
The overall objective: To develop a systems approach to identify specific conceptual approaches, analytical methods, and quantitative data sources that are appropriate for associating population-level changes in antimicrobial use in livestock with population-level changes in antimicrobial resistance.

The specific aims:

1) Review the risk pathway(s) associated with antimicrobial use in food-producing animals and antimicrobial resistance (our first meeting).
2) Assess current and possible future monitoring systems (our first meeting).
3) Identify and develop a proposed analytic methodology (current meeting).
4) Identify a prioritized list of useful, quantitative variables to analyze the relationship between observed changes in antimicrobial use practices in food-producing animals and antimicrobial resistance patterns (current and future meetings).

In-person Meeting #2 (Knoxville, TN, February 23-25, 2015)
Objectives:

1) Reach agreement on scope of project
2) Identify data needs for each component
3) Outline steps to develop each component to “completion”
4) Clarify how components fit together
Day 1 (Monday February 23, 2015): Scope and Status

Brief presentations followed by group discussion, focused on identifying the following for each modeling method:

1. Data needs
2. Consequences if needed data unavailable
3. Outline of work remaining to complete method development
4. Areas for subgroup/breakout session work

8:00-8:40 Breakfast and Registration
8:40-9:00 Welcome: NiMBioS Directors
9:00-9:30 Introductory remarks: (Craig Lewis)
   - Review Working Group Objective:
     “To develop methods to assess the impact of FDA Guidance 213 on population-level changes in antimicrobial use in livestock on population-level changes in antimicrobial resistance.”
   - Update on USG activities
   - Introduce Agenda
   - Logistics
9:30-9:45 Review master document (Yrjo Grohn)

9:45-10.00 Coffee Break

10:00-11:00 1.1. Spatial Risk Mapping (Thomas Van Boekel)
11:00-12:00 1.2. Dynamic Bayesian Network (Yrjo Grohn)

12:00-13:00 Lunch at NiMBioS

13:00-14:00 1.3. Evolutionary Genetics Perspective (Michael Stanhope)
14:00-15:00 1.4. Ecological/evolutionary Models (José Miguel Ponciano)

15:00-15:15 Coffee Break

15:15-17:30 Discussion: Meeting Objectives
   1. Areas for subgroup/breakout session work
   2. What we want to accomplish by the end of Day 3

17:30-18:30 Reception at NiMBioS

Dinner on own
Day 2 (Tuesday February 24, 2015): Special Topics

Brief presentations and group discussion on special topics related to our work, with flexible time built in for group or subgroup work depending on needs identified in Day 1

8:00-8:30  Breakfast

8:30-8:45  Organizer remarks: Recap Day 1

8:45-9:15  2.1. Data Integration (Carolee Carson)
9:30-10:00  2.2. Drug Use and Pharmacokinetics (Victoriya Volkova)

10:15-10:30  Coffee Break

10:30-11:00  2.3. USDA-APHIS Update (Kathe Bjork)
11:15-11:45  2.4. Systems View (Laura Pullman)

12:00-13:00  Lunch at NiMBioS

13:00-14:30  [TBD, based on outcomes of earlier discussions]

15:00-15:30  Coffee Break

15:30-17:30  [TBD, based on outcomes of earlier discussions]
### Day 3 (Wednesday February 25, 2015): Synthesis and Planning

Flexible time built in for group or subgroup work depending on needs identified in Days 1-2, concluding with discussion of project plan, summary of meeting outcomes, and identification of next steps.

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
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<tbody>
<tr>
<td>8:00-8:30</td>
<td>Breakfast</td>
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<tr>
<td>8:30-8:50</td>
<td>Organizer remarks: Recap Day 2, Summarize report from groups From Day 1 and 2, Review “group charge”</td>
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<tr>
<td>9:30-10:00</td>
<td>[TBD, based on outcomes of earlier discussions]</td>
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<td>10:00-10:30</td>
<td>Coffee Break</td>
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<td>12:00-13:00</td>
<td>Lunch at NiMBioS</td>
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<tr>
<td>13:00-14:30</td>
<td>Discuss Project Plan</td>
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<tr>
<td>14:30-15:00</td>
<td>Summarize meeting outcomes and next steps</td>
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<tr>
<td>15:00-15:30</td>
<td>Departures</td>
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## Participants

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation (including departments)</th>
<th>Areas of PhD; Areas of expertise most relevant for the Working Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Craig Lewis</td>
<td>DHHS/FDA/CVM</td>
<td>DVM/MPH; food-animal production medicine, veterinary preventive medicine, public health, public policy</td>
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<tr>
<td>Yrjo T. Grohn</td>
<td>Cornell University (College of Veterinary Medicine, Department of Population Medicine and Diagnostic Sciences)</td>
<td>DVM, MPVM, MS, PhD (Veterinary Medicine, Epidemiology, Genetics, respectively); food supply veterinary medicine, analytical epidemiology and modeling</td>
</tr>
<tr>
<td>Laura Hungerford</td>
<td>DHHS/FDA/CVM</td>
<td>DVM/MPH/PhD (Veterinary Epidemiology); veterinary epidemiology, public health</td>
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<tr>
<td>Beth Karp</td>
<td>DHHS/CDC/OID</td>
<td>DVM, MPH; public health, veterinary preventive medicine</td>
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<tr>
<td>Carole Carson</td>
<td>Laboratory for Foodborne Zoonoses, Public Health Agency of Canada</td>
<td>DVM/PhD (Veterinary Epidemiology; antimicrobial use and resistance modelling); quantitative risk assessment, antimicrobial use and resistance surveillance</td>
</tr>
<tr>
<td>José Miguel Ponciano</td>
<td>University of Florida, Department of Biology</td>
<td>PhD (Bioinformatics and Computational Biology); stochastic models, parameter fitting for stochastic models</td>
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<tr>
<td>Cristina Lanzas</td>
<td>University of Tennessee in Knoxville (College of Veterinary Medicine, Department of Comparative Medicine)</td>
<td>DVM/PhD (Animal Sciences); Mathematical modeling, infectious disease epidemiology, food safety, quantifying the effect of control strategies</td>
</tr>
<tr>
<td>Laura Pullum</td>
<td>Oak Ridge National Laboratory (Computational Data Analytics Group)</td>
<td>DSc (Systems Engineering and Operations Research); software-intensive system dependability and intelligent systems</td>
</tr>
<tr>
<td>Ian Spicknall</td>
<td>DHHS/CDC/OID - ORISE fellow</td>
<td>PhD (Mathematical Modeling) Environmental Determinants of Infectious Disease</td>
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<tr>
<td>Victoriya Volkova</td>
<td>Kansas State University, (College of Veterinary Medicine)</td>
<td>DVM, PhD (Veterinary Medical Sciences); pharmacokinetic modeling, modeling dynamics of infection and genetic transfer</td>
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<tr>
<td>Kathe Bjork</td>
<td>USDA/APHIS/VS/CEAH</td>
<td>DVM/PhD (biostatistics); public health and analysis of antimicrobial resistance data</td>
</tr>
<tr>
<td>Thomas Van Boeckel</td>
<td>Princeton University (Department of Ecology and Evolutionary Biology)</td>
<td>PhD; statistical and epidemiological models to characterize spatio-temporal distribution of the disease, calculate risk maps, and evaluate potential intervention scenarios</td>
</tr>
<tr>
<td>Michael Stanhope</td>
<td>Cornell University (College of Veterinary Medicine, Department of Population Medicine and Diagnostic Sciences)</td>
<td>PhD; (Evolutionary Ecology and Molecular Population Genetics); the application of molecular evolutionary biology principles and techniques to issues of epidemiology, comparative genomics, and population genomics within various groups of bacterial pathogens</td>
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<tr>
<td>Shigui Ruan</td>
<td>University of Miami Florida (Department of Mathematics)</td>
<td>PhD (applied mathematics); differential Equations, dynamical systems, and mathematical biology; nonlinear dynamics in structured biological and epidemiological models; mathematical modeling of the superspreaders of antibiotic-resistant bacteria</td>
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