Basic Information

- **Project No. and Title:** NC1206 : Antimicrobial Resistance
- **Period Covered:** 5/16/2023 to 5/13/2024
- **Date of Report:** 07/02/2024
- **Annual Meeting Dates:** 05/13/2024

Annual Meeting Participants

Maddock, Kelli (kelli.maddock@ndsu.edu)- NDSU Veterinary Diagnostic Laboratory, Outgoing President
Cazer, Casey (clc248@cornell.edu)- Member, Cornell University; Incoming President
Michelle Soupir (msoupir@iastate.edu) – Member, Iowa State University; Incoming Secretary
Ganda, Erika (ganda@psu.edu)- Member, Pennsylvania State University;
Ivanek, Renata (evk5387@psu.edu)- Member- Cornell University;
Wang, Hua (wang.707@osu.edu) – Member, The Ohio State University
Okello, Emmanuel (eokello@ucdavis.edu)- Member, University of California, Davis

Brief Summary of Minutes of Annual Meeting

The meeting started with a brief welcome and introduction of all members. The meeting was moderated by Kelli Maddock and Dr. Casey Cazer. Dr. James Averill welcomed NC1206 members via Zoom. He reminded the group that we are starting year 3 of the 5 year renewal and that he will be conducting a mid-term review in fall 2024.

Research Updates: Drs. Cazer, Ganda, Okello, Ivanek, Soupir, Wang and Kelli Maddock presented current research and future collaboration interests. Multistate, collaborative activities, accomplishments, impacts, funding, and publications are detailed below.

Guest speakers: Dr. Dubraska Diaz-Campos, DVM, PhD, OSU Hospital Microbiology, Chairholder of CLSI VAST (Veterinary Antimicrobial Susceptibility Testing Subcommittee) presented “The veterinary microbiology lab: hurdles and tactics in antimicrobial stewardship for animal health”. She highlighted challenges with antimicrobial resistance (AMR) data gaps, AMR data sharing, antimicrobial stewardship, and diagnostic stewardship. Opportunities for collaboration and future research include harmonization of AST reporting for clinicians and for stewardship, generating data for breakpoints, education on diagnostic stewardship and integrated stewardship model, and education on new topics like susceptible-dose-dependent breakpoints. Dr. Diaz-Campos also gave a tour of the OSU microbiology laboratory.

Dr. Kathe Bjork, USDA NIFA, provided updates regarding NIFA programs related to AMR and NIFA priorities. Several competitive funding opportunities were included in the update along with program contacts for each program. This update will be provided to meeting members.

New leadership: Dr. Casey Cazer formally transitioned to the role as president of NC1206. Thank you to Kelli Maddock for serving as president. Dr. Michelle Soupir was unanimously elected as the group secretary.

Annual meeting schedule, 2025: Group members appreciated the opportunity to combine this meeting with a larger conference. Two options were discussed and leadership will poll group members on preferences

- NIAMRRE: North Carolina in May 2025
- ASM Microbe: Los Angeles in June 2025

Accomplishments

Objective 1: Develop knowledge and tools to improve antimicrobial stewardship, including surveillance and monitoring of antimicrobial resistance, determining the ecology and mechanisms involved in resistance and transmission of resistance, and developing improved diagnostic tests

- Enhancing performance of antimicrobial susceptibility testing (AST) in support of Vet-LIRN activities. Food and Drug Administration (FDA). Methods comparison of Sensititre Broth Microdilution to Vitek 2 Compact for AST of *Enterobacterales, Pseudomonas aeruginosa, Staphylococcus pseudintermedius,* and *Enterococcus* species. Evaluation suggestions consistent under calling of resistance for certain antimicrobials by Sensititre methods. Publication in progress [ND PA]
- Follow-up survey of AAVLD laboratory participants in the 2023 IBQAS AST exercise. [ND PA MA]
- Building AMR monitoring capacity through expanding NGS capabilities. Interdisciplinary sharing of *Enterococcus* and *Pseudomonas aeruginosa* isolates for NGS to AST comparison. Furthers the understanding of genotypic and phenotypic correlation of antimicrobial resistance. [MS PA NC ND MS WA MI]
- Comparison of Etest to Sensititre broth microdilution for antimicrobial susceptibility testing of Streptococci evaluated by the NAHLN AMR monitoring program. [ND CA WA MS]
- Expanded MICs for Veterinary pathogens to assist in ECOFF development. In progress [NE IA]
- Development of disc diffusion MIC correlation data for veterinary pathogens. In progress [NE KS]

Objective 2: Develop and Evaluate Antimicrobial Use Resistance Transmission Mitigation Strategies

- Dietary interventions to enhance intestinal health of nursery pigs without or to reduce the use of antimicrobial growth promoters in feeds. Interventions include: bacterial cell wall compounds, yeast cell wall compounds enhancing mucosal immunity without antibiotics, feed enzymes to hydrolyze antinutritional soluble non-starch polysaccharides, phytase to hydrolyze antinutritional phytate in feeds, antioxidative phytogenic polyphenolic compounds, reduced protein diets to limit the growth of ammonia producing bacteria in the small intestine. [NC, GA, WI, MN]
- Establishing a ranking system for ARGs based on their human health impact, which is designed to be integrated with surveillance data collected from two agricultural watersheds in Nebraska and Iowa to estimate the associated human health risks. The severity of human health outcomes resulting from exposure to ARGs was evaluated based on four criteria: the human accessibility potential index, mobility, relation to pathogenicity, and the importance of the antibiotics to which the genes confer resistance. Using this developed framework, over 400 genes can be ranked. The innovative approach represents an advancement in next-generation risk assessment by incorporating genomic data, which may facilitate more effective surveillance of quantifiable health risks, resonating with the "One Health" initiative. [NE, IA, NY]

- One Health Analysis of *Salmonella enterica* Serotype Newport Isolated from Humans and Exotic Felids. Established interdisciplinary communication between state veterinary CDC and FDA regarding on-going Salmonella detection from exotic animal species in zoos. Development of public health centric messaging to diverse stakeholders. Increases visibility of foodborne pathogens circulating in veterinary medicine and their potential connections to human outbreaks. [ND MN FDA CDC]
- Determine phylogenetic relationships, antimicrobial resistance determinants, and virulence potential of *S.* Dublin from cattle and humans in the United States. *Salmonella* Dublin is highly multidrug resistant and virulent. It has been increasingly isolated from human bloodstream infections. Better understanding the genomic epidemiology of this pathogen might aid in better prevention strategies. [PA, ND, NE]

Objective 3: Create and Deliver Programs on Antibiotic Stewardship

- AVMA Document on resistant bovine pathogens. On working group for updating list in collaboration with American Association of Bovine Practitioners. In progress. [NE, KS]

Funding

"CAMRADES connecting antimicrobial resistance, agricultural decisions, and environmental systems: A tool for mitigating AMR and assessing risk to human health in agro-ecosystems". 2022-2026. USDA NIFA (Grant# 2022-68015-36717). Michelle Soupir (PI, ISU), Daniel Anderson (ISU), Adina Howe (ISU), Diana Aga (U of Buffalo), Shannon Bartelt-Hunt (UNL), Amy Schmidt (UNL), Bing Wang (UNL).

Impacts

According to the World Health Organization and the Centers for Disease Control and Prevention, antimicrobial resistance is one of the greatest threats to the health of humans, animals, and the environment. When considering health across humans, animals, and plants, the approach should be viewed from a "One Health" perspective, which must be addressed using a multidisciplinary and collaborative approach. Members of the NC 1206 Multi-State Research Project have collaborated to accomplish key studies and extension education activities that advance the knowledge, outreach, interdisciplinary collaboration, and mitigation efforts related to antimicrobial resistance. Social sciences have been integrated into education programs to target potential antimicrobial user biases, increase AMR knowledge, and to reach stakeholders across the food chain. The addition of social sciences strengthens the approach and allows for more targeted education of stakeholders.

Publications

Choi, H., A. Sokale, B. Frederick, and S. W. Kim. 2024. Effects of increasing dose of a hybrid bacterial 6-phytase on apparent total tract nutrient digestibility, release of free myoinositol, and retention of calcium and phosphorus, and growth performance of pigs. Animal Feed Science and Technology 308:115876. https://doi.org/10.1016/j.anifeedsci.2024.115876. [NC, GA, MN]

Deng, Z., K. B. Jang. S. Jalukar, X. Du, and S. W. Kim. 2023. Efficacy of feed additive containing zeolite and enzymatically hydrolyzed yeast on intestinal health and growth of newly weaned pigs under chronic

dietary challenges of fumonisin and aflatoxin. Toxins 15:433. https://doi.org/10.3390/toxins15070433. [NC, WI]

Maddock K.J., Bowden, B.S., Campos D.D., Cole S.D., Daniels J.B., LeCuyer T., Li X., Loy J.D., Sanchez S., Stenger B.L.S., Burbick C.R. (2024) Current State and Future Directions for Veterinary Antimicrobial Resistance Research. American Journal of Veterinary Research. Vol 85 (3). [NE, ND, others]

Maddock K.J., Burbick C.R., Cole S.D., Daniels J.B., LeCuyer T., Li X., Loy J.D., Sanchez S., Stenger B.L.S., Campos D.D. (2024). A One Health perspective on the use of genotypic methods for antimicrobial resistance prediction. Journal of the American Veterinary Medical Association. Vol 262 (3). [NE, ND, others]

Feßler A, Wang Y, Burbick C, Diaz-Campos D, Fajt VR, Lawhon SD, Li XL, Lubbers BV, Maddock K, Miller RA, Papich MG, Simjee S, Sweeney MT, Watts JL, Wu C, Shen J, Schwarz S. Antimicrobial susceptibility testing in veterinary medicine: Performance, interpretation of results, best practices, and pitfalls. One Health Advances.2023:1(26). https://doi.org/10.1186/s44280-023-00024-w [ND, WA, others]

Maddock K, Gefroh S, Burbick C. Beta-lactam resistance in veterinary beta-hemolytic Streptococcus species: Are we experiencing a public health or test method crisis? 2023 May. https://doi.org/10.2460/javma.23.03.0172 [ND, WA]