Combatting Antibiotic Resistant Bacteria

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Atlanta, Georgia
• Global Perspective
  – Global Health Security Agenda
  – World Health Assembly

• National Perspective
  – National Strategy for Combatting Antibiotic Resistant Bacteria (CARB)
  – President’s Council of Advisors on Science and Technology (PCAST)
  – Executive Order – CARB

• USDA Roles and Responsibilities
  – National Action Plan
Comprehensive Plans

- Surveillance
- Laboratory capacity
- International standards
- Conservation of antibiotics
- Development of new antibiotics
- Preventive measures
- Point-of-care diagnostics
- Yearly reporting
“One Health” Approach

• Contributing Countries
  – Canada, India, Indonesia, Japan, Norway, Portugal, Thailand, Yemen

• Leading Countries
  – Germany, Netherlands, Sweden, United Kingdom
Collaborating Agencies
• Stakeholders included public health, consumers, and agriculture sectors
• Examine Trends
  • Antibiotic usage
  • AMR organisms
• Alternative Interventions and Strategies
  • Medical interventions
  • Management
• Economic Analyses
  • Policy impacts
• Outreach and Education
  • Surveillance
  • Research
  • Stewardship
“While it is clear that agricultural use of antibiotics can affect human health, what is less clear is its relative contribution to antibiotic resistance in humans compared to inappropriate or overuse in health care settings. This uncertainty is largely due to difficulties in tracing precisely the origins and spread of specific resistant microbes, and more fundamentally, the transmission and spread of specific resistance genes in microbial communities. It also reflects a gap in our understanding of the complexity of resistance across different species and the environment.”
REPORT TO THE PRESIDENT ON COMBATING ANTIBIOTIC RESISTANCE
PCAST

• Notes the diversity of livestock operations
  – Trends,
  – Accurate information is necessary

• Assessing the impact of changes
  – FDA collects sales data

• Calls for national capability for microbial surveillance in humans and agriculture
Animal Agriculture

“...extent to which antibiotic resistance in animal agriculture contributes to human infection is not known.”

“...risks to human health posed by the agricultural use of antibiotics are, appropriately, a matter of serious concern.”
**National Strategy for Combatting Antimicrobial Resistance (CARB)**

**Vision:** The United States will work domestically and internationally to prevent, detect, and control illness and death related to infections caused by antibiotic-resistant bacteria by implementing measures to mitigate the emergence and spread of antibiotic resistance and ensuring the continued availability of therapeutics for the treatment of bacterial infections.
# National Strategy for Combatting Antimicrobial Resistance (CARB)

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National Strategy for Combatting Antimicrobial Resistance (CARB)

2.3 Develop, expand, and maintain capacity in state and Federal veterinary and food safety laboratories to conduct standardized antibiotic susceptibility testing and characterize select zoonotic and animal pathogens.

Implementation steps include working with state and Federal veterinary and food safety laboratories and many other partners to:

i. Expand and maintain *laboratory infrastructure* for the identification of select zoonotic and animal health pathogens through the implementation of new diagnostic technologies (see also Goal 3).

ii. Accelerate and *standardize antibiotic susceptibility* testing and bacterial characterization for select zoonotic and animal health pathogens, coordinating with appropriate stakeholder groups.

iii. Enhance communications and identify mechanisms for *sharing and reporting antibiotic susceptibility data* on select zoonotic and animal health pathogens collected by State and Federal veterinary diagnostic and food safety laboratories. These data should be stored in a *centralized repository* that can be linked with relevant public health databases, as appropriate, while *maintaining source confidentiality*.
2.4. Enhance monitoring of antibiotic-resistance patterns, as well as antibiotic sales, usage, and management practices, at multiple points in the production chain from food-animals on-farm, through processing, and retail meat. Implementation steps include working with veterinary organizations, animal producer organizations, veterinary and food safety laboratories, and other partners to:

i. Enhance *surveillance of antibiotic resistance* in animal and *zoonotic pathogens and commensal organisms* by strengthening the National Antimicrobial Resistance Monitoring System (NARMS) and leveraging other field- and laboratory-based surveillance systems.

ii. Enhance collection and reporting of data regarding *antibiotic drugs sold* and distributed for use in food-producing animals.

iii. Implement *voluntary monitoring of antibiotic use and resistance in pre-harvest settings* to provide nationally-representative data while *maintaining producer confidentiality*.
National Strategy for Combatting Antimicrobial Resistance (CARB)

Next Steps (six months)

• Interagency task force co-chaired by
  – the Secretaries of Health and Human Services, Agriculture, and Defense
  – Develop a National Action Plan for Combating Antibiotic-Resistant Bacteria
  – Implement this National Strategy
  – Address recommendations made in a recent report by the President’s Council of Advisors on Science and Technology (PCAST) on Combating Antibiotic Resistance.
  – The National Action Plan will establish clear milestones and metrics for success
  – These activities will be coordinated by the White House National Security Council (NSC) and Office of Science and Technology Policy (OSTP)
  – Regularly report to the President on progress made in implementing the National Strategy and Action Plan, and toward achieving the National Targets described in Table 3.
  – It is expected that departments and agencies would also take steps to combat antibiotic resistance that are not explicitly included
  – Industry and other non-governmental organizations as well as international partners will play a key role in accelerating progress in combating antibiotic resistance.
  – This National Strategy will solidify an ongoing partnership among these entities that will ensure resources are leveraged effectively to address this urgent threat to public health and national security.
Executive Order
Combatting Antibiotic-Resistant Bacteria

• Task Force
  – Secretaries of Defense, Agriculture, HHS
• 5-year National Action Plan by February 15, 2015
• Establishes a President’s Advisory Council on CARB
  – Secretary of HHS leads

Key message is implementation, resounding themes preventing the spread of resistant bacteria; strengthening national efforts to identify instances of antibiotic resistance; working to develop new antibiotics, therapies and vaccines; and improving international collaboration on this issue.
USDA Agencies Involved - National Action Plan for CARB and I-CARB
USDA Roles

- **Surveillance**
  - Monitor for use of antibiotics in food animals
  - Determine patterns of antimicrobial use in food producing animals, production types, species
  - Monitor antibiotic drug susceptibilities in bacteria, ecologic assessments, economic impacts of policy decisions
  - Risk assessments - animal to human

- **Research and Development**
  - Develop mitigations to reduce AMR
  - Alternatives to antibiotics, other technologies
  - Assessing the potential of transfer of genetic resistance elements
  - More complete data on potential environments that impact transfer of AMR genetic elements in food producing animals

- **Education, Extension, and Outreach**
  - Judicious use
  - Best practices

- **Develop metrics to gauge progress**
Meeting the Challenge

• USDA proposes to obtain and disseminate science-based, actionable, quantitative antibiotic drug use information coupled with the development of resistance in food producing animals and to relate this to livestock management practices.

• FDA:
  – relies on this information to inform its policy and regulatory decisions
  – taps into USDA extensive network of collaborative relationships for outreach
Food and Drug Administration (FDA)

• Approves and regulates the use of all antibiotics
  – Human and Animal

• For animals—collects amounts of antibiotics purchased from most of the pharmaceutical companies and makes information available to the public
  – No information on how it is used
  – No information on exact amounts used
  – No information on some of the antibiotics if smaller amounts to protect confidentiality
USDA AMR Activities

• Focus on the following areas: surveillance; research and development; limited enforcement, and education, extension and outreach.
  
  – more complete data on antimicrobial use in animals and people;
  
  – better surveillance information regarding associations between antibiotic use and resistance patterns for bacteria in food animals; and
  
  – needed data which includes information from on the farm, at the time of slaughter and at retail for meat and poultry products. This will assist with evaluating linkages and determining how and when antimicrobial drug use causes adverse human health impacts.
Objectives

Determine or Model
- Purposes and impacts of antibiotic use in food producing animals.

Monitor
- Antibiotic drug susceptibilities
- Monitor for drug use in food animals presented at slaughter.

Identify
- Feasible management practices
- New technology applications
The Animal and Plant Health Inspection Service

- Conducts monitoring and surveillance
- Collects information about antimicrobial use and biological samples on farms
- Evaluates epidemiologic relationships between farm management, antimicrobial use, and on-farm resistance patterns.
National Animal Health Laboratory Network
National Veterinary Services Laboratories

- Develop a voluntary data system that links AMR testing data across State veterinary diagnostic laboratories and reports resistance trends
- Create a surveillance stream
- Provide information
Online Training

The National Veterinary Accreditation Program – Judicious Use training module

- APHIS, academic partners, FDA, and CDC
  - Periodic updates on the basis of new information gleaned from surveillance efforts and as policy related to antimicrobial drug use is implemented.
  - FDA Guidance #213 calls for greater veterinary oversight of medically important antimicrobials used in feed or water.
National Animal Health Monitoring System (NAHMS)

• Commodity studies
  – Questionnaire
  – APHIS, ARS, and NASS
  – U.S. Code, Title 7, Section 2276 and the Confidential Information Protection and Statistical Efficiency Act (CIPSEA)

• Enhancing NAHMS
  – Ongoing longitudinal studies
  – Detailed data and biological samples
Intramural and Extramural Research and Development

• Research microbial ecology associated with:
  – Feeding antibiotics or antimicrobials at therapeutic, preventive, and production levels.
  – Management and feeding practices,
  – Environment, transport, and the other administration of antimicrobials.
  – Sequencing the microbiome of at least one production animal species (re: CARB)
The National Institute of Food and Agriculture (NIFA)

- USDA extramural research funding agency
- Since 2008, NIFA has funded approximately $9 million in competitive awards
- NIFA's Small Business Innovation Research program supports innovation and product development in many areas, including alternatives to antibiotics and vaccine development along with ARS
- FARAD Food Animal Residue Avoidance Database
NIFA
-continued-

• The 2014 Food Safety Challenge area will make up to $6 million investment
• Available for integrated projects that address AMR through a combination of research, education, and extension.
• In its 2015 budget request, USDA is seeking an increase of $25 million for a public-private innovation institute which will focus on AMR research.
Research and Development
NIFA

• National Institute of Math and Biological Synthesis (NIMBioS)
  • national science center jointly sponsored by NSF, DHS and USDA. The title of the Working Group is:

• Modeling Antimicrobial Resistance (AMR) Intervention: Topic summary - Evaluating the association between shifts in antimicrobial use practices and antimicrobial resistance resulting from FDA’s risk mitigation strategy

http://www.nimbios.org/workinggroups/WG_amr
Education and Outreach

• USDA proposes to partner with the CDC to reinitiate the “Get Smart: Know When Antibiotics Work on the Farm”
  (www.cdc.gov/narms/get-smart.html)

Develop an online informational/educational tool to promote judicious antibiotic use in animal agriculture
  (www.extension.org/search?q=antimicrobial)
Education and Outreach

NIFA 2013 AMR funded conference grant

“ANTIBIOTICS IN AGROECOSYSTEMS: STATE OF THE SCIENCE”

CRIS Project 1002060 – Jean McLain of AZ State

http://cris.nifa.usda.gov/cgi-bin/starfinder/0?path=fastlink1.txt&id=anon&pass=&search=AN%3D1002060&format=WEBLINK
The Agricultural Research Service

• The USDA’s intramural research program.
• Area’s of research:
  – investigating changes in the intestinal microbiome
  – investigating the mechanisms of the development of AMR
  – identifying and characterizing resistant bacteria
  – developing alternatives to antibiotics
  – understanding the impact of antibiotic administration on manure and the environment
  – describing the potential for transfer of AMR food borne pathogens or resistance genes from food animals through food processing to the consumer
Developing Innovative Antimicrobials

• Medically Critical – not IONOPHORES

• Alternatives
  – prebiotics and probiotics
  – novel antimicrobial molecules
  – immune enhancement products
  – genetic resistance to disease
  – animal breeding
  – improving animal management and husbandry in the context of the concomitant

• Obligation to protect animal health and well-being
The Economic Research Service

- Analyzes the impact of various production inputs and practices on production, costs, and revenues on farms.
- Modeling the expected market-level impacts on production and prices if certain antibiotic drugs used in livestock should be phased out.
The National Agricultural Statistics Service

• Conducts surveys
• Prepares reports
• Collects information on antimicrobial use practices in partnership with APHIS and ERS
Agricultural Resource Management Survey (ARMS)

- ARMS is an annual farm-level survey jointly administered by ERS and NASS with consultation from APHIS
- All surveys conducted are voluntary
- Focuses on farm finances
- Enhancing NASS and ARMS surveys
Enhance NASS and ARMS surveys

- Enhanced NASS and ARMS survey questionnaires with new and expanded questions about antibiotic drug use and related production practices.
- National estimates of antibiotic drug use
- Related production practices
- Before and after the finalization of the FDA Guidance #213 and the accompanying changes to the Veterinary Feed Directive rule
- Effect on farm productivity, costs, and production practices
- Track adoption of production practices meant to replace antimicrobial use for growth promotion
- Enable better estimation of the quantities of antibiotics used in animal agriculture.
- Provide the FDA with valuable information regarding the impacts of its guidance.
- Identify critical areas for further focused, collaborative research and education/outreach activities
The U.S. National Residue Program

- Administered by FSIS since 1967
- Designed to:
  - identify, rank, and test for chemical contaminants (including antibiotics) in meat, poultry, and egg products
  - includes approved and unapproved veterinary drugs, pesticides, and environmental compounds
The Food Safety and Inspection Service

• Monitors AMR at slaughter and processing
• Handles all sampling in slaughter plants
  – sampling of the cecal content from a statistically based sampling of animals through the NARMS Cecal Sampling program
  – product sampling through Salmonella Pathogen Reduction: Hazard Analysis and Critical Control Points verification sampling
• Enhancing NARMS program
Enhance NARMS

• Various biological samples could also be collected at slaughter and cultured for multiple bacteria (i.e., *Salmonella*, *Campylobacter*, generic *E. coli*, and *Enterococcus*).
  – Isolates could be tested for antimicrobial drug susceptibility. Changes in microbial and resistance status in the slaughter plant could then be evaluated in light of contemporary on-farm antimicrobial use and management practices.
United States Department of Agriculture

Surveillance; research and development; and education, extension, and outreach.

- Because proposed activities are voluntary, USDA must closely cooperate with Federal, industry, commodity, and academic partners to implement any sort of plan.
- CIPSEA and Title 7, U.S. Code, Section 2276
- Global and International cooperation
Challenges

• Funding

• Coordination of the various Action Plans and agencies
  – This is progressing very smoothly

• Regulatory process in the US

• Support by producers, vets, commodity groups, others

• Develop the Action Plan
USDA Antimicrobial Resistance Action Plan Committee

- Eileen Thacker, ARS
- Cyril Gay, ARS
- David Dargatz, APHIS
- Bruce Wagner, APHIS
- Alecia Naugle, APHIS
- James MacDonald, ERS
- Stacy Sneeringer, ERS
  - Pat Basu, FSIS
- Dan Kerestes, NASS
- Gary Sherman, NIFA
- Mervalin Morant, NIFA
Questions?
“In short, our culture resists the true values of the scientific way of knowing: we disdain observational patience leading to open minded description; we discourage eclectic methodologies; and we dismiss attentive care; failing to recognize the imperative, rather than the prerogative, nature of play.”

Lynn Margulis