SECTION IV. D.

INFECTIOUS DISEASE MORTALITY

CONTENTS

Pneumonia and Influenza
(ICD-9 codes 480-487)

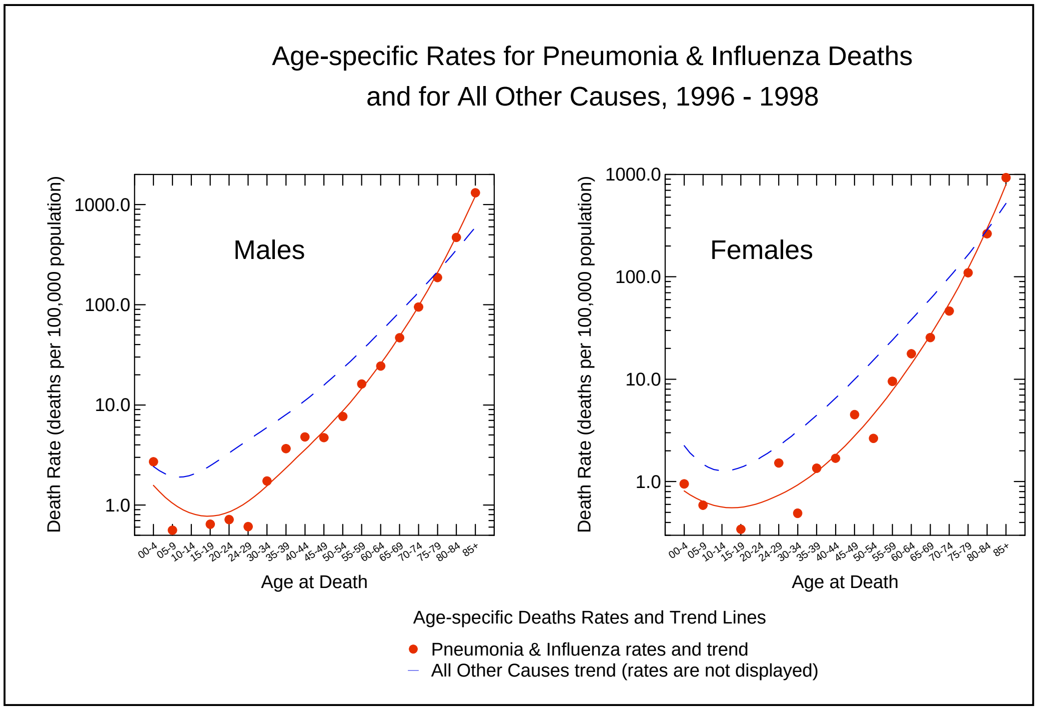
Pneumonia is an inflammation of the lungs caused by bacterial, viral, or fungal infections that affects over three million Americans per year. It may often occur as a complication of influenza, a common viral infection of the respiratory tract (Butler and Schuchat 1999; Sethi 2002). Pneumonia and influenza account for 50,000 to 80,000 deaths per year in the United States (National Coalition for Adult Immunization 1998). In the 1996-1998 period, pneumonia and influenza (P&I) accounted for 3,609 Connecticut resident deaths. Ninety-two percent of these pneumonia and influenza deaths were categorized as "pneumonia, organism unspecified." Those at greatest risk of death from P&I are older persons, persons with compromised immune systems, and persons with pre-existing chronic conditions such as liver, renal, lung, and cardiac diseases (National Coalition for Adult Immunization 1998). Influenza epidemics are associated with increased hospitalizations and mortality from numerous causes in addition to pneumonia, including chronic obstructive pulmonary disease (COPD), congestive heart failure, and septicemia (Thompson, Shay, Weintraub, et al. 2003).

Pneumonia and influenza is the fifth leading cause of death for all Connecticut residents and the fourth leading cause of death for residents aged 85 and over (Appendix V). Connecticut resident death rates due to pneumonia and influenza increase dramatically with age beginning at ages 55 to 59. Connecticut residents 65 years and older, about 17% of Connecticut's total population, accounted for 92% of all P&I deaths in the 1996-1998 period. Age-specific P&I death rates of Connecticut males and females (1996-1998) are depicted in Figure 22.1. P&I age-specific death rates exceed death rates for all other causes combined for males above 79 years of age and for females above 84 years of age.

Pneumonia and influenza mortality rates both nationally and in Connecticut, tend to be higher in men than in women. Age-adjusted P&I death rates were 1.6 times higher for males compared with females during both the 1989-1991 and 1996-1998 periods ($p < .001$ for both comparisons). Premature mortality was also significantly higher for males compared with females in both time periods. In 1996-1998, males had 1.9 times the premature P&I mortality rate of females ($p < .001$).

1996-1998 Pneumonia & Influenza Deaths, CT Residents

- Fifth leading cause of death for all Connecticut residents
- Fourth leading cause of death for ages 85 and over
- Significant decrease in white female mortality since the 1989-1991 period
- Significantly higher premature mortality rates for black males and females compared with white males and females



In Connecticut, P&I mortality rates were significantly lower in Hispanic males and females compared with white males and females in both the 1989-1991 and 1996- 1998 periods. There were no significant differences in P&I mortality rates between white and black males and females, respectively, during these same time periods. There were too few P&I deaths among Asian and Pacific Islander and Native American males and females to report reliable rates (Table 22.1). Nationwide, pneumonia and influenza mortality was 69% higher for males than for females and 48% higher for blacks than for whites (Pickle, Mungiole, Jones et al. 1996)

Black males and females had significantly higher premature mortality due to P&I compared with white males and females in Connecticut, respectively, in both the 1989-1991 and 1996-1998 periods. Black males had 3.3 times the premature mortality rate of white males and black females had 2.2 times the premature death rate of white females. There were no significant differences in premature mortality between white and Hispanic males and white and Hispanic females during these periods (Table 22.1).

From 1989 to 1998, age-adjusted death rates for pneumonia and influenza in Connecticut decreased significantly by an average of 1.4% per year ($p < .001$) for males and by 1.5% for females per year ($p < .01$). P&I mortality for all Connecticut residents decreased significantly between the periods 1989-1991 and 1996-1998. Among gender and racial/ethnic subpopulations, the decrease was statistically significant for white females only (Table 22.1). Connecticut male and female mortality rates for P&I have tended to be lower than the respective U.S. rates for the period 1989 to 1998 (Figure 22.2, Table 22.2).

Table 22.1. Pneumonia & Influenza Deaths[1] Connecticut Residents by Gender, Race and Ethnicity[2], 1996-98

		Age-Adjusted Mortality Rates[3]		Age-Adjusted Premature Mortality Rates to Age 75[3]	
Group	Number of Deaths	AAMR[4]	Change since 1989-91[5]	YPLL[4]	Change since 1989-91[5]
All Residents	3,609	32.2	↓↓	96.0	ns
All males	1,621	42.2	ns	125.8	ns
White	1,524	41.9	ns	107.0	ns
Black	87	44.0	ns	352.0***	ns
Asian PI	8	—		—	
Native American	2	—		—	
Hispanic	30	24.9**	ns	129.8	ns
All females	1,988	26.6	↓	67.7	ns
White	1,892	26.4	↓	62.9	ns
Black	91	30.9	ns	136.5*	ns
Asian PI	4	—		—	
Native American	1	—		—	
Hispanic	32	18.4*	ns	73.4	ns

<u>Notes:</u>

1. This cause of death category includes ICD-9 codes 480-487.

2. Racial groupings (White, Black, Asian & Pacific Islander, Native American) include persons of Hispanic ethnicity.

3. Age-adjusted Mortality Rates (AAMR) and Years of Potential Life Lost (YPLL) rates are per 100,000 based on race and ethnicity specific population estimates. Age-adjusted rates were calculated by the direct method using the 2000 U.S. standard population. Rates were not calculated for fewer than 15 events.

4. Statistical tests were conducted to evaluate differences in rates between race/ethnic groups. The white population serves as the reference group in each comparison (black vs. white, Asian & PI vs. white, Native American vs. white, Hispanic vs. white). Following are explanations of the notations:

   * Significantly different than the respective white resident rate at $p < .05$.
   ** Significantly different than the respective white resident rate at $p < .01$.
   *** Significantly different than the respective white resident rate at $p < .001$.
   — Rate was not calculated due to small numbers.

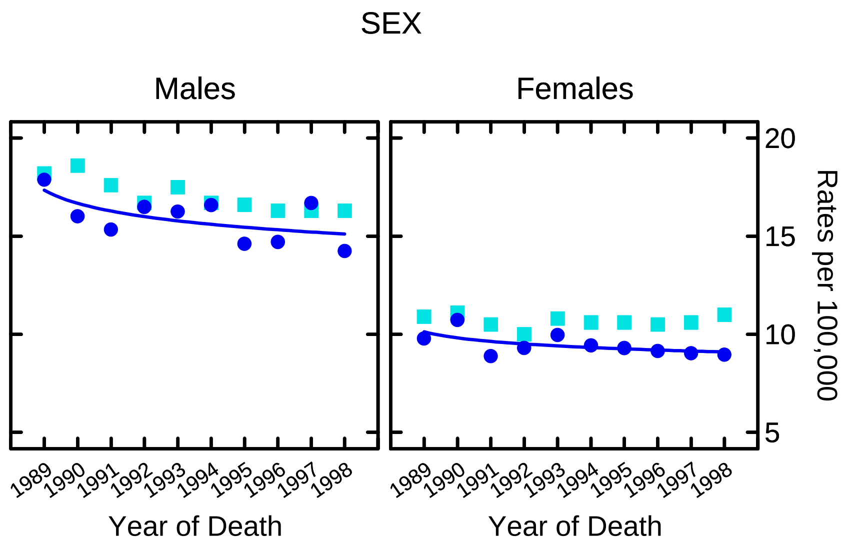
5. Statistical tests were conducted to evaluate changes in rates over time. Comparisons of 1996-98 vs. 1989-91 rates are made within each race/ethnicity group. Following are explanations of the notations:

   ↓ 1996-98 rate is significantly lower than the 1989-91 rate at $p < .05$.
   ↓↓ 1996-98 rate is significantly lower than the 1989-91 rate at $p < .01$.
   ns Indicates the change from 1989-91 to 1996-98 is not statistically significant.

Figure 22.2.

Pneumonia & Influenza Deaths

Comparison of Connecticut and U.S. 1989-1998
Age-Adjusted Mortality Rates* by Sex



Symbols:
- U.S. rates for 1989-1998
- Connecticut rates: an asterisk is used if the rate is significantly different than expected (p<.005), based on the log-linear trend.

* These rates are adjusted to the 1940 US standard million population.
* This classification includes deaths with ICD-9 codes:480-487

Table 22.2. Comparison of CT with US, 1989 and 1998

	1989	1998	1998 Comparison
CT AAMR*	13.0	11.1	---
US AAMR*	13.7	13.2	CT < US AAMR

* age-adjusted mortality rates are per 100,000 population, U.S. 1940 standard million population.

Risk Factors

Elderly persons aged 65 and over, very young children, persons with chronic diseases, and immunocompromised persons are considered at high risk for complications of pneumonia and influenza. Certain other population groups are also considered at risk for complications of P&I because of historically low rates of immunization (Table 22.3).

Among the elderly, those at highest risk of complications from P&I include persons with co-morbid conditions and frequent hospitalizations. The severity of pneumonia in the elderly may not be a result of chronological age per se but rather the presence of underlying illness (Feldman 2001). Respiratory viral infections, especially influenza, oftentimes provoke acute respiratory episodes among persons with chronic underlying conditions, such as COPD and congestive heart failure. This fact underscores the need for effective vaccines and vaccinations for these viruses (Glezen, Greenberg, Atmar, et al. 2000). In 1996-1998, Septicemia was a contributing cause in 10% of Connecticut resident deaths due to P&I.

The influence of low socioeconomic status on increased risk of pneumonia has not been well studied and is not well understood (Butler and Schuchat 1999). The Centers for Disease Control and Prevention (CDC) surveillance data from Greater Atlanta indicate that rates of disease are higher in low-income communities, and higher in blacks than in whites in the lowest income communities; however, in the highest income level communities, there are no differences in pneumonia infection rates of blacks and whites. Recent data examining the

Table 22.3. – Risk Groups and Risk Factors for Complications of Pneumonia & Influenza (Flu)

Disease / Medical Conditions	**Age**
• immunodeficient conditions	• persons over 65
• diabetes mellitus	• nursing home residents 50 & over
• chronic liver disease	• children, 2-23 months (pneumonia)
• chronic renal disease	• children, 6-23 months (flu)
• chronic lung disease	**Due to Historic Underimmunization**
• chronic cardiac disease	• racial & ethnic minorities
• HIV infection	• low socioeconomic status
• cancer	• inner-city residents
• alcoholism (pneumonia)	• low educational level
	• lacking medical services

Sources: National Coalition for Adult Immunization 1998; U.S. Preventive Services Task Force 1996; Centers for Disease Control and Prevention 2000; File 2000; Bridges, Harper, Fukuda, et al. 2003.

population-level impact of vaccinating infants against pneumococcal disease suggests that more frequent contact with children may be a factor in higher P&I incidence rates among black Americans and that vaccination of children can reduce or eliminate the black-white disparity in the incidence of pneumoccocal disease (Flannery, Schrag, Bennett, et al. 2004).

Case-fatality rates from P&I vary considerably among the developed countries, from a low of 9% in Sweden to 40% in Israel and the United States (National Coalition for Adult Immunization 1998). Such broad cross-national differences suggest that preventive measures can play an important role in reducing mortality from P&I.

Costs and Prevention

Total costs of influenza epidemics in the United States are estimated to exceed $12 billion each year (Nichol, Margolis, Wuorenma, et al. 1994). In 1998, pneumonia and influenza hospitalization charges alone in Connecticut exceeded $170 million with average charges of $14,074 for pneumonia and $13,310 for influenza (Bower 2000).

Recommendations for Vaccination

Vaccination is the primary preventive measure for influenza, pneumonia, and their complications. The U.S. Preventive Services Task Force (USPSTF) recommends annual flu vaccination for persons 65 and older and for persons in high-risk groups. Among the general population under age 65, the efficacy of influenza vaccine in preventing or reducing the severity of the illness is estimated at 70% to 80% (U.S. Preventive Services Task Force 1996). Among older persons the efficacy is somewhat less but still substantial.

The CDC Advisory Committee on Immunization Practices (ACIP) considers October through November to be the optimal time for flu vaccination, although vaccination is still beneficial if received during December and later. ACIP identifies key target groups for immunization as persons 65 and older, infants 6 to 23 months of age and pregnant women, persons 2 years and older with chronic medical conditions, persons aged 50-64 because of their high prevalence of chronic medical conditions, and persons living with or caring for those at high-risk, including health care workers and employees of chronic care facilities (Bridges, Harper, Fukuda, et al. 2003).

USPSTF recommends pneumococcal vaccination of persons 65 and older who are immunocompetent (capable of developing an immune response). USPSTF notes that there is insufficient evidence to recommend for or against pneumococcal vaccination of high-risk immunocompromised individuals, but recommendations for vaccinating may be made for other reasons, such as the high incidence of and case-fatality rates from pneumococcal disease and few adverse effects from the vaccine. Finally, USPSTF states that evidence of the efficacy of vaccination for the general U.S. population is, as yet, not conclusive (U.S. Preventive Services Task Force 1996). ACIP also recommends pneumococcal vaccination for immunocompetent persons 2 years and older with chronic illness or asplenia and for those living in high-risk environments, and for all infants 2 to 23 months of age (Centers for

Disease Control and Prevention 2000). Finally, a recent study suggests that vaccination of young children against pneumococcal disease has resulted in a substantial reduction of pneumococcal disease in all age groups (Whitney, Farley, Hadler, et al. 2003).

Cost-Effectiveness

Flu vaccination of both the elderly and working adults has been shown to improve health and save costs (Riddiough, Sisk, and Bell 1983; Mullooly, Bennett, Hornbrook 1994; Nichol, Margolis, Wuorenma, et al. 1994; Centers for Disease Control and Prevention 1993; Yassi, Kettner, Hammond, et al. 1991; Nichol, Lind, Margolis, et a. 1995; Nichol, Wuorenma, and von Sternberg 1998; Nichol and Goodman 2002; Lee, Matchar, Clements, et al. 2002). A study of the cost-effectiveness of pneumococcal vaccination in the 65 and older population showed that vaccination saved costs both in improved health and reduced medical expenses (Sisk, Moskowitz, Whang, et al. 1997). A second study of the cost-effectiveness of invasive pneumococcal vaccination among 50 to 64 year olds suggests that there were cost savings for both high-risk and low-risk individuals (Sisk, Whang, Butler, et al. 2003).

Factors Associated with and Barriers to Immunization

The national *Healthy People 2000* objective is to increase influenza and pneumococcal vaccination to levels of at least 60% among high-risk persons and those aged 65 and over. In 1997, 67% of Connecticut residents aged 65 and over reported that they had received the flu vaccine in the past year and 43% reported they had ever received the pneumococcal vaccine (Centers for Disease Control and Prevention 1998). The national *Healthy People 2010* objective is to increase influenza and pneumococcal vaccination to levels of at least 90% among persons aged 65 and over. In 2001, 69% of Connecticut residents 65 and over reported that they had received the flu vaccine in the past year and 63% reported they had ever received the pneumococcal vaccine (Centers for Disease Control and Prevention 2002).

National Behavioral Risk Factor Surveillance System (BRFSS) survey data suggest that white Americans, persons with higher education, higher income, health insurance, and a physician visit in the previous year were most likely to have been vaccinated. Persons with poorer perceived health status and co-morbidities were also more likely to have been vaccinated in the past year (Kamal, Madhavan, and Amonkar 2003). Another study of the elderly suggested that the main predictor of pneumococcal vaccination included: a recommendation by a physician's office staff person, a physician's recommendation, and a belief that the vaccine is a wise idea (Zimmerman, Santibanez Fine, et al. 2003).

In 1995, about 60% of white Americans received flu shots, compared with only 50% of Hispanics and 39% of African Americans. Approximately 37% of whites received pneumococcal vaccinations compared with about 24% of Hispanics and 20% of blacks (National Coalition for Adult Immunization 1998). Several factors are associated with lower immunization rates among minority Americans including lack of health insurance, missed opportunities during physician visits, and low physician reimbursement rates (Table 22.4).

Table 22.4. - Barriers to Immunization Among Minority Populations
• Lack of access due to lack of health insurance and/or low socioeconomic status
• Other family factors, such as lack of knowledge about the risks of P&I and the benefits of immunization, language barriers, undocumented status, and lack of stable residence
• Lack of incentive to primary care providers to recommend immunization due to low reimbursement
• Missed opportunities during office visits or hospitalizations to immunize

Source: National Coalition for Adult Immunization 1998.

A recent study points to the importance of organizational characteristics in improving immunization rates. Changes in a given health care organization, including changes in staffing and clinical procedures, have been shown to be the factors most likely to improve rates of appropriate adult immunization according to a meta-analysis of 108 studies of adherence to immunization guidelines. Examples of such organizational features include: changes that identify and make delivery of immunizations part of routine patient care, patient reminders that supplement such organizational changes, and financial incentives to immunize, if not in place already (Stone, Morton, Hulscher, et al. 2002).

Standing orders programs, another example of an organizational change, have been demonstrated to improve vaccination rates in health care institutions. Where allowed by state law, standing orders can authorize nurses and pharmacists to administer vaccinations according to an approved protocol without prior order or examination by a physician. The Advisory Committee on Immunization Practices recommends standing orders programs for use in inpatient and outpatient settings (Centers for Disease Control and Prevention 2003a). Up until recently Connecticut hospitals were required by Connecticut law to obtain an individual physician order for each patient vaccination. Pneumococcal vaccination rates in Connecticut adult acute-care hospitals range from 0% to 94% with a median rate of 41% (Connecticut Department of Public Health 2004a). Effective July 1, 2004, Connecticut hospitals are allowed by law to employ standing orders for pneumonia and flu vaccinations of their patients (Connecticut Department of Public Health 2004b).

With the aging of the Connecticut and U.S. populations, respiratory infectious diseases among the elderly will continue to be a major public health concern. This fact underscores the need for appropriate prevention strategies and health care services (Centers for Disease Control and Prevention 1995).

Septicemia
(ICD-9 code 038)

Septicemia is a bacterial infection of the bloodstream that can be life threatening. It usually occurs when another infection is present in the body, commonly in the abdomen, lungs, skin, or urinary tract. Septicemia was the eighth leading cause of death for all Connecticut residents in both the 1989-1991 and 1996-1998 periods (see Appendix V for leading cause of death tables). Because it is a frequent complication of other fatal conditions, such as pneumonia and influenza, examination of septicemia as the underlying cause of death alone does not accurately represent its extensive contribution to overall mortality. While septicemia was the underlying cause of 3,962 resident deaths from 1989-1998, it was listed as an underlying or contributing cause of death for 14,034 Connecticut residents in the ten-year period.

Nationwide, there was an increasing trend in septicemia mortality from at least the 1930s through the 1980s (Salive, Wallace, Ostfeld, et al. 1993). Increased rates of septicemia have been attributed to a few factors, including: 1) increasing numbers of immunocompromised persons at high risk for infections; 2) increased use of invasive medical procedures and devices that have accompanied high technology medicine; and 3) greater awareness and increased recognition of the disease through diagnostic tests (Salive, Wallace, Ostfeld, et al. 1993; Sands, Bates, Lanken, et al. 1997).

Connecticut resident death rates due to septicemia increase dramatically with age beginning at ages 55 to 59. Connecticut residents 65 years and older, about 17% of Connecticut's total population, accounted for 85% of all septicemia deaths in the 1996-1998 period.

Septicemia mortality rates tend to be higher in men than in women. Age-adjusted septicemia death and premature mortality rates were 1.4 times higher for Connecticut male residents compared with female residents in the 1996-1998 period ($p < .001$ for both comparisons) [Table 23.1].

1996-1998 Septicemia Deaths, CT Residents

- Eighth leading cause of death for all Connecticut residents
- Significant decrease in all-CT resident and white female mortality since the 1989-1991 period
- Significantly higher death and premature mortality rates for black males and females compared with white males and females

Table 23.1 Septicemia Deaths[1]
Connecticut Residents by Gender, Race and Ethnicity[2], 1996-98

Group	Number of Deaths	Age-Adjusted Mortality Rates[3] AAMR[4]	Change since 1989-91[5]	Age-Adjusted Premature Mortality Rates to Age 75[3] YPLL[4]	Change since 1989-91[5]
All Residents	1,147	10.4	↓↓	55.8	↓
All males	509	12.4	ns	65.6	ns
White	461	11.9	ns	52.7	ns
Black	45	20.0*	ns	211.0***	ns
Asian PI	2	—		—	
Native American	0				
Hispanic	15	—		—	
All females	638	9.1	↓	46.8	ns
White	584	8.7	↓	39.3	ns
Black	52	16.5**	ns	136.0**	ns
Asian PI	0				
Native American	0				
Hispanic	18	9.6	na	66.7	na

Notes:

1. This cause of death category includes ICD-9 codes 38.

2. Racial groupings (White, Black, Asian & Pacific Islander, Native American) include persons of Hispanic ethnicity.

3. Age-adjusted Mortality Rates (AAMR) and Years of Potential Life Lost (YPLL) rates are per 100,000 based on race and ethnicity specific population estimates. Age-adjusted rates were calculated by the direct method using the 2000 U.S. standard population. Rates were not calculated for fewer than 15 events.

4. Statistical tests were conducted to evaluate differences in rates between race/ethnic groups. The white population serves as the reference group in each comparison (black vs. white, Asian & PI vs. white, Native American vs. white, Hispanic vs. white). Following are explanations of the notations:

   * Significantly different than the respective white resident rate at $p < .05$.
   ** Significantly different than the respective white resident rate at $p < .01$.
   *** Significantly different than the respective white resident rate at $p < .001$.
   — Rate was not calculated due to small numbers.

5. Statistical tests were conducted to evaluate changes in rates over time. Comparisons of 1996-98 vs. 1989-91 rates are made within each race/ethnicity group. Following are explanations of the notations:

   ↓ 1996-98 rate is significantly lower than the 1989-91 rate at $p < .05$.
   ↓↓ 1996-98 rate is significantly lower than the 1989-91 rate at $p < .01$.
   ns Indicates the change from 1989-91 to 1996-98 is not statistically significant.
   na 1989-91 rate was not calculated due to small numbers and so no comparison with 1996-98 rate is available

Septicemia death and premature mortality rates were significantly higher in black males and females compared with white males and females in both the 1989-1991 and 1996-1998 periods. In 1996-1998, black males had 4 times the premature mortality rate of white males and black females had 3.5 times the premature mortality rate of white females (Table 23.1). Septicemia-*related* death and premature mortality rates were also significantly higher in black males and females compared with white males and females in the 1989-1991 and 1996-1998 periods. Black males had 3 times and black females had 2.7 times the premature mortality rate of white males and females, respectively (Table 23.2).

There were no significant differences in septicemia death and premature mortality rates of white and Hispanic females in 1996-1998. There were too few septicemia deaths among Hispanic males in 1996-1998 to report reliable rates (Table 23.1). The septicemia-related death and premature mortality rates of Hispanic and white females during this period were not significantly different (Table 23.2). There were no significant differences in the septicemia-related death rates of Hispanic and white males but Hispanic males had 1.9 times the premature mortality rate of white males. There were too few septicemia and septicemia-related deaths among Asian and Pacific Islander and Native American males and females to report reliable rates (Table 23.1).

Age-specific septicemia death rates of Connecticut males and females (1996-1998) are depicted in Figure 23.1. Age-specific septicemia death rates tend to be lower compared with all other causes of death up to about age 80 for females and up to age 75 for males, at which point they exceed death rates for all other causes.

Figure 23.1

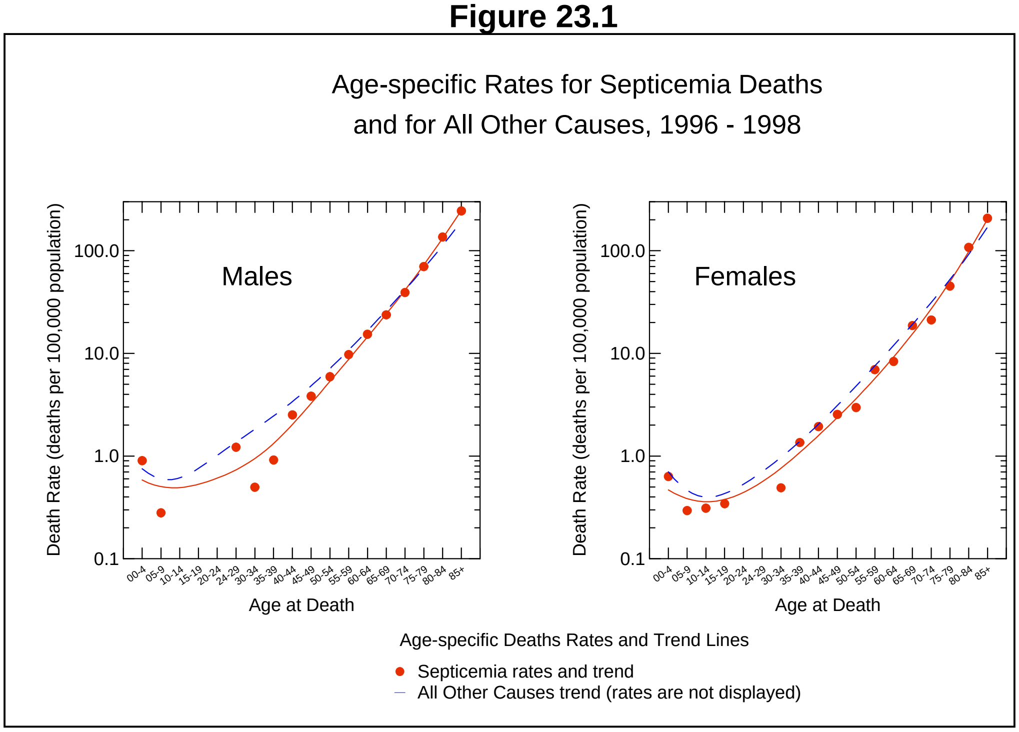


Table 23.2 Septicemia-Related Deaths[1]
Connecticut Residents by Gender, Race and Ethnicity[2], 1996-98

Group	Number of Deaths	Age-Adjusted Mortality Rates[3]: AAMR[4]	Age-Adjusted Mortality Rates[3]: Change since 1989-91[5]	Age-Adjusted Premature Mortality Rates to Age 75[3]: YPLL[4]	Age-Adjusted Premature Mortality Rates to Age 75[3]: Change since 1989-91[5]
All Residents	4,238	38.8	↓↓↓	254.9	↓↓
All males	1,948	46.6	↓↓	296.8	↓↓
White	1,752	44.7	↓	256.8	ns
Black	188	85.7***	ns	805.6***	↓
Asian PI	6	—		—	
Native American	1	—		—	
Hispanic	74	46.7	ns	491.7**	ns
All females	2,290	33.8	↓	216.0	ns
White	2,090	32.3	↓	188.9	ns
Black	190	58.8***	ns	506.3***	ns
Asian PI	7	—		—	
Native American	1	—		—	
Hispanic	51	26.0	ns	228.5	ns

Notes:

1. This cause of death category includes ICD-9 codes 38. "Septicemia-related" deaths include those for which septicemia is the underlying and/or a contributing cause listed on the death certificate.

2. Racial groupings (White, Black, Asian & Pacific Islander, Native American) include persons of Hispanic ethnicity.

3. Age-adjusted Mortality Rates (AAMR) and Years of Potential Life Lost (YPLL) rates are per 100,000 based on race and ethnicity specific population estimates. Age-adjusted rates were calculated by the direct method using the 2000 U.S. standard population. Rates were not calculated for fewer than 15 events.

4. Statistical tests were conducted to evaluate differences in rates between race/ethnic groups. The white population serves as the reference group in each comparison (black vs. white, Asian & PI vs. white, Native American vs. white, Hispanic vs. white). Following are explanations of the notations:

   ** Significantly different than the respective white resident rate at $p < .01$.
   *** Significantly different than the respective white resident rate at $p < .001$.
   — Rate was not calculated due to small numbers.

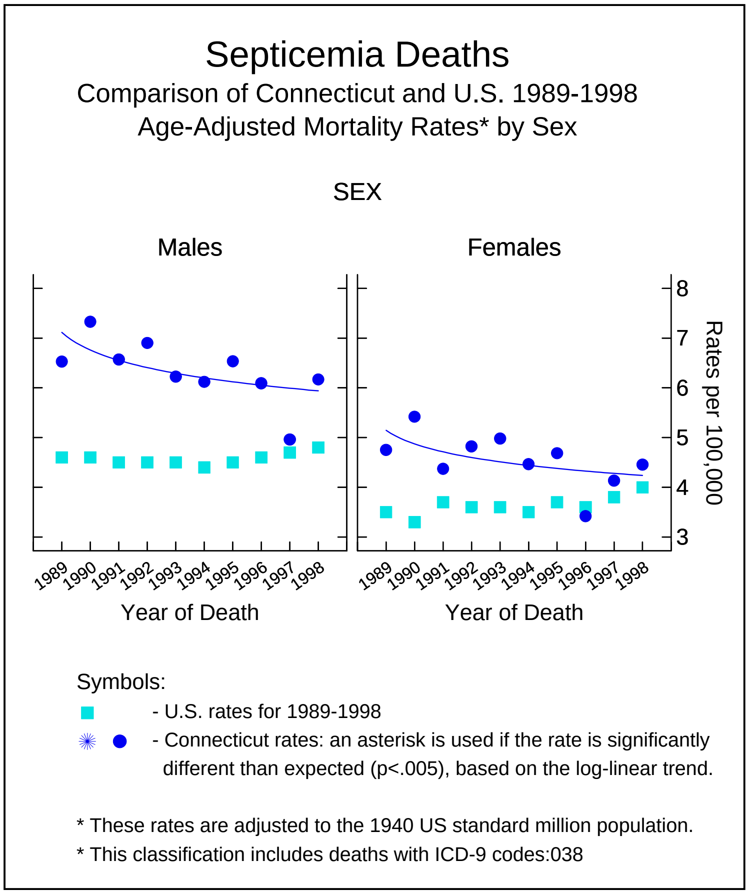
5. Statistical tests were conducted to evaluate changes in rates over time. Comparisons of 1996-98 vs. 1989-91 rates are made within each race/ethnicity group. Following are explanations of the notations:

   ↓ 1996-98 rate is significantly lower than the 1989-91 rate at $p < .05$.
   ↓↓ 1996-98 rate is significantly lower than the 1989-91 rate at $p < .01$.
   ↓↓↓ 1996-98 rate is significantly lower than the 1989-91 rate at $p < .001$.
   ns Indicates the change from 1989-91 to 1996-98 is not statistically significant.

From 1989 to 1998, age-adjusted death rates for septicemia-related deaths in Connecticut decreased significantly by an average of 1.7% per year (p < .001) for males and by 1.2% for females per year (p < .01). Septicemia and septicemia-related mortality for all Connecticut residents decreased significantly between the periods 1989-1991 and 1996-1998.

Among subpopulation groups, the decrease in septicemia mortality was statistically significant among white females only (Table 23.1), while the decrease in septicemia-related mortality was statistically significant for white males and females only (Table 23.2).

Figure 23.2.



Connecticut male and female septicemia mortality rates have tended to be higher than the respective U.S. rates for the period 1989 to 1998 (Figure 23.2, Table 23.3).

Table 23.3 Comparison of CT with US, 1989 and 1998

	1989	1998	1998 Comparison
CT AAMR*	5.5	5.2	---
US AAMR*	4.0	4.4	CT > US AAMR

* age-adjusted mortality rates are per 100,000 population, U.S. 1940 standard million population.

Risk Factors

Septicemia is more likely to occur in persons whose immune systems are weakened due to some illness, such as HIV, or medical treatment, such as chemotherapy. It is commonly associated with the risks of high technology medicine (Pittet, Thievent, Wenzel, et al. 1993; Pittet, Tarara, and Wenzel 1994; Powe, Jaar, Furth, et al. 1999). Very low birth weight infants are also at high risk for septicemia (Fanaroff, Korones, Wright, et al. 1998).

Several research studies have identified risk factors for septicemia in high-risk environments (e.g., hospitals) or populations (e.g., dialysis patients). One multicenter prospective study of hospital intensive care units found that greater severity of illness, chronic cardiovascular insufficiency, multiple organ failures at the time of sepsis, shock, and a low blood ph predicted mortality from septicemia (Brun-Buisson, Doyon, Carlet, et al. 1995). Other clinical risk factors for septicemia mortality include adequacy of the antibiotics used to treat the condition, the source of and type of infection, and the site of infection. Bacteremia caused by Candida and Enterococcus accounts for 30% to 40% of septicemia mortality. Intra-abdominal and lower respiratory tract infections are associated with increased mortality (Angus and Wax 2001).

Persons with end-stage renal disease (ESRD) treated by dialysis are at higher risk of septicemia mortality compared with the general population (Sarnak and Jaber 2000). A

Table 22.4. – Risk Groups and Risk Factors for Septicemia-Related Mortality

Disease / Medical Conditions	**Other Risk Factors**
• immunodeficient conditions • end-stage renal disease • cancer • HIV / AIDS • diabetes mellitus (possible) • prior splenectomy • severe physical disability (possible) • severe cognitive impairment (possible)	current heavy smoking (possible) **Risk Groups** • very low birthweight infants • increasing age (persons aged 65 and over) • male gender • black race

<u>Sources</u>: Salive, Wallace, Ostfeld, et al. 1993; Sarnak and Jaber 2000; Angus, Linde-Zwirble, Lidicker et al. 2001; McBean and Rajamani 2001; Martin, Mannino, Eaton, et al. 2004. et al.

longitudinal study of dialysis patients with ESRD found that among this population, older age and diabetes were independent risk factors for septicemia. Among hemodialysis patients, risk factors associated with increased risk of septicemia mortality included temporary catheters used for vascular access as opposed to permanent catheters; low serum albumin, which may be indicative of nutritional deficiency; and dialyzer reuse (Powe, Jaar, Furth, et al. 1999).

There have been few population-based prospective studies of risk factors for septicemia. Risk factors identified in the general population include advancing age, male gender, and African American / black race (Salive, Wallace, Ostfeld, et al. 1993). One study of septicemia-associated mortality among older adults in a community setting identified heavy smoking and diabetes mellitus as the strongest risk factors for septicemia mortality. Severe cognitive and physical impairment were also associated with a greater risk of septicemia mortality (Salive, Wallace, Ostfeld, et al. 1993). Further investigation of the possible causal relationship between each of these risk factors in the general population and septicemia mortality is needed.

Costs and Prevention

Total nationwide costs of hospitalizations for septicemia have been estimated at $16.7 billion. Eighty-three percent of those costs are spent on patients aged 65 and over. The average cost per hospital patient is estimated at $22,100 with the average length of stay being 19.6 days (Angus, Linde-Zwirble, Lidicker, et al. 2001).

Prevention of septicemia involves appropriate treatment of localized infections, and among high-risk groups (such as heart valve patients) appropriate antibiotic treatment prior to surgery. One multicenter randomized controlled study found that adequate antibiotic therapy for sepsis was significantly associated with decreased mortality (MacArthur, Miller, Albertson, et al. 2004). The recent use of minimally invasive surgical techniques and noninvasive monitoring devices in hospital settings can reduce the risk of bloodstream infections associated with invasive devices and procedures that break the skin and mucous membrane barriers (Weinstein 1998). Among diabetic hemodialysis patients, improving nutritional status and minimizing catheter use may decrease the risk of septicemia (Jaar, Hermann, Furth, et al. 2000).

Hospital-acquired septicemia can be prevented and controlled through implementation of new infection-control technology and techniques. Quality assessment that incorporates hospital staff expertise with infection control surveillance, feedback, and protocols has been shown to predict lower infection rates. Other promising strategies include improved handwashing compliance associated with easily accessible soap dispensers as well as other specific modifications in the hospital environment (Wenzel and Edmond 2001).

The Centers for Disease Control and Prevention (CDC) has established screening-based guidelines for the prevention of early onset group B streptococcal (GBS) sepsis in neonatal infants (Schrag, Gorwitz, Fultz-Butts, et al. 2002). CDC recommends the universal prenatal screening of all pregnant women at 35 to 37 weeks' gestation for vaginal and rectal GBS colonization and also administration of intrapartum antibiotic prophylaxis to women identified as GBS carriers and to women who enter premature labor or rupture of membranes at less than 37 weeks gestation. The CDC also suggests that state and local public health agencies together with area hospitals establish surveillance for early-onset GBS disease and promote perinatal GBS disease prevention and education within the appropriate target populations (Schrag, Gorwitz, Fultz-Butts, et al. 2002). One study review and reanalysis of published data found that intrapartum antibiotic prophylaxis reduced early-onset GBS infection rate by 80% (Benitz, Gould, and Druzin 1999).

HIV Infection
(ICD-9 codes 042-044)

The first cases of what we now know as HIV/AIDS were reported in the United States and Connecticut in 1981 (Centers for Disease Control and Prevention 1981; Connecticut Department of Public Health 2001a). Researchers found that the illness “acquired immune deficiency syndrome” (AIDS), initially recognized in homosexual men and hemophiliacs, was caused by the human immunodeficiency virus (HIV). In 1986, HIV was designated as a disease with a disease classification scheme (Gold and Dwyer 1994). Two decades later, the human immunodeficiency virus (HIV) infection has become a major cause of illness, disability, and death worldwide. From 1996 to 1998, HIV/AIDS accounted for about 61,000 deaths in the United States and 755 deaths in Connecticut (Centers for Disease Control and Prevention 2004) [Table 24.1].

HIV infection is the thirteenth leading cause of death for all Connecticut residents and the fourth leading cause of death for residents aged 25 to 44 (Appendix V). Connecticut residents 25 to 44 years accounted for 66% of all HIV deaths in the 1996-1998 period. Age-specific HIV death rates of Connecticut males and females (1996-1998) are depicted in Figure 24.1. Age-specific HIV death rates for males are lower compared with all other causes of death up to about age 24; from ages 25 to 59 HIV death rates are higher compared with all other causes of death; and from ages 60 and older HIV death rates are lower compared with death rates for all other causes. Among females, age-specific HIV death rates tend to be higher compared with all other causes of death up through age 59. Beginning at ages 60 and older, HIV death rates are lower compared with death rates for all other causes.

HIV mortality rates, both nationally and in Connecticut, are higher in men than in women. Age-adjusted HIV death rates were 4.0 times higher for males compared with females in the 1989-1991 period and 2.8 times higher for males compared with females in the 1996-1998 period ($p < .001$ for both comparisons). In 1998, HIV mortality nationwide was 3.4 times higher for males than for females (Murphy 2000). Premature mortality (to age 75)

1996-1998 HIV Infections Deaths, CT Residents

- Thirteenth leading cause of death for all Connecticut residents
- Fourth leading cause of death for residents aged 25-44
- Third leading cause of death for black residents
- Fourth leading cause of death for Hispanic residents
- Fourth leading cause of premature mortality

Table 24.1. HIV Infection Deaths[1] Connecticut Residents by Gender, Race and Ethnicity[2], 1996-98

Group	Number of Deaths	Age-Adjusted Mortality Rates[3] AAMR[4]	Age-Adjusted Mortality Rates[3] Change since 1989-91[5]	Age-Adjusted Premature Mortality Rates to Age 75[3] YPLL[4]	Age-Adjusted Premature Mortality Rates to Age 75[3] Change since 1989-91[5]
All Residents	755	7.4	↓↓	265.0	↓↓
All males	551	11.0	↓↓↓	381.4	↓↓↓
White	338	7.5	↓	264.1	↓↓
Black	213	56.1***	ns	1,831.4***	↓
Asian PI	0				
Native American	0				
Hispanic	131	40.6***	ns	1,333.7***	ns
All females	204	3.9	ns	152.4	ns
White	102	2.3	ns	89.7	ns
Black	101	21.1***	ns	763.5***	ns
Asian PI	0				
Native American	0				
Hispanic	51	13.4***	ns	498.0***	ns

Notes:

1. This cause of death category includes ICD-9 codes 042-044.

2. Racial groupings (White, Black, Asian & Pacific Islander, Native American) include persons of Hispanic ethnicity.

3. Age-adjusted Mortality Rates (AAMR) and Years of Potential Life Lost (YPLL) rates are per 100,000 based on race and ethnicity specific population estimates. Age-adjusted rates were calculated by the direct method using the 2000 U.S. standard population. Rates were not calculated for fewer than 15 events.

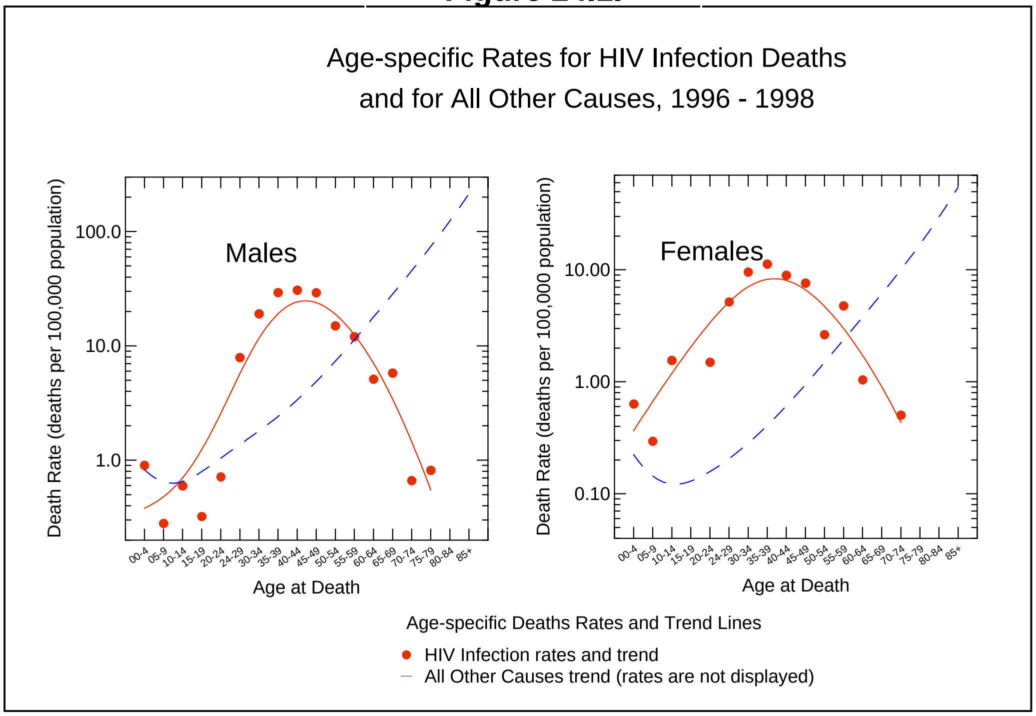
4. Statistical tests were conducted to evaluate differences in rates between race/ethnic groups. The white population serves as the reference group in each comparison (black vs. white, Asian & PI vs. white, Native American vs. white, Hispanic vs. white). Following are explanations of the notations:

   *** Significantly different than the respective white resident rate at $p < .001$.
   — Rate was not calculated due to small numbers.

5. Statistical tests were conducted to evaluate changes in rates over time. Comparisons of 1996-98 vs. 1989-91 rates are made within each race/ethnicity group. Following are explanations of the notations:

   ↓ 1996-98 rate is significantly lower than the 1989-91 rate at $p < .05$.
   ↓↓ 1996-98 rate is significantly lower than the 1989-91 rate at $p < .01$.
   ↓↓↓ 1996-98 rate is significantly lower than the 1989-91 rate at $p < .001$.
   ns Indicates the change from 1989-91 to 1996-98 is not statistically significant.

Figure 24.1.



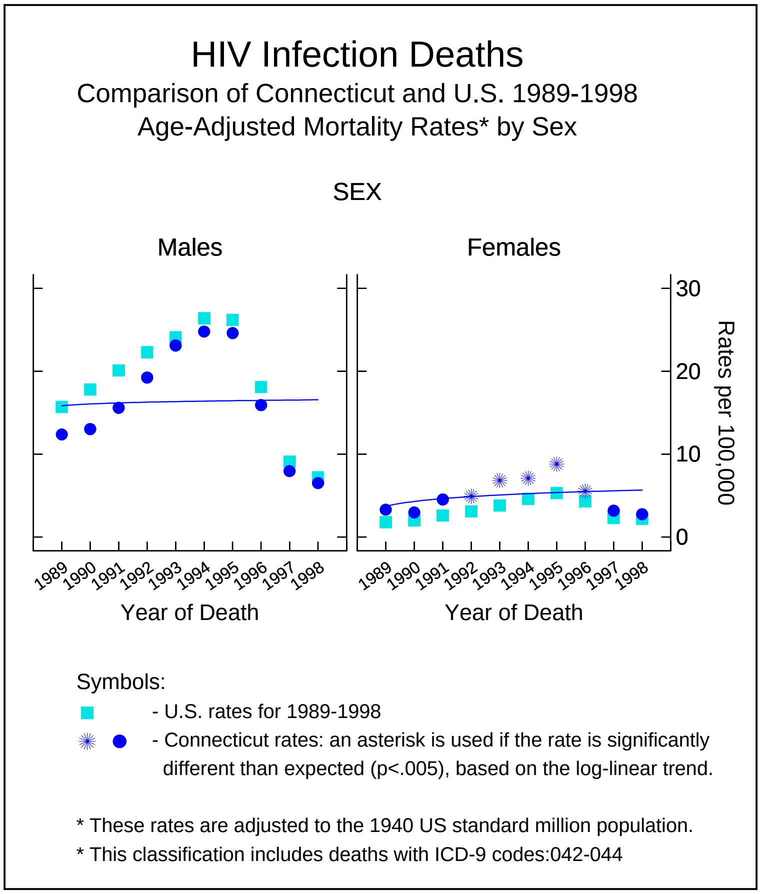
was also significantly higher for Connecticut males compared with females. In 1996-1998, males had 2.5 times the premature HIV mortality rate of females ($p < .001$).

HIV mortality rates were significantly higher in black males and females and Hispanic males and females compared with white males and females, respectively, in both the 1989-1991 and 1996-1998 periods. In the latter period, black males had 7.5 times and Hispanic males 5.4 times the HIV mortality rate of white males in Connecticut, while black females had 9.2 times and Hispanic females had 5.8 times the HIV mortality rate of white females in Connecticut. There were no HIV deaths among Asian and Pacific Islander and Native American males and females in 1996-1998 (Table 24.1).

Black and Hispanic males and females also had significantly higher premature mortality due to HIV compared with white males and females in Connecticut in both the 1989-1991 and 1996-1998 periods. In 1996-1998, black males had 6.9 times and Hispanic males had 5 times the premature mortality rate (to age 75) of white males due to HIV. In the same period, black females had 8.5 times and Hispanic females had 5.6 times the premature mortality rate (to age 75) of white females due to HIV (Table 24.1).

Between the periods 1989-1991 and 1996-1998, the HIV death and premature mortality rates declined significantly for all Connecticut residents. The decline in the HIV death rate was largely accounted for by a significant decrease in deaths in the white male population. The decline in the HIV premature mortality rate was largely accounted for by significant decreases in deaths among both white and black males (Table 24.1).

Figure 24.2.



Mortality analyses of persons with HIV/AIDS for the 1994-1998 period indicate that age, gender, race/ethnicity, and infection risk group were not consistently associated with the risk of death. The most important predictor of death from HIV was being aged 50 years or older at the time of diagnosis ($p < .05$ for the years 1994, 1995, and 1998) [Carley, Roome, and Hadler 1999; Connecticut Department of Public Health 2000].

From 1989 to 1998, age-adjusted death rates for HIV in Connecticut did not exhibit a consistent trend for either males or females (Figure 24.2). The HIV mortality rate for all Connecticut residents showed an increasing trend from 1989 to 1995; from 1995 through 1998 the HIV mortality rate appeared to decrease. This parallels the national trend.

HIV mortality nationwide increased by about 16% per year from 1987 to 1994. In 1994 and 1995 age-adjusted HIV mortality stabilized. By 1996, HIV mortality decreased by about 29%, and in 1997 by about 48% (Centers for Disease Control and Prevention 1999). The dramatic decrease in the HIV death rate in the late 1990s is attributable to newer treatments for HIV, such as highly active anti-retroviral therapy (HAART), that have enabled infected persons to live healthier, longer lives (Centers for Disease Control and Prevention 1999; Connecticut Department of Public Health 2000).

Connecticut male HIV mortality rates were significantly lower than the respective U.S. rates for the years 1989 to 1992, but were not significantly different from the respective U.S. rates in 1997 and 1998. Connecticut female HIV mortality rates were significantly higher than the respective U.S. rates for the years 1989 to 1997. The 1998 Connecticut female HIV mortality rate was not significantly different from the respective U.S. rate (Figure 24.2, Table 24.2).

Table 24.2. Comparison of CT with US, 1989 and 1998

	1989	1998	1998 Comparison
CT AAMR*	7.8	4.6	---
US AAMR*	8.7	4.6	not significantly different

* age-adjusted mortality rates are per 100,000 population, U.S. 1940 standard million population.

AIDS Incidence

There were 662 AIDS cases reported to the Connecticut Department of Public Health in 1998, a decrease of 44% from the number reported the previous year (1,193 cases in 1997) and a decrease of 62% from the high of 1,759 cases reported in 1993. From 1998 to 2000, the number of AIDS cases remained relatively stable. An expansion of the AIDS case definition in 1993 accounted for a large part of the observed increase in AIDS cases in that year (Connecticut Department of Public Health 2001a with 2004 updated figures). The introduction of HAART in the mid-1990s appears to be the most important factor in the decreasing number of AIDS cases; however, a decrease in underlying HIV infection in the population may also account for the observed decrease in AIDS cases (Connecticut Department of Public Health 2000).

Specific subpopulation groups in Connecticut are disproportionately represented among persons with AIDS, with 74% of all cases occurring among males, 46% in persons 30 to 39 years of age, 30% occurring among African American/black residents, 24% in Hispanics, 49% in persons with a history of intravenous (IV) drug use, and 23% in men who have had sex with men (MSM) [Connecticut Department of Public Health 2001a]. The percentage of AIDS cases that are female increased from 26% in 1995 to 38% of all those reported in 2000. [Connecticut Department of Public Health 2001b].

The profile of persons with AIDS in Connecticut (1999) and the United States (1998-1999) differs. A higher percentage of persons with AIDS in Connecticut are female (31.3% vs. 23.4%), Hispanic (29.3% vs. 19.7%), and have injection drug as a likely source of infection use (37.3% vs. 22.4%) [Connecticut Department of Public Health 2000].

Risk Factors

Risk factors for HIV/AIDS are associated with the following social and behavioral risk groups: men who have sex with men (MSM); male injection drug users (IDU); female injection drug users; and women who have sex with high-risk men (Connecticut Department of Public Health 2001b). Appropriate prevention strategies require an understanding of the social settings and behaviors that put each of these groups at higher risk for HIV/AIDS.

HIV is transmitted through the exchange of bodily fluids, such as blood and semen. Transmission of HIV in the United States and other Western countries follows a different pattern from that of the developing world, where heterosexual intercourse is the main source of transmission and females comprise about half of those infected with HIV/AIDS. Over the course of the epidemic, the main sources of transmission in the United States (and Connecticut) have been unprotected anal intercourse and shared use of non-sterile needles to inject drugs (Lorber 1997). More recently, unprotected vaginal intercourse has become an increasingly common source of transmission in the United States [Table 24.3]. In Connecticut, heterosexual transmission of HIV increased from 13% of diagnosed cases in 1990 to 26% in 1998 (Connecticut Department of Public Health 2001a).

Several factors may increase a person's risk for HIV infection. The presence of other sexually transmitted diseases (STDs) that cause ulcerations, such as chlamydia, syphilis, gonorrhea, and genital herpes is an important risk factor for HIV infection (Chesson and Pinkerton 2000). Multiple sexual partners or a partner having multiple sexual partners within a relatively short period of time increases the likelihood of infection by both STDs and HIV (Finer, Darroch, and Singh 1999), as does a high prevalence of HIV infection in the peer group. Exchanging sex to support an addiction (i.e. through prostitution or sex work) is another behavior that places people at higher risk for infection (Des Jarlais 1997).

The AIDS epidemic disproportionately affects low-income, urban minority communities (Karon, Fleming, Steketee, et al. 2001). Approximately 49% of all HIV/AIDS cases in Connecticut have been located in the three largest cities of Hartford, New Haven, and Bridgeport, and 89% of all cases in the state are located in the highly urbanized surrounding areas of Hartford, New Haven, and Fairfield counties (Connecticut Department of Public Health 1998).

Table 24.3. – Risk Groups and Risk Factors for HIV / AIDS

Risk Groups	Risk Factors
• Men who have sex with men (MSM) • Injection drug users (IDU) • Women who have sex with high-risk men • Sex workers	• Use of non-sterile needles or other implements to inject drugs • Unprotected anal intercourse • Unprotected vaginal intercourse • Multiple sexual partners over a short period of time • Concomitant sexually transmitted disease (STD) infections

Sources: Connecticut Department of Public Health (2001b); Des Jarlais (1997); Chesson and Pinkerton (2002); Fife (2002); Finer, Darroch, Singh (1999)

Prevention

Since the beginning of the AIDS epidemic, the CDC has funded primary prevention efforts in local communities that target persons at risk for becoming infected with HIV/AIDS. The main focus of these programs has been to decrease risky sexual and drug-using behaviors, primarily through use of condoms and clean needles, respectively (Centers for Disease Control and Prevention 2001a; Centers for Disease Control and Prevention 2003b). Prevention programs have been tailored to meet the specific needs of subpopulation groups, such as heterosexual adults (Neumann, Johnson, Semann, et al. 2002), sexually active adolescents (Mullen, Ramirez, Strouse, et al. 2002), men who have sex with men (Johnson, Hedges, Ramirez, et al. 2002), and injection drug users (Semaan, Des Jarlais, Sogolow, et al. 2002; Kelly and Kalichman 2002).

In 1996, the CDC initiated the HIV/AIDS Prevention Research Synthesis Project in order to systematically analyze the effectiveness of HIV prevention-intervention studies in reducing sexual and drug risk-taking behaviors (Sogolow, Peersman, Semaan 2002). Key findings from these analyses suggest that:

- Most people at risk will change their behavior to reduce their risk of contracting HIV;
- No single set of intervention programs has successfully eliminated HIV risk-taking behaviors. The "residual" risk behavior that continues after successful interventions have been implemented is of serious concern especially in places with high HIV prevalence, where even low levels of risky behavior may lead to high levels of new infections;
- Reduction of HIV risk behavior is a complex task and no single type of program intervention is effective across the various subpopulation groups; and
- Even with numerous successful prevention efforts, there have been some notable failures (such as the resurgence of HIV in a younger generation of U.S. gay males) that are instructive. Such failures suggest that there may be a decrease in effectiveness of HIV interventions over time, that there may be a need for multiple interventions within a single risk group, and that an effective intervention in one community may not be appropriate for another community. Unsuccessful prevention efforts suggest that a better knowledge base is needed to reduce HIV among high-risk groups (Des Jarlais and Semaan 2002).

Although HIV morbidity and mortality has stabilized since the beginning of the epidemic, there is an increase in the number of persons with HIV and a growing public concern about increasing HIV incidence in certain communities. In 2003, the CDC announced a new initiative "Advancing HIV Prevention: New Strategies for a Changing Epidemic" whose aim is to reduce barriers to early diagnosis of HIV and to increase access to appropriate medical care and prevention services. This initiative emphasizes both primary and secondary prevention strategies and relies on long-standing public health approaches to reduce the incidence and spread of disease, such as routine screening as appropriate, new case identification, partner notification, and available ongoing treatment and prevention services for infected persons. The initiative is made up of four main strategies: 1) making HIV testing a routine part of medical care; 2) implementing new models for diagnosing HIV infections outside medical settings; 3) preventing new infections by working with persons diagnosed with HIV and their partners; and 4) further decreasing perinatal HIV transmission (Centers for Disease Control and Prevention 2003b).

The Connecticut Department of Public Health provides HIV prevention services, program services for people with HIV/AIDS and those affected by HIV, as well as surveillance of HIV/AIDS in the state. The HIV/AIDS Prevention Program (HAPP) supports HIV antibody testing and counseling, needle exchange, drug treatment advocacy, health education, and street outreach. The HIV/AIDS Planning Program (HAP) supervises public information campaigns and community-based HIV prevention campaigns. The Health Care and Social Services Program (HCSS) supervises services for persons with HIV infection, including case management, payment for medication, and help for persons affected by HIV such as the uninfected children of persons with HIV (Connecticut Department of Public Health 2004b). The HIV/AIDS Surveillance Program provides up-to-date information on HIV case surveillance in Connecticut by gender, race/ethnicity, age, mode of transmission, and town, as well as trends in HIV morbidity and mortality over time (Connecticut Department of Public Health 2004c).

Barriers to HIV Prevention

A major societal barrier to HIV/AIDS prevention is stigma, that is, prejudice and discrimination directed toward people with HIV/AIDS. Fear of persons with HIV/AIDS, homophobia, and prejudice against drug users on the part of health care workers can impede prevention efforts by discouraging people from acknowledging their risk, seeking out HIV testing, and delaying treatment. Stigma experienced on multiple levels—individual (i.e., negative interactions with at-risk persons), community (i.e., anti-gay attitudes, lack of candid discussions regarding sexuality and sexual decisionmaking), and societal structures (i.e. discriminatory laws)—can interfere with the effectiveness of HIV prevention and care programs (Centers for Disease Control and Prevention 2001b). Societal and individual attitudes that reinforce male dominance and female submissiveness regarding safer-sex practices are other important barriers to successful HIV/AIDS prevention (Asencio 2002).

Strategies to combat stigmatization of people with HIV/AIDS and high-risk groups include: 1) continued public education about how HIV is and is not transmitted based on facts, not prejudice; 2) making sure that prevention programs are not stigmatizing to the target population and ensuring that programs are reflective of the needs and preferences of that population group; and 3) ongoing education of health care and other service providers who work with HIV-positive people (Valdiserri 2002). Continued leadership at the local, state, and national levels are needed to address discriminatory laws, societal structures, and negative attitudes that can hamper successful HIV prevention efforts (Centers for Disease Control and Prevention 2001b).

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