Tiny Microbes with Big Business Impact: The Economic and Health Implications of Food Safety

Nika Larian, Kelley Cormier, Lise Korsten, Haley Oliver, Cindy Jenks
Speakers

Dr. Kelley Cormier, Food Safety Division Chief, Center for Nutrition, USAID RFS

Cindy Jenks, General Manager, Pick n’ Pay, S. Africa

Dr. Haley Oliver, Director, Feed the Future Innovation Lab for Food Safety

Dr. Lise Korsten, Professor of Microbiology and Plant Pathology, University of Pretoria
Perspective of a retailer facing implications of food safety and current experience of managing food safety risks within supply chains

Cindy Jenks
Significant Food Safety Challenges Facing South Africa

- Load Shedding
- Water Quality
Significant Food Safety Challenges Facing South Africa

- Poor Hygiene
- Lack of Sanitation
The Link Between Food Safety and Food Security

The Link Between Food Safety and Food Security

Food Safety
- Monitoring of Quality
- Training
- Creating a culture of Food Safety

Food Security
- Infrastructure costs
- Impact on small suppliers
- Food Waste
Thank You

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Feed the Future
Food Safety Innovation Lab

Research for Development; Haley F. Oliver, PhD
FEED THE FUTURE INNOVATION LAB
FOR FOOD SAFETY (FSIL)
The Food Safety Innovation Lab (FSIL) is jointly managed by Purdue and Cornell Universities and engages academic, government, and private sector partners.

FSIL leverages global food safety expertise in locally led projects that address the root causes of foodborne illness.

By identifying food safety knowledge gaps and developing data-driven food safety practices and policies, FSIL projects create systemic change that strengthens household and community nutrition, food security, and economic opportunity.

Countries with current or planned activities include Bangladesh, Cambodia, Kenya, Nepal, Nigeria, and Senegal.
WHY FOOD SAFETY?

Foodborne illnesses:
- Contribute to malnutrition
- Can have lifelong negative health effects
- Are preventable
- Are an economic burden

Food safety:
- Removes barriers to economic growth
- Has a global impact
Increase awareness of food safety issues, impacts, and measures to reduce food safety risks.

Build local research capacity and conduct research on regional food safety challenges.

Develop policies that enable conditions for food safety research, translation, and practice.

Accelerate translational research technologies and practices.
FOOD SAFETY IS MULTIDIMENSIONAL

Microbiology & Toxicology
Assessing the risk of foodborne disease from pathogens and contaminants.
Identifying critical control points, effective practices, and data-driven policies.

Social & Behavioral Science
Understanding motivations for and obstacles to the adoption of food safety practices.
Developing effective outreach programs to strengthen food safety practices.

Supply & Demand Economics
Assessing the demand for safer food and the costs/benefits to producers and communities.
Informing market-led food safety policies.
FOOD SAFETY IS MULTIDIMENSIONAL

**Cambodia**
Measuring the capabilities, opportunities, and motivations of vegetable producers, distributors, and vendors to adopt food safety behaviors.

**Bangladesh**
Assessing consumer demand for safer fish and poultry and quantifying the economic benefits of improved food safety on the welfare of consumers.

**Nepal**
Understanding consumer and producer food safety behaviors and identifying factors that drive the supply of and demand for safer salad vegetables.
Through iterative research portfolio assessment, results from awards inform future funding opportunities and refinement of the FSIL research portfolio.
MANAGEMENT TEAM

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Liz Alexander
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FSIL research focuses on nutrient-dense, perishable foods, including dairy, poultry, fish, and vegetables.
Enhancing food safety in fish and chicken value chains of Bangladesh
Reducing foodborne pathogen contamination of vegetables in Cambodia
Chakula Salama: A risk-based approach to reducing foodborne disease and increasing production of safe foods in Kenya
Enhancing resilience of the dairy value chain by leveraging public-private partnerships in Senegal
Market-led food safety in Nepal: Harnessing production incentives and consumer awareness
Strengthening household and community food safety in Nigeria
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TINY MICROBES WITH BIG BUSINESS IMPACT: THE ECONOMIC AND HEALTH IMPLICATIONS OF FOOD SAFETY

Agrilinks Food Safety Month June 2023 Webinar

Prof Lise Korsten
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Downstream Impact of Conflict on Food Safety

[Map showing food security risk index with countries highlighted in different colors]

Food Sovereignty

- Pests
- Pathogens
- Power

Climate Change impact on Food Safety

Selected Effects of Climate Change

Fishery impact drop 50%
Maize down 35%
Drought

Ukraine War-
Food & Fertiliser shortage
Trade disruptors

Crop yield drop 20%

Water
Cholera
What does it take to ensure safe food for all in a food security context.
Evidence-driven decision making and strategic investments to prioritize food safety to improve food security

- 20 countries submitting food safety index
- 25 member states developing plans to increase investment in food safety.

The importance of research in the field of food safety

1. Generating Data for decision making
2. Method optimization for detection and surveillance
3. Directing policy through research findings
Review of the current published literature

Figure 1: The keywords co-occurrence network of *Vibrio cholerae* in fresh produce supply chain-related publications. Colors indicate the publication year while the circles are sized according to keyword co-occurrence.

*Salmonella* as most researched topic

*Salmonella* no 1 in Foodborne Pathogen in Africa

*Vibrio cholerae* non-01 positive control strain on T.C.B.S. selective media
Review of the current published information

Figure 2: The keywords co-occurrence network of *Vibrio cholerae* in fresh produce supply chains-related publications. The keyword “antimicrobial resistance” was highlighted to indicate the increased co-occurrence of foodborne pathogen and antimicrobial resistance keywords in water and fresh produce related publications.
Review of the current published information

1. Fruit & Vegetable link
2. Close association with water and food safety
3. Salmonella & Vibrio link

Figure 3: The keywords co-occurrence network of Vibrio cholerae in fresh produce supply chains-related publications. The keyword “Vibrio cholerae” was highlighted to indicate the co-occurrence of Vibrio cholerae and food safety in water and fresh produce related publications.
“Vibrio cholerae outbreak in the Hammanskraal area is a serious environmental and human health concern”.

- Detection of cholera on irrigated fresh produce

- During sporadic cholera outbreak situations such as the current outbreak in South Africa, the priority should be early detection and appropriate management of people who have been infected.

- In addition, active disease surveillance must take place to monitor transmission patterns.
Antimicrobial resistance is a global crisis. There is no time to wait. A sustained One Health response with a shared vision and goals is essential to tackle antimicrobial resistance and achieve the Sustainable Development Goals.

- Foodborne and waterborne diarrhoeal diseases kill an estimated 2 million people annually.
- AMR Facts: 1.2 million died in 2019 due to antibiotic-resistant bacterial infections.
Duality of the South African food systems

1. Formal Sector Supply Chain: Commercial Farmers/ Major Processors/ Big Retail

2. Informal Sector Supply Chain: Small scale farmers
First report ESBL/AmpC-producing Enterobacteriaceae commercial spinach production from the farm to retail

Total 288 samples: 14.58% contaminated

Processing in formal retailer facilities

Retail
11.6% (7/60)

25% (15/60) retail samples

Enterobacteriaceae isolates: Dominant species - *Serratia fonticola* (45.86%), *Escherichia coli* (20.83%), and *Klebsiella pneumoniae* (18.75%)

98% multidrug resistant
Antimicrobial resistance in the water-plant-food nexus: Should we be concerned?

Beta-lactamase genes detected in *Escherichia coli*, *Klebsiella pneumoniae* and *Salmonella* spp. isolated from water, soil and/or fresh produce samples in different African countries between 2010-2022.

- 80.95% of the studies, AMR in irrigation water samples.
- Analysis of bacterial phenotypic AMR profiles were reported in 95.24% of the studies.
- MAR indexes of potential human pathogenic bacteria (E. coli, K. pneumoniae and Salmonella spp.) were $\geq 0.2$, representing a potential human health risk.
- Only 2 studies used WGS for molecular characterisation.
Economic impact of unsafe food that must be discarded, undermining efforts to increase the availability, access, and affordability of safe and nutritious food.

• The moral vs legal issue - When to discard food?:
  – Quality vs safety standards
  – Product recalls
  – Rejected food at ports of entry
  – Past sell by date?
  – “Left over” food in a restaurant?
  – “Food” in a waste dump?
  – “Declared unfit for human consumption”