



## One Health in food safety and security education: Subject matter outline for a curricular framework



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### ARTICLE INFO

#### Keywords:

One Health  
Food safety  
Food security  
Curriculum  
Education  
Subject matter  
Environment  
Ecosystems

### ABSTRACT

Educating students in the range of subjects encompassing food safety and security as approached from a One Health perspective requires consideration of a variety of different disciplines and the interrelationships among disciplines. The Western Institute for Food Safety and Security developed a subject matter outline to accompany a previously published One Health in food safety and security curricular framework. The subject matter covered in this outline encompasses a variety of topics and disciplines related to food safety and security including effects of food production on the environment. This subject matter outline should help guide curriculum development and education in One Health in food safety and security and provides useful information for educators, researchers, students, and public policy-makers facing the inherent challenges of maintaining and/or developing safe and secure food supplies without destroying Earth's natural resources.

### One sentence summary

A subject matter outline was created to accompany a One Health in food safety and security curricular framework.

One Health approaches are necessary for solving complex societal challenges and problems [1–4]. The ability for agricultural systems in high income and low- to middle-income countries to successfully feed an anticipated 9 billion people by 2050 without destroying Earth's finite resources represents one such complex societal challenge. Indeed, the challenge of establishing and maintaining food safety in today's global markets has been characterized as a complex problem that lacks easy or straightforward solutions and one that will require a One Health approach [5]. According to the 1996 Rome Declaration on World Food Security and World Food Summit Plan of Action, “Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life” [6]. While global demands for safe and sustainable sources of food are greater now than they were in 1996 when this declaration was developed, the problems associated with achieving safe and secure food supplies remain extremely complex. The large variety of diverse factors that impact production and distribution of safe food supplies including availability of natural resources, healthy ecosystems, market globalization, climate change, political instability, and poverty all underscore the need to address these issues using a One Health approach. Creatively solving problems in these and other areas will require an educated workforce that

acknowledges the utility of problem-solving that considers not only an isolated problem, but also upstream factors related to a particular problem. Fortunately, recent interest in the concept of One Health has gained traction throughout the world [7–9] and international forums now exist to assist interdisciplinary groups find solutions to health challenges both locally and globally [10]. Such transdisciplinary approaches to solving problems surrounding food safety and security will be essential for sustainably meeting current and future demands for safe and secure food supplies [11].

To help address needs for an educated workforce trained not only in traditional food safety, security, and public health, but also in other areas including food production, sustainable practices, and ecosystem health, we developed a One Health in food safety curricular framework [12]. That framework grouped food safety/security content into two areas: 1) food safety/security foundations; and 2) food safety/security leadership and management. Major topics were defined within these areas and within each major topic we defined a concept statement that broadly defined student learning objectives in a particular topic. To our knowledge, this framework was the first of its kind for guiding education and training in food safety and security that embraced a One Health approach.

In this manuscript we describe subject matter for each major topic in that curricular framework as well as major themes to be addressed by a One Health Core that spans the awareness and leadership/management sections of the framework. We anticipate that this information will serve as a useful guide for educators tasked with teaching students

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<http://dx.doi.org/10.1016/j.onehlt.2017.04.001>

Received 13 January 2017; Received in revised form 14 April 2017; Accepted 25 April 2017

Available online 26 April 2017

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**Table 1**

Major topics, subtopics, concept statements, and subject matter for food safety/security foundations. See end of table for abbreviations.

Major topic	Subtopic	Concept statement (learning objectives)	Subject matter
Local and Global Food and Feed Supply and Safety	Global Food Supply	Students have knowledge about global food supply chains, including the effects that human populations, the environment, politics and international relations can have on food supply, demand, security, and safety	<ul style="list-style-type: none"> <li>• Changes in global population growth over time</li> <li>• Current and projected world food demands</li> <li>• International food trade</li> <li>• Interdependence of modern civilization on global food production and trade</li> <li>• Food systems sustainability to meet global food demands</li> <li>• Challenges to food and feed production in different parts of the world</li> <li>• Environmental changes affecting food/feed sources and food/feed safety</li> <li>• Effect of politics and international relations in global food and feed trade</li> <li>• Types of foods and domestic oversight by regulatory bodies, domestically (e.g., meat and poultry, milk and dairy, eggs and egg products, produce, processed foods, seafood, domestic vs imported foods)</li> <li>• Regulatory bodies/organizations that oversee national and international food safety laws and standards (e.g. Codex Alimentarius; EC; EFSA; FAO; FDA; FSIS; ISO; OIE; USDA; WHO)</li> <li>• Role of regulatory bodies in governing global food trade</li> <li>• Role of regulatory bodies in overseeing national and international food safety standards</li> <li>• International food safety regulations created by regulatory bodies/ organizations</li> <li>• Regulations (national and international) that help ensure production and sale of safe animal feeds (including feed ingredients, mixed feed, medicated feed, pet food and pet treats)</li> <li>• Actions by regulatory bodies to keep food safe during storage, shipment, and domestic/international transport (e.g., FDA, USDA/FSIS, FSMA)</li> <li>• Effects of global population trends, economic and environmental changes, and cultural diversity in shaping food safety regulations</li> <li>• Challenges to development and implementation of food safety standards in developing economies</li> </ul>
Local and Global Food and Feed Supply and Safety	Regulatory Oversight of Food & Feed Safety	Students know an overview of the regulatory bodies and food/feed safety regulations that govern local and global food/feed safety and contemporary issues that shape development of these standards	<ul style="list-style-type: none"> <li>• Definition of food- and waterborne illnesses</li> <li>• Public health impact of food and waterborne illness worldwide</li> <li>• Microbes (including bacteria, parasites, viruses, prions and fungi) and microbial products that cause food- and waterborne illnesses</li> <li>• Sources of microbes that cause food- and waterborne illnesses</li> <li>• Chemicals and toxins and sources of chemicals and toxins that cause food- and waterborne illnesses</li> <li>• Types of water contamination (microbial, chemical, radiation, toxic)</li> <li>• Impact of different types of water contamination on food safety</li> <li>• Risks for foodborne illness associated with different food types</li> <li>• Role of different food preparation and food storage practices in causing and preventing foodborne illness</li> <li>• Foodborne illnesses associated with pet foods</li> <li>• Association between contaminated animal feed sources and foodborne illness</li> <li>• Growth and survival mechanisms of microbes that impact food safety (e.g. biofilms, spores, cysts, extremophilic species)</li> </ul>
Food- and Waterborne Illness: Sources & Prevention	Food- and Water-borne Illnesses	Students know the causes of food- and waterborne illnesses and resulting public health impacts	<ul style="list-style-type: none"> <li>• Fundamental principles of epidemiology</li> <li>• Fundamental principles of biostatistics</li> <li>• Importance of environmental health in public health</li> <li>• Importance of community health in public health</li> <li>• Importance of community health education</li> <li>• Fundamental principles and methods of food- and waterborne illness and food pathogen surveillance to identify, investigate, and respond to public health threats</li> <li>• Principles and methods of food- and waterborne outbreak investigation and response</li> </ul>
Food- and Waterborne Illness: Sources & Prevention	Public Health	Students know public health principles related to identifying, sourcing, and preventing causes of food- and waterborne illnesses	<ul style="list-style-type: none"> <li>• Basic hygiene practices to ensure human health</li> <li>• Role of hygiene in preventing foodborne illness</li> <li>• Role of hygiene in food preparation to prevent foodborne illness</li> <li>• Role of hygiene in food storage to prevent foodborne illness</li> <li>• Regulatory oversight of hygiene practices</li> <li>• Cultural/social influences on food source types, food preparation methods, and food storage methods as these relate to food safety (examples include: Bush meat, sushi, fresh salads, refrigeration, etc.)</li> </ul>
Food- and Waterborne Illness: Sources & Prevention	Health & Hygiene	Students know principles of human health and hygiene for preventing and mitigating food- and waterborne illness and of the role of food sources, storage practices, and preparation in affecting risks for developing food- and waterborne illnesses	<ul style="list-style-type: none"> <li>• Cultural/social influences on food source types, food preparation methods, and food storage methods as these relate to food safety (examples include: Bush meat, sushi, fresh salads, refrigeration, etc.)</li> </ul>
Food- and Waterborne Illness: Sources & Prevention	Sanitation & Dis-infection	Students know principles of sanitation and disinfection for preventing food- and waterborne illnesses that can be used on the farm, in the processing plant, and in retail establishments	<p><b>General:</b></p> <ul style="list-style-type: none"> <li>• Types of agents used for food and water sanitation and disinfection</li> <li>• Methods of food and water sanitation and disinfection</li> <li>• Regulations regarding pre- and post- harvest sanitation to help ensure food safety</li> <li>• Principles of proper cleaning and disinfection on different types of surfaces</li> <li>• Waste disposal methods to promote food safety</li> </ul>

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