

9 OCCUPATIONAL AND ENVIRONMENTAL HEALTH

Health protection has been an essential function of public health in the U.S. since 1878, when the U.S. Public Health Service was established, and protection from hazards in occupational and environmental settings is an important element of health protection. Exposures to hazardous agents in the air, water, soil, and food and to physical hazards in the environment are major contributors to illness, disability, and death worldwide. Furthermore, deterioration of environmental conditions in many parts of the world slows sustainable development. In the 20th century the U.S. made significant improvements in occupational and environmental health to ensure clean air and water, a safe food supply, healthy workplaces, and to control or eliminate vector-borne illnesses.

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9.1 OCCUPATIONAL INJURY MORTALITY

HP 2010 Objective 20-1: Reduce deaths from work-related injuries to 3.2 per 100,000 workers aged 16 years and older.

Jefferson County Status: The work-related injury mortality rate for the 13-year period 1990 – 2002 was 1.9 deaths per 100,000 workers.

Deaths due to work-related injuries are often preventable, yet they remain common. In the U.S., occupational fatalities decreased between 1980 and the early 1990s, and then stabilized around 1995 at 4.3 deaths per 100,000 workers. Still, the U.S. Bureau for Labor Statistics (BLS) estimates that there are 5,000 worker deaths every year, and that in the U.S., a worker is injured every 5 seconds and temporarily or permanently disabled every 10 seconds.

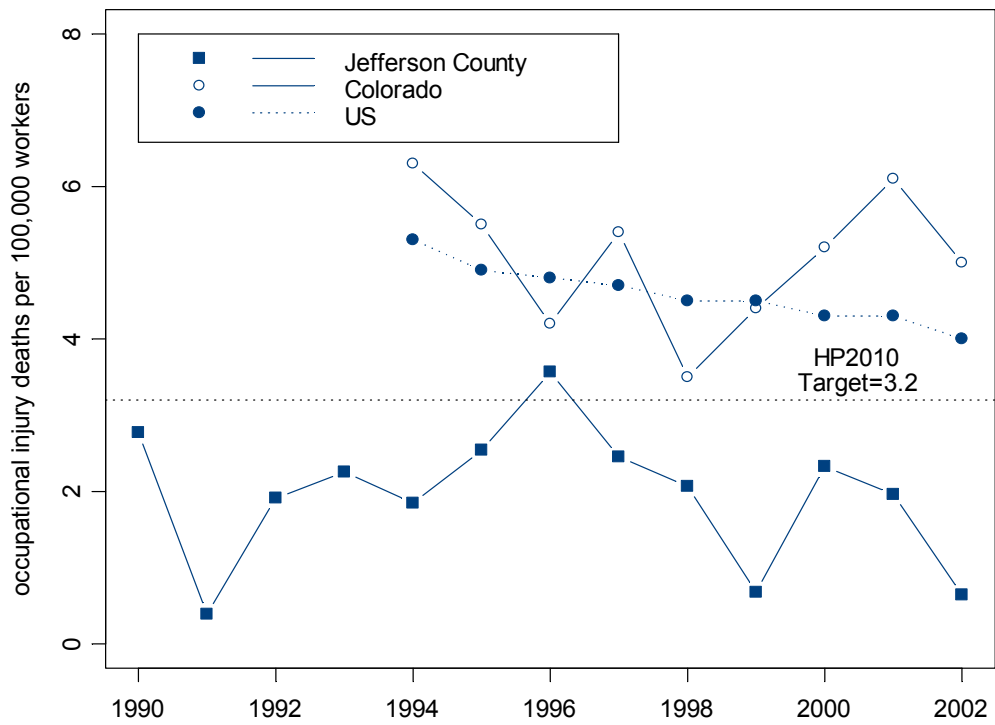
Work-related injuries and illnesses include those occurring while in work-related activities on or off the worksite. Preventing work-related illnesses and injuries is a very active area of research by the National Institute of Occupational Safety and Health and includes evaluative studies of corporate safety and health programs, loss-control programs, engineering controls and educational campaigns to determine impacts on health as well as productivity and long-term operating costs.

The Colorado Department of Public Health and Environment collaborates with the BLS in the annual Census of Fatal Occupational Injuries by extracting occupational fatality data from death certificates.³⁰

Jefferson County Findings

- The occupational injury mortality rate among county residents was highly variable but was well below the national HP 2010 target (Figure 9.1). The county's rates were also well below those of Colorado and the U.S. These estimates must be viewed with caution, however, as the rates are computed based on the workers' residence at the time of death, not the location of death or worksite. Data on worker injuries by location of workplace are not available.

Figure 9.1 Occupational injury mortality, Jefferson County, Colorado and U.S., by year, 1990 – 2002



Source: JCDHE Epidemiology, CDPHE-HSVRD and CDPHE-CFOI

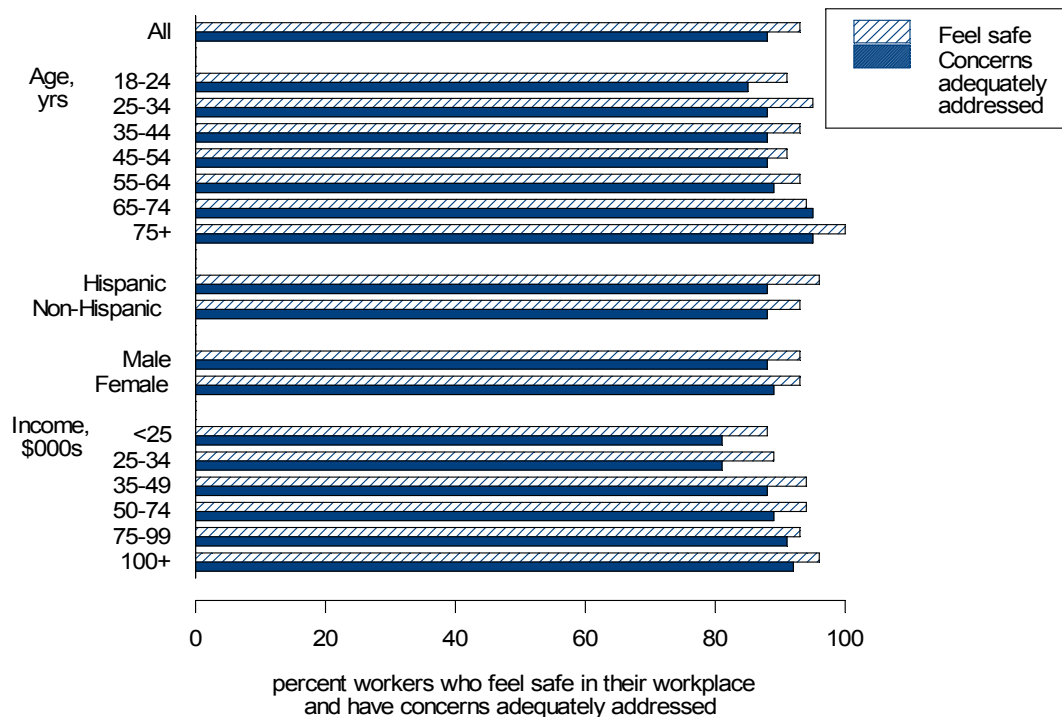
9.2 OCCUPATIONAL SAFETY AND HEALTH

HP 2010 objectives are being developed for improvements in occupational health and safety. They include objectives for reductions in injury and illness due to overexertion and repetitive motion, work-related, noise-induced hearing loss, stress reduction, and homicide and assault. Data for measuring many of these at the national, state and local level are not yet available.

Jefferson County Findings

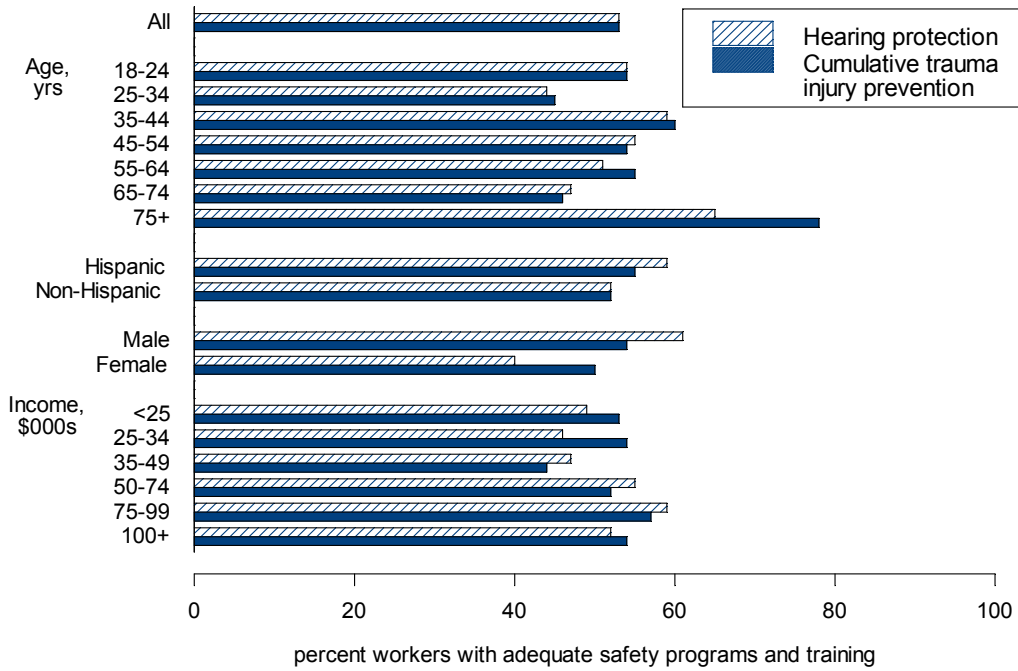
- The 2003 Community Health Survey asked residents who work outside the home about their feelings of safety in the workplace and whether their health and safety concerns were adequately addressed by their employers. More than 90% of all workers (Figure 9.2) responded that they felt safe in their workplace, and 88% responded that their health and safety concerns were adequately addressed. These proportions varied slightly, with workers in the lowest income categories least likely to feel safe and have their concerns addressed in their workplaces.
- Survey respondents were also asked about the development and use of health and safety programs in the workplace, specifically regarding hearing loss protection and prevention of injuries from repetitive motion (Figure 9.3). Only 53% of respondents reported adequate programs for hearing and repetitive injury protection, with some disparities by age and income level of the respondent.

Figure 9.2 Worker safety and adequacy of employers' management of health and safety issues, Jefferson County, by percent, 2003



Source: 2003 Community Health Survey

Figure 9.3 Adequate development and training of worker health and safety programs for hearing protection and trauma prevention, Jefferson County, 2003



Source: 2003 Community Health Survey

9.3 FOODBORNE ILLNESS

HP 2010 Objective 10-1, a through d: Reduce infections caused by:

- *Campylobacter* species to 12.3 cases per 100,000 population,
- *Escherichia coli* O157:H7 to 1.0 case per 100,000 population,
- *Listeria monocytogenes* to 0.25 cases per 100,000 population, and
- *Salmonella* species to 6.8 cases per 100,000 population.

Jefferson County Status: Infection rates among the general population were very close to the targets. Rates among some special populations, such as infants, were much higher than among the general population and the HP 2010 targets.

Foodborne illnesses are caused by ingestion of a food containing or contaminated by a disease-causing agent, one that is usually infectious or toxic in nature. Agents are most commonly biologic, such as viruses, bacteria, or protozoa, or chemical. They may also be allergenic. Every person is at risk of foodborne illness. Foodborne illness is expected to increase in prevalence over time as new pathogens emerge, the food supply becomes increasingly global and the number of people at risk for illness increases due to aging and a compromised capacity to fight disease.

Ensuring the safety of the food supply is the responsibility of numerous agencies at the federal, state and local levels, including the U.S. Department of Agriculture, the Food and Drug Administration, the Centers for Disease Control and Prevention (CDC), and state and local health departments.

The CDC has set targets for reductions in foodborne illnesses for four (4) major pathogens: *Campylobacter* species, *Escherichia coli* (*E. coli*) O157:H7, *Listeria monocytogenes* and *Salmonella* species. Campylobacteriosis, salmonellosis and norovirus infections are the most frequently reported foodborne illnesses. The most common sources of *Campylobacter* infection are raw milk and raw or undercooked chicken. Salmonellosis outbreaks have been related to undercooked or raw eggs, poultry and other meats, un-pasteurized milk and juices and raw, unwashed vegetables. Norovirus infections are growing in frequency in the nation and worldwide as causative agents in community outbreaks and as food- and waterborne illnesses. *E. coli* O157:H7 and *L. monocytogenes* are less commonly reported, but the illnesses associated with them are usually more severe and are sometimes fatal, particularly among infants, children and the elderly. Outbreaks of *E. coli* O157:H7 have been associated with undercooked or raw ground beef, un-pasteurized apple juice and some types of fresh, raw produce. *L. monocytogenes* is often associated with un-pasteurized, raw dairy products or produce.

Shigella species are another group of bacteria that can cause severe enteritis and are associated with outbreaks. Shigellosis is most commonly seen in child care settings among children aged 5 or younger and their caregivers, or others living in crowded conditions, and transmission is usually via the fecal-oral route.

Foodborne and other enteric illnesses are considered to be highly underreported and disease rates may not truly reflect the burden of disease or loss of productivity occurring in a community. This

is because these diseases can be self-limiting in nature, or resolve within a short time without medical intervention. Diseased persons may not visit their health care provider, and those that do may not be able to provide an appropriate sample for laboratory confirmation of an agent.

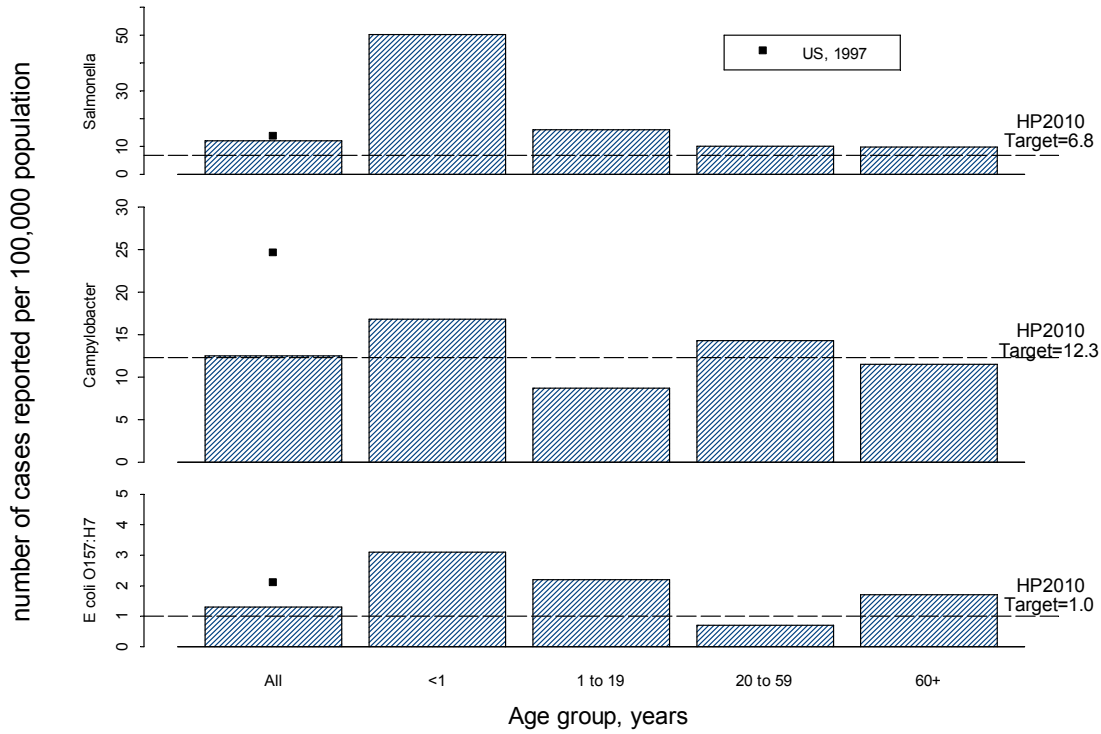
Jefferson County Findings

- Three of the four major foodborne pathogens cited above occurred with regularity in the community, that is, they were endemic (Figure 9.4: *Note* scale differences between graphs). The most commonly reported pathogen of the three reportable food- and waterborne illnesses among all age groups was *Campylobacter* species (middle plot), followed by *Salmonella* and *E. coli* O157:H7. For all ages, the county’s incidence rates were all very close to or identical to the HP 2010 objectives, and the rates for *Campylobacter* and *E. coli* infections were lower than the 1997 national baseline rates.
- Disease incidence varied significantly by age group, with the highest rates for all diseases occurring among infants. In this group the highest disease rate was for salmonellosis, with 50 cases per 100,000 population (Figure 9.4, top).
- Disease incidence varied seasonally, with higher incidence of all gastrointestinal diseases occurring in the warmer months (Figure 9.5).
- Norovirus outbreaks have occurred in several locales and facilities throughout Colorado. In 2004, the county experienced a norovirus outbreak involving 84 persons who became acutely ill after attending a conference at a local hotel.
- Several food- and waterborne illnesses occurred sporadically among county residents in the 6-year period 1998 – 2003 (Table 9.1), including *Listeria monocytogenes* infection. These infections were often attributed to travel outside the county or U.S.

Table 9.1 Reportable Food- or Waterborne Illnesses with 3 or Fewer Occurrences in Jefferson County Residents, 1998 – 2003

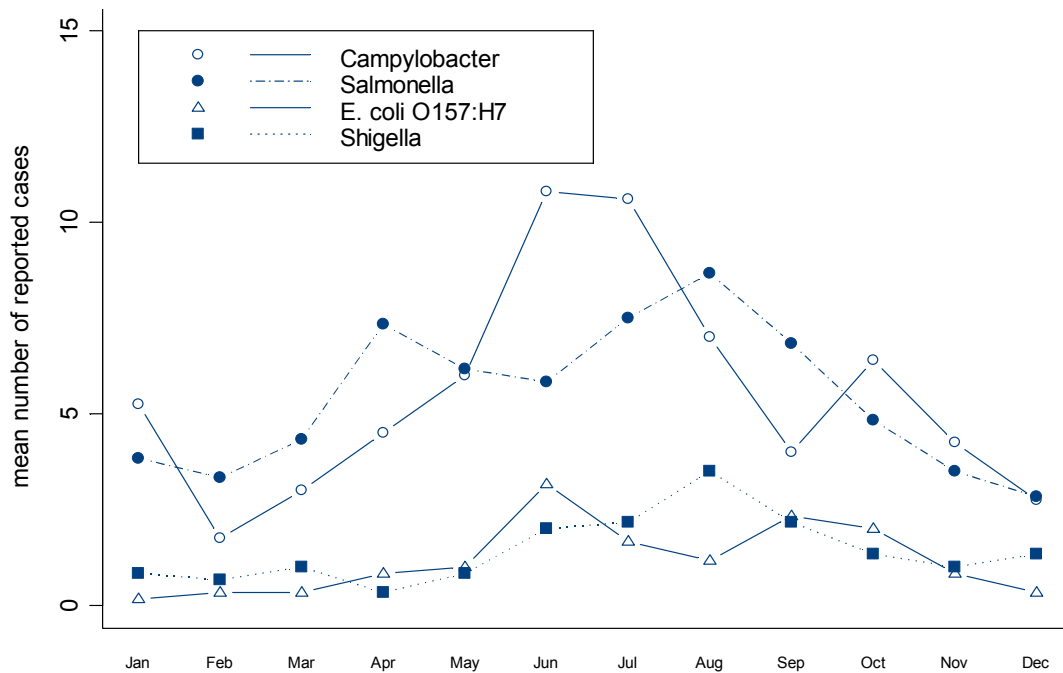
Agent type	Name of agent	Type of disease
Bacterial	<i>Aeromonas veronii</i>	Gastroenteritis
	<i>Vibrio cholera</i>	Cholera gastroenteritis
	<i>Salmonella typhimurium</i>	Typhoid fever
	<i>Listeria monocytogenes</i>	Listeriosis
	<i>Clostridium botulinum</i> toxin	Neurologic toxicosis
	<i>Vibrio parahaemolyticus</i>	Gastroenteritis
	<i>Yersinia enterocolitica</i>	Enterocolitis
Parasitic	Cyclospora cayetanensis	Gastroenteritis
Viral	<i>Hepatitis E virus</i>	Jaundice, gastroenteritis

Figure 9.4 Infection rates of major foodborne diseases, by age group, Jefferson County, 1999 – 2003



Source: JCDHE Epidemiology and CDPHE-DCEED

Figure 9.5 Mean number of reported infections with *Salmonella*, *Campylobacter*, *Shigella* and *E. coli*. O157:H7, by month, Jefferson County, 1998 – 2003



Source: JCDHE Epidemiology and CDPHE-DCEED

9.4 ZOONOSES

Zoonoses are animal borne diseases, that is, the reservoirs of disease exist in animals and the agent can be transmitted from animals to humans. Zoonoses are of special concern for outdoor enthusiasts and for children who may be at increased risk for exposure by interactions with pets, rodents such as prairie dogs, and occasionally ill or injured wildlife. Zoonotic diseases may be viral, bacterial, rickettsial, parasitic or fungal. Primary modes of contact are: direct, such as through scratches or bites, contact with urine or feces, ingestion of contaminated food, or via arthropods such as mosquitoes, fleas or ticks.

Many zoonotic diseases are reportable to public health agencies, although most are believed to be under-reported. In addition, many zoonotic diseases are considered “emerging” among human populations, as they have crossed between species over the past two decades, and have only recently been discovered in humans.

There are no HP 2010 targets specific for zoonotic diseases. With the exception of the West Nile Virus epidemic beginning in 2002, zoonotic infections among county residents have tended to occur only sporadically, with very small numbers of cases over several years. Those agents or diseases that have occurred in the county are described below.

9.4.1 Viral Diseases

9.4.1.1 Rabies Encephalitis

Rabies virus causes acute encephalitis in warm-blooded hosts, including humans, and the outcome is almost always fatal. The most important reservoir of the disease in Colorado and Jefferson County is the bat, and rare cases of bat rabies have been found among terrestrial wild carnivorous animals. The last reported case of human rabies in Colorado was in 1931.

Between 1996 and 2000, rabies testing of bats submitted to the public health laboratories of the Colorado Department of Public Health and Environment after a human exposure showed that about 15% were rabies positive. Eight different species of bats were represented in the sample.

In the 10-year period 1993 – 2002, 14 bats collected in Jefferson County tested positive for rabies.

9.4.1.2 West Nile Virus Encephalitis

West Nile Virus (WNV) encephalitis first appeared in the U.S. in the state of New York in the summer of 1999. Since then, the disease has spread rapidly across the nation, and in 2003 Colorado led the nation with the highest number of cases, 2,943. Jefferson County residents accounted for 157 of those cases.

WNV was originally found in Africa, Asia and the Middle East. The virus has been found to infect over 234 species of birds, reptiles and mammals as of July 2004. The virus tends to grow, or amplify, in bird hosts, and then is transmitted from infected birds to other birds or animals via

mosquito bites. WNV disease can range from mild fever, headache, muscle aches and fatigue, to severe neuroinvasive disease in about 14% of cases. Neuroinvasive diseases include encephalitis (inflammation of the brain), meningitis (inflammation of the membrane around the brain and the spinal cord) and meningoencephalitis (inflammation of both the brain and the meningeal membranes). The case-fatality rate, the proportion of cases that die, ranges from 3 – 15%, and tends to be higher in the elderly.

Prevention measures against WNV infection include eliminating areas where mosquitoes can breed, killing mosquito larvae before they become adults, reducing adult mosquito populations via spraying, wearing clothing as a barrier to mosquito bites and using appropriate strength mosquito repellent when outdoors around dawn and dusk.

9.4.1.3 Western Equine Encephalitis

Western Equine Encephalitis (WEE) is another mosquito-borne neurologic disease that has historically occurred in the rural western U.S. The virus is maintained in a cycle involving birds and mosquitoes (*Culex tarsalis*). The *Culex* mosquito also feeds on horses and humans, resulting in small numbers of cases occurring sporadically. For reasons poorly understood, at intervals of 5 to 10 years, viral transmission intensifies and humans and horses become infected at epidemic and epizootic levels.

The last major outbreak of WEE in Colorado was 1987, with 29 cases and one fatality. There have been no reported cases of WEE among Jefferson County residents in the past 7 years.

9.4.1.4 Hantavirus Pulmonary Syndrome

In 1993, a new type of hantavirus, “Sin Nombre virus”, was isolated from a group of adults in the Four Corners region of Colorado who became ill with severe respiratory disease. About half of the persons who became ill died. Since then, over 30 cases of hantavirus pulmonary syndrome have been reported among Colorado residents, with most occurring on the Western Slope. In 2003, two (2) cases were reported from Jefferson County.

Hantavirus particles are shed in the saliva, urine, and feces of infected mice. Breathing in the virus exposes people, such as from dried urine particles. This can occur via direct contact with rodents or from disturbing dust and feces from mice nests or surfaces contaminated with mice droppings or urine. Preventing hantavirus exposure includes eliminating rodents and their waste products from the environment. Rodent-contaminated areas should be disinfected by spraying a disinfectant solution (e.g. diluted bleach) prior to cleaning. Such contaminated areas should not be swept or vacuumed, but cleaned with a wet mop or towels moistened with disinfectant.

9.4.2 Bacterial Diseases

9.4.2.1 Plague

Plague is a disease of rodents, widespread in the western U.S., caused by the organism *Yersinia pestis*. Two types of severe, often fatal, infections occur in humans and other mammals – bubonic and pneumonic plague. (When the plague organism causes infections in rodent colonies, it is referred to as “sylvatic” plague). The bubonic form is characterized by infection and severe enlargement of lymph nodes; the pneumonic form is an infection of the lungs.

Transmission of plague normally occurs via fleabites or handling of infected animals. Infections and die-offs of colonies of small mammals such as prairie dogs and ground squirrels are often signs of plague bacteria circulating in an area. Transmission to humans can also occur from infected pets, such as cats, that have been bitten by fleas or have otherwise been exposed to rodents. Cats have been known to transmit the disease to humans through coughing and sneezing.

Plague has historically caused worldwide outbreaks and millions of deaths, such as the “Black Death” in Europe in the Middle Ages, from exposures to flea-infested rats. Today, improved sanitation and rodent control have reduced the threat of epidemics in developed countries. Treatment with appropriate antibiotics is effective against plague when a person is treated promptly; without prompt treatment, severe illness or death is likely.

Plague is enzootic in Colorado and along the foothills of Jefferson County. There have been no human cases of plague in Jefferson County residents in the period 1997 – 2003, however, there have been several cases in free-roaming cats. However, there have been numerous reports of die-offs of prairie dog colonies, and approximately one to two (1 – 2) colonies per year test positive for the plague organism.

9.4.2.2 Tularemia

Tularemia, also known as “rabbit fever,” or “deer-fly fever,” is caused by a Gram-negative bacterium, *Francisella tularensis*, which can remain alive for weeks in water and soil. It has been reported from all states in the U.S. except Hawaii. It is typically carried in small mammals such as rodents, rabbits, hares and beavers. Most human cases in the Rocky Mountain area have occurred in rural areas and have been associated with the bites of infective ticks and biting flies or with the handling of infected rodents, rabbits, or hares.

Tularemia bacteria may cause skin ulcers, swollen and painful lymph glands, inflamed eyes, sore throat, oral ulcers, or pneumonia. Early symptoms almost always include the abrupt onset of fever, chills, headache, muscle aches, joint pain, dry cough, and progressive weakness. Treatment is usually successful with appropriate antibiotics.

Three human cases of tularemia occurred among Jefferson County residents in the 5-year period 1998 – 2002, and outbreaks among wildlife have been detected sporadically in the county.

9.5 RADON

HP 2010 Objective 8-18: Increase the proportion of persons who live in homes tested for radon concentrations to 20%.

Jefferson County Status: 19% of 2003 Community Health Survey respondents reported having had their homes tested for radon.

Radon is a colorless, odorless radioactive gas formed from the breakdown of uranium in soil, rock and water. Radon gas can enter buildings through openings or cracks in the foundation. The gas decays into radioactive solids, called radon “progeny,” that can attach to dust in the air and be inhaled. Indoor radon progeny were recognized in the 1970s in Europe and in the U.S. in the 1980s. The U.S. Environmental Protection Agency (EPA) recommends remediation at four (4) picocuries per liter (the “action level”). Approximately six (6) million homes, or six (6) percent of all homes, in the U.S. have radon concentrations above this action level.

Areas of the country with elevated radon levels are those with significant deposits of granite, uranium, shale and phosphate. However, local geology alone is not an adequate predictor of indoor radon risk. Factors that predispose homes to elevated radon include soil porosity, foundation type, building materials used, entry points for gas, ventilation and source of water supply. The only way to determine indoor radon concentration is by inexpensive environmental testing.

Exposure to radon may result in a higher risk for lung cancer. According to the Centers for Disease Control and Prevention’s Agency for Toxic Substances and Disease Registry, radon may be second only to smoking as a cause of lung cancer, and the combination of smoking and radon may create an especially hazardous risk. As many as 7,000 to 30,000 lung cancer deaths in the U.S. each year may be attributable to radon.³¹

Jefferson County Findings

- 19% of residents who responded to the 2003 Community Health Survey had their homes tested for radon, which is very close to the HP 2010 target. Certain demographic groups were more likely to have conducted testing. Older respondents, those with higher income, and non-Hispanics were especially likely to have had their homes tested (Figure 9.6).
- Radon testing varied by location in the county. Residents in the mountains were most likely to have had their homes tested and those in the central-eastern section of the county least likely (Figure 9.7).
- Among survey respondents whose homes were tested, 10% reported that radon was detected at dangerous levels (Figure 9.8). There was no clear association between high levels and any specific demographic or socioeconomic group. None of the Hispanic respondents or those in the youngest age group reported high radon levels.
- Radon testing among survey respondents indicated areas in the county where radon levels in homes may be higher: in the southern mountains, up to 22% of home owners reported detecting radon at high levels (Figure 9.9).

- The Environmental Health Division, Jefferson County Department of Health and Environment, provided radon testing kits to 261 county residents in the 5-year period 1999 – 2003. Of these, 163, or 62%, tested above the EPA action level.

Figure 9.6 Residents of Jefferson County who have had their homes tested for radon, by age, ethnicity, gender and income, 2003

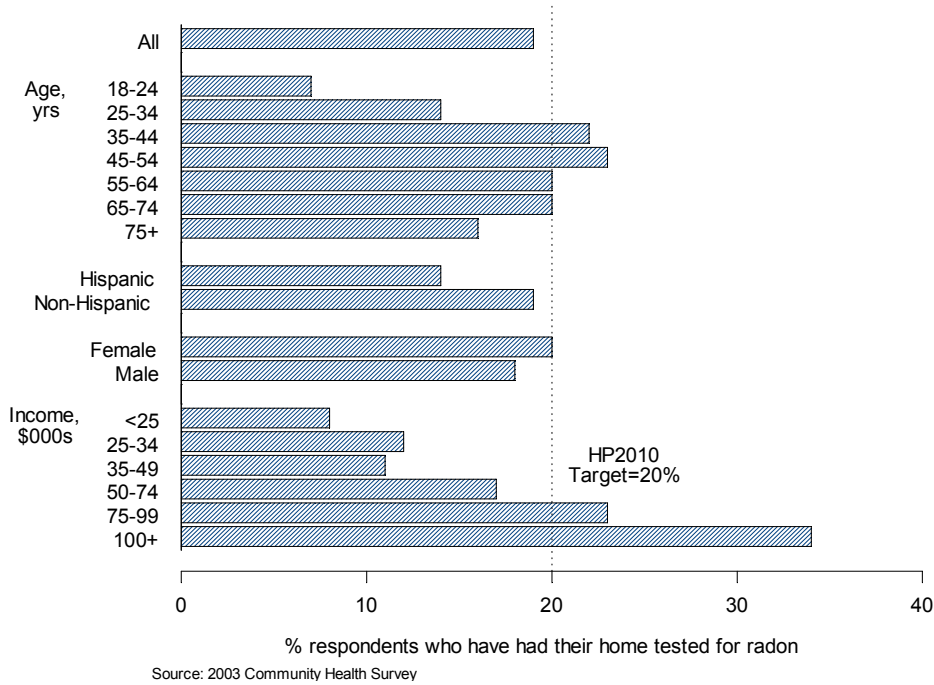


Figure 9.7 Residents of Jefferson County who had high levels of radon detected in their homes, by age, ethnicity, gender and income, 2003

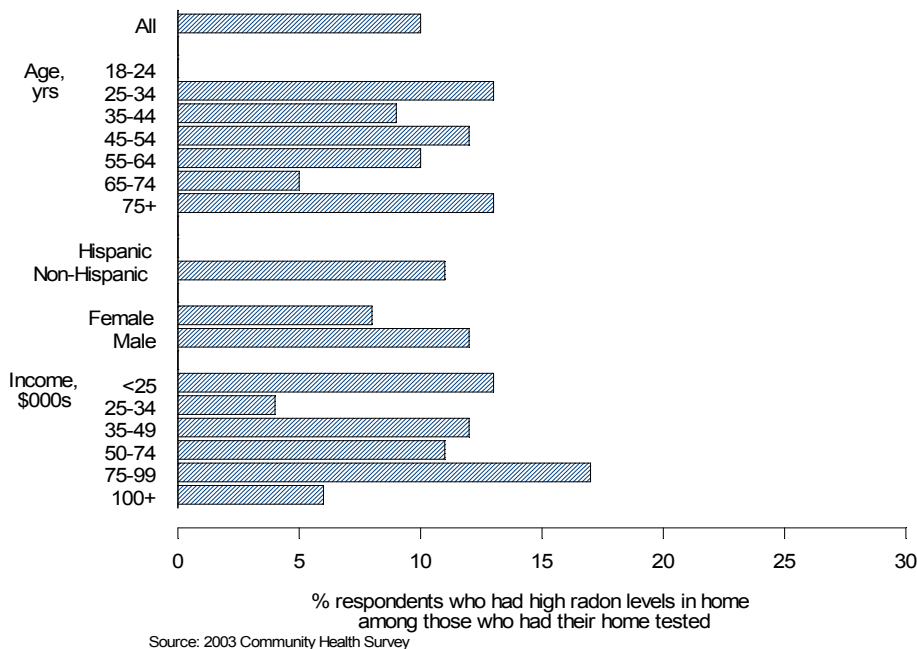
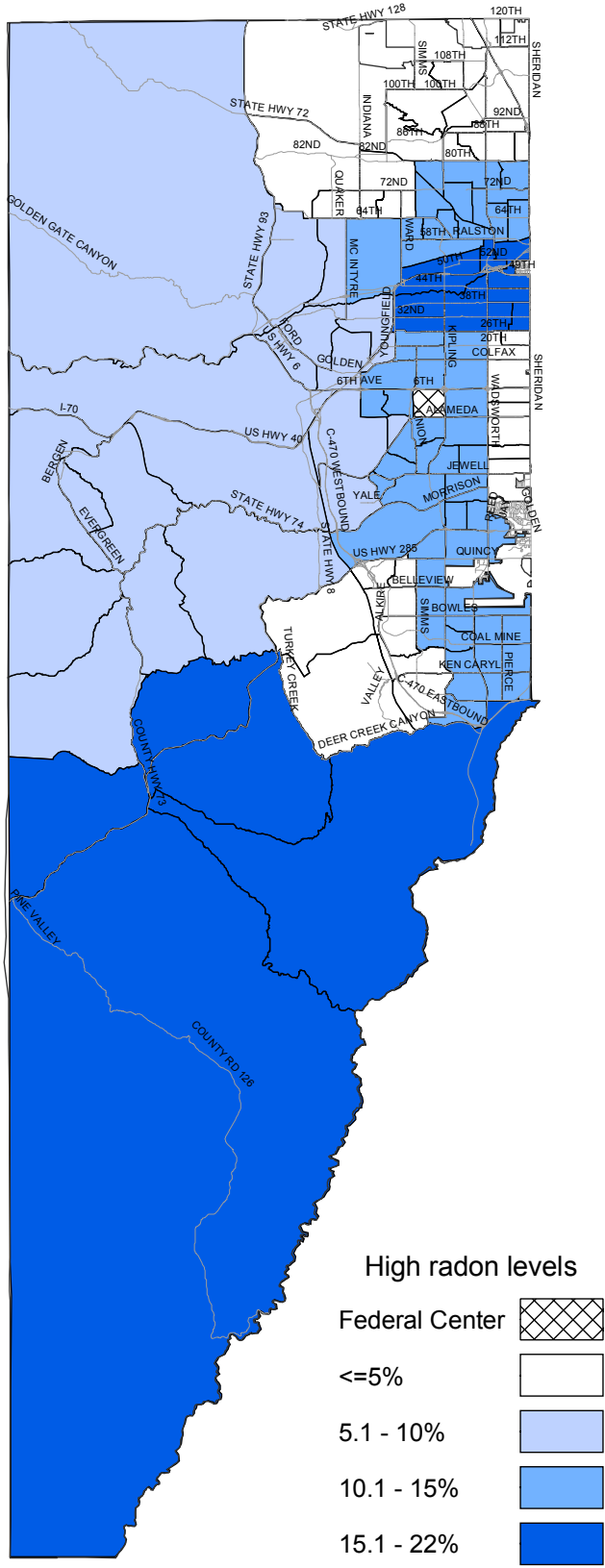


Figure 9.9. Percent of residents reporting detecting high radon levels, among those who have had homes tested, Jefferson County, 2003. (Source: 2003 Community Health Survey).



9.6 OUTDOOR AIR QUALITY

HP 2010 Objective 8-1: Reduce to zero (0) percent the proportion of persons exposed to air that does not meet the U.S. Environmental Protection Agency's (EPA) health-based standards for harmful air pollutants. This target applies to ozone, particulate matter, carbon monoxide, nitrogen dioxide, sulfur dioxide, and lead.

Jefferson County Status

In the summer of 2003, the Denver Metropolitan area, including Jefferson County, recorded ground level ozone levels exceeding the 8-hour ozone standard. This occurred after Denver had not violated any EPA standard for several years. In 2004, air pollution monitors failed to record a single day out of compliance with the federal health-based air quality standards.³²

Air pollution continues to be a widespread public health and environmental problem in the U.S., causing premature death, cancer, and long-term damage to respiratory and cardiovascular systems. Air pollution also reduces visibility, damages crops and buildings, and deposits pollutants on the soil and in bodies of water where they affect the chemistry of the water and the organisms living there. The EPA defines "Nonattainment areas" as those areas exceeding standards for one or more of the six commonly found air pollutants listed in the objective above. Approximately 113 million people in the U.S. live in nonattainment areas.

Although there has been progress in reducing unhealthy air emissions, a substantial air pollution problem remains and millions of tons of toxic air pollutants are released into the environment each year. An unacceptable level of ground level ozone is the largest problem, as determined by the number of people affected and the number of nonattainment areas. Ozone is produced from reactive hydrocarbons and nitrogen oxides in the presence of sunlight. Sources of reactive hydrocarbons are automobile exhaust, gasoline, oil storage and transfer facilities, industrial paint solvents, degreasing agents, cleaning fluids, ink solvents, and some vegetation.

The EPA maintains an online database on air pollution emissions in the U.S. that can be queried. The Aerometric Information Retrieval System (AIRS) is a repository of information from various stationary sources, such as electric power plants, steel mills, factories, refineries, universities, and other facilities including small businesses.³²

Jefferson County Findings

- According to the Colorado Department of Public Health and Environment (CDPHE) Air Quality Control Division, Colorado's air quality has greatly improved over the decades since air monitoring was initiated in the 1970s.
- In the Central Front Range Region, air pollution comes from a variety of sources, with motor vehicle exhaust being the largest. Motor vehicles emit over 700,000 tons of carbon monoxide and 100,000 tons of nitrogen oxide into the Region each year.
- In the summer of 2003, the Denver Metropolitan area, including Jefferson County, recorded ground level ozone levels exceeding the 8-hour ozone standard. This occurred after Denver had not violated any EPA standard for several years. According to the CDPHE Air Quality Control Division high average daily temperatures and a persistent upper level high pressure system led to 17 days out of compliance with the ozone standard.

- Favorable weather led to healthier air throughout the Denver-metropolitan area during the summer of 2004. Monitors failed to record a single day out of compliance with the federal health-based air quality standards for the first time since 1997. This may be attributable to lower daily average temperatures, increased winds and weaker upper level high-pressure systems.
- The Denver Metropolitan area entered into an Ozone Early Action Compact with the EPA in December 2002 to prevent the area from becoming designated as a non-attainment area and to identify steps to reduce ozone levels in order to reach full attainment by 2007.
- Impaired visibility and the “Brown Cloud”, attributable to the fine particulates in air pollution, continue to be stubborn problems for the Denver Metropolitan area. However, in 2003 the CDPHE Air Pollution Control Division reported a 28% improvement in visibility since 1993.
- According to the EPA’s AIRS program, in September 2004, there were 731 regulated facilities in the county that produced and released air pollutants.

9.7 WATER QUALITY AND QUANTITY

9.7.1 Community Water Systems

HP 2010 Objective 8-5: Increase to 95% the proportion of persons served by community water systems who receive a supply of drinking water that meets the regulations of the U.S. Safe Drinking Water Act.

Jefferson County Status

Jefferson County is served by dozens of community and non-community water systems of varying sizes. There were nine (9) health-related Safe Drinking Water Act violations over the period 1993 – 2004.

Most people in the U.S. obtain their drinking water from public water supply systems. Compliance with established Environmental Protection Agency (EPA) regulations is one measure of the public's receipt of a safe water supply, free from disease-causing agents. EPA regulations are based on contaminant level standards for over 85 substances, including radionuclides, microbial agents and organic and inorganic chemicals such as heavy metals and pesticides. Public water supply systems are required to systematically sample and test drinking water and report results to the Colorado Department of Public Health and Environment and the EPA. Information on health or monitoring violations is available publicly online at the EPA *Envirofacts Data Warehouse*.³³

Jefferson County Findings

- There were 40 community water systems in Jefferson County registered with the EPA in September 2004. These systems served as few as 26 individuals and as many as 103,000 people.
- Among the 40 community water systems, only seven (7) had reports of health-based violations since 1993.
- There were 21 non-transient non-community water systems registered with the EPA serving various facilities and entities in 2004. These systems serve the same people, but not year-round, and include some schools that have their own water systems. Among these systems, two (2) had health-based violations reported since 1993.

9.7.2 Waterborne disease outbreaks

HP 2010 Objective 8-6: Reduce to two (2) the number of waterborne disease outbreaks arising from drinking water among persons served by community water systems in the U.S.

Jefferson County Status

There have been no waterborne disease outbreaks arising from drinking water among persons served by community water systems.

The Centers for Disease Control and Prevention (CDC) compiles the results of state investigations into waterborne disease outbreaks arising from water intended for drinking. Between 1987 and 1996, the states reported an average of 15.5 outbreaks per year, of which six (6) were identified as originating from community water supplies. Limited existing data suggest that state and CDC surveillance systems are able to detect most waterborne disease outbreaks.

The most prevalent waterborne disease agents reported over the past two decades in the U.S. were the protozoan parasites, *Cryptosporidia* and *Giardia*. Both cause diarrheal illness and are found in contaminated drinking and recreational water. Once an animal or person is infected with either of these, the parasite lives in the intestine and is passed in the stool. Millions of the parasites can be released in a bowel movement of an infected human or animal. Therefore, organisms may be found in soil, food, water, or surfaces that have been contaminated with feces from infected humans or animals. Coloradans usually become infected after drinking untreated stream water. The *Giardia* parasite is protected by an outer shell and can survive in the environment for a prolonged period of time.

Jefferson County Findings

- Although there have been no waterborne disease outbreaks associated with community water systems, a significant proportion of the county's population lives in households served by wells and individual sewage disposal systems (ISDS). Household wells or other groundwater collection systems are not required by law to undergo systematic testing for water quality and may be a source of waterborne microbial disease agents and chemical agents such as nitrates.
- There were 46 cases of giardiasis diagnosed among county residents in the first half of 2004.

9.7.3 Domestic water withdrawals

HP 2010 Objective 8-7: Reduce per capita domestic water withdrawals to 90.9 gallons per day.

Jefferson County Status

According to the Denver Water Board, the primary supplier of water to the Denver metropolitan area, for the 10-year period ending in 2004, the average per capita domestic water withdrawal was 190 gallons per day.

Historically, water management in the U.S. has focused on directing the country's abundant supplies of fresh water to meet the needs of users. This approach has resulted in the building of large storage reservoirs and conveyance systems, especially in the West. Increasing development costs, capital shortages, government fiscal restraint, diminishing sources of water supply, polluted water, and a growing concern for the environment have forced water managers and planners to begin to rethink traditional approaches to management and to experiment with new ones. Experts on the subject of water supply and demand agree that the West is in transition from the era of water-supply development to an era of water-demand management and conservation. Estimates place the amount of water withdrawn for public supply during 1990 at about five (5) percent more than during 1985. The national per capita use remained about the same for the past decade as the result of active conservation programs that included the installation of additional meters and water-conserving plumbing fixtures.

Colorado is currently in its seventh year of drought conditions. The beginning of a recovery may be at hand after the state experienced a wetter, cooler summer in 2004. Mountain snow pack, however, was still below average in the spring of 2004.

Jefferson County Findings

- Even with restrictions on household water use over the past two years, per capita daily water consumption in the Denver metropolitan area remains greater than twice that of the HP 2010 target. More than half of the water Denver metropolitan area residents use in the summer is for lawn watering and irrigating other vegetation. Watering efficiently and practicing conservation may diminish summertime water use.
- Restrictions on water use were loosened in September 2004. The re-enactment of water use restrictions in 2005 may be expected, as it will likely require several years to recover reservoir levels and water supply.