

## Economics of foodborne disease: overview

( <http://www.ers.usda.gov/briefing/FoodborneDisease/overview.htm> )

Foodborne diseases are caused by ingesting bacteria, fungi, parasites, or viruses through contaminated food or water or through person-to-person contact. Each year, microbial pathogens cause as many as 76 million cases of foodborne disease, 325,000 hospitalizations, and 5,200 deaths. ERS has estimated the annual U.S. economic costs incurred for the major bacterial pathogens: *E. coli* O157 and other STECs (and associated hemolytic uremic syndrome), *Campylobacter* (and associated Guillain-Barré syndrome), *Listeria monocytogenes*, and *Salmonella*. In addition, ERS has developed outcome trees for the illnesses caused by those pathogens, showing the costs incurred and the number of cases by the severity of disease: no physician visit, physician visit, hospitalization, premature death, and chronic complications.

ERS research estimates that the costs associated with five major pathogens alone amount to at least \$6.9 billion annually. These costs include medical costs, productivity losses from missed work, and an estimate of the value of premature deaths, but exclude travel costs in obtaining medical care, time lost from work in caring for sick children, and so forth. ERS recently adjusted its procedure to account for the age distribution of those taken ill.

ERS also evaluated the pros and cons of the two principal methods (cost-of-illness and willingness-to-pay) of estimating the monetary benefits of reducing foodborne diseases as well as pros and cons of three other methods (risk-risk analysis, health-health analysis, and cost-effectiveness analysis) that try to avoid assigning a monetary value to human life and health.

### **Foodborne diseases are acute and chronic**

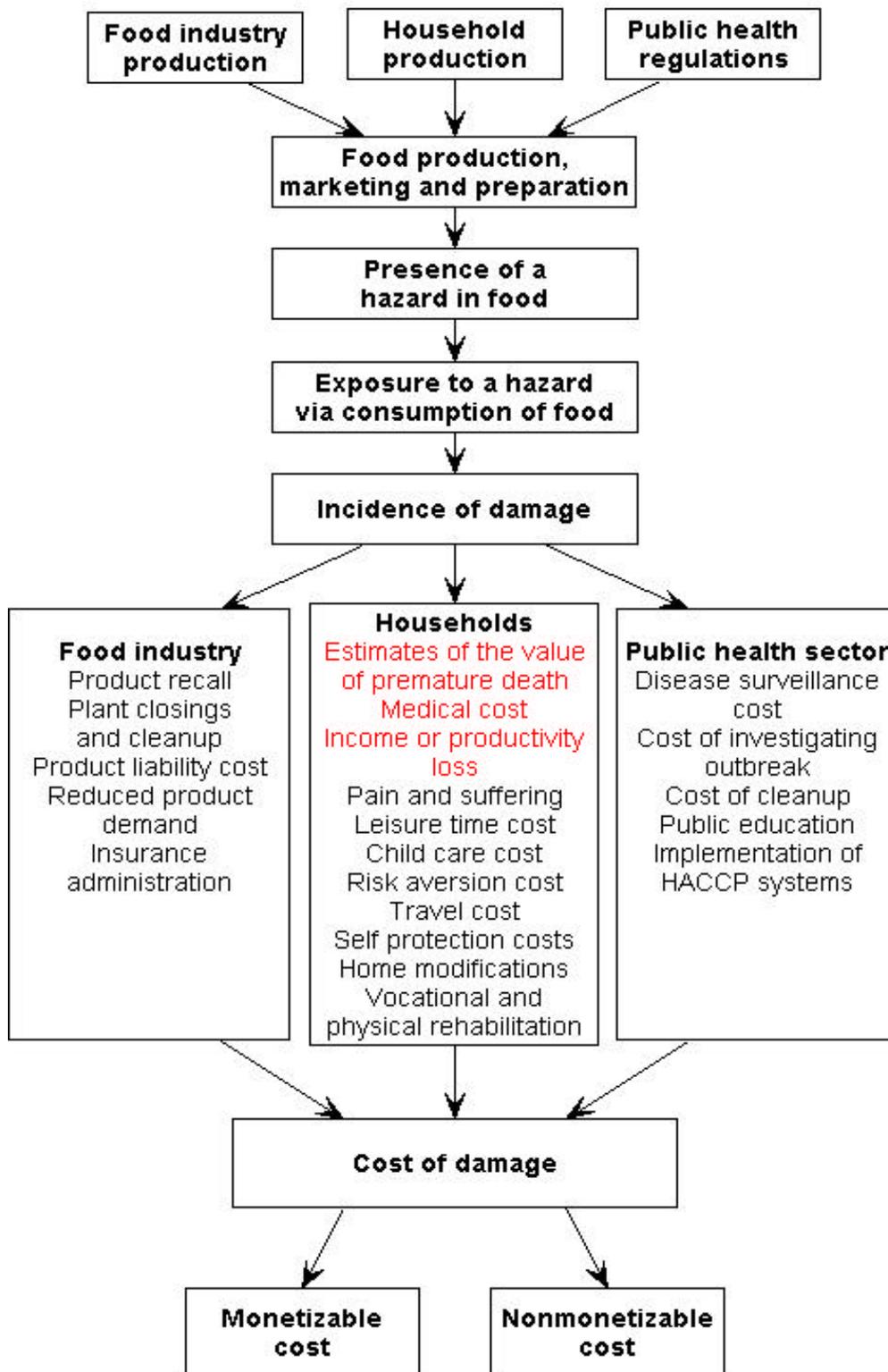
Pathogens are disease-causing microorganisms that include bacteria, fungi, parasites, and viruses. Most cases of foodborne illnesses are classified as "acute." These are usually self-limiting and of short duration, although they can range from mild to severe. Gastrointestinal problems and vomiting are common acute symptoms of many foodborne illnesses. Deaths from acute foodborne illnesses, while rare, are more likely to occur in the very young, the elderly, or patients with compromised immune systems (such as those suffering from AIDS and cancer). However, the U.S. Food and Drug Administration (FDA) estimates that 2 to 3 percent of all acute cases develop secondary long-term illnesses, called "chronic sequelae."

Chronic sequelae of foodborne illness can occur in any part of the body and subsequently affect the joints, nervous system, kidneys, or heart. These chronic illnesses may afflict the patients for the remainder of their lives or result in premature death. For example, *Campylobacter* infections are estimated to be responsible for 20 to 40 percent of Guillain-Barré syndrome (GBS) cases (a major cause of paralysis unrelated to trauma) in the United States. About 1.5 percent of *E. coli* O157:H7 disease patients develop hemolytic uremic syndrome (HUS), which usually involves red blood cell destruction, kidney failure, and neurological complications, such as seizures and strokes.

### **Exposure to pathogens and associated costs**

Actions by the food industry, consumers, and the public health sector all influence how food is produced, marketed, prepared, and consumed. These actions influence the probability that a food item contains pathogens. People who consume contaminated food have some probability of becoming ill. Foodborne illness generates costs that are borne by the food industry, households whose members become ill, or the public health sector.

## Foodborne disease, exposure, and types of costs



ERS estimates of the costs of foodborne disease are limited to estimating the impact on households. Thus, ERS is underestimating the impact of foodborne illness on society. In fact, we estimate only the medical costs, productivity losses, and the value associated with premature death for a selected number of microbial foodborne health risks. The ERS cost estimates undervalue the household's cost of foodborne illness because some costs are omitted, such as travel to obtain medical care, time lost from work caring for sick children, lost leisure time, pain and suffering, and the costs of certain other chronic complications, such as reactive arthritis in the case of *Salmonella*.

## **ERS cost estimation procedures**

ERS cost estimates are calculated from the number of acute and chronic foodborne-illness cases and deaths caused by each pathogen each year. These costs include medical costs, lost productivity costs, other illness-specific costs (such as special education and residential-care costs), and an estimate of the value of premature deaths.

Societal costs have not been estimated for the vast majority of complications associated with foodborne illnesses. The Centers for Disease Control and Prevention estimates that out of a total of 76 million cases of foodborne disease each year in the United States, as many as 62 million cases are of unknown origin. We do, however, cover the following chronic complications in our cost estimates: GBS following *Campylobacter* infections, HUS following *E. coli* O157:H7 infections, and chronic disability or impairment following congenital and newborn infections from *Listeria monocytogenes*.

## **Medical costs**

For each foodborne illness, cases are generally divided into five severity groups:

- those who do not visit a physician,
- those who visit a physician,
- those who are hospitalized,
- those who developed chronic complications, and
- those who die prematurely because of their illness.

For each severity group, medical costs are estimated for physician and hospital services, supplies, medications, and special procedures unique to treating the particular foodborne illnesses. Such costs reflect the number of days/treatments of a medical service, the average cost per service/treatment, and the number of patients receiving such service/treatment.

## **Willingness-to-pay estimates of cost of premature death**

For the 2000 cost estimates, ERS revised the methodology for valuing premature deaths due to foodborne illness. ERS previously assigned all deaths the same value regardless of age at time of death, based on information about the wage premiums for high-risk occupations (the "labor market approach"). Now, the updated cost estimates use information about the age distribution of deaths to adjust this value to account for age at death.

In essence, the labor market approach values the economic cost of premature deaths based on the risk premium revealed by the higher wages paid for dangerous jobs. Under this approach, the value of a statistical life equals \$6.5 million in August 2000 dollars after updating the original 1990 estimate of \$5.0 million to account for inflation. The labor market approach assumes that risk preferences observed in job choices are indicative of risk preferences for food safety.

ERS modified the labor market approach by taking the age distribution of deaths from each pathogen into account, in effect treating the value of life as an annuity paid over the average U.S. life span at an interest rate of 3.0 percent. Following age-adjustment, the assumed cost of each death ranges from \$8.9 million for individuals who died before their first birthday to \$1.7 million for individuals who died at age 85 or older.

Since the five microbial pathogens have different health outcomes for different age groups, adjusting for the age of death raises the cost of some foodborne illnesses and lowers the cost of others. For example, the annual cost of foodborne illnesses caused by *Salmonella* decreases to \$2.2 billion because over two-thirds of the deaths from salmonellosis occur among people over 65 years of age. Adjusting foodborne illness costs for *E. coli* O157:H7 by age at time of death increases the estimates by \$200 million because most deaths are children under the age of five.

## **Productivity losses**

One difficult issue is assigning a value to the productivity losses associated with individuals who become ill and are unable to return to work, or for those illnesses that result in a lifetime of disability (such as prenatal exposure to *Listeria monocytogenes*). ERS currently measures the productivity losses due to nonfatal foodborne illnesses by the value of forgone or lost wages, regardless of whether the lost wages involved a few days missed from work or

a permanent disability that prevented an individual from returning to work. Using the value of lost wages for cases resulting in disability probably understates an individual's willingness to pay to avoid disability because it does not account for the value placed on avoiding pain and suffering. The willingness to pay measure derived from labor market studies that ERS uses to value a premature death is not an appropriate measure of willingness to pay to avoid disability because it measures the higher wages paid to workers to accept a higher risk of premature death, not disability. Methods have been suggested to adjust willingness to pay to reduce the risk of premature death downward to estimate willingness to pay to avoid disability, such as the approach based on measuring "Quality Adjusted Life Years" (QALY). As yet, there is no consensus among economists about how to use these methods to value willingness to pay to avoid the disability, pain, and suffering associated with foodborne illnesses. ERS's conservative estimates of the annual costs due to foodborne illnesses (particularly the chronic conditions associated with *Campylobacter*) would be substantially increased if willingness to pay to avoid disability, pain, and suffering were also taken into account.

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