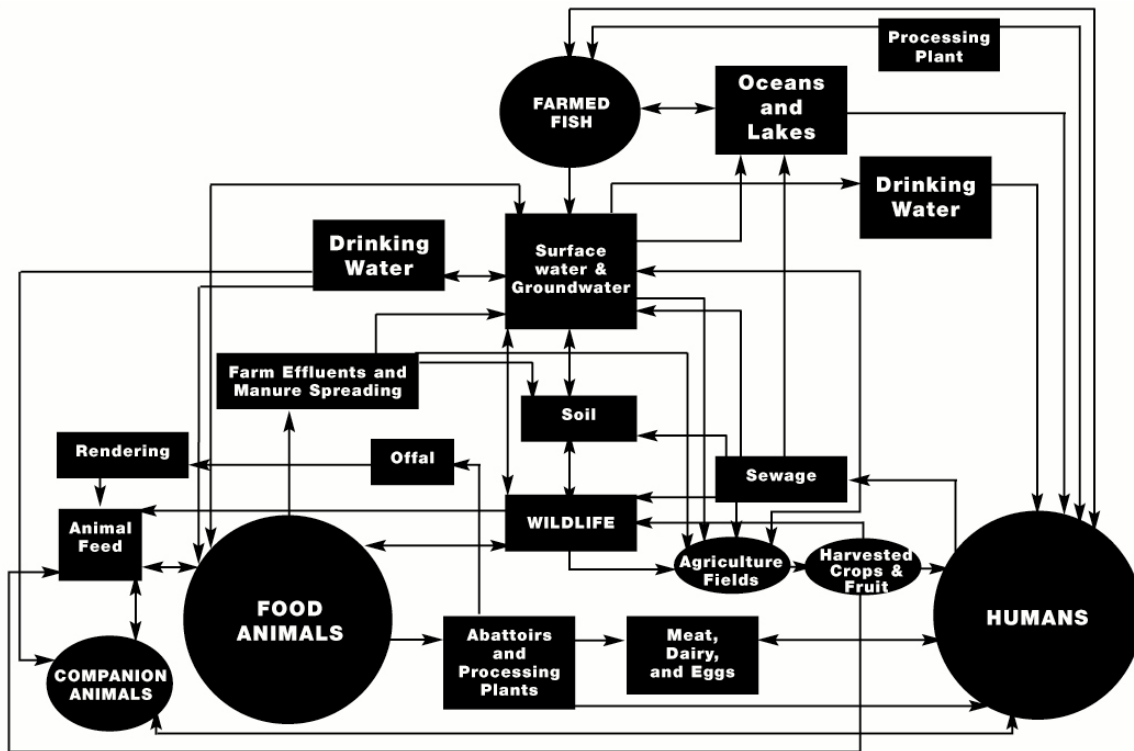


Figure 1: Potential ecological pathways for the flow of antimicrobial-resistant bacteria and genetic resistance determinants through the ecosystem. Ovals indicate points in the system at which antimicrobials are introduced (flowchart adapted from Advisory Committee on Animal Uses of Antimicrobials and Impact on Resistance and Human Health 2002).

In order to evaluate the scientific evidence for human health consequences that may result from antimicrobial use in food animal production, the nonprofit Alliance for the Prudent Use of Antibiotics (APUA) initiated the Facts about Antibiotics in Animals and the Impact on Resistance (FAAIR) Project in 1999. A multi-disciplinary panel of experts was convened to deliberate on these issues over a two-year period.

Acknowledging the potential for both direct and indirect transmission of antimicrobial

resistance between and among bacterial populations, the FAAIR Advisory Panel made recommendations to improve antimicrobial policy and practice in food animal production (FAAIR Scientific Advisory Panel, 2002). A comprehensive report of the FAAIR Project was published as a Supplement to *Clinical Infectious Diseases* under the title “The Need to Improve Antimicrobial Use in Agriculture: Ecological and Human Health Consequences” (Barza and Gorbach, 2000).

One critical data gap identified by the FAAIR I Panel was the lack of surveillance data on antimicrobial use in animals. Noting that no comprehensive animal antimicrobial use data are currently gathered systematically in the United States and that production information reported to the Food and Drug Administration by animal health pharmaceutical companies is not publicly available, the Panel recommended that such data should be made available to improve risk assessment and better inform policy decisions on antimicrobial use in animals (FAAIR Scientific Advisory Panel, 2002). A number of other distinguished committees have made similar recommendations; these include expert groups convened by the Congressional Office of Technology Assessment (US Congress Office of Technology Assessment, 1995), Institute of Medicine (Institute of Medicine, 1989), World Health Organization (World Health Organization, 2000), and the World Organization for Animal Health (Nicholls et al., 2001).

This lack of publicly available, verifiable antimicrobial use data for food animals in the United States served as a starting point for a follow-up Project by APUA. An Advisory Committee on Animal Antimicrobial Use Data Collection in the United States was established in the spring of 2002 in order to address methodological issues surrounding animal antimicrobial use surveillance. In consultation with FAAIR I Panel

members and other stakeholders, potential Committee members were identified from the following groups: academic/research, government officials, animal health industry representatives, public interest scientists and advocates, food animal producers, and veterinary professionals. Invitations to participate were accepted by the 17 Committee members listed below.

Frederick J. Angulo, DVM, MPVM, PhD, Diplomate ACVPM (Epidemiology), Chief, FoodNet and NARMS Activities, Foodborne and Diarrheal Diseases Branch, National Center for Infectious Disease, US Centers for Disease Control and Prevention;
Thomas Burkgren, DVM, MBA, Executive Director, American Association of Swine Veterinarians;

Richard Carnevale, VMD, Vice President, Regulatory, Scientific, and International Affairs, Animal Health Institute;

David A. Dargatz, DVM, PhD, Epidemiologist, Centers for Epidemiology & Animal Health, Veterinary Service, Animal and Plant Health Inspection Service, US Department of Agriculture;

***Paula J. Fedorka-Cray, PhD**, Research Leader—Antimicrobial Resistance Research Unit, Agricultural Research Service, US Department of Agriculture;

Susan F. Kotarski, PhD, Senior Research Investigator, Pfizer Animal Health;

John R. MacMillan, PhD, Vice President Research and Environmental Affairs, Clear Springs Foods, Inc.; President, National Aquaculture Association;

^{a,b}**Scott A. McEwen, DVM, DVSc, Diplomate ACVP**, Professor, Department of Population Medicine, University of Guelph;

^b**Richard Reid-Smith, DVM, DVSc**, Epidemiologist, Antimicrobial Resistance Surveillance Unit, Laboratory for Foodborne Zoonoses, Population and Public Health Branch, Health Canada;

Abigail A. Salyers, PhD, Professor, Department of Basic Sciences, University of Illinois—Urbana-Champaign;

Thomas R. Shryock, PhD, Senior Microbiology Technical Advisor, Elanco Animal Health;

Randall S. Singer, DVM, MPVM, PhD, Assistant Professor, Department of Veterinary Pathobiology, University of Minnesota;

William M. Sischo, DVM, MPVM, PhD, Associate Professor, Veterinary Medicine Teaching and Research Center, University of California-Davis;

Paul Sundberg, DVM, PhD, Diplomate ACVPM, Vice President Science & Technology, National Pork Board;

Linda Tollefson, DVM, MPH, Assistant Surgeon General, US Public Health Service; Deputy Director, Center for Veterinary Medicine, US Food and Drug Administration;

^a Drs. McEwen and Fedorka-Cray served as Committee Co-Chairs.

^b Drs. McEwen and Reid-Smith are Canadian experts included on the Advisory Committee because of their substantive knowledge of veterinary epidemiology and agricultural practices in North America. All other Committee members are located in the United States.

Lyle P. Vogel, DVM, MPH, Diplomate ACVPM, Director, Scientific Activities Division, American Veterinary Medical Association;
David Wallinga, MD, MPA, Antibiotic Resistance Project Director, Institute for Agriculture and Trade Policy.

The Advisory Committee met twice as a group and corresponded via telephone and electronic mail over a period of 24 months. The Committee was asked to identify: 1) methodological options for the collection of antimicrobial use data; 2) potential limitations in these methods; and 3) priorities and a general “strategy” for data collection. DeVincent et al. (internal) describe in detail the process by which the Committee approached these tasks and the framework they developed.

The Committee Co-chairs and APUA staff members were responsible for overall coordination of Committee activities. At the request of the Co-chairs, APUA staff members also prepared a series of written summaries on topics of interest to inform Committee discussions. These “Issue Briefs” are also included in this Report (Viola and DeVincent, 2005).

Finally, in order to represent the spectrum of stakeholder perspectives on the purpose and potential utility of animal antimicrobial use data collection, Advisory Committee members contributed a series of “Stakeholder Position Papers”, which are published in this issue. Covering many of the areas of expertise represented on the Advisory Committee, these papers address the following four questions with respect to animal antimicrobial use in the United States:

1. From your perspective, why are quantitative antimicrobial use data important?
2. How might you (or your colleagues) make use of antimicrobial use data?

3. Are there any additional issues or concerns pertaining to antimicrobial use surveillance that you feel are particularly relevant to your community and/or from your perspective?
4. (optional) Do you have any suggestions for overcoming obstacles to data collection, data use, or policy?

Committee members were encouraged to consult with colleagues in an effort to better represent the diversity of knowledge, opinion, and perspective within a given discipline. In areas where Committee members felt that additional expertise or alternate perspective(s) would be helpful, co-authors were recruited.

Acknowledgements

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