

An Analysis of Food Safety in Wisconsin

Prepared for the Wisconsin Legislative Council

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Foreword

This report is the result of collaboration between the Robert M. La Follette School of Public Affairs at the University of Wisconsin–Madison, and the Wisconsin Legislative Council. Our objective is to provide graduate students at La Follette the opportunity to improve their policy analysis skills while contributing to the capacity of the Legislative Council to provide the Legislature with high quality analysis on issues of concern to the citizens of the state.

The La Follette School offers a two-year graduate program leading to a master's degree in public affairs. Students study policy analysis and public management, and they pursue a concentration in a policy focus area of their choice. They spend the first year and a half of the program taking courses in which they develop the expertise needed to analyze public policies.

The authors of this report are all in their last semester of their degree program and are enrolled in Public Affairs 869, *Workshop in Public Affairs*. Although acquiring a set of policy analysis skills is important, there is no substitute for doing policy analysis as a means of learning policy analysis. Public Affairs 869 gives graduate students that opportunity.

This year the students in the workshop were divided into six teams, three under my supervision and three supervised by my La Follette School colleague Professor Susan Yackee. The authors of this report were assigned to work on a research project for the Legislative Council on the topic of food safety in Wisconsin.

In recent years there has been a growing public awareness of the serious risks of food-borne illnesses as a consequence of the unsafe handling of food. In this report the authors analyze issues of food safety of crop and animal production at the farm level. On the basis of their analysis, they propose the creation of a mandatory audit system for fruit and vegetable producers to decrease risks of bacterial contamination on Wisconsin's farms. The authors also highlight the health risks created by the use of subtherapeutic levels of antibiotics and antimicrobials in poultry and meat production. They propose a policy to require state and local government agencies to only purchase meat and poultry that has been raised without the use of subtherapeutic levels of antibiotics.

This report would not have been possible without the support and encouragement of Terry Anderson, Director of the Legislative Council, and Laura D. Rose, Deputy Director of the Legislative Council. Ms. Rose provided the authors with advice and guidance throughout the semester. A number of other people

also contributed to the success of the report. Their names are listed in the acknowledgements section of the report.

The report also benefited greatly from the support of the staff of the La Follette School. Mary Mead contributed logistic support, and Karen FASTER, the La Follette Publications Director, edited the report and managed production of the final bound document.

By involving La Follette students in the tough issues confronting state government, I hope they not only have learned a great deal about doing policy analysis but have gained an appreciation of the complexities and challenges facing governments at all levels. I also hope that this report will contribute to the work of the Legislative Council and to the ongoing public debates about how maintain and enhance food safety for all Wisconsin residents.

Andrew Reschovsky
May 2010
Madison, Wisconsin, USA

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We wish to thank the many people who provided expertise and feedback to inform our project. We are grateful to Laura Rose and the Wisconsin Legislative Council for the opportunity to conduct this analysis. In addition, several employees of state agencies shared their time and knowledge to broaden our understanding of various aspects of food policy in Wisconsin; they are noted in the list of works cited. Sara Cohen Christopherson contributed her services as a careful copy editor and thoughtful reader.

At the La Follette School, we appreciate the comments from Grant Cummings, Jacob Schneider, Lilly Shields, and Holden Weisman, our peer reviewers. Finally, we are grateful for the guidance of Professor Andrew Reschovsky, who taught this workshop course, and the editorial assistance of Karen FASTER, whose attention to detail made this final publication polished.

We thank all of these individuals for their input, which made this report possible, but acknowledge that any errors are our own.

Executive Summary

In recent years, consumers in the United States have witnessed massive recalls of beef, spinach, and peanut products that were contaminated with dangerous bacteria. Approximately 76 million Americans get sick from eating contaminated food each year, leading to costly consequences for health, medical care, and productivity. In Wisconsin, the estimated cost of food-borne illness was \$2.9 billion in 2009.

Wisconsin has a proud tradition as a leader in agricultural production, research, and policy. For instance, Wisconsin was the first state whose hygiene lab identified the DNA fingerprint of the *E. coli* strain in the national outbreak of contaminated spinach in 2006. In addition, Wisconsin has implemented regulations in response to the development of new agricultural techniques. Despite these advances, Wisconsin consumers and producers continue to face threats to food safety.

In this report, we discuss the safety of crop and animal production at the farm level. We have chosen to focus on preventative measures that may reduce the possibility of contaminants entering the food system during production.

This report presents two policy options to decrease the incidence of food-borne illness in Wisconsin by reducing the risk of bacterial contamination on farms. The first proposal mandates quality certification, using standards and audits to reduce bacterial contamination in the production and packaging of fruits and vegetables. The certification process reflects variation in farm size through tiered requirements based on annual sales. The second proposal involves a program requiring state institutions to purchase meat raised without large quantities of antibiotics. These two proposals are variants of programs that have been discussed and implemented in Wisconsin, in other states, or at the federal level. Both policies are intended to improve consumer safety and confidence in Wisconsin agricultural products, while minimizing the negative impacts of policy action on consumers and producers.

Wisconsin has a strong history of leadership on agricultural policy. The two policy options presented in this analysis could position Wisconsin as a model for addressing new challenges in food safety.

Introduction

Issues of food safety are regularly in the news. In recent years, consumers in the United States have witnessed massive recalls of beef, spinach, and peanut products that were contaminated with dangerous bacteria. Concerned consumers have increased demand for specialized production processes as they buy organic, hormone- and antibiotic-free, grass-fed, or free-range products.¹ Debates around issues of food safety may focus on managing the risk of short-term health hazards like a food-borne illness outbreak, or on longer-term risks to human health posed by unsafe inputs such as chemical fertilizers or high levels of antibiotics.

In this paper we restrict our analysis to the issue of the safety of crop and animal production at the farm level. We have chosen to focus on preventative measures that may reduce the possibility of contaminants entering the food system during production. This can reduce the number of food-borne illness outbreaks, the potential for contamination to spread, and the likelihood that consumers will come in contact with contaminated food.

Research Question

The food safety system is comprised of a large and complex network of producers, processors, distributors, and consumers. In this report, we focus on food safety policy that applies to the first step in food distribution: maintaining the safety and quality of foods at the farm level. We consider the following research question: How can Wisconsin minimize farm-level contamination that causes food-borne illness outbreaks and health threats?

Wisconsin as a Leader

Wisconsin has a proud agricultural tradition and a history of striving to be a model for the nation. In 2007, Wisconsin's agriculture industry contributed nearly \$60 billion to the state economy, representing 12.5 percent of total production (Deller & Williams, 2009). The state is known for high-quality agricultural products, and it emphasizes this reputation through the nickname "America's Dairyland" and the annual crowning of an "Alice in Dairyland." Even the state's *Forward* motto reflects a longstanding drive to be in the forefront among states and a leader for the nation. Legislators, state agency staff, business leaders, and residents strive to maintain this position today (Matson, 2008).

¹ Recently, groups of consumers and farmers in Wisconsin called for improved access to raw milk products, arguing that consumption of non-pasteurized milk provides additional health benefits; opponents say raw milk bears health risks. However, issues of dairy safety will not be addressed in this report.

In 1915, the Wisconsin Department of Agriculture was created through the merger of several boards and agencies. The department later assumed oversight of seed, fertilizer, and pesticide regulation from the University of Wisconsin. This transfer of authority established the Department of Agriculture and Markets in 1929. The current Department of Agriculture, Trade, and Consumer Protection (DATCP) was formed in 1977. Throughout Wisconsin's history as a leading agricultural state, regulations have been implemented in response to the development of new farming techniques. The Wisconsin Legislature has enacted laws on food additives, licensing, sanitation, measurement of quantity, advertising, and sales with the aim of protecting consumers and standardizing the food supply (Matson, 2008).

Many of Wisconsin's legislative initiatives on issues of food safety have preceded similar initiatives on the federal level.² For instance, Wisconsin passed laws defining food adulteration in 1897; this definition later appeared in the federal Food and Drug Act of 1906.³ Wisconsin's 1965 law on meat inspections paved the way for the federal Wholesome Meat Act of 1967 (Matson, 2008).

Despite Wisconsin's history of food safety legislation, consumers and producers continue to face threats to food safety. Annual costs of food-borne illness in Wisconsin were estimated at \$2.9 billion in 2009, or approximately \$516 for each resident (Scharff, 2010).⁴ This cost placed Wisconsin 17th nationally in per-capita costs of food-borne illness. Outbreaks are not the only cost of unsafe food. A 2008 report from DATCP suggests that the prevalence of food-borne illnesses and the increase in antibiotic-resistant strains of bacteria threaten food safety and necessitate a review of policies and procedures to maintain public health (Matson, 2008).

To address ongoing threats to the safety and quality of food in Wisconsin, we propose two policy options aimed at decreasing the incidence of outbreaks of food-borne illness. First, we propose a system of mandatory quality certification that uses standards and audits to reduce bacterial contamination in the production and packaging of fruits and vegetables. Second, we discuss a preferential purchasing program for meat raised with antibiotics for disease treatment purposes only. This policy could provide incentives for farmers to reduce antibiotic usage, thereby extending the useful life of many important human and animal medicines. These two proposals are similar to programs that have been discussed or implemented in other states or at the federal level.

² See Matson (2008) for a thorough history of Wisconsin's food safety system, including an outline of Wisconsin policies that influenced federal action.

³ Matson (2008) notes that the definition used in both pieces of legislation appears to have originated in a British law from 1875.

⁴ Scharff (2010) calculated total cost as the sum of medical costs, quality of life losses such as lost productivity, and lost life expectancy.

Background

The danger of unsafe food comes from a variety of risks, ranging from bacterial contamination to unsafe levels of chemicals. These dangers are countered through regulations at the federal, state, and local levels.

Risks

Food can pose health risks when contaminated with unhealthy substances that can be introduced into the food supply chain during any of the stages from production to preparation. Most major contamination incidents are related to the presence of pathogens in food products. There are several types of food-borne pathogens, although the most common are *E. coli*, *Salmonella*, and *Listeria*. (See Appendix A for a list of main risk factors.) When two or more people get the same illness from the same contaminated food product, the event is called a food-borne outbreak (U.S. Department of Health and Human Services [U.S. DHHS], n.d.a). Tables 1 and 2 outline critical events related to *E. coli* and *Listeria*, respectively, including actions taken to address public health threats by the Centers for Disease Control and Prevention (CDC), U.S. Department of Agriculture (USDA), and U.S. Food and Drug Administration (FDA). Hazard Analysis and Critical Control Points (HACCP) is a system used in the meat production process to identify and minimize risks through preventive checks.

Table 1 Significant *Escherichia coli* O157:H7 Associated Events

Year	Noteworthy Events	Action Taken
1982	CDC conducts investigative studies to identify <i>E. coli</i> O157:H7 and its association with two outbreaks from ground beef sandwiches.	CDC identifies <i>E. coli</i> O157:H7 as a human pathogen and determines that it causes haemorrhagic colitis.
1984	Studies indicate that <i>E. coli</i> O157:H7 has no unique or unusual heat tolerance.	
1985	Several women handling manure-encrusted potatoes become ill.	Outbreak points to manure as a possible source of the pathogen.
1986	CDC investigates a farm identified as source of <i>E. coli</i> O157:H7 outbreak associated with unpasteurized milk.	CDC isolates <i>E. coli</i> O157:H7 in cattle, the first evidence that cattle can be a reservoir or carrier of this organism.
1992	Studies conducted to evaluate fate of <i>E. coli</i> O157:H7 in raw fermented salami.	Determined that organism has some very unusual acid tolerances and could survive sausage-making process.
1993	23 cases of <i>E. coli</i> O157:H7 infection associated with dry, cured salami in California.	USDA requires that processing techniques used in salami production implement critical control points. No outbreaks have occurred since.

Year	Noteworthy Events	Action Taken
	Outbreak involving more than 700 cases, four deaths associated with undercooked ground beef served by a fast-food restaurant chain on the West Coast.	Determined that patties cooked less than 140 degrees Fahrenheit were the source. FDA responds by changing food code to require patties are cooked to an internal temperature of 155 degrees Fahrenheit for 15 seconds.
		USDA issues a rule requiring that safe handling labels be used for raw meat and poultry products.
1994		USDA declares that <i>E. coli</i> O157:H7 is an adulterant in raw ground beef and establishes a zero tolerance.
		USDA initiates end-product testing for raw ground beef.
1995		CDC introduces FoodNet surveillance system that enables monitoring of many of the illnesses attributed to food-borne pathogens.
1996		USDA publishes rule on pathogen reduction that includes the HACCP program.
		FDA approves irradiation of red meat.
1997		CDC, FDA, USDA, and food industry initiate the Fight Bac Campaign to educate consumers on proper food handling practices.
1998		USDA requires implementation of HACCP for large meat processing plants.
		USDA publishes a key facts document recommending that a thermometer be used to measure the temperature of cooked patties.
		CDC FoodNet results reveal that <i>E. coli</i> O157:H7 infections increased in 1998, slightly above 1996 levels.
1999		USDA implements HACCP for small meat processing plants.

Source: Institute of Medicine. (2001a).

Table 2 Significant *Listeria monocytogenes* Associated Events

Year	Noteworthy Events	Action Taken
1986–1987		CDC publishes case-control study results revealing that about 20 percent of listeriosis cases were attributed to consumption of hot dogs or undercooked chicken.
1987		USDA initiates finished product testing program for ready-to-eat meats.
1987–1989	266 cases of illness in United Kingdom out-break associated with pâté.	
1988	Listeriosis case in woman who had eaten a turkey frank.	Continual evidence that frankfurters may be a source of <i>L. monocytogenes</i> . Therefore, USDA expands its finished product testing to more products and increases sample size in testing from 1 to 25 grams of food.
1989–1999		During this time period, USDA tests 24,500 samples with positive rate of 3.1 percent of <i>L. monocytogenes</i> . Results of extensive testing indicate that certain foods, such as bratwurst and frankfurters, enable the growth of this organism at refrigeration temperatures.
1992	Outbreaks in Europe associated with meat, pâté, and jellied pork tongue.	
1998	101 cases of listeriosis associated with frankfurters and possibly some deli meat.	
1999		USDA advises meat processors to reassess HACCP plans and critical control points to identify the levels of <i>L. monocytogenes</i> on source materials, the validation of processes that kill <i>Listeria</i> , steps to control environmental contamination, growth characteristics of <i>Listeria</i> in products and also finished product. USDA also provided guidance to meat processors recommending environmental and end-product testing and increased educational efforts targeted at high-risk consumers.

Source: Institute of Medicine. (2001b).

Each year, an estimated 76 million people become sick from consuming food contaminated by microbial pathogens. Of these, 325,000 are hospitalized and approximately 5,000 die (Mead et al., 1999; Becker, 2009). Such illnesses tend to have a rapid onset, with symptoms appearing within hours of consuming the unsafe food, although contact with microbial pathogens does not always result in illness. Children, older adults, and people who are immuno-compromised tend to be the most susceptible to the effects of food-borne illness (U.S. DHHS, n.d.b).

Table 3 shows the many ways contaminants can enter the food system. Many recent incidents of vegetable contamination resulted when the produce was washed in water polluted with fecal matter that contained dangerous bacteria. Bagged leafy greens carry a high risk for bacterial growth if the bags are not constantly refrigerated from the point of packaging to the point of sale. In any instance where food is being handled, contamination can occur if the food comes in contact with surfaces, workers' hands, or other foods that carry dangerous substances.

Table 3 Steps Leading to Food Contamination

Steps	Definition	Example of Contamination
Production	Growing the plants we harvest or raising the animals we use for food	If fields are sprayed with contaminated water, fruits and vegetables can be contaminated before harvest.
Processing	Changing plants or animals into what we recognize and buy as food.	If contaminated water or ice is used to wash, pack, or chill fruits or vegetables, the contamination can spread to those items.
Distribution	Moving food from the farm or production plant to the consumer or a kitchen.	If refrigerated food is left on a loading dock for long time in warm weather, it could reach temperatures that allow bacteria to grow.
Preparation	Getting the food ready to eat. This may occur in the kitchen of a restaurant, home, or institution.	If a cook uses a knife to cut raw chicken and then uses the same knife without washing it to slice tomatoes, the tomatoes can be contaminated by pathogens from the chicken.

Source: U.S. DHHS. (n.d.a).

While safe handling and proper food preparation can minimize the risks associated with contaminated food, safety measures implemented at the farm level are also a critical part of reducing the risk of contamination. Large-scale farms and feedlots can be breeding grounds for pathogens that may spread further when products are mixed in fast-paced processing plants. This exposure can spread contamination quickly into the high-volume food supply chain that spans across the nation and into other countries (DeWaal & Barlow, 2004). Limiting the conditions that are favorable to the spread of pathogens can contribute substantially to a safer food supply.

In addition to the immediate threat of bacterial contamination, public concern has been growing about inputs used in food production that may compromise human, animal, and environmental health over the long term. As the number of food-borne

infections caused by antimicrobial-resistant bacteria has increased in recent years, scientists have documented the negative effects of administering high quantities of antibiotics on animals to prevent the outbreak of disease among herds (Codex Committee on Food Hygiene, 2001). These pharmaceuticals, classified as antimicrobials, are natural or synthetic substances—including antibiotics—that inhibit the growth of, or kill, microorganisms, including *Salmonella*, *E. coli*, and others. (See Table 4 for examples of uses of antimicrobials by recipient type.) Bacterial pathogens may develop resistance to these drugs, allowing the organisms to evade the actions of an antimicrobial. Microorganisms can develop antimicrobial resistance by transferring genetic material among related and unrelated bacteria (Silbergeld et al., 2008). This causes bacteria to continue to spread infections that are resistant to current treatments, which increases the likelihood that infections and illness may spread. The regulatory system that is responsible for preventing pathogen contamination does not oversee the long-term stability of animal and human health that reflects the overall healthiness of food and production processes. As a result, concerns about the safety of the U.S. food supply remain.

Table 4 Uses of Antimicrobials by Recipient

Subject	Use
Human	Therapeutic (i.e., medical) Consumer (soaps, toys, etc.)
Animal Livestock (cattle, swine, poultry, turkey, goat, etc.) Aquaculture Companion animals	Subtherapeutic (growth promotion, disease prevention) Therapeutic (i.e., medical) Subtherapeutic (disease prevention) Therapeutic (i.e., medical) Therapeutic (i.e., medical)
Plant (orchards, vegetables)	Pesticidal

Source: Mellon et al. (2001).

Controlling Risks to Food Safety

The infrastructure for regulating food and maintaining safety is quite complex: local, county, state, and federal agencies all have varying degrees of authority and responsibility for enforcing rules and regulations, and for responding to outbreaks. The food safety system operates at all times, with agencies handling inspections, lab testing, and surveillance.

Regulation

The Wisconsin Administrative Code and Wisconsin statutes contain explicit language on food safety regulations, including licensing and the issuing of permits to producers and sellers. Food safety is covered in Volume 1 of the

Agriculture, Trade and Consumer Protection (ATCP) Sections 55-88 (Wisconsin Administrative Code, 2009).

The following example illustrates how a person engaging in meat processing would interact with the regulatory food safety system according to ATCP 55:

An individual who processes meat for consumption requires an annual license. Individuals may be exempt if the USDA inspects their establishment, if they process their own meat for their own consumption, or if the license pertains to restaurants, vending, or catering establishments. If they are not exempt under those terms, they can only operate meat establishments with a current annual license. To receive a license, an individual must draft a proposed slaughter and processing schedule, pass a pre-license inspection, and pay an annual fee. In addition to complying with the administrative code, individuals must also comply with any applicable provisions of s. 95.72 Wis. Stats. Furthermore, no person may sell any meat from any food-animal for human consumption unless the USDA has conducted a slaughter inspection.

While the individual in the above example would be primarily in contact with a state body, the Bureau of Meat Safety and Inspection under DATCP, if he or she is engaging in slaughtering, he or she would also have to work with a federal body, the USDA. This example points to the complex interactions among state and federal agencies in the food safety system.

Outbreak Response

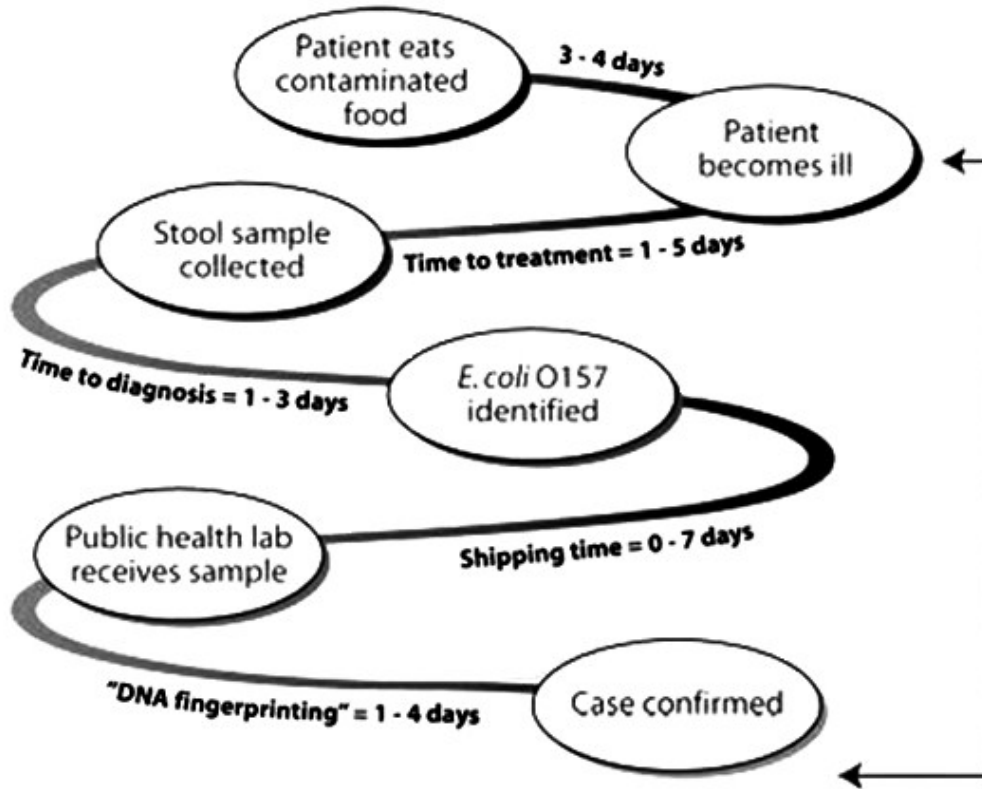
The extent of agency overlap and coordination is best illustrated when the food safety system is responding to a food-borne illness outbreak. To illustrate the complexities, shared responsibilities, and coordination of agencies during a food-borne illness outbreak, we have summarized an example of the food safety system in action. This example focuses on the spinach outbreak in 2006.

On September 14, 2006, the FDA issued a national alert warning people not to eat bagged fresh spinach due to an *E. coli* outbreak that originated in Salinas Valley, California (Wisconsin Department of Health Services, 2009). The Wisconsin Division of Public Health was notified of several *E. coli* cases in areas of the state and the Wisconsin Department of Health and Family Services alerted residents and urged consumers with symptoms to contact their health-care providers. Wisconsin worked closely with federal agencies to identify brand names and stores, while the Wisconsin State Laboratory of Hygiene posted the DNA fingerprint of the *E. coli* strain (becoming the first state laboratory in the nation to do so). The CDC linked that strain to similar strains in the nation to determine the source of the *E. coli* infections. Investigations into the source focused on the farm, analyzing environmental sources such as water, products from cultivated fields, and sediment (Centers for Disease Control and Prevention, 2006b).

See Appendix B for a timeline for reporting and identification of *E. coli* cases. See Figure 1 for a flowchart illustrating this process through case confirmation.

This example illustrates how a state problem can quickly become a national problem, requiring coordination from actors at various levels.

Figure 1 Flowchart for Reporting of *E. Coli* Cases



Source: Centers for Disease Control and Prevention (2006a).

Federal and State Food Safety Regulation

The United States has a large and complex food industry that represents \$1 trillion in consumer spending each year. About 65 percent of that spending is for food produced in the country. The system operates across local, state, and national boundaries. Produce, meat, eggs, and processed foods are produced in large quantities and shipped over very large distances, often very quickly. Despite these complexities, the U.S. food system is considered to be one of the safest systems in the world (Becker, 2009). Yet risks remain within the system, causing consumers to be exposed to preventable and avoidable health threats.

Federal Involvement in Food Safety

The regulatory structure of the U.S. food safety system is scattered across multiple agencies and departments. Over the past decade, many prominent national groups have voiced concerns that the current federal structure fails to adequately meet the risks posed to human, animal, and environmental health (National Sustainable Agriculture Coalition, 2009; David & Taylor, 2009; Austin et al., 2008; Porter, 2007; DeWaal & Barlow, 2004). The FDA and the USDA are responsible for most federal regulation of farm-level production.

U.S. Food and Drug Administration

The FDA is “responsible for ensuring that all domestic and imported food products—except for most meats and poultry—are safe, nutritious, wholesome, and accurately labeled.” The FDA regulates produce, dairy, seafood, and various processed foods, and it shares regulatory obligations with the Food Safety Inspection Service (FSIS) to ensure the safety of meat, poultry, and egg products. The FDA houses the Center for Food Safety and Applied Nutrition (CFSAN), which conducts research on food safety, monitors the implementation of policy, and monitors state safety programs. The FDA is also home to the Center for Veterinary Medicine, which monitors drugs and devices used around food animals (Becker, 2009).

U.S. Department of Agriculture

The USDA regulates meat and poultry production. The agency runs FSIS, which oversees the inspection of animals that are slaughtered for human consumption. In addition to monitoring domestically produced meat and poultry, FSIS is responsible for inspections of imported meat and poultry (Becker, 2009).

Food Safety at the State Level

Each state has authority over certain aspects of the food safety system, including the investigation and tracking of food-borne outbreaks; inspection of farms, processing plants, retail and food service establishments; and outreach in the form of technical training and education (David et al., 2008). States have widely varying approaches to addressing these responsibilities. Wisconsin's efforts to reduce farm-level contamination are primarily managed by DATCP.

Wisconsin Department of Agriculture, Trade, and Consumer Protection

DATCP has purview over “food safety, animal and plant health, protecting water and soil and monitoring fair and safe business practices” (DATCP, 2010). The agency inspects and licenses businesses, analyzes laboratory samples to evaluate food contaminants and quality levels, offers education programs on best practices, and promotes Wisconsin's agricultural industry.

Fiscal Environment

Federal and state funding for food safety services have declined over the past decade. Federal budget cuts have reduced the financial support state programs receive for food safety inspection services. At the state level, many of Wisconsin's food safety operations have historically been funded with general tax revenue, but the state now relies heavily on licensing fees. In addition, the state must match federal funds with state dollars that are not from licensing fees. DATCP food safety staff has declined by 17 percent since 1990, from 118 employees to 98 (Matson, 2008). These cutbacks challenge the department's capacity to respond to food safety threats.

Policy Options

Having discussed the risks of food-borne illness and the structure of our current regulatory system, we address two specific sources of contamination and propose policies that would address the risks they pose to consumers and the agriculture industry.

First, we provide background on state practices for production and packaging of fruits and vegetables. We consider a policy option that would improve safety standards by mandating farm-specific production practices. DATCP would implement this requirement through a three-tier system to maximize benefit and minimize regulatory burden on producers.

Second, we discuss the use of antibiotics for growth enhancement and disease prevention in livestock. We present a policy option (introduced in 2005 in the Wisconsin Assembly) that would create a preferential purchasing program for meat raised with reduced rates of antibiotics. This policy would apply to limited purchases of meat by state agencies.

We have chosen these policy options because they address food safety threats that present documented risk to consumers and producers in Wisconsin, have political precedents, and can be implemented at the state level.

Fruit and Vegetable Production Standards in Wisconsin

The food safety system is a fragmented web of mandatory and voluntary inspections by numerous federal, state, and county agencies. Two key programs have been developed to create safe production standards. The Hazard Analysis and Critical Control Points apply to commercial food processing, while the Good Agricultural Practices and Good Handling Practices apply to the production and packaging of fruits and vegetables.

Hazard Analysis and Critical Control Points

HACCP is a system of preventive checks to assess biological, chemical, and physical hazards throughout the meat production process (University of Nebraska Cooperative Extension, 2005). HACCP is required for meat producers under federal and state laws (Wisconsin, 1999). HACCP comprises seven key components: analysis of hazards, identification of critical control points, establishment of critical limits, procedure monitoring, corrective actions, verification steps, and record-keeping (National Advisory Committee on Microbiological Criteria for Foods, 1997).

In 2001, a committee of experts from federal agencies, universities, think tanks, and corporate food companies suggested that expansion of the HACCP could help address issues with *Listeria* and *E. coli* across the United States (Institute of Medicine, 2001c).

Good Agricultural Practices and Good Handling Practices (GAP/GHP)

In addition to fulfilling mandatory requirements such as HACCP to ensure food safety, many producers engage in an array of activities and implement safety standards on a voluntary basis. The USDA's Good Agricultural Practices (GAP) and Good Handling Practices (GHP) programs are voluntary audit systems to ensure food safety at the farm level.⁵ In GAP/GHP inspections, trained inspectors examine the processes and settings for growth and packing of fruits and vegetables. Wisconsin has two trained GAP/GHP inspectors and is in the process of training a third (Leege, 2010). The USDA also offers tools comparable to GAP/GHP for subsequent phases of the food production and distribution process (Agricultural Marketing Service, 2010a). Because this report is focused on farm-level production, we will focus primarily on the GAP audit process.

⁵ Many other organizations define their own good agricultural practices. The United Nations Food and Agricultural Association's GAP guidelines emphasize sustainability and a holistic approach to agriculture. GAP, as described here, refers specifically to the USDA's principles, which focus on food safety.

A GAP audit comprises seven parts, ranging from harvest practices to the cleanliness of irrigation sources to worker hygiene and sanitation. Farms must evaluate their management and production practices to minimize the risk of microbial contamination. They must also create standard operating procedures of Good Agricultural Practices that detail the food safety protocols that the farm has in place to minimize the risk of bacterial contamination. The standard operating procedures cover hygiene (known as sanitary standard operating procedures), handling of crops, and soil and water contamination. After these are completed, an inspection visit is conducted without prior notification. A successful GAP audit results in a yearlong certification for the given crop or item with no further inspection during the certification period. Certain violations during the inspection visit result in automatic failure, including signs of rodents and employee behaviors that compromise the safety of the food. As a voluntary program, producers who fail audits are not required to make any changes. However, producers have incentives, such as upholding name brand reputation, to keep their production processes sanitary, and to work toward solutions that would bring them into compliance with a future audit.

Sixty producers (of approximately 5,000 total farms producing fruits and vegetables in Wisconsin) passed GAP audits from July 2009 through February 2010, including the phases of Farm Review and Farm Harvest Packing (Agricultural Marketing Service, 2010b; National Agricultural Statistics Service, 2007). The vast majority of audits covered potatoes used for processing, suggesting the audits in Wisconsin tend to apply to produce that will be processed—and thus are sought by larger producers (Agricultural Marketing Service, 2010b).

Shortcomings of Current State Practices

The shortcomings of the current state system fall into two primary categories. First, the system of optional compliance with guidelines creates uneven food safety outcomes and confusion for producers who intend to follow the law but do not elect to participate in audits. Second, these optional practices are more burdensome to small producers than to larger ones.

Voluntary Compliance

Despite the lack of regulation for fruit and vegetable producers under the current system, many producers are motivated to meet common standards for safety (Leege, 2010). High profile outbreaks such as the aforementioned *E. coli* spinach outbreak in 2006 and the *Salmonella* outbreak in 2007 have put pressure on farms to improve food safety practices (Arnade et al., 2010). Some producers voluntarily participate in increased food safety initiatives, and others participate in order to comply with mandates from wholesale buyers of their produce. These large-quantity buyers, including retail grocery stores and restaurant chains, have

demanded that producers show proof that they are following the USDA guidelines for producing and handling food safety. DATCP officials assume that most large commercial growers that have adopted food safety plans are voluntarily following the USDA guidelines (Leege, 2010). However, even with these enhanced food safety plans, outbreaks have continued. When an outbreak occurs, it is often the case that the grower may have used the guidelines incorrectly, inconsistently, or not at all. This system of voluntary compliance for the production of fruits and vegetables has caused confusion about the regulatory system for both consumers (Calvin, 2007) and producers (Cuperus, 2010).

The federal government has begun to take a closer look at regulating the production of ready-to-eat fresh fruits and vegetables. A food safety task force was created soon after President Obama took office in 2009, and House and Senate bills were introduced to increase regulation on farms that produce, pack, and process vegetables and fruits (Arnade et al., 2010).

DATCP is examining how proposed federal regulation around food safety would affect Wisconsin farms (Cuperus, 2010). Farmers and DATCP employees expect GAP and GHP guidelines to become mandatory for fresh fruit and vegetable producers (Krome, 2010; Leege, 2010). To prepare, DATCP now offers classes that help explain how GAP and GHP guidelines work and helps fund voluntary third-party audits (Leege, 2010). Furthermore, the agency is developing online resources that producers can use to create GAP/GHP plans for their crops (Cuperus, 2010).

A Burden on Small Farms

Smaller farms—those with less than \$1 million in sales each year—have also begun to adjust to consumer and regulatory concerns. Some farms have started to voluntarily produce GAP/GHP plans (Cuperus, 2010). Even though these farms have fewer overall sales, they have a greater diversity of crops than their counterparts. Most commercial farms focus their production on one or two crops, while smaller farms can grow more than 30 different crops. The voluntary USDA guidelines specify that each crop must have its own GAP/GHP plan, which presents a significant barrier for small producers due to the hours involved in drafting plans for each crop.

This voluntary system can create still more obstacles for small farmers. For example, many small farmers are unable to sell to larger retail and wholesale markets that prefer GAP/GHP plans because producing those plans for their diversified crop production is not financially feasible (Hobbs, 2003). In an interview for this report, one DATCP employee relayed a story about a small farmer who produced a GAP/GHP plan for just one of these crops (onions) to sell to the fast food chain Chipotle. He spent 80 hours developing the plan

and had to spend another 20 hours in training for his staff. Despite this large investment of time, his total proceeds were \$6,000 for the 2009 season (Cuperus, 2010). A study of strawberry farmers pointed to significant expenses, particularly fixed costs, as a barrier to GAP usage among smaller scale producers (Woods & Thornsbury, 2005). Each produce type requires its own audit. For instance, root crops and leafy greens would be different categories for audits. Consequently, following GAP is time-consuming and inefficient for small farms producing a diverse range of crops.

According to DATCP officials, small farms generally have a good track record in food safety. In January 2010, DATCP surveyed small producers on their food safety practices and concluded they did well on areas such as soil, planting, harvesting and washing. The survey also identified problem areas, noting that producers were less effective with water testing and basic sanitation practices such as having adequate hand-washing sinks and worksite bathrooms for their employees. Despite room for improvement, many of these farms have gone through organic certification and keep detailed records in terms of inputs and traceability back to the farm—elements that are a key part of the GAP/GHP process (Cuperus, 2010).

Scaled GAP/GHP Proposal

We propose that DATCP be given the authority to mandate a scaled version of the USDA Good Agricultural Practices (GAP) and/or Good Handling Practices (GHP) for every produce farm in the state. Under this proposal, practices would include written food safety plans showing how producers would comply with GAPs, effective trace-back systems, third-party audits, and rigorous enforcement of standards. The mandated regulations would be scaled dependent on the level of sales of each producer. The three categories would be broken down as follows:

1. Farms that have sales greater than \$1 million annually, an estimated 80 to 100 farms.⁶
2. Farms that sell from \$100,000 to \$1 million annually, an estimated 800 to 1,100 farms.
3. Farms that sell from \$1,000 to \$100,000 annually, an estimated 3,000 to 3,500 farms.

A three-year aggregate of sales would be used to determine the category in which a farm would be placed. Farms in the first category, those with sales more than \$1 million annually, would have to fully comply with USDA GAP, GHP, or both. The second category of farms—those with annual sales between \$100,000-\$1 million—would be required to comply with a scaled back GAP/GHP. The third category of farms includes many smaller producers who have annual sales ranging from \$1,000-\$100,000. These producers would not be required to comply with GAP/GHP standards but would be required to attend classes on best food safety practices administered by DATCP.

The scaled version of GAP/GHP in the second category would allow farms to use a generalized food safety plan for all of their crops instead of a standard operating procedure for each of their crops. They would be required to write a standard sanitary operating procedure for hygiene; to keep records of cleaning food contact surfaces, refrigeration areas, and transportation machinery; and to designate a single person to oversee the food safety program. Also, farms in this category would be required to test their water for microbial organisms twice a year and to keep records on testing available for inspectors to review. Crops and water sources would need to be protected from contamination by animals of proven significant risk. Physical barriers and risk analysis of water contamination would be required to prevent the spread of bacteria among animals, produce fields, and water sources that could be contaminated by run-off from feedlots.

⁶ Estimates based on sales, crop type, and acreage from the National Agricultural Statistics Service (2007).

Our proposal calls for a third-party auditor to inspect the farms that fall into the first and second categories, to score the results of the audit, and to conduct an exit interview. The current cost of such audits is \$92 per hour (this rate is set by the USDA) and includes the inspector's travel time (Starmer & Kulick, 2009; Leege, 2010). DATCP can reimburse to the farmer 75 percent of the audit's cost. These audits are funded through the USDA's Specialty Crop Block Grant program.⁷ In addition to inspection requirements, the scaled GAP/GHP proposal would require DATCP to develop an online food safety template as a resource for farmers to use in developing their SOP. This template could be similar to the one developed by the University of Minnesota Agricultural Safety and Health Program.⁸

Under the mandated and tiered GAP/GHP system we propose, the state's smallest fruit and vegetable producers would have to attend educational courses on best practices. Courses would include practical information and useful tips to ensure the safety and quality of the fresh fruits and vegetables produced on small farms. In addition, the courses would include the latest updates and resources on federal food safety programs and regulations for small-scale produce growers. Presenters would include university specialists, USDA food safety inspectors, and growers who have completed a food safety certification process. DATCP would run 15 to 20 classes per year throughout the state. In 2009, DATCP held four classes at a cost of \$5,000. The USDA Specialty Crop Block Grant paid for these classes. In addition to courses led by instructors, the USDA has developed videos and information packets in Hmong and Spanish, and is planning to add additional language support (Leege, 2010).⁹

Addressing Risk

Produce is second only to seafood in the number of food safety outbreaks in the United States since 1990 (DeWaal & Barlow, 2004). By mandating a scaled GAP/GHP system, the state would provide a food safety system for fresh fruit and vegetable farmers.

Certain crops and production methods present greater risks than others. Risk of bacterial contamination increases when non-contaminated products come into contact with contaminated material. This could happen if produce from different farms is mixed together for packaging. In addition, packaging may increase risk if processing equipment becomes contaminated. Bacterial growth can occur if food

⁷ A DATCP official assumes that the USDA will continue to fund these grants, based on the history of federal funding sources and the agency's prioritization of funding of GAP/GHP audits (Leege, 2010).

⁸ See <http://safety.cfans.umn.edu/FSP4U.html> for the University of Minnesota template.

⁹ DATCP also offers food code fact sheets in ten languages in addition to English. For more information, see <http://www.datcp.state.wi.us/fs/business/food/publications/foreignLangHandouts.jsp>.

is kept at unsafe temperatures during shipping and storage. This risk increases with the length of the supply chain (Starmer & Kulick, 2009).

Basic food safety measures are important for all farm sizes, crops, and production types (Starmer & Kulick, 2009). According to a survey DATCP conducted on food safety management practices on small farms, the greatest risks of food contamination are related to lack of adequate bathrooms, lack of hand-washing sinks in packing areas, and lack of testing of water sources for microbial contamination (Cuperus, 2010). While small, diversified farms are not without risk, the reach and scale of their operations pose a much smaller risk to food safety. Evidence suggests that the management practices of small, crop-diverse farms are a net benefit to food safety (Starmer & Kulick, 2009).

Recent large outbreaks of food-borne illness have been associated with large-scale agriculture. To have substantial impact on food safety, regulation should focus on larger production farms where risk is the highest (Starmer & Kulick, 2009). This emphasis would increase the effectiveness of the regulation without burdening smaller farms with administrative tasks. The proposed scaled system would decrease the risk of bacterial contamination by targeting contamination-reduction strategies that are appropriate to the production practices at different farm scales. A one-size-fits-all approach would place too many costs on small farms. This proposal places the cost and focus on production situations that have the greatest risk and maintains low barriers to entry for small farms.

Implementation

The public is increasingly aware of food safety issues. Demand for convenient fresh produce, such as bagged lettuce, has increased in recent years (Scharff, 2010). As more people consume these products, the risk of costly and dangerous food-borne illness outbreaks will continue to increase. There appears to be growing public support for government regulation of the food system (Calvin, 2007). The federal government proposed mandatory GAP/GHP in 1997 and in 2003, but there has been a large push back from small farmers (DeWaal & Barlow, 2004). But as the number of small-to-medium diversified farms grows, the farmers themselves are starting to recognize the need for greater food safety programs. Some farmers have begun to voluntarily bring their facilities up to federal GAP/GHP standards, and a few farms have voluntarily been audited. Political feasibility would increase under a system that is manageable for small farms.

We propose that the new requirements be phased in over several years. Farms with sales of \$100,000 to \$1 million would have two years to implement GAP/GHP. In addition, implementation of the proposal would require audit staff

training and financing to fully support this system and to ensure that the farms' food safety plans were adequate. One possible solution would be to integrate the GAP/GHP auditing into the third-party organic certification process. According to the *Census of Agriculture* (National Agricultural Statistics Service, 2008), 395 farms in Wisconsin have annual sales between \$100,000 and \$1 million and are certified organic. Integrating the audits into farms' organic certification process would alleviate the pressure from the state to hire inspectors and integrate the GAP/GHP audits into an established process.

Costs of Scaled GAP/GHP

Producers would bear most of the costs of meeting the new standard. GAP/GHP would require more time for producers to develop plans. Improving plumbing facilities would be another cost to producers. The estimate of time that it takes a small farmer to develop a food safety plan for a single crop varies according to size of the farm and number of acres planted of each crop. Based on an interview with a DATCP official, we estimate that a farmer with annual sales less than \$1 million would spend an extra 40 hours to complete a GAP/GHP food safety plan. (Cuperus, 2010).¹⁰ This estimate assumes the farmer uses an online resource of generic templates the state developed to help producers create food safety plans. A broader food safety plan that covers an entire farm and is not crop specific would likely take the producer 80 hours to develop.

The installation of hand-washing sinks in packing sheds is one key cost for producers. We assume that most producers would only need to install one hand-washing sink. Based on an interview with a plumber, this installation is likely to cost \$1,400. Another possible cost for producers would be installing an employee-dedicated bathroom. This cost would be significant if the farmer needs to install all the plumbing and fixtures for a new bathroom; however, the cost decreases significantly if producers use portable rental bathrooms maintained by a third party. The cost for a rental portable bathroom during the growing season is about \$1,200 and includes a bi-weekly cleaning (Noren, 2008). Furthermore, the average cost of mandatory water testing three times a year would be approximately \$135 (Leege, 2010).

The state uses USDA funds to reimburse the producer for 75 percent of the cost of third-party audits. We assume that the USDA will continue to fund these reimbursements, as they are included in current federal legislation. Third-party auditors charge \$92 an hour¹¹ and typically spend four hours on the farm

¹⁰ These estimates are based on interviews with a GAP/GHP auditor and an economic development specialist at DATCP. Their estimates come from feedback from farmers who have completed GAP/GHP food safety plans and have annual sales less than \$1 million.

¹¹ According to Starmer and Kulick (2009) and Leege (2010), this is the federal reimbursement rate for 2010.

inspecting its food safety procedures. The third-party auditor averages two hours of travel time for each inspection. At current rates, these audits cost farmers about \$550. (Leege, 2010).

We estimate that producers would experience 80 additional work hours during the first year of implementation. Additionally, since most farms do not make significant changes from season to season, the additional work time would decrease to 20 hours after the first year. Based on the cost data spelled out in the previous paragraphs, the proposed program would cost the farmer from \$2,500 to \$3,200 to implement in the first year. The cost associated with this plan after the first year would decrease, as no new facility improvement costs would be necessary; therefore the cost would range from \$1,200 to \$1,800.

Addressing Antimicrobial Use in Agriculture

Another approach to decrease the incidence of food-borne illness outbreaks in Wisconsin would be to address the use of subtherapeutic antibiotics in food-animal production. While therapeutic use of antibiotics prevents the onset and spread of disease among animals, antibiotic use in livestock occurs for many other reasons. Producers also give subtherapeutic levels of antimicrobials to food-animals for weight gain and to prevent disease in overcrowded conditions.¹² In these cases, healthy animals are given lower dosages than they would receive if they were sick.

According to the World Health Organization ([WHO], 2002), excessive use—use beyond what is necessary for prophylaxis, or disease prevention—of antimicrobials on farms contributes to the development of antibiotic-resistant strains of *Salmonella*, *Campylobacter*, and other bacteria in humans. Antibiotic-resistant *E. coli* has been documented in Wisconsin, and longitudinal studies of Wisconsin farms have found that the bacteria have become resistant due to the use of subtherapeutic levels of antimicrobials in animal feed (Shere et al., 1998). This development of antibiotic-resistant bacteria at the farm level has had costly consequences for the health care system and has compromised food safety (Pew Charitable Trusts, n.d.).

Disadvantages of Current Antibiotic Use in Wisconsin

The use of subtherapeutic antimicrobials in food production to enhance farm-animal growth has much greater associated health risks than therapeutic use because antimicrobials administered for growth promotion are often used without veterinary oversight and for long durations in animal production (Codex Committee on Food Hygiene, 2001). The FDA approves the sale, regulation, manufacturing, and distribution of antibiotics used in animals. Within the past few decades, the FDA has taken actions to reduce the negative effects of antimicrobial use in agriculture. However, recent attempts by the FDA to prohibit the use of a single antibiotic, enrofloxacin, have lasted for several years (U.S. General Accounting Office [U.S. GAO], 2004). Food-animal producers have access to non-prescription antimicrobials from retail outlets; the FDA has classified certain drugs as safe for over-the-counter use. This fact makes the tracking of antibiotic usage difficult (McEwen & Fedorka-Cray, 2002).

Few regulations are in place regarding the administration of antibiotics to farm animals in Wisconsin and other states. Critics charge that the regulation of antibiotic use is inadequate because it places the public health at risk (U.S.

¹² In this report, we define subtherapeutic use as administration of antibiotics for purposes other than disease treatment. See Appendix A for further detail on this term.

GAO, 2004). Although measuring and monitoring the use of antimicrobial agents in agriculture is important to understand human health impacts, the United States does not have a system to do so (Anderson et al., 2003).

Moreover, antibiotics are frequently administered at concentrated or confined animal feeding operations to prevent or reduce the spread of disease in crowded conditions, as well as to promote animal growth. In the short run, unlimited antibiotic use gives larger producers a competitive advantage, allowing less expensive production through economies of scale, within conditions that would otherwise foster disease. This may create an uneven playing field for smaller producers, particularly for those who strive to maintain better conditions for their livestock.

Addressing antimicrobial use is important for reducing food-borne bacterial outbreaks and illness. Subtherapeutic use of antimicrobials in food-animals is a significant source of antimicrobial-resistance (McEwen & Fedorka-Cray, 2002; Silbergeld et al., 2008). In addition, antimicrobial-resistant infections are associated with more severe illness and higher rates of mortality (Angulo et al., 2004). Federal and state governments could enact legislation regulating the use of antibiotics in food-animal production to reduce food-borne bacterial contamination.

Prospects for Legislation to Address Antimicrobial Resistance in Agriculture

Individuals, consumer organizations, and the federal government have taken positions on the issue of antimicrobial resistance and food safety for several years. The U.S. House and Senate considered bans on agricultural antibiotic use for subtherapeutic purposes in the Preservation of Antibiotics for Medical Treatment Act (2009a; 2009b), referred to by its acronym, PAMTA. The Senate bill was referred to committee but not heard; the House bill did not proceed beyond a committee hearing.

Many individuals and groups have expressed their positions on PAMTA. The author of the House bill, Congresswoman Louise Slaughter (D-NY), is a microbiologist (Slaughter, 2009). The Obama administration recently stated its support for a ban (Harris, 2009). The Infectious Diseases Society of America is one of 350 organizations supporting the proposed ban (Union of Concerned Scientists, 2010). Opponents to PAMTA include the American Veterinary Medical Association and a coalition of 16 producer and animal feed organizations (American Meat Institute, 2009). The issue of subtherapeutic antibiotic use has become a hot topic for consumer groups as well (Wagstrom, 2006).

The fast food industry appears to be leading a movement away from subtherapeutic antibiotic use in meat production. Steve ELLS, the founder and chairman of Chipotle, gave testimony in support of PAMTA (Ells, 2010). In 2003, the fast-food chain McDonald's stopped purchasing chicken from producers using antibiotics for subtherapeutic purposes (Union of Concerned Scientists, 2006). Opponents of the movement away from routine subtherapeutic antibiotic use in meat production include representatives from the agricultural and pharmaceutical industries; among them are the Institute for Food Technologists Foundation and the National Pork Board (Wagstrom, 2006).

Regulations banning the use of subtherapeutic antimicrobials have been shown to reduce antimicrobial-resistant bacteria at the farm level. In 1998, the European Union banned several antibiotics used for farm-animal growth promotion. The discontinuation of this subtherapeutic usage decreased the prevalence of antimicrobial resistance in animals and animal food products (Anderson et al., 2003). In 1999, Denmark enacted a ban on antimicrobial feed additives. A study by the WHO (2003) concluded that Denmark reduced the prevalence of resistant bacteria at the farm level as a result of the elimination of subtherapeutic use of antimicrobials in swine production. Furthermore, the European Union phased out subtherapeutic use of any antibiotics for growth promotion in 2006 (European Union, 2005).

Eliminating prophylactic antibiotic usage will not remove all risk of bacterial food contamination, and banning all subtherapeutic antimicrobials could have negative effects on animal health if banned at critical stages of animal development. For example, Denmark first imposed a successful antimicrobial ban on pork products at a late stage of swine development and at low costs to producers. However, when the ban was extended to the animal weaning stage, producers encountered significant animal health problems and increased animal mortality (Hayes & Jensen, 2003). Moreover, although Denmark and other European Union countries witnessed a decrease in the prevalence of resistant bacterial organisms after their antibiotic bans, results would likely vary across countries and among farms of different scales and of different animal types.

Because U.S. legislation to address subtherapeutic antibiotic use has not been enacted, Wisconsin could reduce farm-level food contamination by regulating antibiotics at the state level. However, a ban on antibiotic use in food-animal production might place our state's meat producers at a significant competitive disadvantage with producers in other states. Instead, as an alternative, we propose a meat-purchasing preference policy.

Meat-Purchasing Preference Proposal

We propose that the Wisconsin Legislature pass a law requiring state institutions and school districts to purchase certain meat products to help reduce infection risk from microbial (especially antibiotic-resistant) contamination at the farm level. Such a policy would require state agencies to purchase meat products from suppliers who provide meat from animals that have not been produced with subtherapeutic antimicrobials.

The Wisconsin Legislature has previously considered a meat-purchasing preference policy. Legislation was introduced during the 2005 session—as Wisconsin Assembly Bill 837—by Representatives Pope-Roberts, Sherman, Berceau, Turner, and Parisi. This bill aimed to reduce antimicrobial use in food-animal production. This legislation would have required state agencies, including the University of Wisconsin System, school districts, and technical college districts to give preference to purchasing meat products from suppliers who provide meat from animals that have not been produced with subtherapeutic antimicrobials. This bill would have required a purchasing agency to buy chicken, turkey, beef, and pork products only from wholesalers who annually submit an affidavit to the purchasing agency stating that the meat products being supplied are produced without the subtherapeutic use of antibiotics. However, this purchasing preference only required state agencies to purchase the alternative meat “if there is a reasonable similarity between the quality, quantity, availability, and prices” with the current meat supply. Although a public hearing was held in January 2006, Assembly Bill 837 was not scheduled for a vote. The bill has not been reintroduced.

Political Precedents

There are political precedents for reducing antibiotic usage in food production. Several European nations have strictly regulated or banned the use of antibiotics in the raising of meat and poultry for subtherapeutic purposes (The Humane Society of the United States, 2009). Within the United States, Maine and California have adopted or proposed bills that encourage or mandate state institutions (including school systems) to purchase meat products from suppliers that do not use subtherapeutic antimicrobial treatments. The Maine policy has been enacted, while the California policy is in the proposal phase.

Maine’s Policy

In May 2006, Maine became the first state in the nation to adopt a meat-purchasing policy that encourages state institutions and school districts to give preference to purchasing meat products produced without subtherapeutic use of antimicrobials. Similar to Wisconsin Assembly Bill 837 (2005), state or school meat purchasers in Maine must purchase meat products only from a broker or

wholesaler who annually submits an affidavit to the purchaser stating that the meat products have been produced without subtherapeutic use of antibiotics as long as the meat is of “reasonable similarity in quality, quantity, availability and price” (Maine Act, 2005).

California’s Proposed Policy

California’s bill (2009) proposes a mandatory phase-out of the use of subtherapeutic antibiotics in meat products purchased for school meal programs. Under this bill, California schools cannot serve meat products treated with subtherapeutic antibiotics after January 1, 2012. And by January 1, 2015, this bill would require state and local government officials to give preference to purchasing meat products produced without antibiotic feed additives. This legislation has not yet been passed, but numerous consumer and trade organizations have taken formal positions on the matter. Supporters include the Center for Food Safety, Institute for Agricultural and Trade Policy, and the Union of Concerned Scientists; opponents include the Agricultural Council of California, California Farm Bureau Association, and California Veterinary Medical Association (California Senate Rules Committee, 2009).¹³ In January 2010, the bill failed to pass the California Senate, and as of April 2010, no further actions had been taken on the initiative (California, 2010).

Analysis of Meat-Purchasing Preference Proposal

Enacting legislation similar to Wisconsin Assembly Bill 837 (2005) could reduce the prevalence of resistant bacteria at the farm level if farmers supplying meat to state agencies altered their production behavior to reduce antimicrobial use in reaction to the purchasing policy. However, the fiscal estimate for the bill notes that because of a price caveat in the current language, the legislation could have a limited impact (Wisconsin Fiscal Estimate, 2005). The caveat states that the purchasing policy only requires state agencies to purchase the alternative meat “if there is a reasonable similarity between the quality, quantity, availability, and prices” to the current meat supply. The current language is vague and would have little impact unless the bill more precisely defined the parameters of cost.

Changing the legislative wording to remove the “similar price” caveat (or specifying acceptable ranges for alternative meat prices) could be very costly to the state, farmers, and consumers. However, for a meat-purchasing preference policy to significantly impact and reduce antimicrobial usage in the state, the price clause must be removed or altered. Our analysis and financial cost estimates below assume that the current price caveat would be removed if a bill similar to Assembly Bill 837 were reintroduced in Wisconsin.

¹³ For a full list of supporters and opponents of the California bill, see http://info.sen.ca.gov/pub/09-10/bill/sen/sb_0401-0450/sb_416_cfa_20090602_164813_sen_floor.html.

We expect that this proposal will have varying impacts on state agencies, farms, producers, consumers, and other industries.

Costs Incurred by the State

Estimating the importance of antibiotics as feed additives and growth promoters in animal production is vital for determining the potential cost of implementing preferential meat-purchasing policies. The use of subtherapeutic levels of antimicrobials in animal production is common. According to a report by the Animal and Plant Health Inspection Service (2000), more than 83 percent of animal feedlots administered at least one type of antimicrobial to cattle in feed or water for prophylaxis or to promote growth. Therefore, legislation that encourages or mandates that producers limit the use of subtherapeutic antimicrobials will result in short-term increases in costs for producers and, subsequently, for state agencies, schools, and other institutions who purchase the meat products.¹⁴

The University of Wisconsin System operates four food service entities at Madison, Milwaukee, Platteville, and Stout. The other campus food operations are contracted through for-profit food service providers. If the price clause in the Assembly Bill 837 is removed and the university system is required to purchase food produced without subtherapeutic levels of antimicrobials, the purchase costs for meat may increase from 20 to 50 percent, according to the bill's fiscal note (Wisconsin Fiscal Estimate, 2005). For example, the University of Wisconsin–Madison campus purchases 42,000 pounds of hamburger patties per year for its residence halls at \$2.87 per pound (Brinkmeier, 2010). According to Doug Wubben at the University of Wisconsin-Madison Center for Integrated Agricultural Systems (2010), the available antimicrobial-free hamburger patty supplier, Davis Mountains, charges \$3.94 per pound of hamburger patties. If the university were required to purchase all of its hamburger patties for the residence halls at the higher price, it would incur an additional yearly cost of approximately \$45,000 (a 37 percent increase), with additional expenses incurred for hamburger patties served at campus sites other than residence halls.¹⁵

The fiscal note for Wisconsin Assembly Bill 837 (2005) lists prices for the university's bulk meat purchases and compares these to available antimicrobial-free meat prices. For example, in 2005, the university system purchased bulk pork chops at \$1.78 on average, while the replacement antimicrobial-free meat cost

¹⁴ Producers might not pass on all of the higher production costs to consumers; therefore, the price transfer from producers to consumers would likely not be a 1:1 ratio. For instance, as food prices rise, consumers might shift their purchasing toward substitute goods that have a lower cost.

¹⁵ This estimate assumes that the same amount is purchased at the higher price and represents the largest possible price increase. In making these estimates we recognize that consumer demand for hamburger may decrease and consumers may find substitute products; therefore, the total cost increase would be reduced.

\$2.75 per pound. The fiscal note estimates that the price of chicken quarters produced without subtherapeutic levels of antibiotics is nearly double the price of the regular meat supply. The Wisconsin fiscal note estimates that the cost to the university for switching all meat to products not produced with subtherapeutic antimicrobials would exceed \$1.6 million a year. The fiscal note associated with Maine's legislation (2005) estimates a much higher yearly additional cost for the University of Maine System to switch meat products. The fiscal note estimates that the Maine University System would incur an additional cost of \$2.4 million. The fiscal note also mentions that because Maine dining services are self-supporting, students and others who purchase meat at the campuses would pay for increased meat costs; the increase in meat price could translate into an 11 percent increase in the cost of student meal plans.

The fiscal note attached to the original Maine bill (2005) also estimated potential costs to the state if other non-university state agencies switched to products that were not produced with subtherapeutic levels of antimicrobials. The document states that the antimicrobial-free ground beef available from the current Maine supplier is three times more costly per pound (\$4.18) than the ground beef supply in use, which costs \$1.27-1.56 per pound. Maine's state institutions (not including the public university systems) purchase 81,616 pounds of meat per year. At this quantity, the higher price would result in the state incurring an additional cost of approximately \$230,000 a year for ground beef only (estimated in 2010 dollars). Comparatively, the University of Wisconsin System purchases 22,810 pounds of ground beef for their residence halls at a price of \$1.91 per pound (Brinkmeier, 2010). Using Maine's antimicrobial-free ground beef price of \$4.18 per pound, the University of Wisconsin residence halls could incur an additional \$41,970 per year if they replaced their ground beef products. This price is more than double the current yearly ground beef expenditures.

Under a meat-purchasing preference policy, public school districts would face additional costs if they were required to purchase meat products produced without antibiotics. For example, the Chilton School District purchases 720 pounds of beef per month for 1,000 students at \$2.05 per pound in bulk (Wubben, 2010). If this district switched to antibiotic-free ground beef products at Maine's estimated \$4.18 per pound, the school district would incur an additional cost of more than \$13,000 per school year.

Even though a purchasing preference bill would result in additional immediate costs to the state, recently introduced federal legislation could provide additional funding for Wisconsin schools to improve the quality of their school lunches (Healthy, Hunger-Free Kids Act of 2010). According to this act, schools would receive a performance-based increase in the federal reimbursement rate of school lunches to help provide healthier meals. Wisconsin schools could enter a federal

grant competition to establish programs to increase the quantity of organic foods provided to school children. Organic meat products are produced without the use of subtherapeutic levels of antibiotics, and therefore this grant program could provide a way for Wisconsin schools to comply with a meat-purchasing preference policy at lower costs.

Mandating meat-purchasing preferences would present additional costs to the state. However, if a percentage of the total meat purchased was mandated to come from state suppliers, purchasing preference policies could help strengthen the Wisconsin agricultural industry by providing a greater demand for state-produced food. Steven Deller of the Department of Agricultural and Applied Economics at the University of Wisconsin-Madison estimated that for every \$100,000 of new sales of local food, 2.2 jobs are created and \$77,000 of income is brought in to the state (Mackin, 2010). For example, Wisconsin Assembly Bill 782 introduced in 2009 would require state entities that receive funding from the state and have food expenditures over \$25,000 per year (including school districts, child care providers, and hospitals) to spend 10 percent of their food expenditures on food products that are “grown, processed, packaged, and distributed in the state” by the year 2020.

Impact on Wisconsin Farms and Producers

In a statement on Assembly Bill 837, the University of Wisconsin System (2010) says that there is probably not sufficient antimicrobial-free meat product available in the market to meet campus food service needs. Similarly, the fiscal note associated with Maine’s bill (Maine, 2005) mentions that Maine’s state meat supplier did not generate enough meat produced without subtherapeutic levels of antibiotics to properly supply all state facilities and schools. The potential market impact for smaller farms that produce meat without subtherapeutic antibiotics in Wisconsin could be significant if state entities were required to purchase large quantities. Initially, increases in demand for meat from organic farms and other farms not using subtherapeutic antibiotics would be substantial, especially if Wisconsin adopted an immediate, mandatory compliance bill. However, this demand might taper as other Wisconsin meat producers adapted their facilities and procedures to remain competitive for state agency business. A meat-purchasing preference bill for Wisconsin could be phased in over five years, as proposed in California (2009). This phase-in would reduce the immediate, substantial demand on farms that do not use subtherapeutic antibiotics.

Adoption of a meat-purchasing preference policy may encourage some producers to modify their farming and production behavior to compete for state institution and school district meat sales. However, adapting production methods to eliminate subtherapeutic antimicrobial usage would be costly, especially for large-scale farms. Therefore, some Wisconsin meat producers might choose to continue

subtherapeutic antimicrobial use to keep production costs down and remain competitive in the national market.¹⁶

Meat industries and farms that utilize subtherapeutic antimicrobial treatments may react to a purchasing preference policy by adjusting general management, herd size, and sanitation issues to reduce on-farm contamination. In general, risks of disease are intensified by increased scale of animal husbandry because large numbers of susceptible host animals facilitate the exchange of bacterial pathogens, including antimicrobial resistant bacteria (Silbergeld et al., 2008). For example, the burden of the 1986 ban on over-the-counter in-feed antimicrobials in Sweden was smallest on farms that followed good hygiene practices (Hayes et al., 2002). Producers may have to compensate for reduced antimicrobial use by adopting alternative techniques for livestock treatment and different methods of preventing bacterial contamination (such as reducing herd size or increasing housing space). These changes in production techniques may burden large-scale meat industries more than small-scale producers, especially in the short term.

Costs Incurred by Producers

The benefits of using antimicrobial agents for growth promotion in food-animals are related to the reduced costs of production, including reduced time to achieve harvest weight and reduced animal husbandry costs. However, these benefits tend to be more substantial when hygiene is poor (Hayes et al., 2002). In 1999, Denmark enacted a ban on antibiotic feed additives. A 2003 study by the WHO found that Denmark reduced overall use of antimicrobials in agriculture by nearly half and experienced a reduction in resistant bacteria in animals without causing significant price increases or compromising food safety. Similar bans have been enforced in all European Union countries since 2006. According to the WHO report, the total estimated cost of removing antimicrobial growth promoters from pigs was estimated to be \$1.04 per pig, resulting in a 1 percent increase in production costs. Moreover, the WHO concluded that any additional costs associated with reduced antimicrobial use might be partially offset by the benefits of increased consumer confidence in, and demand for, meat products produced without antimicrobials.

A study on the use of subtherapeutic antibiotics in U.S. pig production estimated a higher cost to producers as a result of a theoretical ban (Borsen et al., 2002). The researchers estimated an average additional production cost of \$2.75 per hog, which would result in a total increase of around 2 percent for hog production.

¹⁶ If most Wisconsin producers sell a majority of their meat to non-state agencies or out-of-state buyers, Wisconsin legislation alone would likely not be effective in reducing the levels of antibiotic-resistant bacteria because industries would have no incentive to modify production methods.

This study also noted that short-run annual costs associated with reducing antimicrobials in animal production would be significantly greater than long-run costs. Alternatively, reducing antimicrobial usage in food-animal production may decrease costs associated with the management of animal waste and further reduce risk of contamination of crops intended for human consumption that are fertilized by the waste (Codex Committee on Food Hygiene, 2001).

Impact on Consumers

Increased meat production costs would be passed to consumers. A study by Hayes et al. (1999) estimated that a ban on antibiotic use in hogs in the United States would result in a retail price increase by 5 cents per pound (7 cents in 2010 dollars), which resulted in a yearly aggregate cost of \$748 million for all consumers, or approximately \$977 million in 2010 dollars (Bureau of Labor Statistics, 2010). A study by the National Research Council in 1999 also measured higher prices passed to consumers resulting from restricting antimicrobial use in food-animals. The estimated change in price consumers could pay for poultry was the lowest, averaging 1.3 to 2.6 cents per pound, with pork and beef prices increasing by 6 cents per pound. For all meat products combined, the National Research Council estimated total consumer costs to increase \$1.2 billion to \$2.5 billion per year, based on estimated increased per-capita costs ranging from \$4.82 to \$9.72 per year. However, this study also noted that these costs must be balanced with the potential savings from a reduced number antibiotic resistant infections in and subsequent lowered medical treatment costs in people.

Impact on Other Industries

Pharmaceutical companies and other retailers have financial incentives to market antimicrobial products to animal producers who will not support meat-purchasing preference legislation. According to a USDA report by Mathews (2001), 90 percent of all antimicrobial drugs used in the United States are used as prophylactics or growth promoters; this level of antimicrobial use results in approximately \$600 million spent on antimicrobial feed additives per year. Moreover, some veterinarians derive income from pharmaceutical sales, including the sale of antimicrobials for food-animals. It is uncertain if profit motives directly affect antimicrobial prescription practices of veterinarians in Wisconsin. Many farmers can purchase certain antibiotics over the counter and do not need a veterinarian prescription. In attempts to prevent profit-driven antimicrobial prescriptions, other countries, like Denmark, have placed restrictions on the degree that veterinarians can profit from antimicrobial prescriptions (McEwen & Fedorka-Cray, 2002).

Many professional organizations recommend limiting or discontinuing the use of antibiotics in animals, including the WHO, the Institute of Medicine of the National Academy of Sciences, and the Alliance for the Prudent Use

of Antibiotics. Moreover, several professional associations for veterinary medicine such as the American Veterinary Medical Association and the American Association of Swine Practitioners agree on the goal of reducing antibiotic usage in animals, but differ on the means to achieve this goal (U.S. GAO, 2004). It is likely that these organizations would support legislation to reduce the usage of subtherapeutic antimicrobials in food production, but it is uncertain if these organizations would support a preferential meat-purchasing policy mandated by the state. A substantial number of organizations and industries oppose the legislation adopted or proposed by Maine and California. Commercial farming industries and pharmaceutical companies would likely be opposed to this type of legislation because of the significant burdens and costs associated with altering production methods or the loss of sales of antimicrobial products.

Conclusion

This report examined Wisconsin's food safety system and offered two proposals to reduce the incidence of bacterial contamination in food production. Both of these proposals would preserve Wisconsin's position as a national model by addressing challenges in food safety.

Increasing the use of GAP/GHP policies would promote safer food-production practices. Implementation of GAP/GHP would reduce the prevalence of food-borne bacteria and reduce the risk of contamination that consumers face. Utilizing more stringent GAP/GHP standards would also improve the value of Wisconsin products, open new markets for smaller producers, and help all of the state's producers continue a legacy of growing high quality fruit and vegetables.

Implementing a purchasing preference policy for meat raised without subtherapeutic levels of antibiotics may reduce the prevalence of antibiotic-resistant bacteria on Wisconsin farms if food-animal industries were to modify their behavior by discontinuing subtherapeutic antimicrobial usage. Therefore, this policy would contribute to maintaining the health of human and animal populations. In addition, a meat-purchasing preference policy may increase demand for meat produced without subtherapeutic levels of antibiotics.

Wisconsin can continue its history of leadership on agricultural policy by enacting policies in response to producers' adoption of new agricultural techniques and to federal changes to food safety laws. We recommend further consideration of these proposals to reduce the risk of bacterial contamination and to improve food safety in Wisconsin.

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Appendix A: Causes of Risks

Bacteria in food and antimicrobial-resistant bacteria can create risks to human health.

Health Hazards: Short-Term Risks to Health

Food can cause immediate illness as a result of bacteria, viruses, parasites, molds, toxins, contaminants, and allergens. Of these, three bacterial pathogens cause a majority of outbreaks: *E. Coli*, *Listeria*, and *Salmonella* (Iowa State University Extension, 2010).

E. Coli: Escherichia Coli 0157:H7 is a type of bacteria commonly found in cattle feces. According to the Centers for Disease Control and Prevention, as many as 20,400 cases of *E. coli* infection and 500 deaths from *E. coli* disease occur annually in the United States.

Salmonella: Salmonellosis is the most common food-borne illness, but it is usually preventable. Foods like eggs, raw milk, and all raw foods of animal origin may carry *salmonella*. The *salmonella* family includes about 2,000 different strains of bacteria, but only ten strains cause most reported *salmonella* infections.

Listeria: Listeria Fruits and vegetables can become contaminated with *Listeria monocytogenes* through soil, water, or fertilizer. Seemingly healthy animals can carry *Listeria* and contaminate foods of animal origin, such as meats and dairy products. In the United States, an estimated 2,000 persons become seriously ill with listeriosis each year, leading to around 500 deaths annually.

The Healthiness of Food: Long-Term Risks to Health

Humans are not only susceptible to the pathogens listed above, but to antimicrobial-resistant infections as well. People come in contact with microbes that are resistant to antibiotics when they consume meat and plant products that are contaminated with animal fecal material (DeWaal & Barlow, 2004). Runoff waste from large farms is also a source of antimicrobial resistant bacteria recovered from food crops grown in soils irrigated with contaminated water (Silbergeld et al., 2008). Increasing antimicrobial resistance is a food safety problem because the development of resistant bacteria may cause more people to become ill from eating contaminated food. For example, when healthy persons consume food contaminated with a few ordinary *Salmonella* bacteria, they normally do not become ill because the usual bacteria in their intestines are able to combat the infection. However, even very small amounts of antibiotic-

resistant *Salmonella* in food can cause severe illness in otherwise healthy individuals, and subsequently result in a greater number of infections in the general population, which may lead to more severe illness, increased hospital visits, and higher mortality rates (Angulo et al., 2004). Moreover, antimicrobial resistance can lead to decreased efficacy of current therapeutic options.

In food-animal production, it is often more efficient to treat groups of animals rather than individuals with antimicrobial agents by medicating feed or water (McEwen & Fedorka-Cray, 2002). Additionally, cattle and chickens are often fed low doses (subtherapeutic) of antimicrobials in their feed to promote rapid growth. This type of antimicrobial use is also termed “nontherapeutic” or “prophylactic.” One source of antimicrobial-resistance emerges from the subtherapeutic use of antimicrobials in food-animals and the consequent transfer of resistant bacterial genes among food-animals, animal products, and the surrounding environment. Fecal waste from agricultural animals is often spread as a fertilizer. Waterways contaminated by food-animal waste through fertilizer run-off may facilitate the spread of antimicrobial resistant bacteria in the food system (McEwen & Fedorka-Cray, 2002; Silbergeld et al., 2008).

The safety of the food supply is maintained through careful attention to contamination prevention and control at each step in the production, processing, and distribution system. Food safety is a product of protective measures ranging from regular hand washing to refrigeration, from barn cleanliness to rapid food recalls. While substantial research is available on the pathogens and substances that introduce health risks into the food supply, we have incomplete knowledge on where contamination originates. Reporting systems vary widely by state (Greenhalgh, 2010). Wisconsin has higher numbers of outbreaks than some states, but this could well be the product of a more thorough reporting system. The non-profit Center for Science in the Public Interest (2010) has called for an increase in state reporting systems in order to improve the information available on origin and spread of dangerous food. As advancements in agricultural techniques make large-scale production more feasible, food products can travel farther. This means that potential contaminants are more easily spread across large geographic areas.

Appendix B: Timeline for Reporting of *E. Coli* Cases

This timeline quoted from the Centers for Disease Control and Prevention (2006a) describes the stages and timing from consumption of contaminated food through identification of a patient as part of an outbreak.

To find cases in an outbreak of *E. coli* O157 infections, public health laboratories perform a kind of “DNA fingerprinting” on *E. coli* O157 laboratory samples. Investigators determine whether the “DNA fingerprint” pattern of *E. coli* O157 bacteria from one patient is the same as that from other patients in the outbreak and from the contaminated food. Bacteria with the same “DNA fingerprint” are likely to come from the same source. Public health officials conduct intensive investigations, including interviews with ill people, to determine if people whose infecting bacteria match by “DNA fingerprinting” are part of a common source outbreak.

A series of events occurs between the time a patient is infected and the time public health officials can determine that the patient is part of an outbreak. This means that there will be a delay between the start of illness and confirmation that a patient is part of an outbreak. Public health officials work hard to speed up the process as much as possible. The timeline is as follows:

1. **Incubation time:** The time from eating the contaminated food to the beginning of symptoms. For *E. coli* O157, this is typically 3-4 days.
2. **Time to treatment:** The time from the first symptom until the person seeks medical care, when a diarrhea sample is collected for laboratory testing. This time lag may be 1-5 days.
3. **Time to diagnosis:** The time from when a person gives a sample to when *E. coli* O157 is obtained from it in a laboratory. This may be 1-3 days from the time the sample is received in the laboratory.
4. **Sample shipping time:** The time required to ship the *E. coli* O157 bacteria from the laboratory to the state public health authorities that will perform “DNA fingerprinting”. This may take 0-7 days depending on transportation arrangements within a state and the distance between the clinical laboratory and public health department.
5. **Time to “DNA fingerprinting”:** The time required for the state public health authorities to perform “DNA fingerprinting” on the *E. coli* O157 and compare it with the outbreak pattern. Ideally this can be accomplished in 1 day. However, many public health laboratories have limited staff and space, and experience multiple emergencies at the same time. Thus, the process may take 1-4 days.

The time from the beginning of the patient’s illness to the confirmation that he or she was part of an outbreak is typically about 2-3 weeks. Case counts in the midst of an outbreak investigation must be interpreted within this context.