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The Food Industry Center
UNIVERSITY OF MINNESOTA

Working Paper 04-01
The Food Industry Center
University of Minnesota
Printed Copy \$25.50

**DOES FOOD SAFETY CONFLICT
WITH FOOD SECURITY?
THE SAFE CONSUMPTION OF FOOD**

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January 2004

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The work was sponsored by The Food Industry Center, University of Minnesota, 317 Classroom Office Building, 1994 Buford Avenue, St. Paul, Minnesota 55108-6040, USA. The Food Industry Center is an Alfred P. Sloan Foundation Industry Study Center.

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ABSTRACT

This paper concludes by saying no, food safety and security reinforce each other. It combines food safety and food security into the concept of “safe food consumption.” Unsafe food consumption occurs when food contains known substances that lead to short or long term illness or death (botulism) and suspect substances that are believed to lead to delayed diseases (pesticides). It also occurs when hunger or over eating contribute to long-term illness and shorter life expectancy.

The costs of illnesses related to obesity are six to fourteen times as great as the costs attributed to food born illnesses caused by microbial contamination. The implications for health care costs due to Type 2 Diabetes alone make this a health crisis in slow motion.

Obesity is not a problem unique to westernized countries. On balance, 8.2 percent of the world’s population is obese while 5.8 percent are underweight. The magnitude of these dual food and diet issues clearly poses new challenges for global food policy and food security.

Unsafe food eaten by poor people jeopardizes their health as surely as too little food. These concepts operate in tandem. Hunger and being overweight often co-exist in the same household which jeopardizes ones ability to earn income and in turn, purchase healthy food. Safe food consumption is compatible and consistent with food security in all parts of the world.

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DOES FOOD SAFETY CONFLICT WITH FOOD SECURITY? THE SAFE CONSUMPTION OF FOOD

This paper will conclude by saying no, food safety and security reinforce each other. But first some new definitions are in order. Food is an edible substance that will nourish the human body, provide it with energy for normal activities and maintain or enhance its healthy state. Safe food consumption makes a person feel good in the short and the long run. It does not make you sick! This defines food by its fundamental purpose and how well it performs rather than its physical characteristics like grams of nutrients, production technology like organically grown, or implied freedom from pathogens due to being “triple washed” or irradiated. Safe food consumption focuses on a simple but comprehensive performance standards. That is, eating or drinking food facilitates the health and growth of the human body.

When consuming food does not achieve this end it cannot be defined as safe food consumption. Unsafe food consumption constitutes ingesting a fast acting poison or a set of substances that lead to debilitating diseases over a long period of time. Some dangerous food substances are well known (e.g. wild mushrooms); some are unknowable until long after the damage is done (e.g. pesticides). At the University of Minnesota there was a course in food safety titled “The Dose Makes the Poison.” This is an incredibly insightful title. There are many substances in this world that are harmful to human health; some of them are in the foods we eat every day. In minute quantities they are not harmful. However, there is some quantity of exposure that tips the scales; at some dose they become dangerous. That dose differs by the size, genetics and immunities of individuals, but at some critical level food that carries potentially harmful substances interferes with nourishment and, therefore, diminishes health, normal cell

growth and bodily functions. This is consistent with the educational slogans of many nutritionists who say, “there are no bad foods, just bad diets.” Rather than focus on substances in food that make it unsafe, this *new definition focuses on the safe consumption of food*. It requires the acceptance of some risk, an acknowledgement that quantity matters, and responsibility for the dietary context and needs of people in various situations and cultures.

In this paper the boundaries of the safe food consumption and public policies that might alleviate unsafe consumption will be explored. The implications for food security, which also now has two distinctly different definitions, will be considered as a function of how well food and diets enhance the health and well-being of people. Unsafe consumption of food and subsequent health issues include:

- 1) Foods that contain microbes in sufficient quantities to lead to short term illness or death such as botulism or *E.coli* O157 H7.
- 2) Foods that contain substances that are believed to pose potential long term health problems such as pesticide residues or bovine spongiform encephalopathy.
- 3) Foods that have unknown, but suspected, health consequences such as foods that have been genetically modified or irradiated.
- 4) Foods that contain nutrients or ingredients such as trans-fats or simple sugars, that, when consumed in excess quantities lead to chronic diseases such as diabetes, cancer, and cardiovascular heart disease.

Microorganisms and the safe consumption of food

Traditionally, those who study and regulate food safety concentrate their research and policy analysis on microbial contamination. Table 1 lists the ten top most well known and well

tracked pathogens leading to food-borne illnesses in the U.S. The Centers for Disease Control (CDC) estimates that these pathogens represent only about twenty percent of the cases and hospitalizations and less than half of the deaths actually caused by food-borne pathogens. Norwalk-like viruses generate the largest number of reported cases of food-borne illnesses per year, *Toxoplasma gondii* (a parasite) generates the largest number of hospitalizations, and campylobacter causes the largest number of deaths (Ropeik & Gray). Identifying a hazardous organism and the probability of it causing a food-borne illness and then deciding on an acceptable level of risk in order to set food safety standards involves long and arduous study and debate. The tasks involve science, politics, culture, and international consensus. It is one thing to say that regulations should be based on science. It is quite another to agree on the scientific evidence and how to apply it. Two organizations intimately involved in setting standards for food safety as it relates to microbial contamination are the International Commission on Microbiological Specifications for Foods (ICMSF) and Codex Alimentarius. The former is a group of scientists that assess risk and establish protocol for setting food safety objectives and standards;¹ the later is the consensus building arm of the United Nations that identifies international standards for food safety. Figure 1 depicts the complex decision process proposed by ICMSF to manage food safety and prevent as many food-borne illness as possible (ICMSF, p5).

Hazard is the measurable probability that contamination exists in an amount sufficient to cause illness. This can generally be determined by laboratory tests. Risk refers to the hazard plus the consequences that consumers will suffer when they are subjected to the hazard and become ill. To assess the risk, one needs to know the probability that people of various ages and lifestyles will become ill when exposed to various hazards in their food. This involves epidemiological

¹ A Commission of the International Union of Microbiological Societies.

data that track outbreaks of food-borne illnesses and identifies their cause. Tracking such data requires some nationally agreed upon reporting system by doctors and hospitals. A national food safety management system involves identifying the hazards, the risks and the magnitude of the problem for consumers' health (van Schothorst, 1998). It also involves identifying the magnitude of the problem for a nations' economy.

In assessing the magnitude of the problem one looks at the pain and suffering caused to individuals, the costs of health care and the value of lost productivity due to illness and death. The value of these losses is a measure of the benefits that that could be derived from eliminating, or drastically reducing, the food-borne illness. Finding policies and practices that can be used to ensure the safe consumption food involves assessing the public and private consequences of food-borne illnesses. Yes, there is a "public good" aspect to the safe consumption of food. The benefits are non-rival and non-exclusive. That is, the safety, health, trust and security that one person enjoys from safe food consumption is not diminished by a neighbor's enjoyment of the same. In fact, the more healthy people there are in a society, the better off everyone is. There is a positive (negative) spillover effect from having a community of healthy (unhealthy) people. The role of governments and food industry executives is to discover the right combination of policies and practices that will work in a given economy and culture in order to deliver the optimum level of safe food consumption.

Figure 2 presents a continuum of types of policies that may be implemented to match various levels of hazard and risk to appropriate public policies (Kinsey). Moving from left to right along the continuum the characteristics of food and their accompanying hazards and risks increase from disappointment in the taste or convenience to acute and then chronic illnesses and even death. At the left end, policies and practices that focus on consumer information are

adequate. Here the characteristics of food under consideration are largely private goods and the characteristics are transparent or can be readily made so with labeling and education. Moving to the right, food characteristics become increasingly non-transparent and the consequences of consumption more uncertain. Pesticide residues are believed to make people ill, even cause cancer, but there is little proof. Food additives, antibiotics, fats, and hormones may lead to illness in some people at some dose, but the amounts are uncertain. As you move to the far right, there are some contaminants that cause violent illnesses or immediate death (e.g. E.coli 0157H7 or botulism); they are not transparent and the only way to effectively deal with them is to eliminate them from the food supply. In the center of the continuum appropriate practices and policies are less clear. Here is where scientists and policy makers alike debate the standards for products and processes in order to protect people from harm and provide some regulatory clout to monitor and penalize offending food providers. Examples in the middle of the continuum might include pesticides, trans-fatty acids and antibiotics in animal feed. Designing public and private policies to maximize the potential for good health and longevity is a balancing act between the cost of regulation and/or building safety into a product and the benefits of healthy, productive people who might be incapacitated from a food-borne illness.

Which food safety problems are consumers most concerned about? In surveys taken by the Food Marketing Institute (FMI) consumers have ranked microbes and the chance of being exposed to microbes higher than pesticides since 1995 (Figure 3, FMI). The concern about microbes leads to concern about food handling practices and spoiled food. With consumers relying on many strangers' hands to prepare their food, its freshness and how it is handled is a proxy for fear of microbes and the illnesses they can cause. Between 1995 and 1997 when FMI

asked consumers to identify the most serious health hazards related to food they consistently ranked microbes first, pesticides second, antibiotics third and biotechnology last (FMI).

Acute Illnesses and Costs

The cost of food-borne illnesses caused by microbes is estimated at \$6.9 to \$33 billion per year (USDA). This includes direct medical costs as well as lost wages, productivity and estimated value of life lost to premature death. Figure 4 illustrates the types of costs and considerations included in the calculations. It makes one realize the vast number and types of costs involved in food-borne illnesses and the great loss to individuals and society. The numbers quoted herein do not even begin to include the costs to the food industry or to the public health sector.

Dollar estimates have a wide range partly because food-borne illnesses are vastly under reported both by consumers and doctors. Most consumers who become ill think they have the flu and though violently ill in many cases, they recover in a few days and go on about their lives. A few, less fortunate, die. There are an estimated 2654 to 5000 deaths per year in the U.S. attributable to food-borne illness.

These acute and temporary illnesses are largely preventable by good manufacturing practices (GMP) and good handling practices in the supply chain starting at the farm and ending with the consumer. Many studies have been conducted to estimate the cost of diminishing these illnesses. They typically find that safe handling and storage practices cost less than the resulting benefits. For example, Ollinger and Mueller found that a Pathogen Reduction/Hazard Analysis and Critical Control Point programs in meat and poultry plants would cost plants about 1.1 percent of their total costs adding about 1.2 cents to a pound of beef, 0.7 cents to a pound of pork

and 0.4 cents to a pound of poultry. The benefits were estimated to range from \$1.9 to \$171.8 billion annually. This translates into a benefit value (in terms of health cost savings) that is at least two times the cost to the industry. Lakhani estimated that the benefit cost ratio from reducing salmonella enteritidis in shell eggs by refrigeration to be 0.65, 3.56, 2.56 and 8.87 depending on the method used to calculate the benefits. Since three of four estimates are greater than one, measures to reduce salmonella caused food-borne illness was deemed to be worthwhile. A third example comes from an analysis of adopting HACCP programs in meat and poultry slaughterhouses in the U.S. using a Social Accounting Matrix (SAM) method (Golan et al.). This provides a comprehensive picture of how well an entire economy fairs as a result investments in food safety. Their model showed that for every dollar saved by preventing a premature death from a food-borne illness, there is an economy-wide gain of \$1.92. They also found that for every dollar of household income saved due to lower medical expenses the whole economy lost \$0.27. On the cost side, they found that for every dollar spent implementing a HACCP program, the economy gained \$0.66 leading to a net increase in production output of \$10.63 billion, an increase in factor payments of \$6.08 billion, and an increase in household income of \$9.38 billion (in 1993 dollars) not considering the benefits from reduced work-loss days.

Antle points out that studies indicate that consumers are willing to pay more for safer food than the losses that might incur due to illness using the cost-of-illness approach to measuring the benefits of safer food. In the real world consumers demonstrate their willingness to pay at the supermarket when they buy organic food to avoid pesticides. They pay for safer food at tax time when they support government agencies such as the Food and Drug Administration, Departments of Agriculture, and state health departments who test, inspect and

regulate the processes by which food is produced, labeled and sold. In most developed countries consumers have come to expect their government to ensure safe food and they are generally willing to pay for it.

Chronic and Long Term Illnesses

Food-borne illnesses due to microbes are well known; cause and effect is relatively well established. The relationship between food, diet and chronic diseases and delayed illnesses is less well established. For example, there is virtually no known link between pesticide residue in food and cancer even though most believe it to exist. Many believe that there is a link between antibiotic resistance in humans and eating meat from animals that have been routinely fed antibiotics to keep them healthy and fast growing. Some fear that feeding growth hormones to cattle or genetically modifying plants and animals will lead to human illness though there is little to no scientific evidence to support these suspicions. The link between spongiform encephalopathy (mad cow disease) and variant creutzfeldt Jakob disease (vcjd) was confirmed using transgenic mice in 1999 (Acheson) but the time lag between exposure and illness is several years making epidemiological evidence in humans hard to establish. Many chronic and long term illnesses suspected of being linked to unsafe food consumption are difficult to trace to the source due to time lags and intervening genetic and environmental factors.

On the other hand, Type 2 diabetes (Knowler et.al.) and twenty to forty percent of cancers in U.S. adults (Calle, et al) are known to be linked to obesity and are rising at a near epidemic rate. The rapid rise in obesity in the U.S. and around the world leads us to redefine the boundaries of safe food consumption. With obesity, individual food characteristics are not the problem but the quantity eaten – the total dose is. Just as it is the quantity of microbes in the

food that leads to acute illness, it is the quantity of calories in the diet, relative to energy expended by the body, that leads to diabetes and other obesity related complications.

In 1999, an estimated sixty-one percent of adults and thirteen percent of children and adolescents in the U.S. were overweight. Adult obesity has doubled since 1980 to 24 percent of the population and overweight adolescents have tripled since 1980 to 15 percent. (FDA; CDC). Overweight children ages 2-5 have increased from 7 to 10 percent since 1994. Eight percent of U.S. adults (Knowler et al.) and about four percent of children in America have Type 2 diabetes. The rise in this non-inherited, Type 2 diabetes in children is of great concern since diabetes is a chronic disease that absorbs over ten percent of all health care dollars. It is growing along with obesity in children; it is a health care disaster in slow motion. Obese children with diabetes will absorb an increasing amount of our health care dollars for as long as they live. Figure 5 illustrates the higher cost of all types of health care for people with body mass indexes (BMI)² more than 30 or 35 (obese and morbidly obese). One study estimated that health care for overweight and obese people costs an average of thirty-seven percent more than for people of normal weight, adding an average of \$732 to the annual medical bills of every American (Connolly). This places the problem of obesity squarely in the realm of a public good (bad) and one that will take a concerted effort on the part of many agents in society to correct.

What does it cost for obesity related diseases in the U.S.? Total and indirect costs were estimated to be \$93 billion (Connolly) to \$117 billion in 2000 (FDA). Some public officials are quoting \$230 billion (T. Thompson, Secretary of Health and Human Services). Table 2 compares the costs of microbial related food-borne illnesses to health care costs related to obesity. By any comparison you want to select, the cost of obesity is much larger than the costs of microbial

² BMI is measured by dividing an individual's weight in kilograms by height in meters squared (weight in pounds by the height in inches squared x 703). BMI of 20-25 is considered healthy. BMI over 25 is considered overweight and over 30 is obese.

contamination. The \$117 billion for obesity health care costs is 1.1 percent of the 2000 U.S. gross domestic product of \$10,236.9 billion (Ec. Report to Pres.) and as indicated on Figure 4, these costs do not include all the costs to industry or the public health sector.

Obesity and related health problems are not just an American problem. Obesity is being documented around the world and ironically, it exists side by side with poverty and undernourishment. Haddad points out that in seventy-eight developing countries under and over-nutrition coexist with 5 percent of the population being obese and seven percent being underweight. Often this condition exists in the same household (Garrett and Ruel). Around the world it is estimated that fifty-three percent of children and eighteen percent of the world's population is undernourished but in Australia, twenty percent of children are overweight or obese. Likewise for seventeen percent of Malaysian boys, eight percent of Malaysian girls, and seven percent of urban Chinese children (IFIC). Most of the undernourished in 1998 were in India, China and Sub-Saharan Africa (FAO). Figure 6 shows that the global prevalence of both underweight and obese adults in 2000 (WHO). On balance 8.2 percent are obese and 5.8 percent are underweight, only a 2.4 percentage point difference. In developing countries more than two thirds as many people are obese as are undernourished. In the poorest countries, twenty percent as many people are obese as are undernourished. The magnitude of these dual food and diet issues clearly poses new challenges for global food policy and food security.

Food Security and Safe Food Consumption

There are now two distinct definitions of food security. The traditional and well known definition refers to having enough food to maintain growth and health. The USDA defines food security as having access to enough food, at all times, for an active, healthy life (Nord). The new

definition of food security refers to the production, processing and distribution chain being secure from bio terrorists so that food cannot be *deliberately* contaminated with an agent that would make people ill, cause death, or economic chaos. Arguably, if food is produced according to good farming and manufacturing practices the chances of it being compromised by a deliberate terrorist is small but certainly not zero. And, government agencies such as FDA and USDA in the U.S. are actively studying this new hazard, developing educational programs, and taking precautionary measures to minimize the impact of any such event. Consequently, for purposes of this discussion I will focus on the traditional definition of food security.

The proposition herein is that food security is not jeopardized by activities designed to improve the safety of food consumption. People who do not have enough to eat and are undernourished obviously benefit from more food availability, but food that makes them ill is not helpful. Making the food delivered to all people as safe and nourishing as possible should be a paramount criteria for delivering nourishment at all levels of income and caloric intake. Arguments that focus on the inability of developing countries to meet the food safety standards of countries that are potential importers and, therefore, should be allowed a lower food safety standard, end up jeopardizing the health of people everywhere, including the poor in a potentially exporting, developing nation. It is well known that hunger and poverty go together, everywhere. If resources are focused on helping poor nations to meet health and safety standards for their citizens and to be able to participate in world commerce, their incomes should rise, and food security problems can start to be alleviated.

Even in the United States, almost eleven percent, or 11.5 million households, were not food secure in 2001. One-third of them were hungry at some time. They spent an average of fifteen percent of their income on food per year, per person compared to 5.5 percent for food

secure households (Nord). Several studies have shown that people, especially women, in these food insecure households are also overweight (Olson; Townsend). Women between ages 19 and 55 who were in food insecure households were found to be significantly more likely to be overweight. They consumed ninety-one calories more per day than women in food secure households (Bastiotis & Lino). Based on the standard conversion of calories to body weight of 100 calories per day leading to 10 pounds of weight gained (or lost) per year, it is easy to see how those who are food insecure are more likely to be overweight. It begs the question of whether cheaper food has more calories and fat than more expensive foods, but it is a common observation that inexpensive and fast food is often higher in calories than higher priced food or food that is prepared slowly from scratch. The point is that poverty, hunger and being overweight exist simultaneously and that being overweight jeopardizes health which jeopardizes the ability to work and be productive which in turn jeopardizes one's ability to earn income to buy healthy food. Therefore, safe consumption of food is compatible and consistent with food security in all parts of the world. The goal of food consumption is to nourish the body and improve health over a lifetime. If the food available is not safe or its consumption does not improve health, it does not contribute to food security.

In conclusion I quote Lawrence Haddad, "The diet transition in the developing world seems to be accelerating. It seems to be a transition towards an increased burden of chronic disease. It is increasing human costs in terms of mortality and the disease burdens. It is increasing the economic costs in terms of lower productivity. It is driven by changing preferences fuelled by growing incomes, changing relative prices, urbanization; by changing options fuelled by changes in food technology and changes in the food distribution systems, and by a legacy of low birth weights from the previous generation." He posits that there is a good

case for public investment in efforts to influence the diet transition towards increasingly healthy outcomes. To do so will require us to address the dual issues of over and under consumption of food.

Food safety does not jeopardize food security; both act together to enhance human health. New definitions of both food safety and food security broaden the scope of concern and provide applied economists and policy makers with ever new challenges in analysis and public policy.

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Tables

Table 1 Reported Food-Borne Illnesses From Bacteria, Viruses, or Parasites – United States

	Cases/Year (millions)	Hospitalization	Deaths
Norwalk-like virus	9.200	20,000	124
Campylobacter (1/1000 cases lead to Guillain-Barre syndrome)	2.00	10,500	1000
Salmonella	1.413*	15,600	550
Clostridium perfringens	0.250	50	10
Giardia lamblia	.200	500	1
Escherichia coli	.173	2,800	80
Listeria monocytogenes	.003*	2,500	500
Taxoplasma gondii	.113	22,600	375
Shigella	.090	1,250	14
Total Reported	13.440	75,896	2,654
CDC Estimated Total Incidents	76.00	325,000	5,000

Source: Ropeik and Gray, 2002

* Adjusted from data on

<http://www.ers.usda.gov/data/foodborneillness/>

Table 2 Costs Associated with the Unsafe Consumption of Food leading to Obesity: U.S., 2000

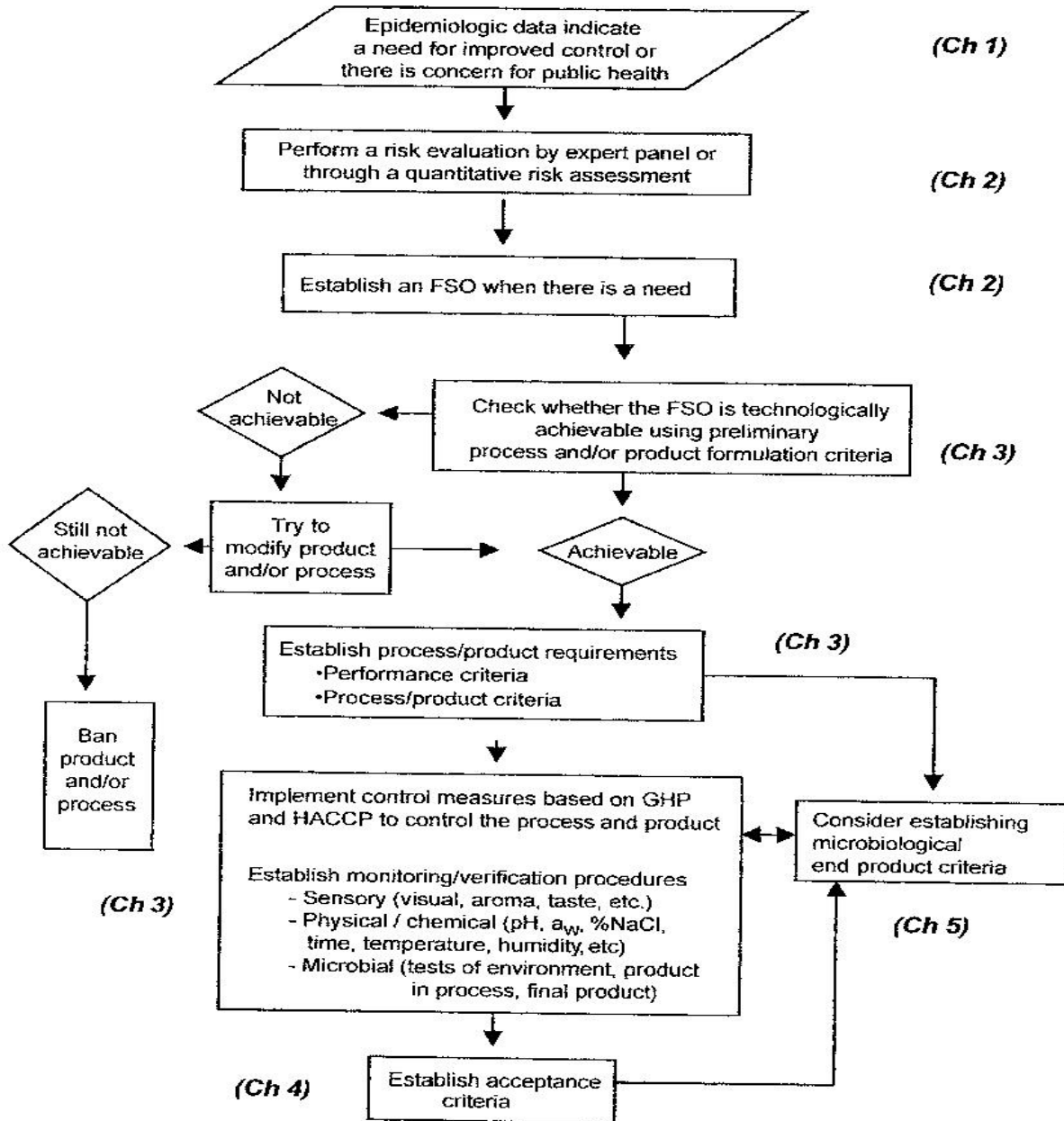
Type of Health Care Problem	Health Care Costs	Deaths
Microbial Contamination	\$6.9* - \$37 billion (includes losses due to death)	2,654-5,000
Obesity Related Diseases	\$93 - \$230 billion (direct and indirect costs)	300,000
Diabetes (10% of all health care costs)	\$132 billion** (direct and indirect costs)	
Ratio of Obesity Costs to Microbial Costs	Low: $93/6.9 = 13.5$ High: $230/37 = 6.2$	$300/5 = 60$
Ratio of Diabetes Costs to Microbial Costs	Low: $132/37 = 3.5$ High: $132/6.9 = 19.1$	

* Estimated cost based on four types of microbes: Campylobactor, Salmonella, E.-coli, Listeria
<http://www.ers.usda.gov>

** 2003 update on www.cdc.gov/diabetes/pubs/estimates.htm

Figures

Figure 1 Food Safety Management Scheme



(Figures in parentheses refer to chapters)

Source: ICSMF, p. 5

Figure 2 Food Safety Policy Depends on Nature of the Risk

Continuum of Food Attributes

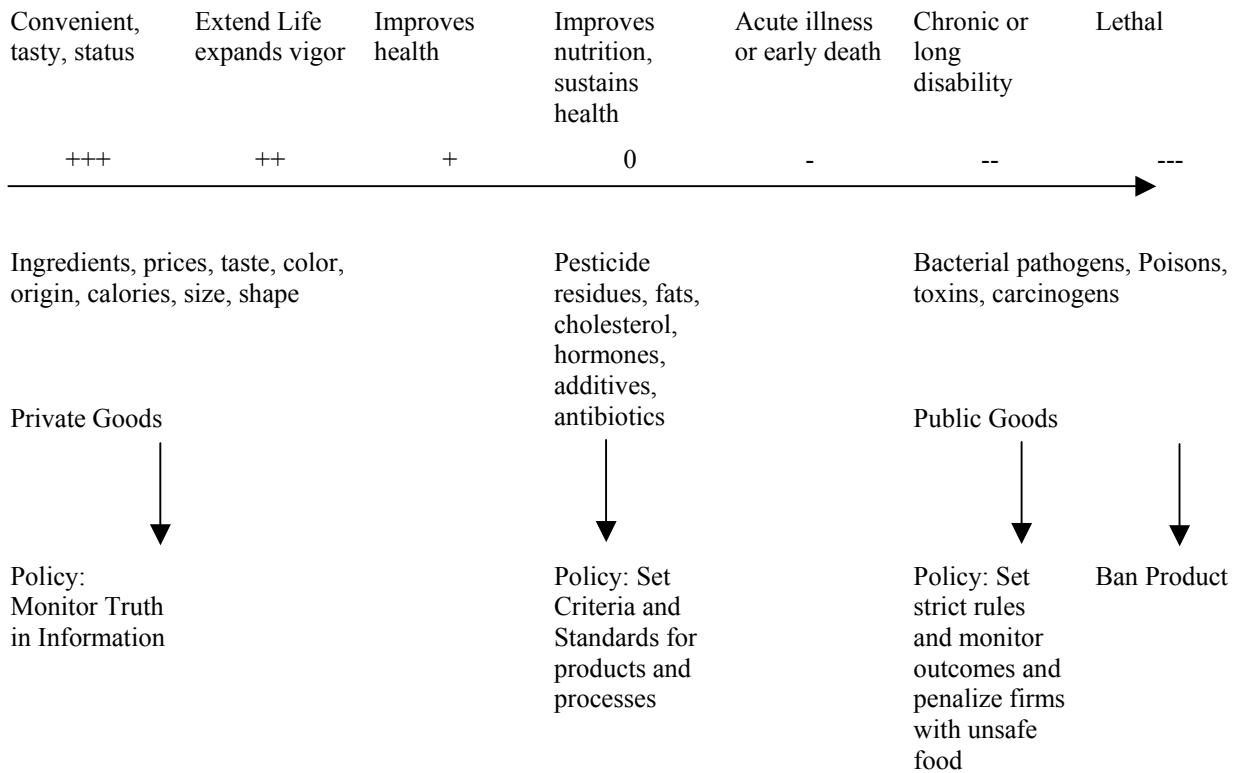
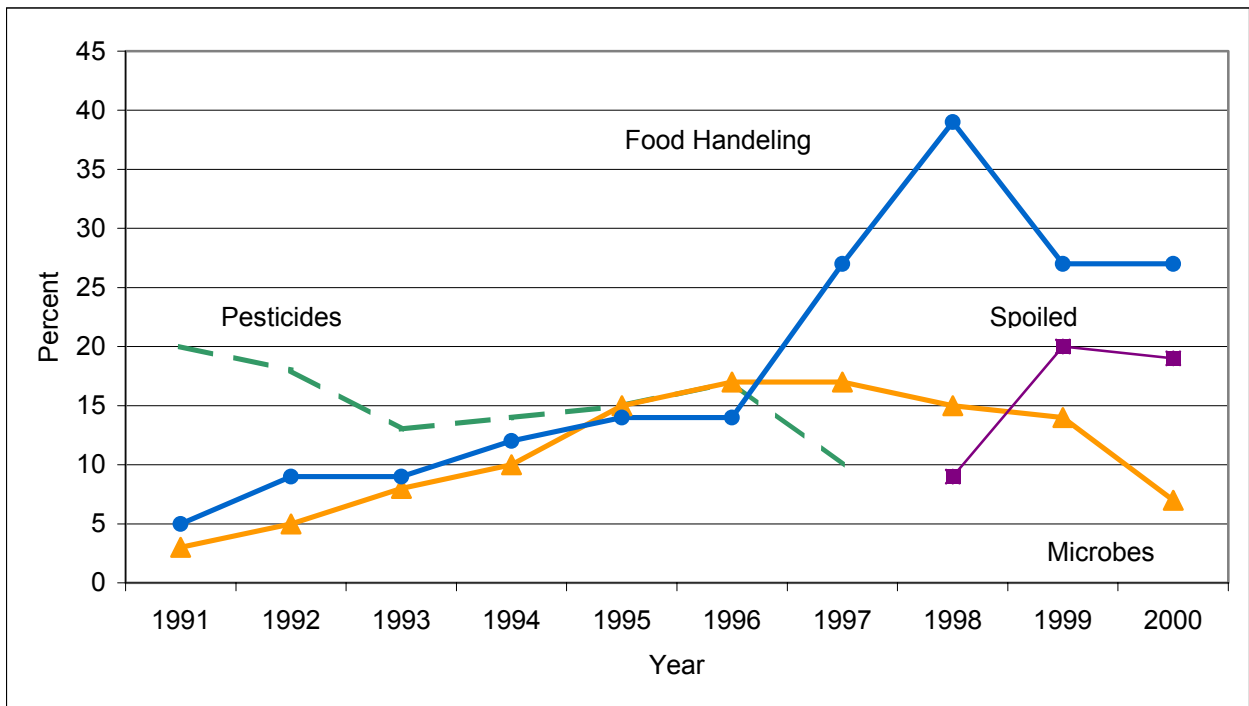


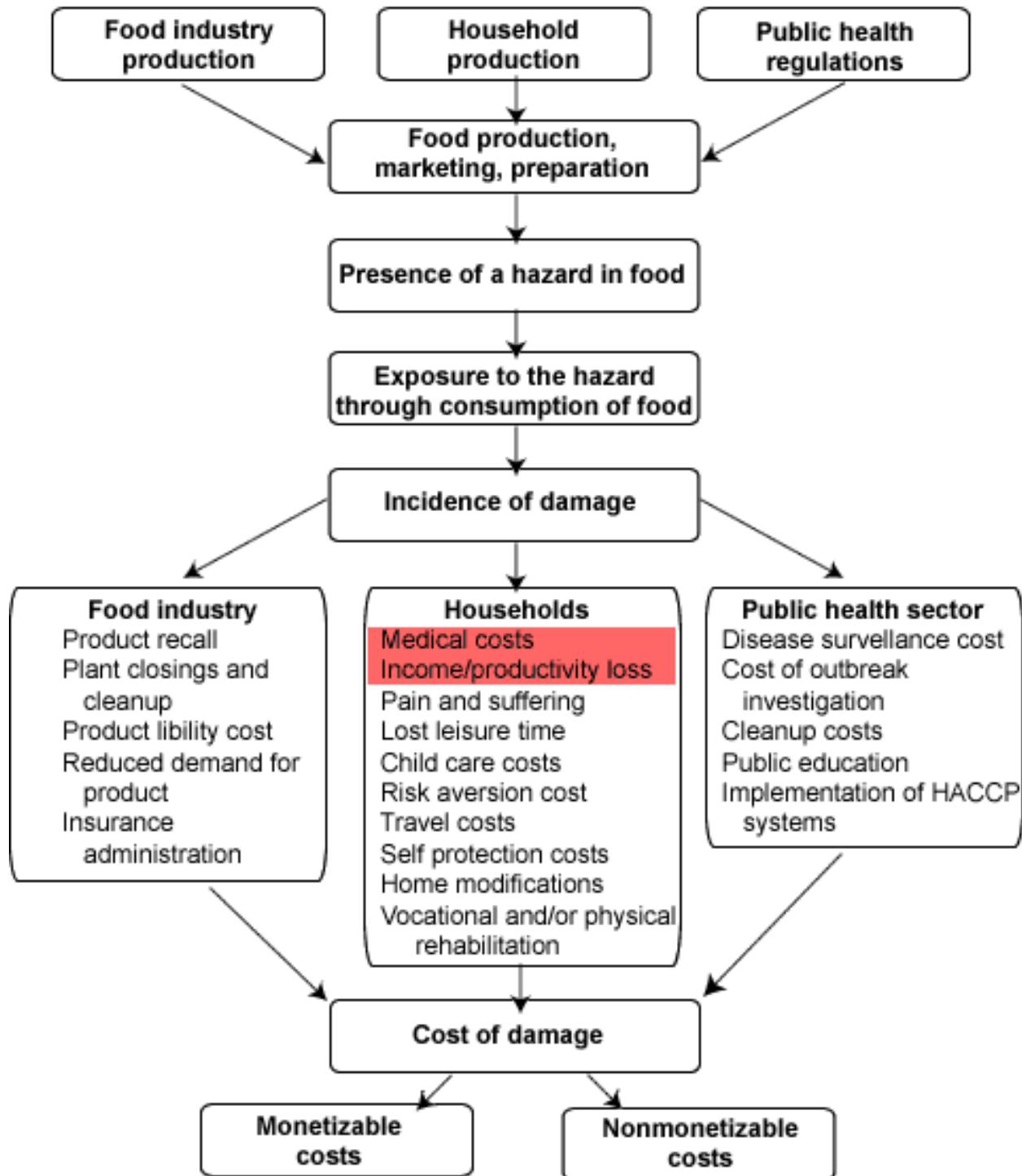
Figure 3 U.S. Consumers Perceptions of Food Safety Problems



Source: Consumer Trends, Food Marketing Institute, Washington D.C. 1993-2000

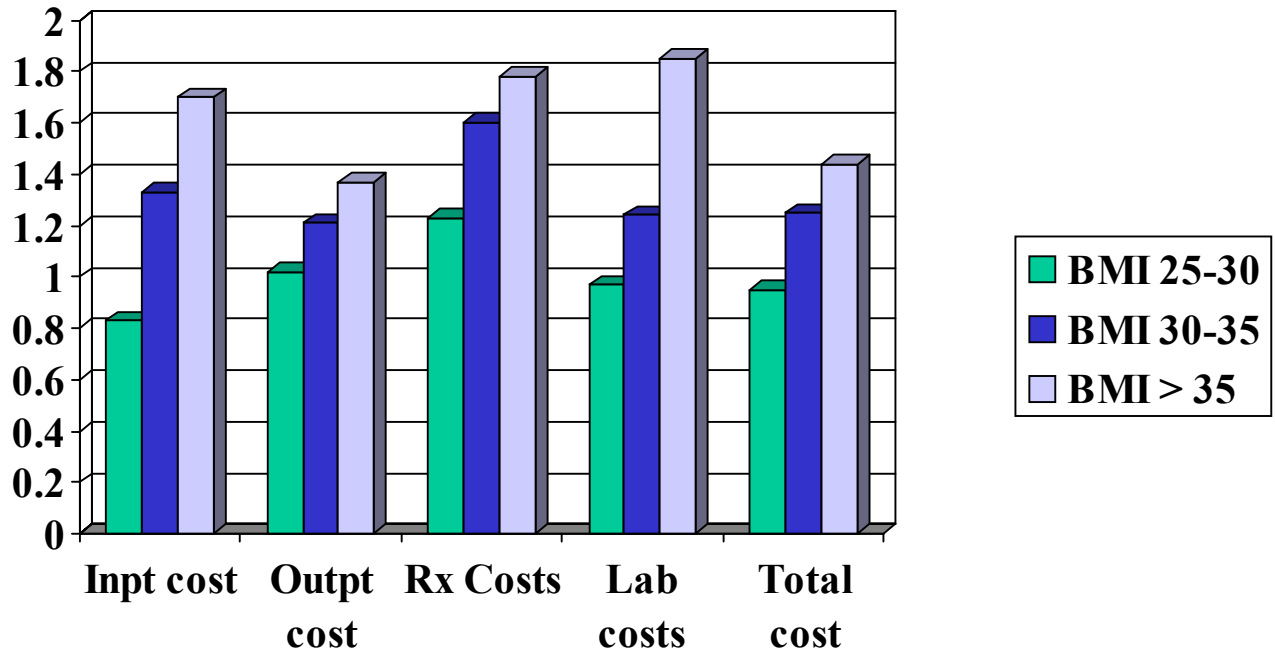
Figure 4

Foodborne disease, exposure, and types of costs



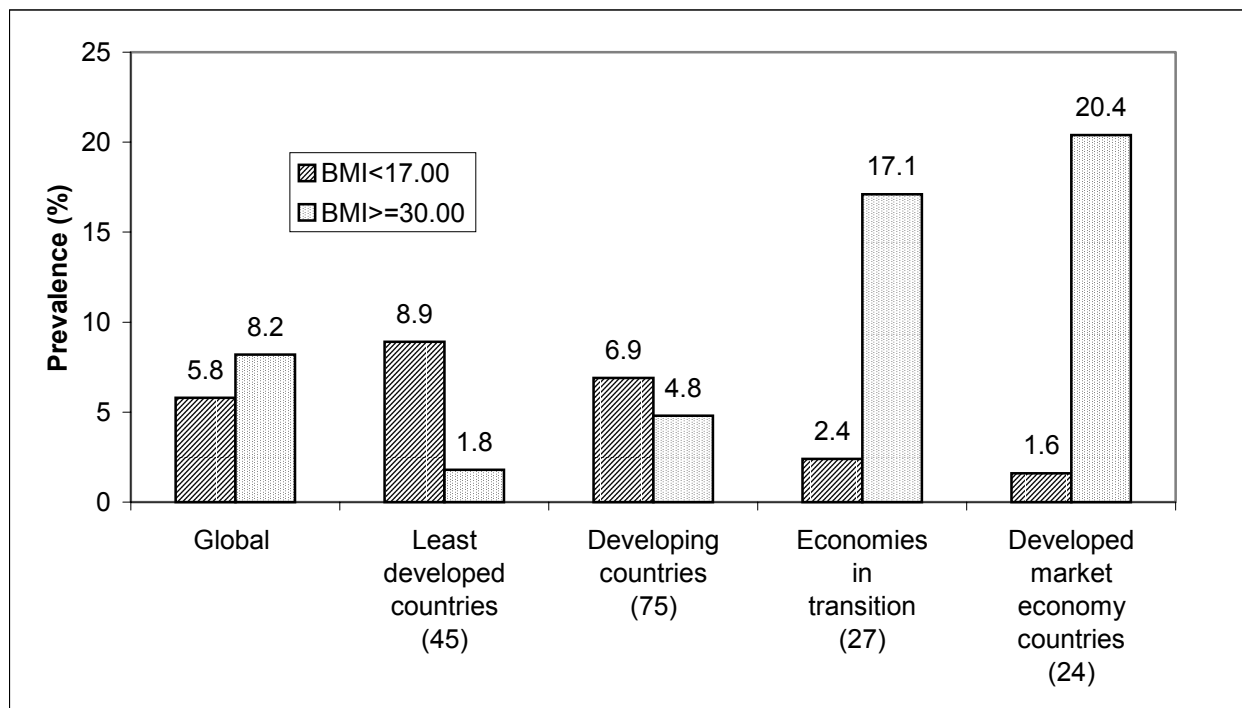
Source: <http://www.ers.usda.gov/Briefing/FoodborneDisease/gallery/FoodborneDiseas.gif>

Figure 5 Health Care Costs Index by Body Mass Index



Source: American Journal of Managed Care, 4:3, 141.145, 1998

Figure 6 Global Prevalence of Underweight and Obesity in Adults for Year 2000, by Level of Development



Source: Nutrition for Health and Development, A Global Agenda for Combating Malnutrition, WHO 2000.
www.who.int/nut/db_bmi.htm.