

Identifying Beef Safety Issues and Recommending Research Priorities: The AMSA-NCBA Joint Beef Safety/Emerging Pathogens Symposium

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Introduction

The mission of the American Meat Science Association is “to contribute to the betterment of human life by leading the discovery and application of sound scientific and technological principles of the meat sciences through research and education.” What better way to accomplish this mission than to participate in the establishment and implementation of research priorities on an issue of national importance - beef safety. It was with this in mind that the Board of Directors sought early last year to co-sponsor a national symposium with the National Cattlemen’s Beef Association to identify emerging microbial pathogens and issues in beef. The intention was to recommend research priorities which had broad support and backing and to “get ahead of the curve” of public opinion by looking forward to upcoming issues. This is a summary of how the symposium was established and the outcomes of the meeting. I believe it serves as a model for setting priorities and working together to make meaningful progress in food safety.

The People

Table 1 lists those who were involved with organizing and implementing the symposium. I would like to specifically recognize Dr. Mohammad Koohmaraie who initiated program planning but was unable to complete the process due to family illness. Of course, financial and program support from the National Cattlemen’s Beef Association made the whole program possible.

The Participants

Given the intent to construct research recommendations with broad consensus and support, it was important

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Reciprocal Meat Conference Proceedings, Volume 51, 1998.

Table 1. Organizing Committee.

Dr. Mohammad Koohmaraie - USDA, Agricultural Research Service, U.S. Meat Animal Research Center (Committee Chair)
Dr. Chris Calkins - University of Nebraska, Department of Animal Science (Conference Chair)
Dr. Curtis Kastner - Kansas State University, Department of Animal Sciences and Industry
Dr. Arthur Miller - USDA, Agricultural Research Service, Eastern Regional Research Center
Dr. J.O. “Bo” Reagan - National Cattlemen’s Beef Association
Ms. Molly Patterson - National Cattlemen’s Beef Association
Dr. Thomas Powell - American Meat Science Association

the participants to the symposium came willing to participate in the process. Advanced notices clearly indicated this was to be a working meeting and all who came were active contributors. The symposium drew about 90 people, which equally represented academia, government, industry, and commodity/advocacy groups.

The Program

The organizing committee wanted the program to contain information from a variety of sources. We identified federal employees, academic scientists involved in cutting edge research, industry representatives, and epidemiologists as speakers and participants. Ultimately, the format evolved to include a keynote speech by the USDA Under Secretary for Food Safety, Dr. Catherine Woteki, followed by a response panel containing representatives from The Center for Science in the Public Interest, Academia, State Epidemiology, and the Fast Food Industry (see Table 2). This set the stage for rapid identification of issues and perspectives by presenters and conference participants and stimulated discussion very early in the meeting.

The flow of the meeting then allowed for individual reports on potential pathogens of concern which had been previously identified by the organizing committee.

Table 2. Conference Speakers and Respondents for the Opening Session.

The Food Safety Research Agenda - Emerging Microbial Pathogens and Issues

Dr. Catherine E. Woteki,
Under Secretary for Food Safety, USDA

Response Panel

Ms. Caroline Smith DeWaal,
Center for Science in the Public Interest
Dr. Michael P. Doyle, University of Georgia
Dr. Craig Hedberg, Minn. Dept. of Health,
Acute Epidemiology
Mr. Skip Seward, McDonald's Corp.

Each presenter was specifically challenged to address four issues: the current status of knowledge about the pathogen (what's known, what's unknown), the level of food safety risk, perceived importance, and any other pertinent information. The speakers, identified in Table 3, discussed *Salmonella typhimurium* DT104, *Mycobacterium paratuberculosis* and Johne's disease, campylobacter and related organisms, *E. coli* O157:H7, and the general area of viruses, cyclospora, and cryptosporidium. The session ended with a report on risk assessment. It's a credit to the speakers that each one took the assignment seriously, addressed the issues posed to them, and provided a paper for the proceedings.

Table 3. Invited Presentations to the Beef Safety Symposium.

Salmonella typhimurium DT104

Dr. Fred Angulo, Centers for Disease Control and Prevention, National Center for Infections Diseases

Mycobacterium paratuberculosis and Johne's disease

Dr. Judith Stabel, USDA, Agricultural Research Service, National Animal Disease Center

Campylobacter and related microorganisms

Dr. Irene Wesley, USDA, Agricultural Research Service, National Animal Disease Center

Escherichia coli O157:H7

Dr. Michael P. Doyle, University of Georgia, Center for Food Safety and Quality Enhancement

Viruses, Cyclospora and Cryptosporidium

Dr. Dean O. Cliver, University of California - Davis, School of Veterinary Medicine, Population Health, and Reproduction

Risk Assessment

Dr. Richard Whiting, USDA, Agricultural Research Service, Eastern Regional Research Center

Participants were assigned to a discussion group for one of the five significant pathogens. Discussion leaders (Table 4) were charged to address six questions:

1. Is the organism a significant health risk?
2. Does it pose a problem for the beef industry?
3. If so, how soon is it likely to be a problem?
4. What is the current status of the methodology for this pathogen?
5. How can the pathogen be controlled (interventions)?
6. What are the research priorities and time lines to address the issues related to this pathogen?

Table 4. Breakout session leaders.

Salmonella typhimurium DT104

Dr. Arthur Miller, USDA, Agricultural Research Service, Eastern Regional Research Center

Mycobacterium paratuberculosis and Johne's disease

Dr. Joe Harris, Southwest Meat Association

Campylobacter and related microorganisms

Dr. Dennis Burson, University of Nebraska, Department of Animal Science

Escherichia coli O157:H7

Dr. Greg Siragusa, USDA, Agricultural Research Service, U.S. Meat Animal Research Center

Viruses, Cyclospora and Cryptosporidium

Dr. Randall Phebus, Kansas State University, Department of Animal Sciences and Industry

The Research Priorities

Although a symposium proceedings has been created and distributed, it is important to review the results of the meeting. Further information can be found in those proceedings.

Salmonella typhimurium DT104

A unique feature of this organism is its genetic resistance to multiple antibiotics, its enhanced virulence, and the ability to ecologically displace other types of *Salmonella*. The research priorities were:

1. Determine DT104 prevalence in cattle and associated risk factors. Identify causality of the pathogen.
2. Survey subtherapeutic use of antibiotics in cattle production.
3. Characterize virulence factors that make DT104 a highly invasive organism.

Mycobacterium paratuberculosis

There is no known health risk from this organism at the moment, although the possible connection between

Johne's disease in cattle and Crohn's disease in humans cannot be conclusively eliminated. There is an extreme lack of reliable diagnostic tools in this area.

1. Develop diagnostic tools to aid in detection.
2. Determine conclusively if there is a link between Crohn's disease and Johne's disease.
3. Develop curative and preventive treatments and vaccines for both Crohn's and Johne's disease.

Campylobacter

Campylobacter is a significant cause of food borne illness, but few outbreaks are associated with beef. High levels in beef could be a source of contamination of human water supplies.

1. Study the extent of contamination of human water supply from run off. If water is the primary source of human illness associated with Campylobacter, how do beef cattle contribute to Campylobacter in water?
2. Conduct survey information to determine the on-farm ecology, the incidence in beef cattle, the extent of public health risk, and any geographic distribution differences that may exist.
3. Monitor and survey the antibiotic resistance of Campylobacter.

E. coli O157:H7

This pathogen poses a significant health risk. The size and scope of this class of pathogens will likely increase within the next few years with increased surveillance activity.

1. Investigate beef production and management practices which promote increased risk of growth, shedding, and spreading of *E. coli* O157:H7 in the environment.
2. Fund research on utilizing existing interventions at different plant critical control points.
3. Fund research and development for real or near-real time tests for *E. coli* O157:H7 that are inexpensive, quick, and high through-put which can be used as a research tool.

Viruses, Cyclospora, Cryptosporidium

Available information does not support a major concern for viruses or cyclospora in safety of beef. Cryptosporidium is a health risk and can be harbored in cattle (although this is not a major threat to consumption).

1. Develop better methodologies for Cryptosporidium and viral detection, enumeration, viability and infectivity for use in beef risk assessment.
2. Determine proportion of human cryptosporidiosis traceable to bovine (versus human and other animal) species.
3. Develop manure management strategies to address Cryptosporidium in bovine agriculture.

Following the initial discussion group meetings, participants were invited to attend other discussion groups. The top three priorities from each group were presented to the entire symposium and discussed. Each participant was then asked to allocate \$1 million to the priorities as identified (except that manure management strategies were generally identified as important to more than just Cryptosporidium.) The strength of the consensus on research priorities was reflected by the fact that each of the major participant groups (academia, government, industry, and commodity/advocacy groups) ranked the top three overall issues nearly identical. The top three priorities were:

1. Investigate beef production and management practices which promote increased risk of growth, shedding, and spreading of *E. coli* O157:H7 in the environment.
2. Fund research and development for real or near-real time tests for *E. coli* O157:H7 that are inexpensive, quick and high through-put which can be used as a research tool.
3. Develop manure management strategies to address pathogen ecology in bovine agriculture.

A striking feature of these recommendations was the emphasis on pre-harvest investigation. This marked a significant departure from ongoing research strategies.

Recommendations forwarded

The results of the symposium were forwarded to the National Cattlemen's Beef Association for consideration by their beef safety research committee. Results were also widely distributed to other NCBA members. Every AMSA member received a copy of the proceedings. The thoughts and issues identified by the symposium figured significantly into the research agenda for the Beef Industry Food Safety Council, a coalition from the beef industry, academia, government, and organizations, designed to focus on beef safety.

Conclusions

This cooperative effort allowed an independent, science-based organization to play a key role in establishing industry research priorities on a critical topic. Our efforts helped the National Cattlemen's Beef Association to gain valuable input with a strong consensus. The audience mix for the conference was an unusual combination from industry, academia, government, and commodity/advocacy groups. Clearly, collaboration and discussion are powerful ways to educate and build consensus. There is a clear role for the American Meat Science Association in helping to set the research agenda.