ONE HUNDRED FIFTY-FIRST CONNECTICUT REGISTRATION REPORT

Births, Deaths, Marriages, Divorces

1998

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CONNECTICUT RESIDENT HOSPITALIZATIONS

1998

CONNECTICUT DEPARTMENT OF PUBLIC HEALTH

2002

State of Connecticut

ONE HUNDRED AND FIFTY-FIRST REGISTRATION REPORT

for the year ended

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Prepared by:

Carol E. Bower
Associate Research Analyst
Federico A. Amadeo
Associate Research Analyst
Lloyd M. Mueller
Epidemiologist IV Supervisor

CONNECTICUT DEPARTMENT OF PUBLIC HEALTH
OFFICE OF POLICY, PLANNING, AND EVALUATION
DIVISION OF POLICY, PLANNING, AND ANALYSIS

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We gratefully acknowledge the contributions of the following staff
of the Connecticut Department of Public Health:

OFFICE OF POLICY, PLANNING, AND EVALUATION
DIVISION OF POLICY, PLANNING, AND ANALYSIS

Michael J. Hofmann, *Director of Research and Planning*
Barbara O'Connell, *Health Care Analyst*
Adrienne E. Ronsani, *Epidemiologist 1*
Carol L. Stone, *Epidemiologist 1*

OFFICE OF POLICY, PLANNING, AND EVALUATION
DIVISION OF VITAL RECORDS

Frances Battagler, *Office Assistant*
Eulando Clarke, *Office Assistant*
Dianne Gustafson, *Medical Records Technician II*
Angela Jimenez, *Research Analyst*
Carol Mangiafico, *Health Program Assistant II*
Suzanne Speers, *Registrar*
David Stevenson, *Office Assistant*

BUREAU OF ADMINISTRATIVE AND SUPPORT SERVICES
DIVISION OF DATA PROCESSING

Bruce R. Wallen, *Data Processing Manager*
Conrad Wopperer, *Systems Developer 3*

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CONNECTICUT DEPARTMENT OF PUBLIC HEALTH
410 CAPITOL AVENUE
P.O. BOX 340308
HARTFORD, CT 06134-0308

http://www.dph.state.ct.us

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THEN AND NOW

Highlights of Connecticut Vital Statistics 100 Years Ago and Today[a]

Statistic or Event	1898	1998
Population (estimated)	893,060	3,274,069
Live births	21,023	43,741
Rate (per 1,000 population)	23.5	13.4
Deaths	14,170	29,619
Rate[b] (per 1,000 population)	15.9	9.0
Fetal deaths[c]	916	298
Rate[b] (per 1,000 live births)	43.6	6.8
Infant deaths (<1 year old)	2,935	305
Rate (per 1,000 live births)	139.6	7.0
Marriages	6,565	20,292
Rate (persons per 1,000 population)	14.7	12.4
Divorces	429	10,362[d]
Rate (persons per 1,000 population)	1.0	6.3
Ratio of divorces to marriages	1:15	1:2

[a] The 1898 Registration Report did not distinguish between events by residence and occurrence. All 1998 figures are by residence.

[b] Death rates are expressed as "crude rates."

[c] Fetal deaths were called "still births" in the 1898 Registration Report.

[d] Divorce decrees and annulments are reported to DPH by Connecticut Superior Courts. The 1998 reporting was incomplete from Ansonia-Milford, Hartford-New Britain, Middlesex, New Haven, Stamford-Norwalk, and Tolland Superior Courts.

Top Ten Leading Causes of Death: 1898 and 1998

	1898[a]				1998		
Rank	Cause of death	No.	Rate[i]	Rank	Cause of death	No.	Rate[i]
1	Consumption[b]	1,438	161.0	1	Diseases of the heart	9,612	293.6
2	Diseases of heart	1,101	123.3	2	Malignant neoplasms	7,067	215.8
3	Pneumonia	1,092	122.3	3	Cerebrovascular disease	1,939	59.2
4	Infantile	1,089	121.9	4	COPD[g]	1,234	37.7
5	Apoplexy[c]	739	82.7	5	Pneumonia & influenza	1,228	37.5
6	Accidents[d]	648	72.6	6	Unintentional injuries	1,110	33.9
7	Bright's disease[f]	536	60.0	7	Diabetes mellitus	659	20.1
8	Cancer	517	57.9	8	Septicemia	418	12.8
9	Bronchitis	464	52.0	9	Kidney diseases[h]	370	11.3
10	Old age[e]	353	39.5	10	Chron. liver dis./cirrhosis	284	8.7

[a] From Connecticut's *Registration Report for the Year Ending December 31, 1898*, Diagram E, and Table VII. Deaths from other infectious diseases included measles (80), typhoid fever (189), diphtheria (219), whooping cough (172), "la grippe" (290), and malaria (124). There were 127 deaths associated with pregnancy and childbirth, 5 homicides, 82 suicides, and 1 execution by hanging. Stomach cancer (107) "cancer of the womb" (80), and breast cancer (58) were the leading causes of cancer deaths. In addition, 78 deaths were attributed to intemperance or chronic alcoholism, and 49 to "softening of the brain."

[b] Pulmonary tuberculosis.

[c] Cerebrovascular disease; stroke.

[d] Accidental deaths in 1898 included 108 drownings, 59 falls, 70 burns and scalds, 41 poisonings, 23 gun-shot wounds, and 132 railroad injuries.

[e] In 1898 "old age" began at 50 years of age.

[f] Bright's disease = chronic nephritis.

[g] COPD = Chronic obstructive pulmonary disease (chronic bronchitis, emphysema, etc.).

[h] Nephritis, nephrotic syndrome, and nephrosis.

[i] Crude death rates per 100,000 population.

INTRODUCTION

Registration of Vital Statistics in Connecticut

This volume marks the publication of the one hundred fifty-first annual *Registration Report* for the State of Connecticut. The series began with the report of 1848 and has been published annually since then, except for 1852. In the United States, only Massachusetts, whose 1997 report will be the 156th in a series, has a longer record of continuous publication of vital statistics.

The first reference to the registration of vital statistics in Connecticut appeared in the *Colonial Records of Connecticut, 1636-1665, Volume I*, where it was stated that the Court of Election on June 3, 1644 ordered town clerks or registrars to record births and marriages. The court of 1650 provided for the registration of deaths in addition to births and marriages. These functions previously had been the responsibility of the clergy, rather than government officers. Until the mid-1800's, the records were used primarily as legal statements to help protect the rights of individuals; then vital statistics became central to the organization and practice of public health, and their compilation at the state level was begun.

From 1850 to 1900, national-level birth and death statistics were based on decennial census data. The data were incomplete and inaccurate, however, so the U.S. Bureau of the Census established "registration areas" comprising states or large cities, with the intention of creating areas that would provide reliable vital statistics that were at least 90% complete. Connecticut was among the first states to be admitted into such areas--for deaths in 1890 and for births in 1915. Central filings of marriage and divorce data in Connecticut began in 1897 and 1947, respectively.

Today's *Registration Report* is published each year by the Connecticut Department of Public Health. Connecticut's vital statistics data base currently contains records pertaining to three types of events: births, deaths, and fetal deaths. Although DPH is no longer mandated to collect detailed data on marriages and divorces, state totals of marriages and divorces and town-level counts of marriages (Table 2A) are still provided in this report. Beginning with the 1997 report, summary data on hospitalizations also are included.

General Comments

Completeness of Registration

The statistics presented in the *Registration Report* reflect not only vital events that occur in Connecticut but also those involving Connecticut residents that occur in other states and Canada. The Connecticut Department of Public Health reciprocates with every other state in the U.S. and the provinces of Canada in exchanging copies of complete birth and death records for non-residents. The exception is New York City, which does not report cause of death for non-resident deaths or birthweight for non-resident births. Registration of births in Connecticut is essentially 100% complete, and there is no under-reporting of deaths.

There is no interstate transfer of marriage, divorce, or fetal death records; consequently, the registration of these events for Connecticut residents slightly underestimates the true counts.

Reporting for Local Health Districts

Summary statistics are reported for multi-town local health districts in several tables, to enable local health agencies to better understand and serve their resident populations. The composition of the respective health districts reflects membership as of May 29, 2001 (see listing and map in Appendix II).

Rates and Percentages

Rates and percentages based on few events tend to be less stable than those based on many events. Because of this instability, rates or percentages were not calculated for less than five related events. For birth data, the denominator used to calculate percentages was the total number of events for which the given characteristic was "known" (i.e., total number minus number of "unknowns.") The term "unknown" as used in this report includes both "missing" responses (no code entered) and responses coded as "unknown." Rates were calculated using the equations given in Appendix I.

Tests of Statistical Significance

Statistical assessments of data for birth risk factors and outcomes, infant deaths, and fetal deaths have been included to distinguish group differences attributable to chance from those signifying noteworthy patterns. Two types of assessments are given: comparisons between the current and prior years (1998 and 1997); and comparisons among selected demographic subgroups or geographic regions for the current year alone. The health status of the state's largest eight towns is discussed, regardless of the level of statistical significance, as these towns are considered to be of broad interest. The results of the tests of statistical significance by race and ethnicity and by health districts and towns, and a more complete discussion of the methods used in this assessment, are given in Appendix V.

Population

Population Estimation Methodology

Population estimates are used to calculate rates of births, deaths, marriages, and divorces. The U.S. Census Bureau's Population Estimates Program issues total population estimates for Connecticut counties and towns as of July 1 of even-numbered years. Thus, for 1998, the U.S. Census Bureau figures were adopted without modification as Connecticut's town estimates. For odd-numbered years, a methodology first used for the 1997 Connecticut estimates is followed [1].

Births

Inclusion of "Presumptive Marital Status"

"Presumptive marital status" is included in Table 3 of this report for historical reasons, even though its validity is limited [2a]. Connecticut law has forbidden reference to illegitimacy, birth in or out of wedlock, or marital status on the birth certificate for more than 50 years; nonetheless, "illegitimate" or "out-of-wedlock" births have always been included in the State's vital statistics reports. From 1947-1988 such births were inferred from the absence of a father's name on the birth record, and since 1989 the mother's presumptive marital status has been determined by matching of surnames. Even in early registration reports dating to the 1800's, numbers of illegitimate births were characterized as "approximations to the real facts." Modification of the birth record to include a "marital status" field will enable reporting of actual rather than presumptive marital status beginning with the 1999 *Registration Report*. [2a]

Deaths

Cause-of-Death Data

Causes of death are all the diseases, morbid conditions, or injuries that either resulted in or contributed to death, and the circumstances of the accident or violence that produced any such injuries. Based on information from the death certificate and following international rules, every Connecticut death is attributed to one underlying condition. The *underlying cause of death* is the disease or injury that initiated the chain of morbid events leading directly to death, or the circumstances of the accident or violent act that produced the fatal injury. On the Connecticut death certificate, the underlying cause of death is distinguished from the *immediate cause of death* (the final disease, injury, or complication directly causing death) and any intervening conditions. Other significant conditions that were unrelated to the cause are listed on the death certificate as *contributing* conditions.

For the purpose of vital statistics reporting, the underlying cause of death is given as the main cause of death. This is not necessarily true for other death reporting systems used by the Department of Public Health, so death counts from other programs may differ from those published in the *Registration Report.* The HIV/AIDS Surveillance Program, for example, counts every death occurring to a person with HIV/AIDS, regardless of the underlying cause. Consequently, for any given year the HIV/AIDS mortality figures published in the *HIV/AIDS Surveillance Report* generally exceed those published in the *Registration Report.*

The system for classifying causes of death, the *International Classification of Diseases* (ICD), is revised occasionally to reflect changes in medical practices and new medical knowledge. As each ICD revision results in a degree of discontinuity in cause-of-death statistics, a ratio of comparability is used to adjust for classification changes in the revisions. Causes of death in 1998 were coded using the ninth revision of the ICD (known as the ICD-9), which became effective in 1979, and using the *Addendum to the International Classification of Diseases Ninth Revision* for the classification of infection with human immunodeficiency virus.

Changes to the 1998 Registration Report

Birth Data

Adequacy of Prenatal Care. Accurate assessment of prenatal care utilization by pregnant women is key to determining the need for health services among different populations, for following trends, and for understanding how prenatal care affects birth outcomes like low birthweight and prematurity. A modified version of the Kessner Index, the standard method of measuring adequacy of prenatal care, was employed in previous Connecticut *Registration Reports*. The Kessner Index has several shortcomings, however, such as its failure to follow the entire prenatal care schedule recommended by the American College of Obstetricians and Gynecologists (ACOG). Consequently, it depicts prenatal care utilization incompletely or inaccurately[2b] (see Appendix III for further discussion).

In keeping with the methodology adopted by the National Center for Health Statistics for use in the National Vital Statistics System [2c], a newer index, the Adequacy of Prenatal Care Utilization (APNCU) Index [2b] will be used in Connecticut to report on prenatal care utilization starting in 1998 (Tables 3 and 4). The APNCU Index compares the actual number of visits with the expected number, based on full ACOG recommendations; additionally, it adjusts for time of entry into prenatal care and gestational age at delivery. By overcoming the major deficiencies of the Kessner Index, the APNCU Index gives a more accurate picture of prenatal care conforming to ACOG guidelines, and helps in formulating new guidelines for prenatal care.

To facilitate interpretation of state- and town-level data during the transition from one index to another, prenatal care adequacy for 1998 births is presented using both indices (Tables 3 and 4). Appendix VI contains a comparison of the two indices' assessments of prenatal care utilization levels for 1998 Connecticut resident births.

Smoking during Pregnancy. The risk factor "smoking during pregnancy" has been added to the analysis of statistical significance (Appendix V).

Death Data

Alzheimer's disease is a form of progressively debilitating dementia that is believed to be underreported on death certificates. It was added to the ICD-9 in 1979 and was incorporated into the CDC's listing of selected causes of death in 1993. In Connecticut, Alzheimer's disease has ranked above atherosclerosis as a leading cause of death since 1993 and above HIV since 1997. It has been added to the Connecticut *Registration Report* for reporting 1998 deaths (see Table 9, Appendix IV, and related discussions).

Hospitalization Data

Data on inpatient hospital utilization by age, sex, and principal diagnosis were added to the *Registration Report* in 1997. For 1998, hospitalization data have been expanded and are presented as a separate report attached to the 1998 *Registration Report.*

Divorce Data

Effective January 1, 1998, Special Session Public Act 97-8 repealed *Connecticut General Statutes,* Section 46b-68, concerning reports of marriage dissolutions and annulments; as a result, the Department of Public Health does not receive copies of divorce and annulment records. These records are maintained at the Superior Courts of Connecticut's 13 judicial districts. DPH is sent monthly counts of marriage dissolutions and annulments by most of the Superior Courts. Incomplete divorce counts for 1998 were received from the Superior Courts of Ansonia-Milford (2 months missing), Hartford (1 month missing), Middlesex (2 months missing), New Haven (1 month missing), Stamford-Norwalk (1 month missing), and Tolland (2 months missing). Accordingly, 1998 divorce counts and rates may be under-reported.

Supplemental Information

The following supplemental tables for 1998 are available: Supplemental Table 3 contains town-specific birth data in the format of Table 3; Supplemental Table 8 contains town-specific information in the format of Table 8 (Infant Mortality); Supplemental Table 9 contains town-specific information in the format of Table 9 (Mortality by Age, Race/Ethnicity, and Sex); and Supplemental Tables A and B contain state-level cause-of-death frequencies by age, race/ethnicity, and sex using 3- and 4-digit ICD-9 codes, respectively.

Availability of Data Electronically and on the Internet

The complete *1998 Registration Report* is available as Adobe Acrobat (PDF) files at the DPH web site (address below). Tables 2A through 10 also are available electronically as Microsoft Excel spreadsheets from the Office of Policy, Planning, and Evaluation. Supplemental tables A, B, and 3 are available in electronic form (complete tables).

How to Reach Us

Mailing address:

Connecticut Department of Public Health
Office of Policy, Planning, and Evaluation
Attn: FOI Requests
410 Capitol Avenue, MS-13PPE
P.O. Box 340308
Hartford, Connecticut 06134-0308

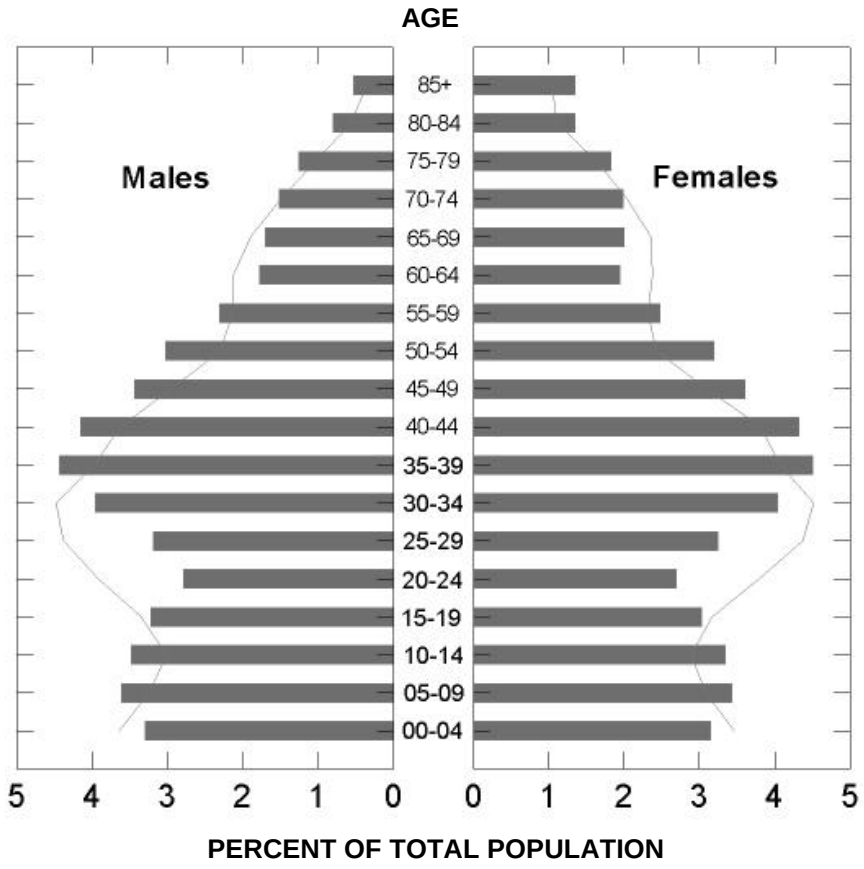
Phone: (860) 509-7127
Fax: (860) 509-7160
E-mail: *charles.nathan@po.state.ct.us*
DPH Web site: *http://www.state.ct.us/dph*
Link for Registration Reports: *http://www.state.ct.us/dph/reports.html#oppe*

POPULATION DISTRIBUTION

Age and Sex

The estimated July 1, 1998 population of Connecticut was 3,274,069 [1], which was 13,047 (0.4%) lower than the July 1, 1990 census count but 4,211 (0.1%) greater than the 1997 estimate. Of the total population, 48.5% were males and 51.5% were females. In the age groups from <1 year through 20-24 years, the number of males exceeded that of females. In all subsequent 5-year age cohorts, however, females exceeded males. Women 65+ years of age outnumbered men by a factor of 1.5, and there were 2.5 times as many women as men who were 85+ years of age (Fig. 1, Table 1).

Figure 1
Comparison of Connecticut Population Distribution, 1998 and 1990
(1998 shown as bars; 1990 shown as lines)



The estimated racial and ethnic composition of the Connecticut population as of July 1, 1998 was: white race, 88.0%; black race, 9.3%; Asian and Pacific Islander races, 2.4%; American Indian and Alaska Native races, 0.2%; and Hispanic ethnicity (any race), 8.2% [18].

Towns

Compared to the 1990 census populations, the 1998 estimated populations were lower in 54 Connecticut towns and higher in 115 towns [3]. Fifteen towns lost 1,000 or more residents (compared to 16 towns in 1997), and 11 towns grew in population by more than 1,000. Hartford, New Haven, New Britain, New London, Bridgeport, and West Hartford lost the most people, and Newtown, Stamford, Shelton, New Milford, Colchester, and Monroe gained the most. New London lost the greatest percentage of residents (16.4%), and Sterling had the greatest percentage gain (19.4%), both for the second consecutive year. Among the five towns with populations greater than 100,000, the estimated populations of four towns decreased between 1990 and 1998 (Hartford, -5.9%; New Haven, -5.6%; Waterbury, -3.3%; Bridgeport, -3.0%), while the estimated population of the fifth town, Stamford, increased by 2.4%. In contrast, among Connecticut's five smallest towns, the populations of four increased (Scotland, 18.7%; Union, 11.6%; Warren, 6.6%; Colebrook, 4.8%), while that of Canaan decreased by 0.5%.

BIRTHS

Number and Rate

The total number of live births to Connecticut residents in 1998 was 43,741. This represents an increase of 693 live births or 1.6% from 1997, and a decrease of 6,357 (12.7%) from 1990. The birth rate was 13.4 live births per 1,000 population (Table 2A), up from 13.2 in 1997 and marking the first increase in birth rate since 1990, when it was 15.2. The 1998 U.S. birth rate was 14.6 per 1,000 population [6a].

Demographic Factors

Town of Residence

In 1998, six towns (Darien, Hebron, Colchester, Norwalk, Hartford, Andover) had birth rates that were 25% or more above the state rate, and 38 towns were 25% or more below the state rate. Darien had the highest rate (20.2 per 1,000 population) and Warren had the lowest rate (3.8 per 1,000). Seven towns (Bridgeport, Hartford, New Britain, New Haven, Norwalk, Stamford, and Waterbury) each registered more than 1,000 births during the year. These seven towns accounted for 28.2% of resident births but only 23.1% of the population in the state (Table 2A). Compared to 1997, birth rates decreased in Bridgeport and increased in the other six towns.

Mother's Race and Ethnicity

Of the 43,741 resident live births, 28,283 were to white non-Hispanic mothers (an increase of 2.4% from 1997) and 4,903 were to black non-Hispanic mothers (up 2.0%), representing 64.7% and 11.2% of total 1998 resident births, respectively. There were 6,178 births to mothers of Hispanic origin (an increase of 8.5% from 1997), representing 14.1% of the total number of resident births (Table 3). Race was unknown for 902 births and ethnicity was unknown for 2,738 births (Table 2B, footnote b).

Infant's Sex

Of the total live births, 22,429 (51.3%) were male and 21,312 (48.7%) were female (Table 3).

Place of Delivery

All but 238 (0.5%) of the total resident births occurred in hospitals (Table 3). Home births accounted for about three-fourths of non-hospital deliveries (Table 3).

Live Birth Order

Of babies delivered in 1998 for which birth order was known, 40.7% were first-born, 34.1% were second-born, and 25.2% were third-born or more. Birth order was not known for 9.0% of total deliveries.

Plurality

Of total live births, 96.0% were singletons and 4.0% (1,767) were multiple births (Table 3), compared to 3.7% in 1997. Of the multiple births, 1,567 were twins, 180 were triplets, and 20 were quadruplets. Between 1980 and 1998, the proportion of multiple births in Connecticut nearly doubled, from 2.1% to 4.0% of total births. White non-Hispanics were more likely than women of other races and ethnicities to have multiple births; 4.5% of births to white non-Hispanics, 3.3% of births to black non-Hispanics, and 3.2% of births to Hispanics were multiple. Relative to total births, white non-Hispanics were over-represented (71.4% of multiple births vs. 64.7% of all births) whereas Hispanics and non-Hispanic blacks were under-represented (11.3% of multiple vs. 14.1% of total, and 9.2% of multiple vs. 11.2% of total, respectively).

Mother's Presumptive Marital Status

Connecticut law prohibits inclusion of the mother's marital status on birth records; consequently, marital status is inferred by matching the mother's, father's, and child's surnames according to certain criteria [2a]. Although this method of assessing marital status is of limited validity, it has been used in Connecticut since 1989. Following these criteria, in 1998, 13,686 resident births (31.3%, down from 32.8% in 1997), were presumptively to unmarried mothers (Table 3). This figure was lower than the 1998 U.S. value of 32.8% [6a].

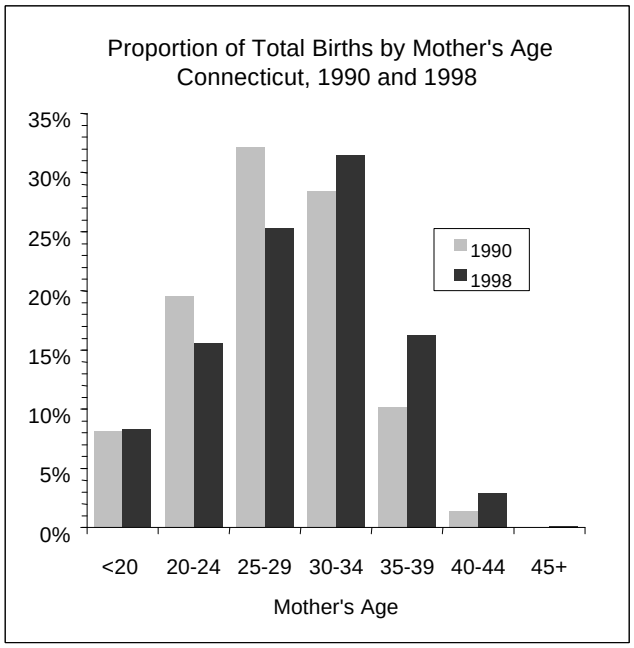
Mother's Education

The education level of Connecticut mothers is increasing. In 1998, 40.5% of deliveries were to mothers with 12 or less years of education, compared to 48.6% in 1990. Similarly, the percentage of mothers with 13 or more years of education rose from 51.4% in 1990 to 59.7% in 1998. White non-Hispanic females with college educations outnumbered those with 12 or less years of education by a factor of 2.2. In contrast, 1.7 times more black non-Hispanic mothers and 2.8 times more Hispanic mothers had high school educations than those with college educations (Table 3).

Mother's Age

(See *Births to Teens* on page 16 for discussion of births to females under age 20.)

From 1990 to1998, the distribution of births by mother’s age shifted to older women (see illustration below). For the sixth consecutive year, more births occurred to women 30-34 years of age than to women in any other five-year age cohort. For at least the prior 48 years women in the age groups 20-24 or 25-29 accounted for the greatest numbers and proportions of births to Connecticut residents [4]. In addition, 19.3% of 1998 births were to women 35+ years of age, compared to 18.5% in 1997, thus continuing the trend toward childbearing at later ages.



Birth Outcomes and Associated Risk Factors

Low Birthweight

Overall, 7.8% of all births in 1998 were of low birthweight (<2,500 grams) (Table 4), an increase from 7.3% in 1997. This was the highest percentage of low birthweight births since 1970, when the same percentage was reported. The Connecticut percentage exceeded the U.S. value of 7.6% [6a]. As in the past, the risk of low birthweight delivery differed across communities (Table 4) and risk groups (Table 3). Variation in low birthweight occurred within categories defined by mother's race/ethnicity, infant's sex, plurality of births, live birth order, mother's presumptive marital status, mother's education, mother's age, trimester of initiation of prenatal care, adequacy of prenatal care, tobacco use during pregnancy, alcohol use during pregnancy, and mother's place of residence, as noted below.

Race/Ethnicity

The percentages of low-birthweight deliveries in 1998 to white non-Hispanic, black non-Hispanic, and Hispanic residents were 6.5%, 13.2%, and 9.7%, respectively (Tables 3 and 4). These represented relative increases from the prior year of 4.8% for white non-Hispanics, 8.2% for black non-Hispanics, and 16.9% for Hispanics. The annual change was statistically significant only for Hispanics (Appendix V).

The disparity in risk of low birthweight among minorities compared to non-Hispanic whites increased in 1998. Black non-Hispanic mothers and Hispanic mothers had 2.0 and 1.5 times the risk of white non-Hispanic mothers, respectively, to deliver low-birthweight babies, and 3.3 and 1.8 times the risk, respectively, for very low birthweight delivery (<1,500 grams). Compared to the lowest risk group, white

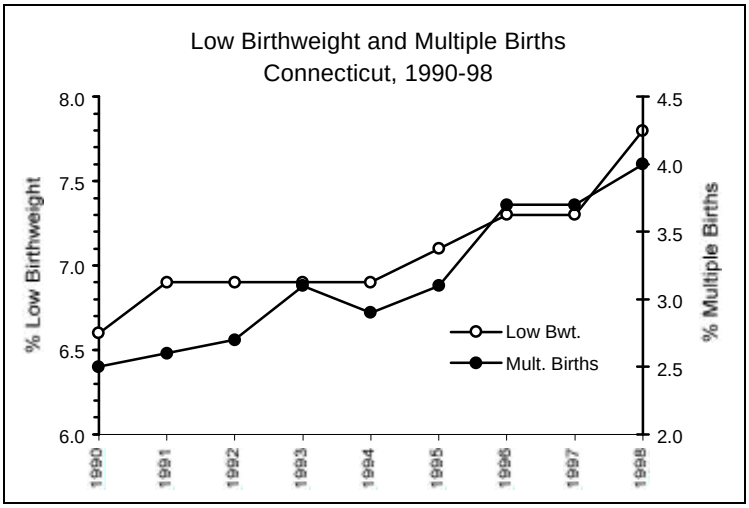
non-Hispanics, the percentage values for low-birthweight and very low birthweight were significantly higher for both Hispanics and black non-Hispanics (Appendix V).

Infant's Sex

As in prior years, and independent of race or Hispanic ethnicity, female babies were more likely than male babies to have low birthweight (8.3% and 7.3%, respectively) (Table 3).

Plurality

Multiple births accounted for 28.1% of low birthweight deliveries and 29.5% of very low birthweight, but only 4.0% of total births in 1998. More than half (54.7%) of all multiple births in 1998 were low birthweight, compared to only 5.8% of singleton births, and one in eight (12.6%) was very low birthweight, compared to 1.2% of singletons (Table 3). Between 1990 and 1998, low birthweight for singleton deliveries remained fairly constant at 5.5% to 5.8%, whereas low birthweight for all deliveries (singleton plus multiple) rose from 6.6% to 7.8%. About 90% of thise overall increase in low birthweight was due to the increase in multiple births during the same period [6e]. The recent trend in overall low birthweight deliveries parallels an increase in multiple births from 2.5% to 4.0% of total births (see illustration below).



Live Birth Order

Compared to infants that were second-born (6.5% low birthweight), first-born and third-or-more-born were more likely to be of low birthweight (8.4%, and 8.5%, respectively) (Table 3).

Mother's Presumptive Marital Status

Unmarried mothers [2a] had 1.7 times the risk of married mothers to deliver low birthweight babies (10.7% and 6.4%, respectively) (Table 3). Unmarried mothers accounted for 43.4% low birthweight deliveries and 47.3% of very low birthweight deliveries, but only 31.3% of total births.

Mother's Education

Of mothers with known educational attainment, those with 12 years or less of education had the highest percentage (9.2%) of low-birthweight deliveries. Overall and regardless of race/ethnicity, the percentage of low birthweight deliveries decreased with increasing years of education (Table 3).

Mother's Age

As in the past, mothers less than 15 years of age and more than 44 years of age had the highest percentages of low birthweight deliveries (15.5% and 25.8%, respectively), whereas women aged 25-29 and 30-34 had the lowest percentages (7.2% and 6.9%, respectively) (Table 3). Teens accounted for disproportionate amounts of low birthweight (11.8% low birthweight vs. 8.3% of total resident births), as did women aged 40+ years (3.5% of low birthweight vs. 2.9% of total births). The proportion of total low birthweight deliveries among older (40+ years of age) women in 1998 was lower than in 1997, whereas the proportion of low birthweight attributable to teens was slightly higher. Compared to women 30-34 years of age, who had the lowest rate of low birthweight deliveries, the rate of low birthweight was 1.6 times greater among those 15-19 years of age and 1.2 times greater among those 40-44 years of age.

For all age groups, percentages of low-birthweight deliveries generally were highest among black non-Hispanic mothers and reached double digits in all age groups for which there were sufficient data for calculation (Table 3). Where calculations were possible, in most age groups the percent low birthweight for Hispanics was higher than that for white non-Hispanics and lower than that for black non-Hispanics.

Initiation of Prenatal Care

The trimester of pregnancy in which a woman begins prenatal care is a strong indicator of risk of low birthweight. Generally, the later the prenatal care begins, the greater the likelihood of low birthweight deliveries. Women who received no prenatal care were 3.6 times more likely than women who began care during the first trimester of pregnancy to deliver low-birthweight babies (25.8% and 7.2%, respectively). Women who began prenatal care during the second or third trimester were 1.2 times more likely to have a low birthweight delivery (8.5% and 8.9% low birthweight, respectively) compared to those who began care in the first trimester (Tables 3 and 4).

Adequacy of Prenatal Care

Adequacy of prenatal care, as defined by a modified Kessner Index, is a composite measure involving three items from birth records: the month prenatal care began, the total number of prenatal visits, and the length of gestation (see Appendix III). According to this index, the highest risk group, “inadequate” care, had 2.7 times the percentage of low-birthweight deliveries as the lowest risk group, “adequate” care, and the “intermediate” care group had 1.4 times the percentage of low birthweight deliveries as the “adequate” care group (Table 3). The percentages of low birthweight in all three groups were higher than in 1997.

The APNCU Index involves the same data elements from birth records, but applies them differently (see *Introduction* and Appendix III). Using this index, relative to the "adequate" prenatal care group, the "inadequate" care group had 3.2 times the percentage of low birthweight, and the "intermediate" care group had the same percentage. Mothers who received "intensive" care (prenatal care utilization that exceeds clinical recommendations), were the most likely to have low birthweight deliveries (4.1 times the percentage of those with "adequate" care). The association between intensive utilization of prenatal care and birth outcomes is discussed more fully in Appendix VI.

Although both indices showed strong associations between birthweight and level of prenatal care, the proportions of low-birthweight deliveries with "nonadequate" prenatal care (inadequate plus intermediate) were strikingly different, depending on the index (Table 3). The Kessner percentage of "non-adequate" care for "all races" was more than twice the APNCU value (26.5% and 12.2%, respectively), and comparable differences occurred between indices for the various racial and ethnic groups. By both measures, however, black non-Hispanic mothers with low-birthweight deliveries were the most likely to have received non-adequate prenatal care (Table 3).

Tobacco Use

Of women who delivered in 1998, the percent of low birthweight deliveries to those who smoked during pregnancy was nearly twice that of those who did not smoke during pregnancy (13.4% and 7.1%, respectively). This relationship was similar for all racial/ethnic subgroups.

Alcohol Use

The percent of low birthweight births was 2.3 times greater for those who consumed alcohol during pregnancy as for those who did not (17.5% and 7.6%, respectively), with similar findings for all racial/ethnic subgroups.

Health District and Town of Residence

As in previous years, percent low birthweight varied greatly across communities within Connecticut (Table 4). Percent low birthweight exceeded the state value of 7.8% in two health districts, Bristol-Burlington (8.3%) and North Central (8.4%), but these differences were not statistically significant. Percent low birthweight was significantly lower than the state value in the East Shore and Pomperaug health districts (Appendix V).

Of the seven towns with 1,000 or more births, the state percentage of low birthweight was exceeded in all but Norwalk (Table 4). The elevated percentages of low birthweight were significantly higher than the state value in Bridgeport, Hartford, New Britain, and New Haven, but not in Waterbury or Stamford (Appendix V). Among towns with 200 to 999 births (Table 2A), the percentage of low birthweight was significantly lower than the state value in Bethel, Colchester, Farmington, and Greenwich (Appendix V).

Between 1997 and 1998, the percentage of low birthweight deliveries increased significantly in the Chesprocott, Bristol-Burlington, and North Central health districts and in the towns of Bristol, Cheshire, Hamden, Rocky Hill, and Windham. A significant decrease in low birthweight occurred in the East Shore health district, and in the towns of Colchester, East Haven, and Greenwich (Appendix V).

With respect to the state percentage, very low birthweight was significantly higher in Bridgeport, Cheshire, East Hartford, Hartford, and New Haven, and significantly lower in the East Shore and Farmington Valley health districts, and in the towns of Berlin, Bethel, and Simsbury (Appendix V). From 1997 to 1998 there was a significant increase in very low birthweight in the Chesprocott health district, and in the towns of Cheshire, Guilford, Meriden, and Rocky Hill. Significant one-year decreases occurred in the East Shore health district and in the towns of Farmington (for the second consecutive year), Middletown, and Torrington (Appendix V).

Premature Births

In 1998, 10.1% of all resident births were premature (<37 weeks of gestation) [5], up slightly from 10.0% in 1997 (Table 3) and representing the highest percentage of premature births in at least 30 years. Substantial variation in premature births occurred within the categories defined by mother's race/ethnicity, infant's sex, plurality, live birth order, mother's presumptive marital status, mother's education, mother's age, trimester of initiation of prenatal care, adequacy of prenatal care, mother's use of tobacco and alcohol during pregnancy, and mother's place of residence. These differences were similar to those noted for low-birthweight deliveries.

Race/Ethnicity

The percentages of premature births by race/ethnicity were: white non-Hispanic, 9.0%; black non-Hispanic, 14.2%; and Hispanic, 12.6% (Table 3). These values were higher than in 1997 for white non-Hispanics and Hispanics, but not significantly so. Relative to white non-Hispanics, the risk of preterm delivery was 1.6 times greater for black non-Hispanics and 1.4 times greater for Hispanics, and these differences were statistically significant (Appendix V).

Infant's Sex

Although more females than males had low birthweight, proportionately more males than females were born prematurely (10.6% and 9.5%, respectively) (Table 3).

Plurality

More than half (54.7%) of multiple births were premature, compared to 8.3% of singleton births (Table 3).

Live Birth Order

Second-born infants were less likely than first-born or third-or-more-born infants to be premature (9.1, 10.1%, and 11.2%, respectively) (Table 3).

Mother's Presumptive Marital Status

Among presumptively unmarried women [2a], premature delivery was 1.4 times more likely than among married women (12.8% and 8.9%, respectively).

Mother's Education

Premature delivery occurred more frequently among mothers who had 12 years or less of education than among college-educated and post-college-educated mothers (11.3%, 9.3%, and 8.5% prematurity, respectively) (Table 3).

Mother's Age

For mothers of all ages except 25-29 and 30-34 years of age, the percentages of premature delivery equaled or exceeded the overall value of 10.1% (Table 3). Percentages of prematurity were highest among the oldest and youngest mothers (45+ years of age, 30.6%; <15 years of age, 25.8%). Relative to the age group with the lowest rate of premature deliveries (30-34 years, 9.2%), premature delivery by women 45+ and <15 years old were 3.3 and 2.8 times greater, respectively. Rates of premature delivery were 1.3 times greater among women 15-19 years of age, and 1.2 times greater among those 40-44 years of age. Among women 20 years of age and older, the percentages of premature deliveries to Hispanics and black non-Hispanics were consistently in double digits and higher than values for white non-Hispanics.

Initiation of Prenatal Care

Compared to women who began prenatal care in the first trimester of gestation, the percentage of premature delivery was 3.4 times greater for those who received no prenatal care and 1.5 times greater for those who began prenatal care during the last trimester (9.6%, 32.7%, and 14.0% prematurity, respectively) (Table 3).

Adequacy of Prenatal Care

Premature delivery varied with adequacy of prenatal care, as defined by a modified Kessner Index (Appendix III). Women who received inadequate care were 2.5 times more likely to deliver prematurely than were those who received adequate care (Table 3). Risk of premature delivery was also elevated for intermediate-level care (1.4 times relative to adequate care). Although the risk level in intermediate-level prenatal care is low, it is still important to reduce risk because it is so common; in 1998, 17 times more women received intermediate care than inadequate care.

Using the APNCU Index, the risk of pre-term delivery was 6.9 times greater for women who received inadequate prenatal care than for those who received adequate care, whereas those who received intensive care had 10.9 times the risk of those with adequate care (Table 3). The association between intensive utilization of prenatal care and birth outcomes is discussed more fully in Appendix VI.

Although both indices showed strong associations between prematurity and level of prenatal care, the proportions of premature births with “nonadequate” prenatal care (inadequate plus intermediate) were strikingly different, depending on the index (Table 3). The Kessner value for “all races” was 2.6 times greater than the APNCU value (35.1% and 13.7%, respectively), and comparable differences occurred

between indices for the various racial and ethnic groups. By both measures, however, black non-Hispanic with pre-term deliveries were the most likely to have received non-adequate prenatal care (Table 3).

Tobacco and Alcohol Use

Women who smoked during pregnancy were 1.5 times more likely than those who did not smoke to deliver preterm (14.0% and 9.6% preterm deliveries, respectively) (Table 3). Those who used alcohol during pregnancy were nearly twice as likely to deliver preterm than those who did not (18.8% and 9.9% preterm deliveries, respectively) (Table 3).

Health District and Town of Residence

In 1998, the percentages of preterm deliveries were significantly higher than the state percentage in the towns of Bridgeport and Hartford, and significantly lower in Norwalk and West Hartford (Appendix V). Compared to 1997 values, the 1998 percentage of prematurity increased significantly in the Bristol-Burlington health district and in the towns of Bristol, Hamden, and Norwich, and they decreased significantly in the towns of Norwalk and West Hartford (Appendix V).

Births to Teens and Older Women

Since 1987, the percentage of births to women under 20 years of age has fluctuated between 8.0 and 8.6%. In 1998, 8.3% of all live resident births or 3,621 births were to teenagers (Table 4); although this represented an increase in number of teen births compared to 1997, the percentage did not change (3,578 births, 8.3%).

Race/Ethnicity

Of total births to women of all races, 3.1% (1,373) were to females under age 18; these included 71 births to mothers under the age of 15 (Tables 3 and 4). Females under age 20 accounted for 4.1% of all births to white non-Hispanics, 17.9% of all births to black non-Hispanics, and 21.8% of all births to Hispanic women. Compared to the percentage of teen births to white non-Hispanic women, values for black non-Hispanics and Hispanics were significantly higher (Appendix V). With respect to the prior year, teen birth percentages were lower for white non-Hispanics, black non-Hispanics, and Hispanics alike, but none of these decreases was statistically significant.

Trends

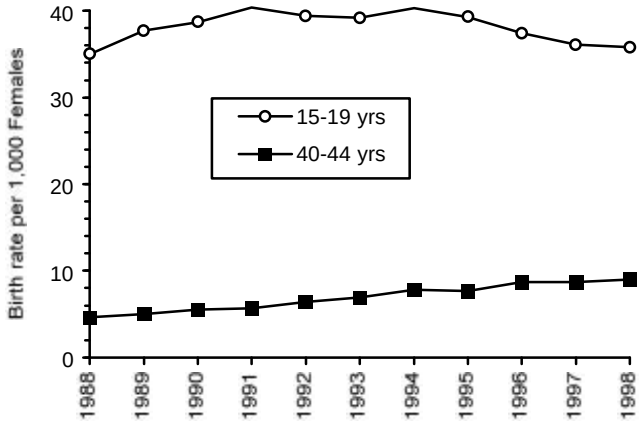
While the percentage of births to teens has been fairly stable over time, the proportion of births to older women has risen dramatically. Between 1987 and 1998, the number of births to women 40+ years of age more than tripled, from 423 to 1,332, and the percentage of births climbed from 1.1% to 3.0%.

Because the statistic “percentage of births” is expressed as a fraction of total births, it is affected by changes in the number of births to all women, regardless of age. Consequently, changes in this statistic do not always reflect corresponding changes in the number or *rate* of births to women of specific ages,

expressed as the number of births per 1,000 females of a given age. (The teen birth rate is expressed as births per 1,000 females 15-19 years of age, and the rate for older women as births per 1,000 females 40-44 years of age.) Divergence between percentages and rates occurred in 1998, when, compared to the prior year, the number of teen births increased, the percentage stayed the same, and the rate declined (Fig. 2). In general, rates provide a better estimate of population-based risk, but they are usually not available for sub-county regions such as health districts and towns.

The rate of births to Connecticut teens 15-19 years of age has decreased annually since 1994, and in 1998 it fell to its lowest value since 1989—35.8 births per 1,000 females 15-19 years of age (Fig. 2). This was considerably lower than the U.S. teen birth rate of 51.1 per 1,000 [6a]. During the same period, the rate of births to women 40-44 years of age nearly doubled, from 5.0 to 9.0 per 1,000 births (Fig. 2).

FIGURE 2
Age-specific Birth Rates
Females 15-19 and 40-44 Years of Age
Connecticut, 1988-1998



Health District and Town of Residence

With respect to the state value (8.3%), the percentage of teen births was significantly higher in the Uncas Region health district and significantly lower in 11 other health districts (Appendix V). Of the seven Connecticut towns that registered 1,000 or more births, five (Bridgeport, Hartford, New Britain, New Haven, and Waterbury) had teen birth percentages that were significantly higher than the state value, and one (Stamford) was significantly lower (Appendix V).

Among towns with 200 to 999 births, six (Bloomfield, East Hartford, Meriden, New London, Norwich, Windham) had significantly higher percentages of teen births than the state value, while 33 towns had significantly lower values (Appendix V).

From 1997 to 1998, percentages of teen births did not change significantly in any health districts, but they increased significantly in the town of Torrington and decreased significantly in the towns of Naugatuck and New Milford (Appendix V).

Prenatal Care

Trimester of Initiation of Prenatal Care

The timing of entry into prenatal care is an important indicator of prenatal care utilization; however, because it does not take into account the number, if any, of subsequent prenatal care visits, it gives an incomplete or inaccurate depiction of prenatal care utilization.

In 1998, 87.8% of Connecticut mothers began prenatal care during the first trimester of pregnancy. This was lower than the 1997 value of 89.1% (Appendix V). In addition, 9.1% began care during the second trimester, 2.8% in the third trimester, and 0. 3% (120 women) received no prenatal care at all (Table 3). Connecticut had the fifth highest percentage for early entry into prenatal care in the U.S.; the national value was 82.8% [6a].

The percentage of Connecticut women who entered prenatal care late (after the first trimester) or not at all was 12.2%, which was significantly higher than the 1997 value (10.9%). The percentages of late/no prenatal care for black non-Hispanic mothers (20.7%) and Hispanic mothers (21.9%) were greater than that for white non-Hispanic mothers (8.8%) by factors of 2.4 and 2.5, respectively, and these differences were statistically significant (Appendix V). From 1997 to 1998, percentages of late/no prenatal care increased for all three racial/ethnic groups, but the only significant increase was for white non-Hispanics (Appendix V).

The percent of late/no prenatal care was significantly lower than the state value in seven health districts, but was not significantly higher in any (Appendix V). Of the seven towns with 1,000 or more births, five (Bridgeport, Hartford, New Britain, New Haven, Waterbury) were significantly higher than the state value, and one (Danbury) was significantly lower (Appendix V). Of towns that registered 200 to 999 births, six were significantly higher than the state value, whereas 20 were significantly lower (Appendix V).

Compared to 1997, the 1998 values increased significantly in the Farmington Valley, Northeast, Torrington Area, and West Hartford-Bloomfield health districts and in eleven towns. Significant decreases occurred only in the towns of Ansonia and Stamford.

Adequacy of Prenatal Care

According to the modified Kessner Index, adequate prenatal care is that which begins during the first 13 weeks of pregnancy and comprises 3 or more visits, depending on the gestational age at birth (see Appendix III). Using this index, of mothers who gave birth in 1998, 85.6% had adequate care, 13.6% had intermediate care, 0.8% had inadequate care (i.e., 14.4% received non-adequate care). All percentages were the same as in 1997 (Tables 3 and 4).

As noted in the Introduction to this report, a newer index, the Adequacy of Prenatal Care Utilization (APNCU) Index [2b] is now being used to report prenatal care utilization (Tables 3 and 4). As defined by the APNCU Index, adequate prenatal care is that which begins during the first 4 months of pregnancy and includes 80% or more of the clinically recommended number of visits for any given gestational age (see *Introduction,* Appendix III, and Appendix VI). Using the APNCU Index, the overall percentage of prenatal care that conformed with this definition (i.e., the sum of the categories "adequate" and "intensive") was equal to that obtained using the Kessner Index (85.6%), and the percentage of non-adequate care was fractionally lower (Table 4).

One advantage of the APNCU Index over the Kessner Index is its ability to identify mothers who receive "intensive" prenatal care, that is, those who obtain more than the clinically recommended number of prenatal visits. In 1998, 41.6% of births were to mothers who received intensive prenatal care; however, not all recipients of intensive care had favorable birth outcomes. As noted above, mothers who received intensive prenatal care had even greater percentages of premature and low birthweight deliveries than those who received inadequate care (Appendix VI). Similar findings have been reported by others [6b, 6c]. Intensive care, like all prenatal care, is not 100% effective. Although intensive care may reduce poor birth outcomes among the higher risk women who usually receive it, it does not reduce the risk to levels experienced by other women.

Adequacy by Race and Ethnicity

Hispanic and black non-Hispanic mothers were more than twice as likely as white non-Hispanic mothers to receive non-adequate care, as defined by the modified Kessner Index (25.5%, 23.2%, and 10.8%, respectively) (Table 4); these differences were statistically significant. Relative to 1997, the percentage of non-adequate care in 1998 was significantly higher for white non-Hispanics, but was not significantly different for black non-Hispanics or Hispanics (Appendix V).

Compared to Kessner values, APNCU percentages for non-adequate prenatal care were 1% higher for white non-Hispanics, 4.2% lower for black non-Hispanics and 3.3% lower for Hispanics.

Intensive utilization of prenatal care also varied by race and ethnicity [6d], with black non-Hispanics and Hispanics having slightly lower percentages of intensive care, compared to white non-Hispanics (Table 4). When intensive care was calculated as percentage of care that was at least adequate (i.e., adequate plus intensive), the value for black non-Hispanics was less than 1% lower than that for white non-Hispanics, and the value for Hispanics was less than 1% higher; these differences were not statistically significant (Appendix V).

Adequacy by Health District and Town of Residence

Although overall prenatal care adequacy and non-adequacy percentages for the state were about the same when assessed by either index, great variation between indices sometimes occurred at the local level. For example, the APNCU percentage of non-adequate care was 1.7 times higher than the Kessner value for the Weston-Westport health district, whereas the Kessner percentage was 1.3 times greater than the APNCU value for the Northeast health district. Values were even more disparate for racial and ethnic subgroups in some towns (Table 4).

According to the Kessner Index, the percentage of non-adequate prenatal care was significantly higher than the state value in eight towns and significantly lower than the state value in seven health districts and 20 towns, and (Appendix V). Relative to 1997, the percentages of non-adequate prenatal care in 1998 decreased significantly in the Naugatuck Valley health district and in seven towns, whereas significant 1-year increases occurred in the Farmington Valley, Northeast, and West Hartford-Bloomfield health districts and in seven towns.

According to the APNCU Index, the percentage of non-adequate prenatal care was significantly higher than the state value in the Torrington Area health district and significantly lower in six other health districts. Percentages of non-adequate care were significantly higher than the state value in eight towns and significantly lower in 17 towns. Single year changes for the health districts and towns were not determined.

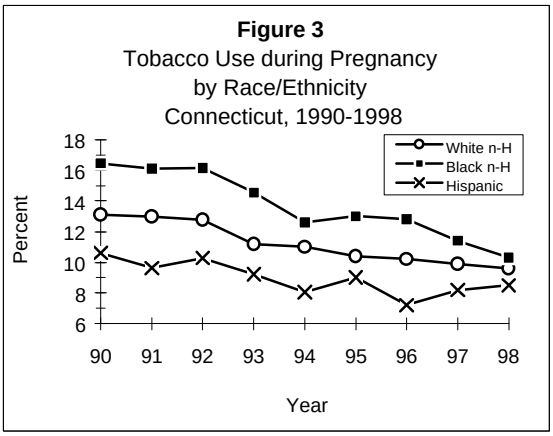
Calculated as percentage of prenatal care that was at least adequate (i.e., adequate plus intensive), intensive utilization of prenatal care was significantly higher than the state value in five health districts and 14 towns, and significantly lower in five health districts and 13 towns (Appendix V).

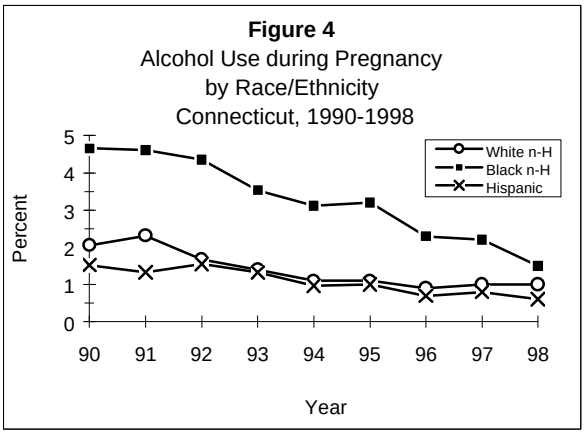
Tobacco Use during Pregnancy

In 1998, 3,787 births (9.4%) were to mothers who smoked during pregnancy (Table 3) [7]. This represented a slight but statistically insignificant improvement over 1997, when reported smoking during pregnancy was 9.7% (3,762 births). The percentage of tobacco use during pregnancy among Connecticut women was below the national value of 12.9% [6a]. Tobacco use was lowest among Hispanic mothers (8.5%), compared to white non-Hispanics (9.6%) and black non-Hispanics (10.3%). Nationally, white non-Hispanic women are more likely than women of black race or Hispanic ethnicity to smoke during pregnancy [6a]. Although the value for Hispanics was significantly lower than that for white non-Hispanics, the percentage of Connecticut Hispanics who smoked during pregnancy increased from 1997 to 1998. Still, the disparity in smoking behavior among racial and ethnic groups has narrowed considerably since 1990 (Fig. 3).

Of Connecticut's 18 health districts, seven were significantly higher than the state value of 9.4%, and eight were significantly lower, with respect to women who smoked during pregnancy (Appendix V). Weston-Westport had the lowest percentage of smokers (1.0%) and the Northeast health district had the highest (19.1%). Seventeen towns were significantly higher than the state percentage, whereas 18 were

significantly lower. Compared to 1997 values, the 1998 percent of births to mothers who smoked increased significantly in the town of New Britain and decreased significantly in the Central Connecticut and Northeast health districts and in the town of Wethersfield (Appendix V).





Alcohol Use during Pregnancy

In 1998, 399 births (1.0%) were to mothers who used alcohol during pregnancy (Table 3). This was a decrease from the 1997 value of 1.1%. Alcohol use during pregnancy is substantially under-reported on U.S. birth certificates [8] and is also likely under-reported in the Connecticut birth records. Even when under-reporting is taken into account, national data show a clear pattern of elevated risk of low birthweight among infants born to mothers who report consuming alcohol during pregnancy [7].

Compared to Hispanics, who had the lowest percentage of alcohol use during pregnancy (0.6%), white non-Hispanics and black non-Hispanics were 1.7 and 2.5 times more likely, respectively, to drink during pregnancy (Table 3). Similar percentages and differences between racial and ethnic groups have been reported nationally [6b, 6c]. Racial and ethnic differences in alcohol use during pregnancy have decreased since 1990 (Fig. 4).

FETAL DEATHS

Fetal deaths (stillbirths) are deaths to fetuses after 20 or more weeks of gestation. There were 298 resident fetal deaths statewide in 1998, for a rate of 6.8 per 1,000 live births (Table 2A), representing an increase from 6.1 per 1,000 in 1997. Of fetal deaths of known sex, 55.3% were male and 44.7% were female (Table 5). Of fetal deaths, 8.4% represented multiple fetuses (Table 5); whereas only 4% of live births were multiples (Table 3); 79.5% of fetal deaths had a gestational age of less than 37 weeks. The percent distribution of fetal deaths by mother's age was roughly comparable to that of live births by mother's age for all age groups (Tables 3 and 5). The fetal death rate for blacks (12.9 per 1,000 live births) was more than double that for whites (5.9 per 1,000), and the rate for Hispanics was 7.0 per 1,000 (calculated from Table 2B).

Town of Residence

Among the towns with five or more fetal deaths in 1998, only Middletown had a fetal death rate that was significantly higher than the state rate (Appendix V). None of the single-year changes in fetal death rates was statistically significant (Appendix V) [9].

Low Birthweight and Premature Delivery

Three out of four (75.9%) resident fetal deaths were of low birthweight (<2,500 grams), about two in three (65.5%) were of very low birthweight (<1,500 grams), and 79.5% were delivered prematurely (<37 weeks of gestation) (Table 5).

Leading Causes of Fetal Death

The three leading causes of fetal death for all races in 1998 were the same as in previous years: 1) "other and ill-defined conditions originating in the perinatal period" (127 deaths); 2) "fetus affected by complications of placenta, cord, and membranes" (47 deaths); and 3) "disorders relating to short gestation and unspecified low birthweight" (45 deaths) (Table 6). These categories are based on the standard groupings used by the National Center for Health Statistics [10]. The top three leading causes of death were the same for whites and Hispanics, but not for blacks (Table 6).

INFANT DEATHS

In 1998, there were 305 resident infant deaths, down from 311 in 1997, and the infant mortality rate decreased from 7.2 in 1997 to 7.0 per 1,000 live births. The neonatal mortality rate, based on 222 deaths to infants less than 28 days old, was 5.1 deaths per 1,000 live births, down from 5.6 in 1997; nearly three out of four infant deaths (72.8%) occurred during the neonatal period [11]. The postneonatal mortality rate (based on 83 deaths to infants 28 days to 364 days old) was 1.9 deaths per 1,000 live births, up from 1.6 in 1997 (Table 2A). None of the single-year changes in infant, neonatal, and post-neonatal mortality rates was statistically significant. As noted below, there was considerable variation in infant mortality rates by race and by town of residence.

Infant's Race

Infant mortality rates were calculated using two race-specific components: births, which reflect the race of the *mother*; and deaths, which reflect the race of the *infant*. As in the past, 1998 infant mortality rates varied markedly by race, with disproportionate deaths to black infants. Blacks accounted for 31.1% of resident infant deaths, up from 25.1% in 1997, but only 12.2% of total resident births (Table 2B). There were 199 deaths to infants of white race, for a rate of 5.5 per 1,000 live births, 95 deaths to infants of black race, for a rate of 17.7 per 1,000, and 5 deaths to infants of other races. There also were 58 deaths to infants of Hispanic ethnicity, for a rate of 8.3 per 1,000 (Table 2B) [12a].

Town of Residence

In 1998, infant deaths occurred to residents of 80 Connecticut towns (Table 2B). Of the 15 towns where infant mortality rates could be calculated (i.e., five or more events), the rates were significantly higher than the state rate in four towns—Bridgeport, Hartford, New Haven, and New London. None of these rates was associated with multiple births. Differences between 1997 and 1998 infant mortality rates were not statistically significant for any town (Appendix V) [9].

Leading Causes of Infant Death

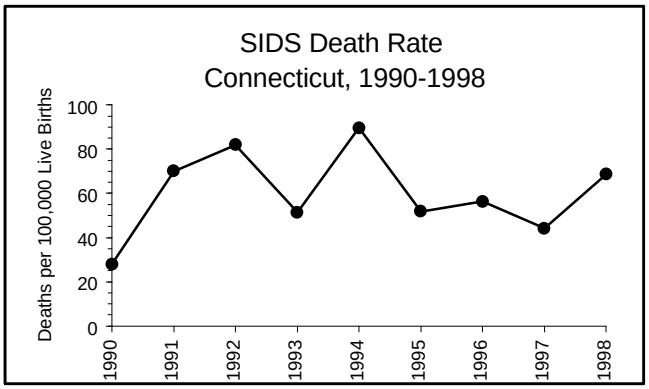
Since 1991, classifications for the leading cause of infant deaths in Connecticut have followed the standard groupings used by the National Center for Health Statistics [10]. Based on these groupings, the top three leading causes of infant death among all Connecticut residents in 1998 were: 1) "disorders relating to short gestation and unspecified low birthweight;" 2) "congenital anomalies;" and 3) “sudden infant death syndrome” (Table 8). The rankings of leading causes varied, however, by racial and ethnic subgroup (see below).

Rank Order of Leading Causes of Infant Death by Infant's Race and Hispanic Ethnicity
Connecticut, 1998
(Rankings derived from data in Table 8)

	Race			Hispanic
Cause of Death (ICD-9 Codes)	**All**	**White**	**Black**	**Ethnicity**
Disorders relating to short gestation or unspecified low birthweight (765)	1	2	1	1
Congenital anomalies (740-759)	2	1		2
Sudden infant death syndrome (SIDS) (798.0)	3		2	
Newborn affected by maternal complications of pregnancy[a] (761)		3[b]	3	3
Newborn affected by complications of placenta, cord, membranes (762)			3	
Other respiratory conditions of newborn (770)		3[b]		

[a] Includes incompetent cervix, premature rupture of membranes, oligohydramnios, polyhydramnios, ectopic pregnancy, multiple pregnancy, maternal death, malpresentation before labor, and spontaneous abortion.
[b] The same number of deaths (17) occurred for both listed causes.

The death rate for sudden infant death syndrome (SIDS) decreased in 1995 and 1996, then rose again in 1998 (see illustration below). In 1998, SIDS became the third leading cause of infant deaths overall



and the second leading cause of deaths to black infants. SIDS also was the leading cause of postneonatal infant deaths (i.e., 28+ days of age) overall and for each of three racial/ethnic groups (Table 8). The risk of SIDS increases when an infant is placed in a prone sleep position (on stomach), and since 1994, mothers have been encouraged to place newborns on their backs to sleep [12b]. The higher risk of SIDS among black infants may be due, in part, to the higher prevalence among blacks of infant sleeping position on stomach [12c].

DEATHS (All Ages)

There were 29,619 deaths to Connecticut residents in 1998. The crude death rate was 9.0 deaths per 1,000 population--highest level since 1968--for the fourth consecutive year (Table 2A). Total resident deaths were determined by age of decedent for each sex, race, and ethnicity (Table 9). There were 18,122 deaths to persons aged 75 years and over, representing 61.2% of total resident deaths; this was an increase from 60.3% in 1997.

Of total resident deaths, 47.1% were males and 52.9% were females; 92.4% were of white race, 6.9% were of black race, and 2.7% were of Hispanic ethnicity (Table 9).

All Causes of Death

Town of Residence

Among the four towns that reported 1,000 or more deaths in 1998 (Table 2A), the crude death rates for Waterbury, Bridgeport, and New Haven were higher than the state rate of 9.0 per 1,000, whereas Hartford's rate (8.3 per 1,000) was lower. Among Connecticut's 169 towns, Hartland had the lowest crude death rate (4.1 per 1,000 population) and Southbury had the highest (15.8 per 1,000).

Age at Death

Median Age at Death

The 1998 median age at death was 79 years for both sexes combined, 76 years for males, and 82 years for females [13]; all three medians increased by 1 year from 1997 values (Fig. 5). Although racial and ethnic differences have been narrowing, marked variation in median age at death still exists (Fig. 6). In 1998, the median age at death was 79 years for whites (the same as in 1996 and 1997), 68 years for blacks (an increase of 2 years from 1997), and 62 years for Hispanics (an increase of 3 years from 1997).

Figure 5
Median Age at Death by Sex
Connecticut, 1991-1998.

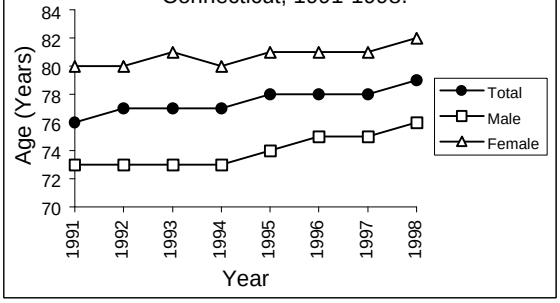
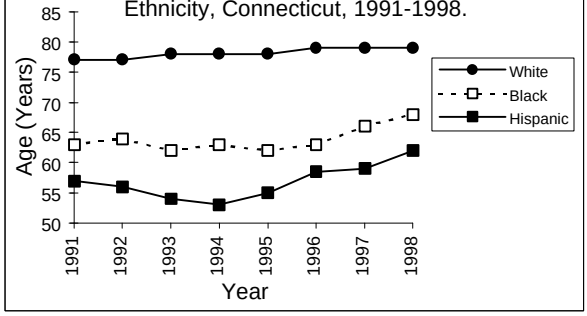
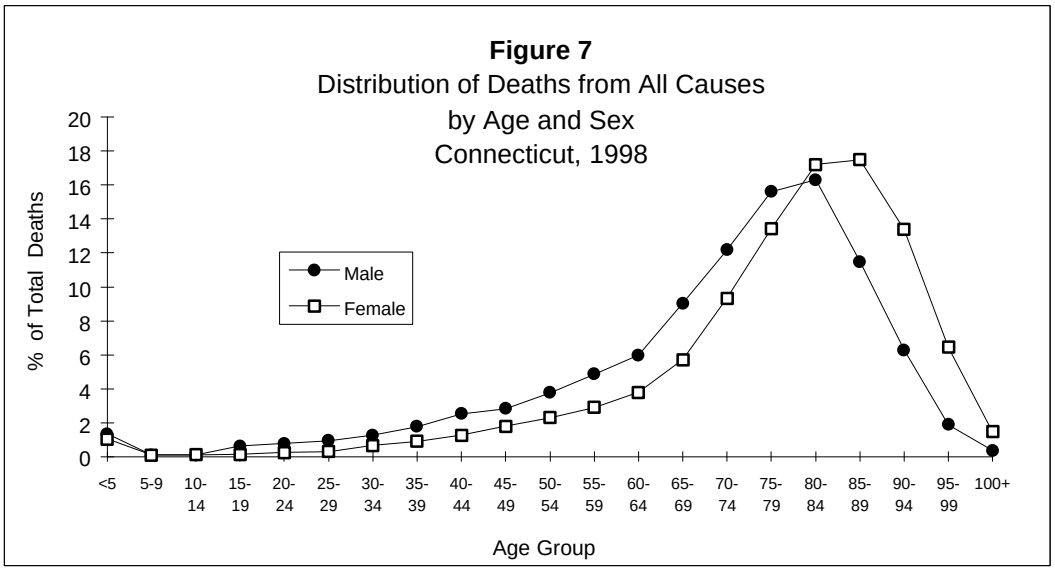


Figure 6
Median Age at Death by Race and Hispanic
Ethnicity, Connecticut, 1991-1998.



Distribution of Deaths by Age and Sex

Death counts for “all causes” rose progressively with age for both sexes, with deaths to males outnumbering deaths to females through age 79 and females outnumbering males thereafter (Table 9). Overall, only 21% of deaths occurred below age 65, whereas 49% of all deaths occurred at ages 65 to 84 years and another 30% after age 84 (Fig. 7). This pattern differed for males and females; 27% of deaths to males but only 16% of deaths to females occurred before age 65. After age 84 the converse was true, with the percentage of deaths to females (39%) exceeding that to males (20%).



Leading Causes of Death

The five leading causes of death in 1998 for persons by sex and age group are shown in rank order in Table 10. By proportional share of total deaths, they were: 1) "diseases of the heart” (32.5%); 2) "malignant neoplasms” (23.9%); 3) "cerebrovascular disease” (6.5%); 4) "chronic obstructive pulmonary disease (COPD)" (4.2%); and 5) "pneumonia and influenza" (4.1%). These top five leading causes of death have been the same since 1989, with occasional alternation in rank order between “COPD” and “pneumonia and influenza.”

Age and Sex

The top five leading causes of death by age and sex are detailed in Table 10 and summarized in the table below. Between 1997 and 1998, age-specific death rates stayed about the same or decreased in groups under 75 years of age, whereas they increased in groups 75 years of age and older. The exception was an increase in the 15 to 19 year age group, due largely to an increase in suicides among males.

Top Five Ranked Leading Causes of Death by Age for Females (○) and Males (●), Connecticut, 1998[a,b]

Cause of Death	Age in years (Total deaths by age)											
	1-4 (46)	5-9 (27)	10-14 (32)	15-19 (109)	20-24 (145)	25-34 (461)	35-44 (940)	45-54 (1,562)	55-64 (2,556)	65-74 (5,314)	75-84 (9,250)	85+ (8,872)
Benign/unspec. neoplasms; carcinoma in situ	⑤											
Nephritis, nephrotic syndrome, and nephrosis	⑤											
Meningitis		③										
Hernia				④								
Anemias				⑤								
Congenital anomalies	⑤ ❸	❹	❹	⑤ ❺								
Homicide & legal intervention	①	❷	③	② ❷	② ❷	❸						
Suicide and self-inflicted injury				② ❸	③ ❸	③ ❷	⑤ ❹					
HIV infection	⑤		③			⑤	④ ❺	❹				
Unintentional injuries	② ❷	① ❶	① ❶	① ❶	① ❶	① ❶	② ❶	③ ❸	❺			
Chronic liver disease/cirrhosis								⑤ ❺	❹			
Diabetes mellitus									④	⑤ ❺		
Malignant neoplasms	② ❶	① ❷	② ❷	⑤	③ ❹	② ❺	① ❸	① ❷	① ❶	① ❶	② ❷	② ❷
Diseases of the heart	② ❹	③ ❹	③ ❷	⑤ ❹	⑤ ❺	④ ❹	③ ❷	② ❶	② ❷	② ❷	① ❶	① ❶
Cerebrovascular disease			❹					④	⑤ ❸	④ ❹	③ ❸	③ ❹
Chronic obstructive pulmonary disease	⑤		❹	⑤					③	③ ❸	④ ❹	⑤ ❺
Pneumonia and influenza	❹	③									⑤ ❺	④ ❸

[a] Five or fewer deaths accounted for the following rankings: Ages 1-4 and 5-9, all ranks for both sexes; age 10-14 ranks 2-4 (males) and all ranks for females; age 15-19 ranks 4-5 (males) and ranks 2-5 (females); age 20-24 rank 5 (males) and ranks 2-5 (females). There were >5 male and female deaths per rank in all older age groups.

[b] Summarized from data in Table 10.

As shown above, two causes of death—"malignant neoplasms" and "diseases of the heart" ranked highly across all age groups. Both intentional and unintentional injuries accounted for ranked causes of death mainly among younger age groups, whereas "diabetes mellitus," "cerebrovascular disease," COPD," and "pneumonia and influenza" became important causes of death mainly among the near-elderly and elderly.

Total deaths in each age group ranged from 27 (ages 5-9) to 9,250 (ages 75-84) (Table 10). There were 25 or fewer deaths in all groups of females under 20 years of age and among males 5-9 and 10-14 years of age, and many of the top five rankings had five or fewer deaths (see below). Because of small numbers of deaths, even single deaths were sometimes designated as leading causes of death in these groups, leading to considerable variation among leading causes of death from year to year. Individual ranks in lower age groups thus do not necessarily have equal importance.

Leading-Cause-of-Death Rankings
with Five or Fewer Deaths per Age Group
Connecticut, 1998

Age Group	Rank									
	Males					Females				
	1	2	3	4	5	1	2	3	4	5
1-4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5-9	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
10-14		✓	✓	✓	✓	✓	✓	✓	✓	✓
15-19				✓	✓		✓	✓	✓	✓
20-24					✓		✓	✓	✓	✓

<1 Year of Age. (See INFANT DEATHS, p. 23.)

1-4 Years of Age

There were only 46 deaths in this age group, so every ranked cause of death represented 5 or fewer deaths (see above). "Malignant neoplasms," "unintentional injuries," "diseases of the heart," and "congenital anomalies" were among the ranked leading causes of death for both sexes, but the leading cause of death to females was "homicide," and "malignant neoplasms" was the leading cause of death to males.

5-24 Years of Age

The age groups within this interval accounted for 313 deaths, or 1.1% of total deaths. "Unintentional injuries" was the leading cause of death to both males and females in all the age groups. The other ranked causes of death varied considerably by age and sex, as most rankings represented 5 or fewer deaths.

25-34 Years of Age

The 25-34 year age interval accounted for 461 deaths, or 1.6% of total deaths. "Unintentional injuries" remained the leading cause of deaths to males and females in this age cohort. In 1998, "suicide" and "homicide" moved into second or third rank for both females and males, and "diseases of the heart" became a leading cause of death to males in this age group for the first time.

35-44 Years of Age

This age group accounted for 940 deaths (3.2%) in 1998. "Malignant neoplasms" led by breast and lung cancers, was the leading cause of death to females, whereas "unintentional injuries" was the leading cause of death to males. In 1998, "HIV infection" rose from fifth in 1997 to fourth ranked leading cause of death to females and fell from fourth to fifth leading cause of death to males. "Diseases of the heart" and "suicide" remained leading causes of death to both females and males.

45-54 Years of Age

This age group accounted for 1,562 deaths (5.3%) in 1998. "Diseases of the heart" and "malignant neoplasms" were the top ranked leading causes of death to males and females, and "unintentional injures" dropped to third rank for both males and females. "HIV infection," unranked in 1997, became the fourth leading cause of death to males, and "chronic liver disease and cirrhosis" continued to grow in importance, appearing as the fifth leading cause of death to females as well as males.

55-64 Years of Age

This age group accounted for 2,556 deaths (8.6%) in 1998. The top-ranked leading causes of death for females and males alike were "malignant neoplasms" and "diseases of the heart," and "COPD" and "cerebrovascular disease" ranked third for females and males, respectively. For males, "chronic liver disease and cirrhosis" replaced "diabetes mellitus" as fourth leading cause of death, and "unintentional injuries" appeared as the fifth leading cause of death in 1998. The rankings for females were unchanged from 1997.

65-74 Years of Age

This group accounted for 5,314 deaths (17.9%). The 1998 top five rankings were unchanged from 1997 and were the same for males and females: "malignant neoplasms," "disease of the heart," "COPD," "cerebrovascular disease," and "diabetes mellitus."

75-85^{+} Years of Age

The two age groups above 74 years accounted for 18,122 deaths, or 61.2% of total deaths in 1998. The leading cause of death for both sexes was “diseases of the heart,” and the second leading cause of death was “malignant neoplasms.” “Cerebrovascular disease,” “chronic obstructive pulmonary disease,” and “pneumonia and influenza” were the remaining ranked causes of death for females and males.

Selected Causes of Death

Numbers of resident deaths, listed for 57 groupings of ICD-9 codes, and presented by sex, age, and race/ethnicity, are given in Table 9. Sixteen selected causes of death, which are listed in Appendix IV, are discussed in greater detail below. The selected causes represent the top 15 ranked leading causes plus "motor vehicle accidents," a subset of "unintentional injuries." These 16 categories are also the focus of the discussion of age-adjusted mortality rates (see next section and Appendix IV). Distributions of deaths by sex and age for certain causes of death also are discussed, to call attention to population groups at elevated risk.

Ratios of Deaths by Sex

Although numbers of deaths to males and females were about equal for most causes of death and “all causes” combined, the numbers were disproportionate for certain causes (Table 9). Differences between sexes in the numbers of deaths from these causes reflect the composite influences of demographic, biological, cultural, and social factors, all of which are related to health and which may affect males and females differently [14]. Identifying such differences can guide the targeting of prevention and intervention efforts. As shown in the table below, death counts for males and females differed by a factor of 1.5 or greater (i.e., 50%) for nine causes of death. Of these, males outnumbered females for six causes.

Within the category of “unintentional injuries,” males outnumbered females for deaths due to “poisonings” and “drowning” by ratios of 3.0 and 3.8, respectively (Table 9). Three times more males than females also died from “suicide” and “homicide.” While deaths from “malignant neoplasms” (all cancers) were about equal for both sexes, deaths to males from bladder cancer outnumbered those to females by a factor of 2.3. Similarly, 1.6 times as many females as males died from “hypertension.” The statistical significance of male/female differences are discussed under *Age-adjusted Mortality Rates* (below).

Ratios of Deaths for Selected Causes of Death[a]
Connecticut, 1998
(M/F = male to female ratio; F/M = female to male ratio.)

Cause of death	Ratio (M/F)	Ratio (F/M)
ALL CAUSES	0.9	1.1
Suicide and self-inflicted injury	3.1	
Homicide and legal intervention	3.0	
Human immunodeficiency virus (HIV) infection	2.4	
Motor vehicle accidents	1.8	
Unintentional injuries	1.7	
Chronic liver disease and cirrhosis	1.5	
Alzheimer's disease		2.2
Atherosclerosis		1.6
Cerebrovascular disease		1.7

[a] See list of selected causes of death in Appendix IV. Only ratios ≥ 1.5 are shown.

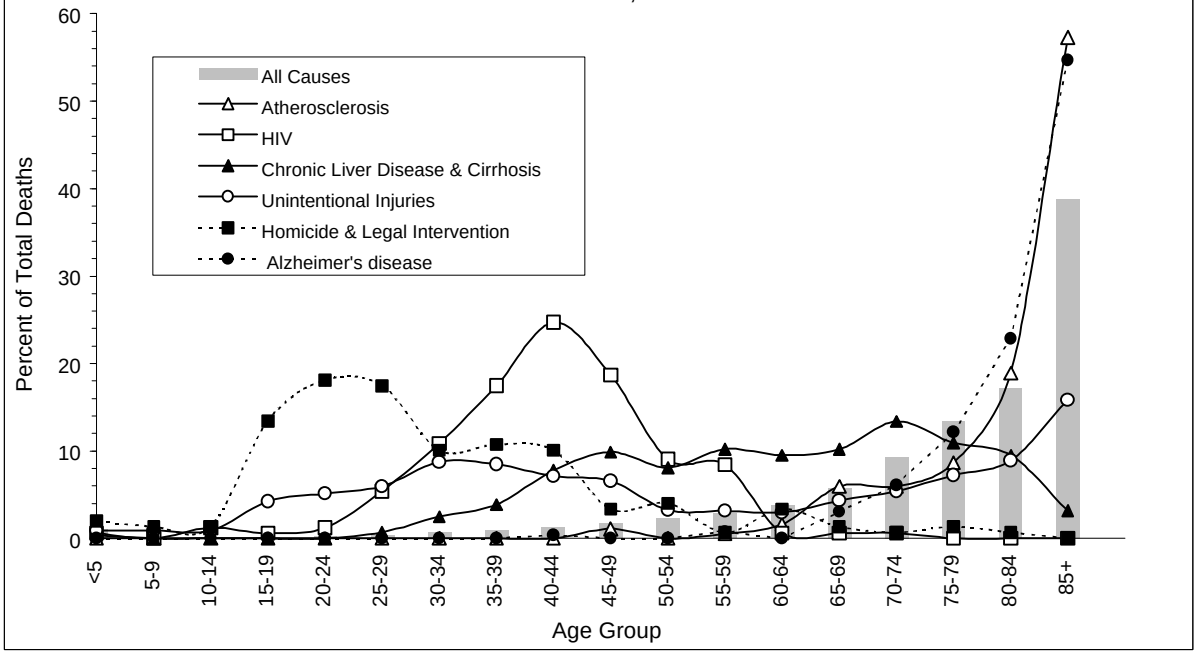
Variation also existed between sexes in different racial and ethnic groups. For "all causes" of death, there were 14.4% more deaths to females than males among whites. In contrast, deaths to males outnumbered deaths to females by 5.7% among blacks and 34.3% among Hispanics (Table 9). For "cerebrovascular disease," deaths to females of white race and black race outnumbered deaths to males by 72% and 87%, respectively, whereas deaths to Hispanic males and females were about equal. Relative to whites, disproportionately low percentages of deaths due to "Alzheimer's disease" were represented by members of minority groups.

Differences in Distributions by Age

The age distribution for each cause of death was compared with the "all causes" distribution, which increased gradually until about age 65 and more rapidly thereafter (Figure 8; Table 9). All distributions differed somewhat from the "all-causes" distribution. For six causes, however, the cumulative percentage differences between the comparison and reference ("all ages") age groups in the distributions was 50% or greater. Four of these involved younger populations. "Unintentional injuries" and "homicide and legal intervention" became important causes of death beginning at 15-19 years of age. The percentage of HIV deaths began rising at 25-29 years of age and peaked at 40-44 years of age, representing a shift to slightly older age groups compared to the 1997 age distribution. "Chronic liver disease and cirrhosis" began to affect persons at age 30 and above. The age distributions for the remaining two selected causes of death, "Alzheimer's disease" and "atherosclerosis," were substantially skewed toward an older population.

Age distributions generally were consistent for both males and females. For "unintentional injuries," however, deaths to males were more concentrated in younger age groups.

Figure 8
Age Distributions for Selected Causes of Death
Connecticut, 1998



AGE-ADJUSTED MORTALITY RATES FOR SELECTED CAUSES OF DEATH

Trends in age-adjusted mortality rates (AAMRs) for 1970, 1980, and 1988-1998 for “all causes” and for 16 selected causes of death are shown in Appendix IV and Figures 10-14. Age-adjusted rates, rather than crude rates, were used so that populations with different age distributions could be compared. For the following discussion, rates were adjusted to the 1970 U.S. standard population, using the direct method [15]. However, rates were also adjusted to the U.S. 2000 projected standard million population (Appendix IV), which is the national standard for age adjusting mortality statistics.

Relative to 1997, the 1998 AAMR for "all causes" decreased 1.1% to 586.4 deaths per 100,000 population. This was the fourth consecutive year of decrease, and represents the lowest rate since Connecticut began reporting annual rates in 1980 (Fig. 11 and Appendix IV). AAMRs for nine of the 16 selected causes of death were lower than in 1997, six were higher, and one (cerebrovascular disease) was unchanged. None of the changes was statistically significant. Age-adjusted mortality rates consistently were lower for females than for males, and such differences were statistically significant for “all causes of

death" and for 12 of the 16 selected causes of death (see below). Despite the high female-to-male ratio for Alzheimer's disease deaths (see p. 30, *Ratios of Deaths by Sex*), the age-adjusted mortality rates were not significantly different.

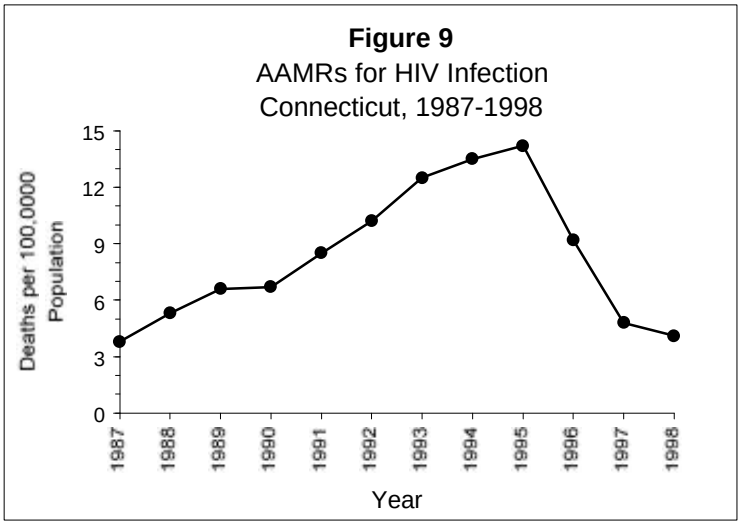
**Age-adjusted Mortality Rates (AAMRs)
for Selected Causes of Death by Sex:
Significant Differences between Males and Females
Connecticut, 1998**

	1998 AAMRs [a,b]			
Cause of Death	Both Sexes	Males	Females	Significant Difference
All causes	586.4	713.8	488.0	
Diseases of the heart	175.5	223.0	137.1	
Malignant neoplasms	155.5	186.0	134.8	
Cerebrovascular disease	33.2	34.4	31.7	
Unintentional injuries	26.7	38.1	16.3	
Motor vehicle accidents	9.7	13.3	6.0	
COPD	23.6	27.6	21.6	
Pneumonia and influenza	19.7	25.2	16.4	
Diabetes mellitus	13.6	15.6	12.1	
Septicemia	7.8	9.2	6.8	
Suicide & self-inflicted injury	7.1	11.2	3.2	
Nephritis & nephrotic disease	7.0	8.3	6.2	
Chronic liver disease & cirrhosis	6.9	9.4	4.7	
HIV infection	4.1	5.9	2.4	
Homicide & legal intervention	4.8	7.3	2.4	
Alzheimer's disease	4.0	3.6	4.1	
Atherosclerosis	2.9	3.2	2.7	

[a] Rates were age adjusted to the 1970 U.S. standard population.
[b] There were no significant changes in 1998 AAMRs ($p<0.05$) compared to 1997 rates.

AAMRs That Decreased from 1997 to 1998 (*Figures 10-14*)

Relative to 1997, the AAMR for "HIV infection" fell 14.6% to 4.1 deaths per 100,000 population (Appendix IV; Fig. 13). This was the lowest rate since 1987, when AAMRs were first calculated for "HIV infection" in Connecticut (Appendix IV, Fig. 13). The mortality rate for AIDS has fallen more than 70% since peaking in 1995, but the annual rate of decline has slowed (Fig. 9). Although the AAMR for HIV infection among males dropped 15.7%, from 7.0 to 5.9 per 100,000, this decrease was not statistically significant [16].



Note: Rates were age adjusted to 1970 U.S. standard population.

"Diseases of the heart" fell 3.5%, continuing a trend of decline (Appendix IV; Fig. 11). The AAMR for "suicide and self-inflicted injury" decreased for the third consecutive year to 7.1 per 100,000, its lowest value since 1982 (Appendix IV; Fig. 13). The AAMR for "malignant neoplasms" fell 1.0% to 155.5 per 100,000, its lowest value since annual reporting began in 1980. The AAMR for "pneumonia and influenza" fell 5.3% to 19.7 per 100,000. The AAMR for "chronic obstructive pulmonary disease" fell 5.2% to 23.6 per 100,000, following two consecutive annual increases. The AAMR for "motor vehicle accidents" fell 7.6% to 9.7 per 100,000, the lowest value since 1992, and "chronic liver disease and cirrhosis" fell 6.8% to 6.9 per 100,000, the lowest value since annual reporting began in 1980. The AAMR for "Alzheimer's disease" decreased 2.4% to 4.0 per 100,000; this rate has varied within a narrow range since 1990.

AAMRs That Increased from 1997 to 1998 (*Figures 10-14*)

Relative to 1997, the 1998 AAMR for "atherosclerosis" increased 16.0 % to 2.9 per 100,000 (Appendix IV; Fig. 14). The AAMR for "septicemia" rose 14.7% to 7.8 per 100,000, after falling to a 12-year low in 1997 (Fig. 13). The AAMR for "nephritis and nephrotic disease" rose 9.4% to 7.0 per 100,000, following 2 years of decline (Fig. 14). The AAMR for "homicide and legal intervention" increased 6.7% to 4.8 per 100,000, but is still near its 10-year low of 4.5 per 100,000 (Fig. 14). The AAMR for "diabetes mellitus" increased 3.8% to 13.6 per 100,000 (Fig. 12). The AAMR for "unintentional injuries" increased 2.3% to 26.7 per 100,000 (Fig. 12). Within the category of "malignant neoplasms," rates of malignant melanoma and oral/pharyngeal, lung, pancreatic, bladder, and brain/CNS cancers increased among males, and rates of leukemia and oral, colorectal, breast, endometrial, and ovarian cancers increased among females [16]. None of these increases was statistically significant.

FIGURE 10

AGE-ADJUSTED MORTALITY RATES FOR SELECTED CAUSES OF DEATH
CONNECTICUT, 1970, 1980, and 1988-1998
(Age adjusted to 1970 U.S. standard population)

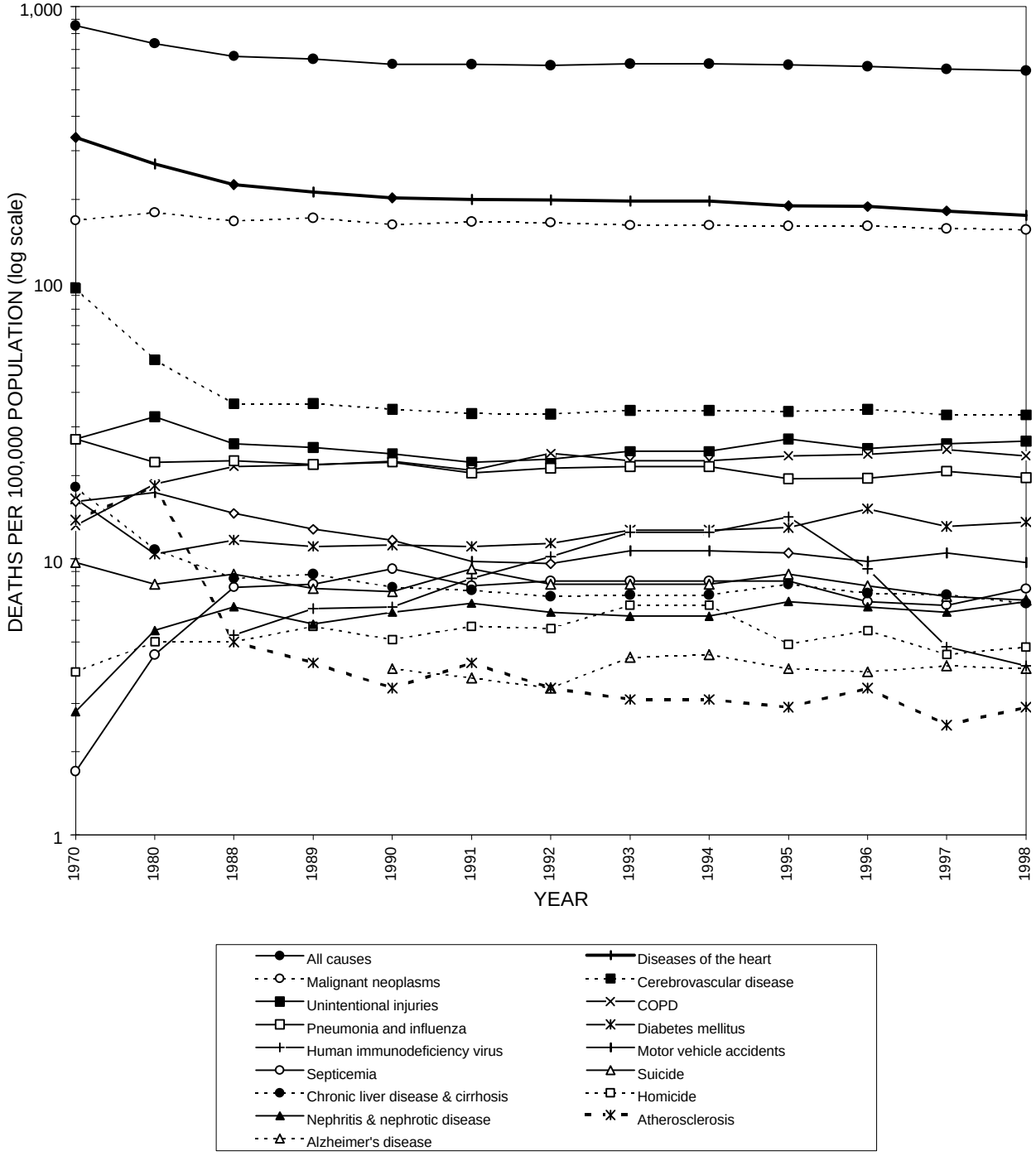
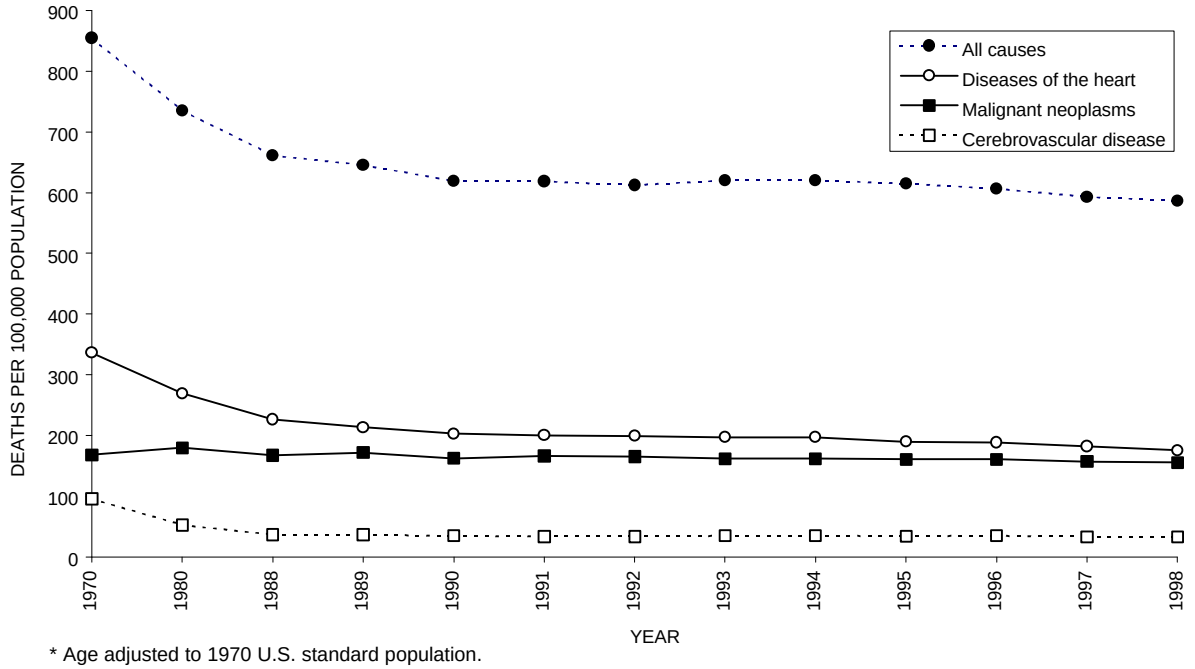


FIGURE 11

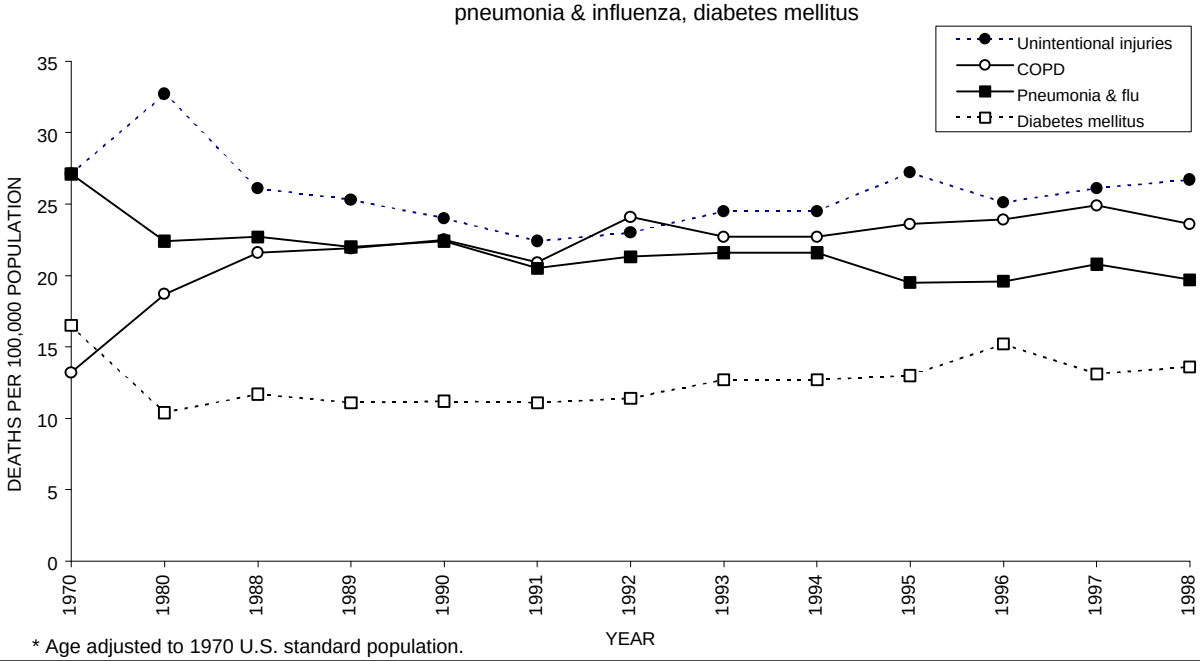
AGE-ADJUSTED MORTALITY RATES* FOR SELECTED CAUSES OF DEATH
CONNECTICUT, 1970, 1980, and 1988-1998
All causes, diseases of the heart, malignant neoplasms, cerebrovascular disease



* Age adjusted to 1970 U.S. standard population.

FIGURE 12

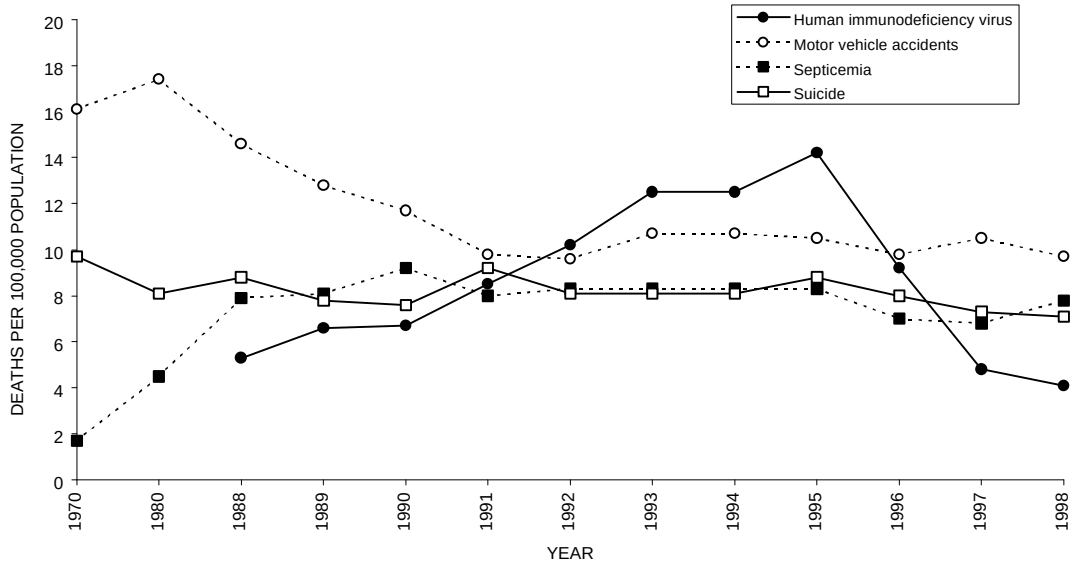
AGE-ADJUSTED MORTALITY RATES* FOR SELECTED CAUSES OF DEATH
CONNECTICUT, 1970, 1980, and 1988-1998
Unintentional injuries, chronic obstructive pulmonary disease (COPD),
pneumonia & influenza, diabetes mellitus



* Age adjusted to 1970 U.S. standard population.

FIGURE 13

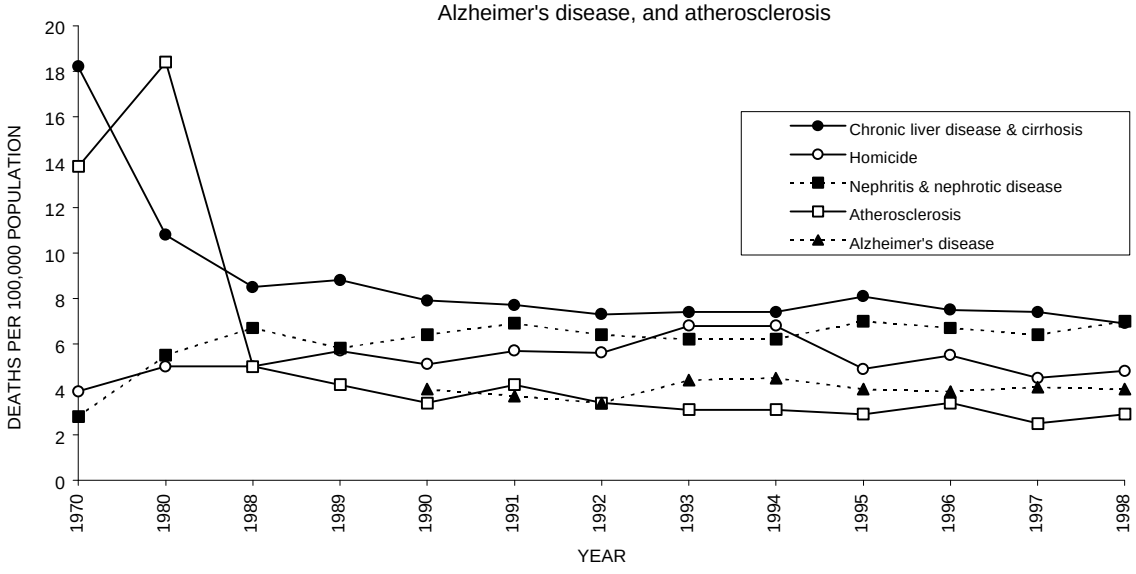
AGE-ADJUSTED MORTALITY RATES* FOR SELECTED CAUSES OF DEATH
CONNECTICUT, 1970, 1980, and 1988-1998
Human immunodeficiency virus, motor vehicle accidents, septicemia, suicide



*Age adjusted to 1970 U.S. standard population.

FIGURE 14

AGE-ADJUSTED MORTALITY RATES* FOR SELECTED CAUSES OF DEATH
CONNECTICUT, 1970, 1980, and 1988-1998
Chronic liver disease & cirrhosis, homicide, nephritis & nephrotic disease,
Alzheimer's disease, and atherosclerosis



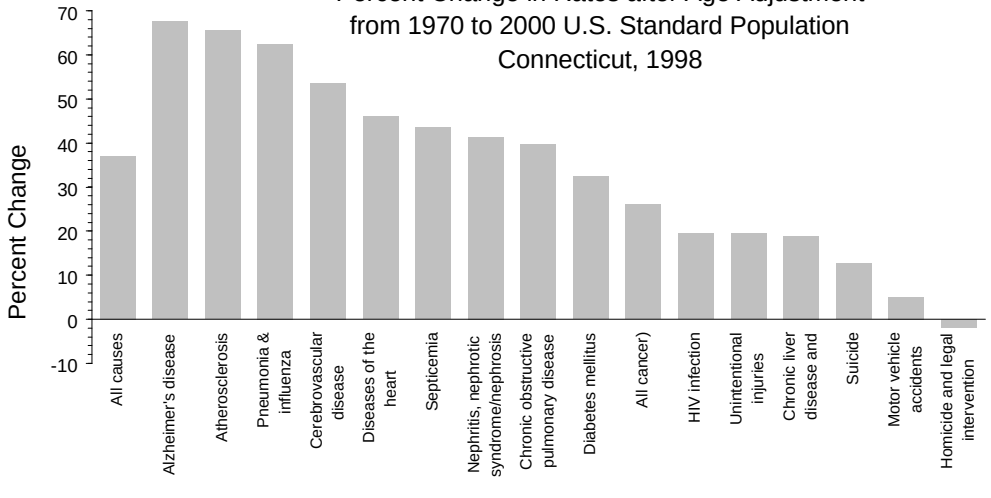
*Age adjusted to 1970 U.S. standard population.

Impact of New U.S. Standard Reference Population on Age-Adjusted Death Rates

Between 1970 and 2000, the U.S. population grew by 37% (see Appendix III, *Age-adjusted Mortality Rates*). During this period, the proportion of the American population under 30 years of age decreased, while the proportion of Americans 65+ years of age increased. Because of such changes in population distribution, age adjusting the same number of Connecticut deaths to 1970 or 2000 U.S. reference populations produces different mortality rates. The relative importance of the selected causes of death also shifts, as adjustment to the 2000 reference population adds weight to those causes of death that affect older populations and decreases the weightings of those that affect younger persons.

Death rates age adjusted to 1970 and 2000 U.S. standard million populations are compared below. The 37% growth of the U.S. population from 1970 to 2000 was reflected by an equal increase in the 2000 AAMR for "all causes" of death. AAMRs adjusted to the 2000 population were higher for all but one of the 16 selected causes of death (Fig. 15). Because of the shift in age distributions, the greatest increases occurred for causes of death that occur mainly later in life ("Alzheimer's disease," "atherosclerosis," "pneumonia and influenza," "cerebrovascular disease"), whereas smaller increases or decreases occurred for causes of death that affect the younger population ("suicide," "chronic liver disease and cirrhosis," "unintentional injuries" including "motor vehicle accidents," and "homicide").

Figure 15
AGE-ADJUSTED MORTALITY RATES FOR SELECTED CAUSES
Percent Change in Rates after Age Adjustment
from 1970 to 2000 U.S. Standard Population
Connecticut, 1998



The relative importance of selected causes of death also changed, depending on the reference year of age adjustment (see table below). "Unintentional injuries" (which affects mostly young people) dropped from fourth to sixth rank after adjustment from the 1970 to 2000 U.S. standard populations. Similarly, "suicide" and "homicide and legal intervention" fell in rank. In contrast, the rankings of "COPD," "pneumonia and

influenza," "nephritis, nephrotic syndrome, and nephrosis," "chronic liver disease and cirrhosis," "Alzheimer's disease," and "atherosclerosis" rose after age adjustment to the 2000 reference population.

Age-adjusted Mortality Rates for Selected Causes of Death
Comparison of Rates Adjusted to 1970 and 2000 U.S. Standard Populations[a]
Connecticut, 1998

	Reference Population			
	1970		2000	
Cause of Death	**Rank**	**Rate**	**Rank**	**Rate**
All causes	-	586.4	-	803.8
Diseases of the heart (390-398,402,404-429)	1	175.5	1	256.2
Malignant neoplasms (140-208)	2	155.5	2	195.9
Cerebrovascular disease (430-438)	3	33.2	3	51.0
COPD[b] (490-496)	5	23.6	4	33.0
Pneumonia & influenza (480-487)	6	19.7	5	32.0
Unintentional injuries (E800-E949)	4	26.7	6	31.9
Diabetes mellitus (250)	7	13.6	7	18.0
Septicemia (038)	8	7.8	8	11.2
Motor vehicle accidents (E810-E825)	-	9.7	-	10.2
Nephritis, nephrotic syndrome/nephrosis (580-589)	10	7.0	9	9.9
Chronic liver disease and cirrhosis (571)	11	6.9	10	8.2
Suicide (E950-E959)	9	7.1	11	8.0
Alzheimer's diseases (331.0)	14	4.0	12	6.7
HIV infection (042-044)	13	4.1	13	4.9
Atherosclerosis (440)	15	2.9	14	4.8
Homicide and legal intervention (E960-E978)	12	4.8	15	4.7

[a] See further discussion of U.S. standard populations under "age adjusted mortality rate" in Appendix III.
[b] COPD = Chronic obstructive pulmonary disease.

The rankings of the top three leading causes of death ("diseases of the heart," "malignant neoplasms," and "cerebrovascular disease") and of "diabetes mellitus," "septicemia," and "HIV infection" were the same no matter which reference population was used for age adjustment.

MARRIAGES

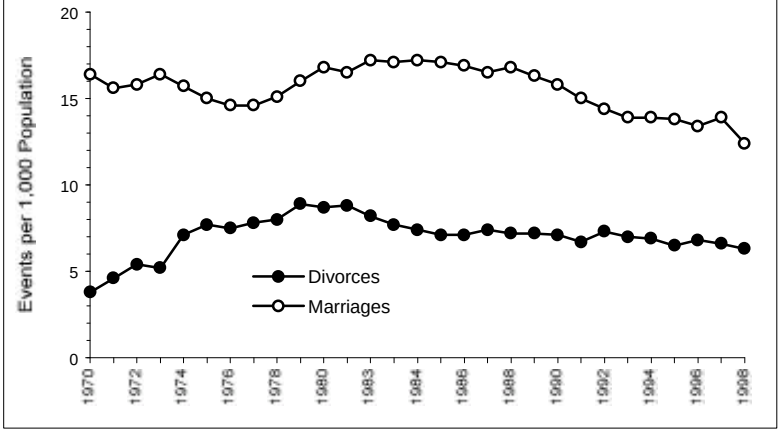
Marriage Rate

In 1998, there were 20,292 marriages in Connecticut (Table 2A), which was 2,406 (10.6%) less than in 1997. The marriage rate was 12.4 persons per 1,000 population, down from 13.9 in 1997. This was the lowest number of marriages registered in Connecticut since 1964 and the lowest marriage rate since 1938. Connecticut marriage rates have been declining since they peaked in the early 1980's (Fig. 16).

Town of Occurrence

Marriages are registered by town of occurrence. Five towns each registered more than 500 marriages in 1998, though no town registered more than 1,000 (Table 2A). They were Hartford (973), New Haven (908), Bridgeport (789), Stamford (670), and Waterbury (583). The greatest number of marriages was registered in Hartford, and the fewest marriages (3) were registered in Union.

Figure 16
MARRIAGE AND DIVORCE RATES
Connecticut, 1970-1998



DIVORCES

In 1998, 10,362 divorce decrees and annulments (6.3 per 1,000 population) were reported in Connecticut [17]. The Connecticut marriage dissolution rate has been trending downward since peaking at 8.9 per 1,000 in 1979

NOTES

[1] *Estimated Populations in Connecticut as of July 1, 1997*. Hartford: Connecticut Department of Public Health, Office of Policy, Planning and Evaluation, September, 1998.

Estimated Populations in Connecticut as of July 1, 1998 Hartford: Connecticut Department of Public Health, Office of Policy, Planning and Evaluation, September, 1998.

[2a] According to the *Connecticut General Statutes*, through June 30, 1997, "No certificate of birth shall contain any specific statement that the child was born in or out of wedlock or reference to illegitimacy of the child or to the marital status of the mother." Public Act 97-7 (incorporated into Section 7-50 of the *Connecticut General Statutes*) provided the exception that information on whether the child was born in or out of wedlock and the marital status of the mother be recorded on the confidential portion of the birth certificate.

Because the modified birth record containing a marital status data field did not come into use until June, 1998, the proxy marital status indicator, “presumptive marital status,” is used for 1998 births. It is based on the matching of surnames, with the classification "married" assigned under the following three conditions: i) if there is an exact match between the mother's and father's surnames; ii) if the father's and child's surnames match exactly, but the mother's name is missing; iii) if the child's surname is a hyphenated combination of the mother's and father's surnames (either entire surnames or portions of the parents' hyphenated surnames). This method of assessing marital status is probably of limited validity, because it assumes that married women who do not adopt their husbands' surnames are unmarried.

[2b] Kotelchuk, M. 1994. An evaluation of the Kessner adequacy of prenatal care index and a proposed adequacy of prenatal care utilization index. *American Journal of Public Health* 84: 1414-1420.

[2c] Ventura, S.J., J.A. Martin, S.C. Curtin, and T.J. Mathews. 1998. Report of final natality statistics, 1996. *Monthly Vital Statistics Reports* 46(11) Supplement. 100 pp.

[3] *Population Estimates by Town for Connecticut, 1990-1998*. Unpublished worksheet. Hartford: Connecticut Department of Public Health, Office of Policy, Planning and Evaluation.

[4] In Connecticut, live births were not tabulated annually by age of mother until 1947, when only 21.3% of total live births were to women aged 30-34. Between 1947 and 1992, the greatest proportions of live births occurred to women aged 20-24 or 25-29. In 1993, for the first time in the state's recorded history, the 30-34 age group gave birth to the most babies of any 5-year age cohort. The age-specific birth rates for women in this group were, however, greater in 1947 than in 1993 through 1998 (123 births per 1,000 female population in 1947, and 104 per 1,000 in 1998). It is noteworthy, however, that the resident birth rate for women of all ages was 23.9 per 1,000 in 1947, nearly double the 1998 rate of 13.4 per 1,000.

[5] Gestational age is calculated using the date of the last menstrual period (LMP) or the clinical estimate of gestational age, if the LMP is not available (Table 3).

[6a] Ventura, S.J., J.A. Martin, S.C. Curtin, T.J. Mathews, and M.M. Park. 2000. Births: Final data for 1998. *National Vital Statistics Reports* 48(3): 1-100.

[6b] Kotelchuk, M. 1994. The Adequacy of Prenatal Care Utilization Index: Its U.S. distribution and association with low birthweight. *American Journal of Public Health* 84: 1486-1489.

[6c] Kogan, M.D., et al. 1998. The changing pattern of prenatal care utilization in the United States, 1981-1995, using different prenatal care indices. *Journal of the American Medical Association* 279: 1623-1628.

[6d] High levels of intensive prenatal care utilization have been found across all populations and may be associated with certain sociodemographic and fertility-related variables and selected medical and behavioral risk characteristics. Minority women, however, seem to be less likely than whites to obtain intensive care, regardless of behavior risks or medical problems. (*See:* Clarke, L.L., et al. 1998. The role of medical problems and behavioral risks in explaining patterns of prenatal care use among high-risk women. *Health Services Research* 34: 145-170.)

[6e] Mueller, L. 2001. Pregnancy and birth. Pages 26-37 in: *Connecticut Women's Health.* Hartford: Connecticut Department of Public Health.

[7] The elevated risks of poor pregnancy outcomes due to smoking and alcohol use are well documented. (*See*: Ventura, S.J., J.A. Martin, S.C. Curtin, T.J. Mathews, and M.M. Park. 2000. Births: Final data for 1998. *National Vital Statistics Reports* 48(3): 1-100.)

[8] Buescher, P.A., K.P. Taylor, M.H. Davis, and J.M. Bowling. 1993. The quality of the new birth certificate data: A validation study in North Carolina. *American Journal of Public Health* 83(8): 1163-65.

[9] Because the numbers of fetal and infant deaths are small even in the most populous towns, standard tests of single-year differences are statistically significant only when the changes are great. Hartford's fetal death rate, for example, would have had to decrease by about 47%, from 12.4 deaths per 1,000 live births in 1997 to 6.6 per 1,000 in 1998, to reach statistical significance ($p<0.05$). The actual 1998 rate was 8.3 per 1,000. Similarly, the infant mortality rate for Hartford would have had to increase 58% from 13.3 to 21.0 per 1,000 live births to be statistically significant.

To determine whether changes in fetal and infant death rates are meaningful requires methods other than the simple one-year comparisons made in this report, such as use of multi-year data and trend analysis with control for confounding variables. Such analyses are, however, beyond the scope of this report.

[10] Some of the leading causes of death used by the NCHS for fetal or infant deaths are:

ICD-9 code(s)	Cause of Death
480-487	Pneumonia and influenza
740-759	Congenital anomalies
761	Fetus or newborn affected by maternal complications of pregnancy
762	Fetus or newborn affected by complications of placenta, cord, and membranes
765	Disorders relating to short gestation and unspecified low birthweight
768	Intrauterine hypoxia and birth asphyxia
769	Respiratory distress syndrome
771	Infections specific to the perinatal period
798.0	Sudden infant death syndrome
E-800-E949	Unintentional injuries

The adoption of the NCHS classifications for ranking infant death makes it easier to make comparisons with national statistics. The standard cause-of-death categories used by NCHS for infants are different than those used for other age groups. (See, for example, "Table 33. Leading causes of death and numbers of deaths, according to age: United States, 1980 and 1998," in *Health, United States, 2000*, National Center for Health Statistics, Hyattsville, Maryland, National Center for Health Statistics, DHHS Publ. No. 00-1232, p. 176.) Also, the NCHS classifications tend to be more narrow and specific than the categories used in prior Connecticut vital statistics reports. For example, the large category used in prior reports, "Conditions originating in the perinatal period" (ICD-9 codes 760-779), is broken out by NCHS classification into smaller components, as noted in the table above and in Tables 8 and 10 of the current vital statistics report.

[11] Of the 222 neonatal deaths in 1998, two-thirds (149 deaths or 67.1%) occurred during the first day of life and of these, 59 (40.0%) occurred less than one hour after birth. (Connecticut Department of Public Health, Office of Policy, Planning, and Evaluation, unpublished data.)

[12a] Data from a linked birth-death file were used to calculate the 1998 infant mortality rate for Hispanics.

[12b] Lipscomb, L.E., C.H. Johnson, B. Morrow, et al. 2000. *PRAMS 1998 Surveillance Report.* Atlanta: Division of Reproductive Health, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention.

[12c] Pregnancy Risk Assessment Monitoring System Working Group. 1998. Assessment of infant sleeping position—Selected states, 1996. *Morbidity and Mortality Weekly Report* 47:873-877.

[13] *Median Age at Death for CT Residents, 1989-1998*. Unpublished tables. Hartford: Connecticut Department of Public Health, Office of Policy, Planning, and Evaluation.

[14] The following examples are provided to illustrate important sex differences in mortality. Male-female differences in suicide, homicide and unintentional injuries appear during and after adolescence, influenced by physiological maturation. The highest suicide rate for women occurs at or about the age of menopause, another biological marker. Unintentional injury fatalities are higher among males, reflecting their higher frequency of risk-taking activities and their tendency to sustain more severe injuries. Males are also more likely to engage in hazardous professions, which contributes to sex differences in unintentional deaths. Social expectations also may contribute to sex differences in mortality, to the extent that they result in higher levels of alcohol consumption among men. Excessive alcohol consumption is directly related to increased risk of chronic liver disease, and indirectly related to motor vehicle accidents. Females outnumber males for deaths due to Alzheimer's disease, atherosclerosis, and cerebrovascular disease largely because of differences in age distributions between the sexes; more women are alive at older ages when the risk of death from these causes is prevalent (see Fig. 1 and Table 1).

[15] Age-adjusted mortality rates for 1970, 1980, and 1988-1998 were calculated using 10-year age intervals, following the direct method. (Fleiss, J.L. 1981. *Statistical Methods for Rates and Proportions.* New York: John Wiley & Sons, p. 224-247.)

The direct method of adjustment requires age-and sex-specific population figures. Population data for different time periods were obtained from different sources, as noted below.

a) The 1970 rate denominators were published in the Connecticut *Registration Report* for 1970.

b) The 1980 rate denominators were published in the Connecticut *Registration Report* for 1980.

c) The denominators used for the years 1988-1989 were the intercensal estimates published in: U.S. Bureau of the Census, *Preliminary Intercensal Estimates of the Population of States: 1981-1989*, November 1, 1991. The U.S. Bureau of the Census has revised these intercensal figures using 1990 MARS data. These final intercensal figures vary little from the preliminary figures; hence, the 1988-1989 AAMRs were not recalculated using the final figures. The final intercensal figures are available upon request from the CT Department of Public Health.

d) The 1990 denominators are the modified population counts by age, race, and sex published by the U.S. Bureau of the Census. (U.S. Bureau of the Census. 1990. *Age, sex, race and Hispanic origin information from the 1990 Census: A comparison of census results with results where age and race have been modified.* Publ. No. 1990 CPH-L-74.)

e) The 1991-1996 denominators were calculated based on two components: (*i*) Connecticut population estimates published by the Connecticut Department of Public Health; and (*ii*) age-sex population distributions for Connecticut published by the U.S. Bureau of the Census. The

estimated Connecticut age-sex population counts were calculated by multiplying (*i*) and (*ii*), with appropriate rounding of the resulting figures.

Connecticut population estimates for 1991-1996 are given in the annual reports entitled, *Estimated Populations in Connecticut as of July 1*, published by the Connecticut Department of Public Health, Office of Policy, Planning and Evaluation.

The U.S. Census Bureau's estimated age-sex distributions of the Connecticut population are given in the following publications:

Davis, S. *Estimates of the Population of States by Age, Sex, Race and Hispanic Origin: 1991.* U.S. Bureau of the Census, Population Division, 1994.

Byerly, E. and K. Deardorff. *National and State Population Estimates: 1990-1994.* U.S. Bureau of the Census, Current Population Reports, p. 31-32. Washington, DC: U.S. Government Printing Office.

Resident Population of the U.S. and States, by Single Year of Age and Sex: July 1, 1995 Estimates. Washington, DC: Population Estimates and Population Distribution Branches, U.S. Bureau of the Census.

Estimates of the Population of the U.S. and States, by Single Year of Age and Sex: July 1, 1996. Washington, DC: Population Estimates Program, Population Division, U.S. Bureau of the Census.

f) The denominators used for 1997 and 1998 were from the U.S. Census Bureau's intercensal estimates:

Estimates of the Population of the U.S., Regions, Divisions, and States by 5-year Age Groups and Sex: Annual Time Series, July 1, 1990 to July 1, 1997 (Includes revised April 1, 1990 census population counts). Population Estimates Program, Population Division, U.S. Bureau of the Census, Washington, DC. Internet release date July 21, 1998. (*http://www.census.gov/population/estimates/state/97ageby5.txt*)

Population Estimates for Minor Civil Divisions: Annual Time Series, July 1, 1990 to July 1, 1998. Population Estimates Program, Population Division, U.S. Bureau of the Census, Washington, DC. Internet release date June 30, 1999. *http://www.census.gov/population estimates/metro-city/mcdts/MCD98_CT-DR..txt*

[16] *Connecticut Resident Deaths, 1998. Number of Deaths, Crude Mortality Rate, and Age-adjusted Mortality Rate for Selected Causes of Death by Sex of Decedent.* Unpublished worksheet. Hartford: Connecticut Department of Public Health, Office of Policy, Planning and Evaluation.

[17] Public Act 97-8 repealed *Connecticut General Statutes,* Section 46b-68, concerning reports of marriage dissolutions and annulments; as a result, effective January 1, 1998, the Department of Public Health no longer receives copies of divorce and annulment records. These records are maintained at the Superior Courts in Connecticut's 13 judicial districts. DPH is sent monthly counts of marriage dissolutions and annulments by most of the Superior Courts. Incomplete divorce counts for 1998 were received from the Superior Courts of Ansonia-Milford (2 months not reported), Hartford-New Britain (1 month missing), Middlesex (2 months missing), New Haven (1 month missing), Stamford-Norwalk (1 month missing), and Tolland (2 months missing). Accordingly, 1998 Connecticut divorce counts may be under-reported.

[18] Population Estimates Program, Population Division, U.S. Census Bureau. 2000. Population estimates for states by race and Hispanic origin: July 1, 1998 (ST-99-31). Washington, DC: U.S. Census Bureau. (Internet release date: August 30, 2000.)

For 1998 Registration Report Tables, please see separate Excel Files

Appendix I

RATE DEFINITIONS

Age-specific birth rate = $\frac{\text{Number of live births in a specific age group}}{\text{Total resident population in specific age group}}$ x 100,000

Age-specific death rate = $\frac{\text{Number of deaths in a specific age group}}{\text{Total resident population in specific age group}}$ x 100,000

Crude birth rate = $\frac{\text{Number of resident live births}}{\text{Total resident population}}$ x 1,000

Crude death rate = $\frac{\text{Number of resident deaths}}{\text{Total resident population}}$ x 1,000

Divorce rate[a] = $\frac{\text{Number of persons granted divorces}}{\text{Mid-year total resident population}}$ x 1,000

Fetal death rate[b] = $\frac{\text{Number of fetal deaths}}{\text{Number of live births}}$ x 1,000

Infant death rate = $\frac{\text{Number of infant deaths}}{\text{Number of live births}}$ x 1,000

Marriage rate[a] = $\frac{\text{Number of persons married}}{\text{Mid-year total resident population}}$ x 1,000

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[a] Marriage and divorce counts provided in the tables in this report refer to number of *couples*, not *individuals*, who married or divorced. To calculate the marriage or divorce *rates*, the marriage or divorce counts were multiplied by two.

[b] This fraction is often referred to as a *ratio*, rather than a *rate*, because the denominator (live births) does not contain the numerator (fetal deaths).

Appendix II

HEALTH DISTRICT CONSTITUENT TOWNS AS OF MAY 29, 2001

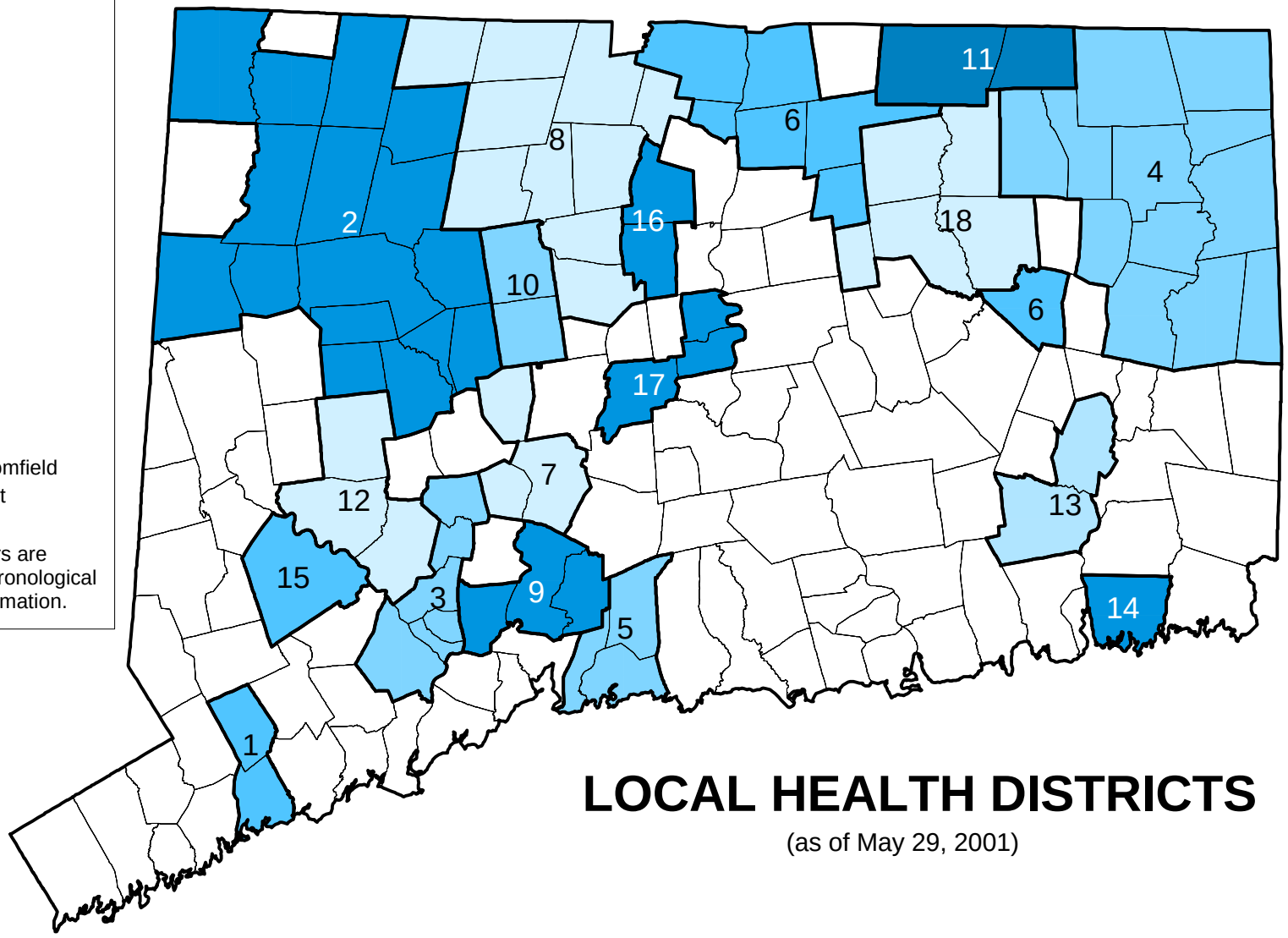
Health District	No.[a]	Constituent Towns[b]
Bristol-Burlington Health District	10	Bristol, Burlington
Chesprocott Health District	7	Cheshire, Prospect, Wolcott
East Shore Health District	5	Branford, East Haven, North Branford
Eastern Highlands Health District	18	Bolton, Coventry, Mansfield, Tolland, Willington
Farmington Valley Health District	8	Avon, Barkhamsted, Canton, Colebrook, East Granby, Farmington, Granby, Hartland, New Hartford, Simsbury
Ledge Light Health District	14	City of Groton, Town of Groton
Naugatuck Valley Health District	3	Ansonia, Beacon Falls, Derby, Naugatuck, Seymour, Shelton
Newtown Health District	15	Town of Newtown, Borough of Newtown
North Central Health District	6	East Windsor, Ellington, Enfield, Suffield, Vernon, Windham, Windsor Locks
Northeast Health District	4	Ashford, Brooklyn, Canterbury, Eastford, Hampton, Killingly (Danielson Borough), Plainfield, Pomfret, Putnam, Sterling, Thompson, Woodstock
Pomperaug Health District	12	Oxford, Southbury, Woodbury
Quinnipiack Valley Health District	9	Hamden, North Haven, Woodbridge
Berlin-Rocky Hill-Wethersfield Health District	17	Berlin, Rocky Hill, Wethersfield
Stafford Health District	11	Stafford (Stafford Springs Borough), Union
Torrington Area Health District	2	Bethlehem, Canaan, Cornwall, Goshen, Harwinton, Kent, Litchfield (Town, Bantam Borough, Litchfield Borough), Morris, Norfolk, Plymouth, Salisbury, Thomaston, Torrington, Warren, Watertown, Winchester
Uncas Regional Health District	13	Montville, Norwich
West Hartford-Bloomfield Health District	16	Bloomfield, West Hartford
Weston-Westport Health District	1	Weston, Westport

[a] Numbers are assigned in order of date of formation of health district.

[b] Since publication of the 1997 Registration Report, the following changes occurred: Tolland and Willington joined the Eastern Highlands HD; Canaan joined the Torrington Area HD; The Berlin-Rocky Hill-Wethersfield HD became the Central CT HD. The town of Ledyard joined the Ledgelight HD effective 5/30/2001, after the files for the current report had been closed.

No.	District*
1	Westport-Weston
2	Torrington Area
3	Naugatuck Valley
4	Northeast
5	East Shore
6	North Central
7	Chesprocott
8	Farmington Valley
9	Quinnipiack Valley
10	Bristol-Burlington
11	Stafford
12	Pomperaug
13	Uncas
14	Ledge Light
15	Newtown
16	West Hartford-Bloomfield
17	Central Connecticut
18	Eastern Highlands

* The District numbers are assigned in the chronological order of district formation.



LOCAL HEALTH DISTRICTS

(as of May 29, 2001)

Appendix III

GLOSSARY

Adequacy of prenatal care: See *Adequacy of Prenatal Care Utilization Index* and *Kessner Index*.

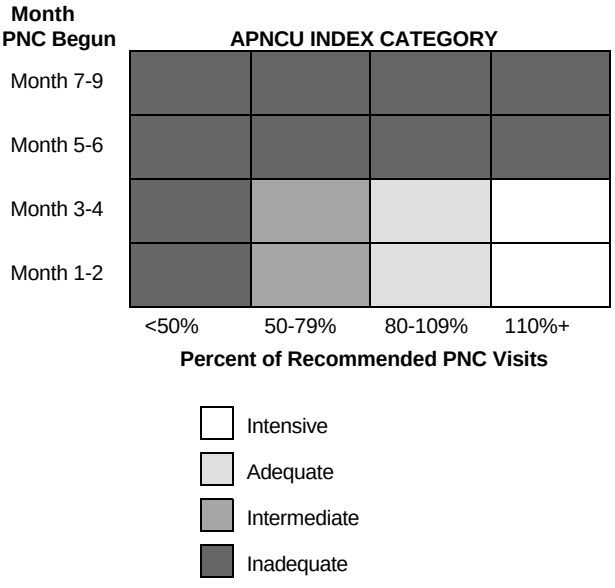
Adequacy of Prenatal Care Utilization Index. The Adequacy of Prenatal Care Utilization (APNCU) Index characterizes prenatal care utilization based on two independent dimensions – time of initiation of prenatal care, and number of prenatal care visits after care has begun.

The APNCU Index classifies prenatal care utilization by comparing the *actual* number of prenatal care visits to the *expected* number of visits. The expected number of visits is the total number recommended by the American College of Obstetricians and Gynecologyists (ACOG), adjusted for the length of gestation. The ACOG recommendations for a full-term (40-wk) pregnancy without complications are: one visit every 4 weeks for the first 28 weeks; one visit every 2-3 weeks until 36 weeks; and weekly visits for the rest of the pregnancy.

When prenatal care begins by the fourth month of pregnancy, the care is considered *intensive* if actual vists are 110% or more of expected visits, *adequate* if the actual-to-expected ratio is 80-109%, *intermediate* with an actual-to-expected ratio of 50-79%, and *inadequate* with an actual-to expected ratio of less than 50%. In cases where prenatal care begins after the fourth month of gestation, the care is termed *inadequate* regardless of the total number of visits.

Summary of APNCU Index Categories

Category	Timing of Initiation of Care		Number of Visits
Intensive	Prenatal care initiated in first 4 months	*and*	110% or more of expected visits received
Adequate	Prenatal care initiated in first 4 months	*and*	80% to 109% of expected visits received
Intermediate	Prenatal care initiated in first 4 months	*and*	50% to 79% of expected visits received
Inadequate	Prenatal care initiated in month 5 or later	*or*	less than 50% of expected visits received



The APNCU Index has been adopted by the National Center for Health Statistics for reporting adequacy of prenatal care, and is considered to overcome several limitations of the Kessner Index.

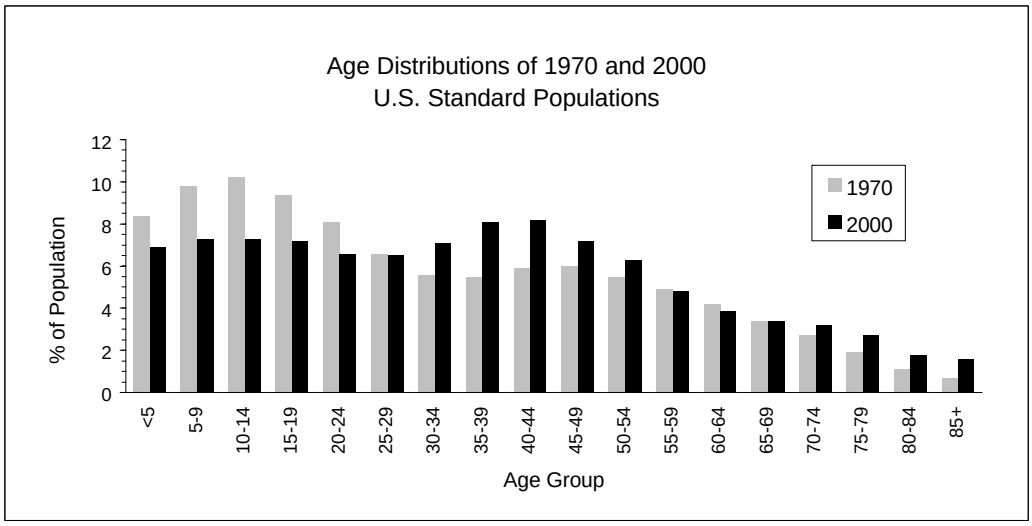
Age-adjusted mortality rate (AAMR)--Direct method: Applies *age-specific death rates* of an observed population to the age distribution of a standard population. The AAMR is the death rate that the observed population would have, *if* its age distribution were the same as that of the standard population. Age-adjustment allows comparisons to be made between different population groups or populations in different geographic areas, by eliminating differences stemming from variations in age distributions.

Age adjusted death rates can be compared only if they are adjusted to the same standard population. The 1970 U.S. population has been used in the past for age adjustment of Connecticut death rates. The 2000 U.S. population standard is being introduced in 1998 for consistency with national standards set by the U.S. Department of Health and Human Services. For ease of comparisons, the U.S. population is converted to a population of exactly one million with the same proportional age groups as the total U.S. population; this is called the "U.S. standard million" population.

Between 1970 and 2000, the U.S. population grew by 76.4 million or 37%, and the population distribution by age also shifted. The 1970 and 2000 U.S. standard million population distributions are shown below.

	U.S. Standard Million Population			
	1970		2000	
Age	No.	%	No.	%
<5	84,416	8.4	69,136	6.9
5-9	98,204	9.8	72,533	7.3
10-14	102,304	10.2	73,032	7.3
15-19	93,845	9.4	72,169	7.2
20-24	80,561	8.1	66,477	6.6
25-29	66,320	6.6	64,529	6.5
30-34	56,249	5.6	71,044	7.1
35-39	54,656	5.5	80,762	8.1
40-44	58,958	5.9	81,851	8.2
45-49	59,622	6.0	72,118	7.2
50-54	54,643	5.5	62,716	6.3
55-59	49,077	4.9	48,454	4.8
60-64	42,403	4.2	38,793	3.9
65-69	34,406	3.4	34,264	3.4
70-74	26,789	2.7	31,773	3.2
75-79	18,871	1.9	26,999	2.7
80-84	11,241	1.1	17,842	1.8
85+	7,435	0.7	15,508	1.6
Total	1,000,000	100.0	1,000,000	100.0

Compared to the 1970 U.S. standard million population, the 2000 reference population has less people in younger age groups and more people in older age groups (see below). The number of persons <5 to 24 years of age is 23% lower in the 2000 population, whereas the population 65 years of age and older is 28% greater. Consequently, adjustment of death rates to the 2000 reference population accentuates deaths in older age groups and de-emphasizes deaths in younger age groups. The effects of different reference populations on mortality rates for selected causes of death are discussed in the narrative section of this report, under *Age-Adjusted Mortality Rates*.



Age-specific birth rate: The number of live births to women in a specific age group per 1,000 females in the population in the same age group.

Age-specific death rate: The number of deaths in a specific age group, per 1,000 population in the same age group.

Birthweight: The first weight of a fetus or infant at time of delivery. This weight is usually measured during the first hour of life, before postnatal weight loss occurs.

Cause of death: The underlying cause of death determined to be the primary condition leading to death, based on the international rules and sequential procedure set forth for manual classification of the underlying causes of death by the National Center for Health Statistics and the World Health Organization (*International Classification of Disease, Ninth Revision)*. (See also: "Underlying cause of death.")

Cause of hospitalization: A condition that is chiefly responsible for occasioning the admission of a patient for care.

Crude death rate: The number of deaths per 1,000 population. This rate should not be used for making comparisons between different populations when the age, race, and sex distributions of the populations are different. (See "Age-adjusted death rate" and "Age-specific death rate.")

Divorce: The final legal dissolution of a marriage.

Ethnicity: See "Hispanic ethnicity."

Fetal death: Death prior to the complete expulsion or extraction from the mother of a product of conception, which has passed through at least the 20th week of gestation. The fetus shows no signs of life such as heartbeat, pulsation of the umbilical cord, or movement of voluntary muscles.

Gestational age: The number of completed weeks elapsed between the first day of the last normal menstrual period (LMP) and the date of delivery.

Health district: A local governmental entity consisting of two or more towns that is responsible for the public health of its constituent towns. (See Appendix II for a listing of the 16 health districts in existence in Connecticut as of June 8, 1995.)

Hispanic ethnicity: Refers to people whose origins are from Spain, the Spanish-speaking countries of Central America, South America, and the Caribbean, or persons of Hispanic origin identifying themselves as Spanish, Spanish-American, Hispanic, Hispano, Latino, and so on. In Connecticut, the birth, death, and fetal death certificates have a separate line item for the individual's Hispanic status, to attempt to distinguish Hispanic ethnicity from race. Individuals identifying themselves as "Hispanic" can be of any race, and are also counted in the race breakdown as either "white," "black," or "other."

Infant death: Death occurring to an individual of less than one year (365 days) of age, comprising the sum of *neonatal death* and *postneonatal death*.

Kessner Index (Modified): The Kessner Index is a composite indicator of the adequacy of prenatal care a mother receives during her pregnancy. Prenatal care is categorized as *adequate*, *intermediate*, or *inadequate* based on three items from the birth certificate: timing of the first prenatal visit; total number of prenatal visits; and length of gestation. The term, *non-adequate* prenatal care, which is the sum of the intermediate and the inadequate levels of care, is used in Table 4 of the present report.

The Kessner Index has four major limitations. 1) It is overwhelmingly a measure of the timing of initiation of prenatal care, rather than continuity of care once enrolled. 2) It does not differentiate between inadequacy based on too few visits and inadequacy based on late entry into care. 3) It does not characterize prenatal care utilization for normal and post-normal gestation periods, as the maximum required number of visits--nine--is less than the ACOG-recommended number of visits for pregnancies longer than 36 weeks. 4) Because the index initially was not well documented, definitions and calculation methods are not standardized, so many public health authorities have developed their own systems, which are not consistent with those of other entities.

Summary of Kessner Index Categories

Category	Gestational Age (wks)		Number of Prenatal Care Visits
Adequate	13 or less	and	1 or more or not stated
	14-17	and	2 or more
	18-21	and	3 or more
	22-25	and	4 or more
	26-29	and	5 or more
	30-31	and	6 or more
	32-33	and	7 or more
	34-35	and	8 or more
	36+	and	9 or more
Inadequate	14-21	and	0 or not stated
	22-29	and	1 or less or not stated
	30-31	and	2 or less or not stated
	32-33	and	3 or less or not stated
	34+	and	4 or less or not stated
Intermediate	All combinations other than those specified above		

The modified Kessner Index used in this report differs from the usual definition in that more extensive efforts have been made to minimize the amount of missing information. (The Kessner Index does not specify how to treat records with missing gestational age, number of visits, or date of entry into prenatal care.) In addition, certain extreme values of gestational age, which may have resulted from the mother's inability to recall the date of the last menstrual period, have been redefined as "missing" (about 1% of the records). A more detailed definition of the Modified Kessner Index, describing the three index components and the methods used to calculate each, is available from the Connecticut Department of Public Health, Office of Policy, Planning and Evaluation.

Because of the limitations noted above, the National Center for Health Statistics has replaced the Kessner Index with the Adequacy of Prenatal Care Utilization Index (APNCU) for reporting on prenatal care utilization and clinical adequacy (*see* “Adequacy of Prenatal Care Utilization Index”).

Live birth: The complete expulsion or extraction from the mother of a product of conception, regardless of the duration of pregnancy; after such separation, shows signs of life (e.g., heartbeat, pulsation of the umbilical cord, or movement of voluntary muscles).

Live birth order: The number of children born alive to the same mother, including the current birth (first born, second born, third born, etc.).

Low birthweight: A birthweight of less than 2,500 grams (approximately 5 lbs., 8 oz.).

Median: The number that lies exactly in the middle of a set of numbers arranged in order of magnitude, such that 50% of the numbers fall above it and 50% fall below it. If the set consists of an even number of values, the median is taken to be the value halfway between the two middle numbers.

Neonatal death: Death occurring to an infant less than 28 days of age.

Occurrence: Place of occurrence identifies where the vital event actually took place, regardless of the place of residence of the individual.

Plurality: The number of siblings born as the result of a single pregnancy; commonly expressed as *singleton* or *multiple*.

Postneonatal death: Death occurring to an infant aged 28 days to 364 days.

Premature: A live birth or fetal death that occurs before the completion of the 37th week of gestation.

Presumptive marital status: Because of statutory limitations, there is no "marital status" field on the Connecticut birth record. Marital status is inferred by comparing the child's and parents' surnames. A birth is classified as occurring to a married couple if: 1) the parents' surnames are the same; or 2) if the child's and father's surnames are the same and the mother's current surname is missing in the birth certificate. A birth is classified as occurring to an unmarried couple if: 1) the father's name is missing; or 2) the parents' surnames are different.

Race: A population of individuals who identify themselves from a common history, nationality, or geographical place. When responses in the "race" line item on vital records are associated with the definition of Hispanic origin, they are re-coded to "white race," as described in the National Center for Health Statistics instruction manuals for coding vital records. Individuals identifying themselves as either "white," "black," or "other" race can be of any ethnic group. (See also "Hispanic ethnicity.")

Residence: The usual place of abode of the person to whom the vital event occurred. For births and fetal deaths, residence is defined as the mother's usual place of residence.

Teenage mother: A woman under 20 years of age on the date of delivery.

Trimester of pregnancy: One-third of the total gestation period of a full-term pregnancy, or 13 weeks per trimester. The "third trimester" classification comprises pregnancies of 27 or more weeks gestation. The weekly count begins on the first day of last menstrual period.

Underlying cause of death: The disease or injury that initiated the sequence of events leading directly to death, or the circumstances of the accident or violence that produced the fatal injury.

Very low birthweight: A birthweight of less than 1,500 grams (approx. 3 lbs., 5 oz.).

Appendix IV

1. AGE-ADJUSTED MORTALITY RATES FOR SELECTED CAUSES OF DEATH CONNECTICUT, 1970, 1980, AND 1988-1998

(*Age adjusted to 1970 U.S. standard population* [a])

	Year of Death												
Cause of Death	**1970**	**1980**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
All causes	854.6	735.1	661.1	645.5	622.5	618.5	612.3	620.0	622.0	614.8	606.6	593.1	586.4
Diseases of the heart	336.1	269.0	226.6	213.2	204.5	200.1	199.2	197.3	192.5	189.8	188.5	181.9	175.5
Malignant neoplasms	168.0	179.6	167.3	171.8	163.2	166.2	165.3	161.5	163.9	160.3	160.5	157.0	155.5
Cerebrovascular disease	95.5	52.6	36.4	36.5	35.1	33.6	33.5	34.5	34.5	34.2	34.8	33.2	33.2
Unintentional injuries	27.1	32.7	26.1	25.3	24.0	22.4	23.0	24.5	25.6	27.2	25.1	26.1	26.7
Motor vehicle accidents	16.1	17.4	14.6	12.8	11.7	9.8	9.6	10.7	10.0	10.5	9.8	10.5	9.7
COPD[b]	13.2	18.7	21.6	21.9	22.6	20.9	24.1	22.7	24.2	23.6	23.9	24.9	23.6
Pneumonia and influenza	27.1	22.4	22.7	22.0	22.7	20.5	21.3	21.6	21.0	19.5	19.6	20.8	19.7
Diabetes mellitus	16.5	10.4	11.7	11.1	11.2	11.1	11.4	12.7	13.6	13.0	15.2	13.1	13.6
Septicemia	1.7	4.5	7.9	8.1	9.3	8.0	8.3	8.3	7.8	8.3	7.0	6.8	7.8
Suicide & self-inflicted injury	9.7	8.1	8.8	7.8	7.6	9.2	8.1	8.1	8.7	8.8	8.0	7.3	7.1
Nephritis & nephrotic disease	2.8	5.5	6.7	5.8	6.5	6.9	6.4	6.2	6.3	7.0	6.7	6.4	7.0
Chronic liver disease & cirrhosis	18.2	10.8	8.5	8.8	7.9	7.7	7.3	7.4	7.7	8.1	7.5	7.4	6.9
Homicide & legal intervention	3.9	5.0	5.0	5.7	5.1	5.7	5.6	6.8	6.8	4.9	5.5	4.5	4.8
HIV infection[c]	-	-	5.3	6.6	6.7	8.5	10.2	12.5	13.5	14.2	9.2	4.8	4.1
Alzheimer's disease[d]	-	-	-	-	4.0	3.7	3.4	4.4	4.5	4.0	3.9	4.1	4.0
Atherosclerosis	13.8	18.4	5.0	4.2	3.5	4.2	3.4	3.1	3.3	2.9	3.4	2.5	2.9

[a] Mortality rates per 100,000 population were adjusted to the 1970 U.S. standard population, using the direct method.
[b] COPD = Chronic obstructive pulmonary disease (emphysema, chronic bronchitis, etc.).
[c] HIV = Human Immunodeficiency Virus. Cause-of-death codes for HIV infection first became available in 1987.
[d] Death rates for Alzheimer's disease in Connecticut were first determined in 1990.

2. AGE-ADJUSTED MORTALITY RATES[a] FOR SELECTED CAUSES OF DEATH CONNECTICUT, 1980 AND 1988-1998[d]

(*Age-adjusted to U.S. 2000 standard population and listed in order of 1998 rates*)

	Year of Death											
Cause of Death	**1980**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
All causes	982.5	898.7	873.5	841.7	840.9	837.7	846.3	844.3	837.1	829.1	812.7	803.8
Diseases of the heart	379.6	329.0	308.4	293.0	288.9	288.7	286.6	279.5	275.6	274.7	265.6	256.2
Malignant neoplasms	223.7	209.1	214.0	204.0	207.8	209.2	203.8	205.2	201.8	202.3	198.9	195.9
Cerebrovascular disease	81.9	56.8	56.1	54.1	51.8	52.3	53.5	52.5	52.3	53.4	51.4	51.0
COPD[b]	25.3	29.4	29.8	30.4	29.0	33.6	31.4	33.5	32.6	33.1	34.4	33.0
Pneumonia and influenza	34.5	36.7	35.3	36.6	33.8	34.6	34.8	33.7	31.1	31.5	33.2	32.0
Unintentional injuries	37.0	29.7	28.0	27.5	25.4	27.1	28.3	29.8	32.1	29.6	30.6	31.9
Motor vehicle accidents	17.4	14.7	12.6	11.9	9.6	9.9	10.8	10.0	10.8	9.9	10.8	10.2
Diabetes mellitus	15.1	16.6	14.6	14.9	14.8	15.1	16.7	18.0	17.1	20.1	17.2	18.0
Septicemia	6.1	12.0	11.7	13.4	11.7	11.7	12.1	11.2	12.0	10.1	10.0	11.2
Nephritis & nephrotic disease	7.0	8.9	8.4	9.1	9.7	9.5	8.8	9.0	10.3	9.5	9.5	9.9
Chronic liver disease & cirrhosis	13.4	10.3	10.2	9.3	9.1	8.6	8.7	9.1	9.7	8.9	8.7	8.2
Suicide & self-inflicted injury	8.9	9.7	8.7	8.5	10.0	9.1	8.9	9.6	9.7	8.7	8.3	8.0
Alzheimer's disease	0.9	6.0	6.3	6.4	6.0	5.6	7.3	7.4	6.7	6.5	6.9	6.7
HIV infection[c]	-	5.8	8.0	8.2	10.5	12.6	15.5	16.6	17.8	11.5	5.8	4.9
Atherosclerosis	29.4	8.6	7.2	5.8	6.9	5.9	5.4	5.8	4.9	5.8	4.2	4.8
Homicide & legal intervention	5.6	4.9	5.7	4.9	5.5	5.4	6.4	6.4	4.7	5.4	4.2	4.7

a Mortality rates per 100,000 population were adjusted to the 2000 U.S. standard population, using the direct method. See "age adjustment" in Appendix III for discussion of differences between the 1970 and 2000 reference populations and their effect on mortality rates.

b COPD = Chronic obstructive pulmonary disease (emphysema, chronic bronchitis, etc.).

c HIV = Human Immunodeficiency Virus. Cause-of-death codes for HIV infection did not become available until 1987.

d Rates for 1980 and 1988 from CDC Wonder data base. All other rates from DPH Office of Policy, Planning, and Evaluation, Division of Planning and Analysis.

Appendix V

STATISTICAL ANALYSES

Tests of statistical significance were conducted on data for birth outcomes and risk factors, infant deaths, and fetal deaths, by health district* and town, and for racial/ethnic groups. Two types of statistical assessments were made: 1) comparisons between the current and prior years (1998 and 1997) for the same town, health district, or racial/ethnic group; and 2) comparisons between a reference group and the other groups within the current year. In the current-year comparisons, the reference group for towns and health districts was the state of Connecticut; the reference group for racial/ethnic groups was "white non-Hispanic." Results for the state, health districts, and towns are given in Table V-1, and results for racial and ethnic groups are shown in Table V-2.

To balance the need to screen out random fluctuations with the need to detect meaningful differences, analyses were limited to geographic regions with at least 200 births or 5 or more infant or fetal deaths, and appropriate significance levels were selected. For determining annual significant changes for fetal and infant deaths, an additional criterion—a total of 10 or more deaths in both years combined—was applied. Comparisons were labeled "significant" in either of two situations: $p<0.01$ for comparisons within the current data year; or $p<0.05$ for differences between the current year and prior year. The latter, less stringent probability level was used because statistically significant changes over time are more difficult to detect than significant differences within the same year.

A limitation of an annual significance testing is that single-year figures for some towns are too small to allow valid conclusions to be drawn. Readers are thus cautioned to use the statistical assessments as a guide, not as an absolute dictum. Also, the choice of an appropriate "*p*-value" for use as a reporting threshold varies with the point of view of the reader or analyst. The *Registration Report* is often used by persons primarily concerned with information about a single town. The appropriate "*p*-value" for single-town analyses can differ considerably from that used in this report to survey all 169 Connecticut towns.

Statistical Analysis of Intensive Prenatal Care Utilization

For 1998, prenatal care utilization was assessed using both the Kessner and APNCU indices (see Appendices III and VI). Percentages of births to mothers who received non-adequate care according to the Kessner and/or APNCU indices were tested for statistical significance at the state, health district, and town levels, and by racial/ethnic subgroup. As in the past, the denominator for calculating these percentages was total births with known prenatal care. The results of significance testing for non-adequate care are given in Tables V-1 and V-2.

Unlike the Kessner Index, the APNCU Index distinguishes mothers who receive the number of prenatal care visits recommended by the American College of Gynecologists and Obstetricians

* Health district composition reflects status as of May 29, 2001. Ledyard joined Ledge Light HD as of May 30, 2001, but this change was not included in the analyses. See Appendix II for constituent towns in each health district.

("adequate care") from those who receive substantially more than the recommended number ("intensive care"). Intensive utilization of prenatal care probably results from a variety of factors, including maternal and fetal health problems that make pregnancies "high-risk," and local variation in provider practice patterns (see Appendix VI). Reduction of intensive utilization of prenatal care is desirable and can be achieved by decreasing the health problems that appropriately require intensive care, and also by curtailing inappropriate excess utilization

The proportion of births to Connecticut women who received intensive care in 1998, calculated as percentage of total births with known prenatal care, is given in Tables 3 and 4 of the *Registration Report.* For significance testing, however, the percentage of births to women who received intensive care was calculated by using as the denominator births that met or exceeded ACOG guidelines for prenatal care visits (i.e. "adequate care" plus "intensive care"). Use of this denominator highlights the importance of determining factors that distinguish women who receive more than the recommended number of visits from those who simply receive the recommended number. The results of significance testing of intensive prenatal care utilization are given in Table V-3. Percentages based on total births are included for comparison, but tests of statistical significance were not performed using these values.

Significant differences in intensive care utilization should be interpreted with caution. For example, a "high" percentage of intensive care in a given town, relative to the state percentage, could be consistent with that town's high-risk population, whereas a "high" percentage in another town could indicate that some of the excess care was unnecessary. Because information available from birth records is limited, further analysis would not necessarily explain intensive care utilization in individual towns.

TABLE V-1
Statistical Analysis of Birth Outcomes and Their Risk Factors, Infant Mortality and Fetal Mortality at the State, Health District, and Town Levels Connecticut, 1998

Health District or Town	1998 No. Events	1998 Percent	1998 Significantly Different from State Percent[a] (p<0.01)	1997 Percent	Significant Change from 1997-1998[a] (p<0.05)
LOW BIRTHWEIGHT					
Connecticut	3,384	7.8	N/A	7.3	Increase
Health District					
Bristol Burlington	75	8.3	-	5.7	Increase
Chesprocott	30	5.3	-	2.4	Increase
East Shore	38	4.6	Lower	8.0	Decrease
North Central	142	8.4	-	6.4	Increase
Pomperaug	13	3.7	Lower	-	-
Town					
Bethel	7	3.0	Lower	-	-
Bridgeport	217	9.6	Higher	-	-
Bristol	67	8.3	-	5.6	Increase
Cheshire	20	6.5	-	2.0	Increase
Colchester	6	2.6	Lower	9.0	Decrease
East Haven	17	4.9	-	9.3	Decrease
Farmington	7	2.7	Lower	-	-
Greenwich	33	4.7	Lower	9.2	Decrease
Hamden	47	8.1	-	5.2	Increase
Hartford	314	13.7	Higher	-	-
New Britain	106	10.1	Higher	-	-
New Haven	215	11.7	Higher	-	-
Rocky Hill	21	10.5	-	4.6	Increase
Windham	33	10.3	-	5.7	Increase
VERY LOW BIRTHWEIGHT					
Connecticut	738	1.7	N/A	1.6	-
Health District					
Chesprocott	15	2.7	-	0.5	Increase
East Shore	3	0.4	Lower	1.4	Decrease
Farmington Valley	7	0.7	Lower	-	-
Town					
Berlin	0	0	Lower	-	-
Bethel	0	0	Lower	-	-
Bridgeport	59	2.6	Higher	-	-
Cheshire	13	4.2	Higher	0.3	Increase
East Hartford	22	3.2	Higher	-	-

TABLE V-1 (Continued)
Birth Outcomes and Their Risk Factors, Infant Mortality, and Fetal Mortality

Health District or Town	1998 No. Events	1998 Percent	1998 Significantly Different from State Percent[a] (p<0.01)	1997 Percent	Significant Change from 1997-1998[a] (p<0.05)
VERY LOW BIRTHWEIGHT					
Town					
Farmington	1	0.4	-	3.5	Decrease
Guilford	6	3.0	-	0.0	Increase
Hartford	91	4.0	Higher	-	-
Meriden	18	2.2	-	0.7	Increase
Middletown	3	0.5	-	2.5	Decrease
New Haven	61	3.3	Higher	-	-
Rocky Hill	8	4.0	-	0.6	Increase
Simsbury	0	0.0	Lower	-	-
Torrington	3	0.7	-	3.0	Decrease
TEEN BIRTHS					
Connecticut	3,621	8.3	N/A	8.3	-
Health District					
Central Connecticut	15	2.1	Lower	-	-
Chesprocott	13	2.3	Lower	-	-
Eastern Highlands	13	4.2	Lower	-	-
East Shore	41	5.0	Lower	-	-
Farmington Valley	10	0.9	Lower	-	-
Naugatuck Valley	80	5.3	Lower	-	-
Newtown	1	0.3	Lower	-	-
Pomperaug	3	0.9	Lower	-	-
Quinnipiack	31	3.5	Lower	-	-
Torrington Area	77	6.0	Lower	-	-
Uncas Region	88	13.3	Higher	-	-
Weston-Westport	0	0.0	Lower	-	-
Town					
Berlin	6	2.8	Lower	-	-
Bethel	8	3.4	Lower	-	-
Bloomfield	32	15.8	Higher	-	-
Branford	13	4.1	Lower	-	-
Bridgeport	429	18.9	Higher	-	-
Cheshire	3	1.0	Lower	-	-
Colchester	7	3.0	Lower	-	-
Darien	2	0.5	Lower	-	-
East Hartford	89	13.1	Higher	-	-
Fairfield	9	1.1	Lower	-	-
Farmington	2	0.8	Lower	-	-
Glastonbury	5	1.3	Lower	-	-
Greenwich	7	0.9	Lower	-	-

TABLE V-1 (Continued)
Birth Outcomes and Their Risk Factors, Infant Mortality, and Fetal Mortality

Health District or Town	1998 No. Events	1998 Percent	1998 Significantly Different from State Percent[a] (p<0.01)	1997 Percent	Significant Change from 1997-1998[a] (p<0.05)
TEEN BIRTHS					
Town					
Guilford	4	2.0	Lower	-	-
Hamden	27	4.7	Lower	-	-
Hartford	569	24.9	Higher	-	-
Meriden	133	16.0	Higher	-	-
Milford	20	3.1	Lower	-	-
Monroe	4	1.6	Lower	-	-
Naugatuck	18	4.3	Lower	8.1	Decrease
Newington	4	1.4	Lower	-	-
New Britain	195	18.5	Higher	-	-
New Canaan	1	0.4	Lower	-	-
New Haven	305	16.5	Higher	-	-
New London	56	14.6	Higher	-	-
New Milford	14	4.0	Lower	7.8	Decrease
Newtown	1	0.3	Lower	-	-
North Haven	2	0.9	Lower	-	-
Norwich	75	15.6	Higher	-	-
Ridgefield	2	0.6	Lower	-	-
Rocky Hill	3	1.5	Lower		
Shelton	15	3.3	Lower	-	-
Simsbury	1	0.4	Lower	-	-
Southington	16	3.6	Lower	-	-
South Windsor	5	1.8	Lower	-	-
Stamford	97	5.4	Lower	-	-
Torrington	39	9.4	-	5.4	Increase
Trumbull	5	1.2	Lower	-	-
Wallingford	20	3.7	Lower	-	-
Waterbury	258	15.2	Higher	-	-
Watertown	6	2.9	Lower	-	-
West Hartford	31	4.7	Lower	-	-
Westport	0	0.0	Lower	-	-
Wethersfield	6	2.0	Lower	-	-
Wilton	0	0.0	Lower	-	-
Windham	60	18.6	Higher	-	-
LATE OR NO PRENATAL CARE					
Connecticut	5,005	12.2	N/A	10.9	Increase
Health District					
Bristol-Burlington	71	8.2	Lower	-	-
Chesprocott	46	8.3	Lower	-	-
East Shore	48	6.2	Lower	-	-
Farmington Valley	124	11.9	-	3.9	Increase

TABLE V-1 (Continued)
Birth Outcomes and Their Risk Factors, Infant Mortality, and Fetal Mortality

Health District or Town	1998 No. Events	1998 Percent	1998 Significantly Different from State Percent[a] (p<0.01)	1997 Percent	Significant Change from 1997-1998[a] (p<0.05)
LATE OR NO PRENATAL CARE					
Health District					
Naugatuck	126	8.9	Lower	-	-
Newtown	15	4.7	Lower	-	-
Northeast	131	14.2	-	10.8	Increase
Quinnipiack	53	6.4	Lower	-	-
Torrington Area	124	9.9	-	7.4	Increase
West Htfd-Bloomfield	100	12.4	-	6.7	Increase
Weston-Westport	7	1.7	Lower	-	-
Town					
Ansonia	19	8.3	-	16.8	Decrease
Bethel	12	5.1	Lower	-	-
Branford	19	6.4	Lower	-	-
Bridgeport	408	21.1	Higher	-	-
Bristol	67	8.7	Lower	-	-
Cheshire	22	7.4	Lower	-	-
Danbury	83	8.4	Lower	-	-
Darien	7	2.2	Lower	-	-
East Hartford	82	13.5	-	8.6	Increase
East Haven	22	6.8	Lower	-	-
Fairfield	25	3.5	Lower	-	-
Farmington	31	12.7	-	4.2	Increase
Glastonbury	51	14.0	-	4.0	Increase
Greenwich	44	6.3	Lower	-	-
Hamden	39	7.2	Lower	-	-
Hartford	336	17.1	Higher	10.9	Increase
Killingly	41	18.5	Higher	11.4	Increase
Meriden	169	20.9	Higher	-	-
Middletown	89	16.0	Higher	-	-
Milford	41	6.6	Lower	-	-
Monroe	4	1.7	Lower	-	-
New Britain	174	18.7	Higher	-	-
New Canaan	7	2.8	Lower	-	-
New Haven	334	20.5	Higher	-	-
New London	86	22.8	Higher	-	-
Newington	33	12.5	-	6.6	Increase
Newtown	15	4.7	Lower	-	-
North Haven	11	5.2	Lower	-	-
Norwich	80	16.6	Higher	-	-
Ridgefield	14	4.6	Lower	-	-
Shelton	21	5.1	Lower	-	-
Simsbury	31	13.0	-	2.9	Increase
Southington	31	7.2	Lower	-	-

TABLE V-1 (Continued)
Birth Outcomes and Their Risk Factors, Infant Mortality, and Fetal Mortality

Health District or Town	1998 No. Events	1998 Percent	1998 Significantly Different from State Percent[a] (p<0.01)	1997 Percent	Significant Change from 1997-1998[a] (p<0.05)
Town					
South Windsor	28	10.3	-	5.0	Increase
Stamford	230	13.4	-	16.9	Decrease
Stratford	44	8.2	Lower	-	-
Trumbull	11	2.8	Lower	-	-
Waterbury	436	27.2	Higher	23.2	Increase
West Hartford	77	12.5	-	6.6	Increase
Westport	7	2.5	Lower	-	-
Windham	62	19.8	Higher	-	-
Windsor	39	12.3	-	5.9	Increase
NON-ADEQUATE PRENATAL CARE (Kessner Index)					
Connecticut	5,600	14.4	N/A	14.4	-
Health District					
Bristol-Burlington	91	10.8	Lower	-	-
East Shore	58	8.2	Lower	-	-
Farmington Valley	121	12.1	-	6.6	Increase
Naugatuck Valley	135	10.2	Lower	12.8	Decrease
Northeast	154	16.7	-	12.9	Increase
Newtown	17	5.5	Lower	-	-
Pomperaug	30	8.9	Lower	-	-
Quinnipiack	61	7.9	Lower	-	-
West Htfd-Bloomfield	104	13.5	-	8.2	Increase
Weston-Westport	13	3.4	Lower	-	-
Town					
Ansonia	20	9.3	-	18.9	Decrease
Bethel	18	7.8	Lower	-	-
Branford	24	8.9	Lower	-	-
Bridgeport	404	26.1	Higher	-	-
Cheshire	24	8.3	Lower	-	-
Danbury	95	9.7	Lower	-	-
Darien	10	3.2	Lower	-	-
East Haven	25	8.5	Lower	-	-
Enfield	51	10.3	Lower	-	-
Fairfield	31	4.6	Lower	-	-
Farmington	33	14.0	-	5.5	Increase
Glastonbury	58	16.5	-	5.5	Increase
Greenwich	62	9.0	Lower	-	-
Hamden	45	9.0	Lower	-	-
Hartford	290	16.6	-	13.4	Increase
Meriden	231	29.8	Higher	40.1	Decrease

TABLE V-1 (Continued)
Birth Outcomes and Their Risk Factors, Infant Mortality, and Fetal Mortality

Health District or Town	1998 No. Events	1998 Percent	1998 Significantly Different from State Percent[a] (p<0.01)	1997 Percent[c]	Significant Change from 1997-1998[a,c] (p<0.05)
NON-ADEQUATE PRENATAL CARE (Kessner Index)					
Town					
Milford	46	7.8	Lower	-	-
Monroe	5	2.2	Lower	9.5	Decrease
New Britain	217	24.4	Higher	-	-
New Canaan	12	5.1	Lower	-	-
New Haven	348	25.1	Higher	-	-
New London	90	24.5	Higher	-	-
Newtown	17	5.5	Lower	-	-
North Haven	13	6.5	Lower	-	-
Ridgefield	17	5.7	Lower	-	-
Shelton	29	7.5	Lower	-	-
Simsbury	28	12.2	-	4.5	Increase
Southington	47	11.1	-	16.9	Decrease
South Windsor	33	12.4	-	5.5	Increase
Stamford	283	16.6	-	20.5	Decrease
Stratford	44	9.0	Lower	-	-
Trumbull	13	3.7	Lower	7.6	Decrease
Wallingford	71	14.3	-	28.7	Decrease
Waterbury	442	29.5	Higher	-	-
West Haven	116	19.0	Higher	-	-
Westport	10	3.8	Lower	-	-
West Hartford	79	13.3	-	8.2	Increase
Windham	68	21.9	Higher	-	-
Windsor	46	15.2	-	6.0	Increase
NON-ADEQUATE PRENATAL CARE (APNCU Index)[c]					
Connecticut	5,576	14.3	N/A	N/A	N/A
Health District					
Chesprocott	54	10.2	Lower	N/A	N/A
East Shore	68	9.6	Lower	N/A	N/A
Naugatuck Valley	132	9.9	Lower	N/A	N/A
Newtown	24	7.7	Lower	N/A	N/A
Quinnipiack	66	8.5	Lower	N/A	N/A
Torrington Area	236	18.9	Higher	N/A	N/A
Weston-Westport	22	5.8	Lower	N/A	N/A
Town					
Bethel	15	6.5	Lower	N/A	N/A
Branford	23	8.5	Lower	N/A	N/A

TABLE V-1 (Continued)
Birth Outcomes and Their Risk Factors, Infant Mortality, and Fetal Mortality

Health District or Town	1998 No. Events	1998 Percent	1998 Significantly Different from State Percent[a] (p<0.01)	1997 Percent[c]	Significant Change from 1997-1998[a,c] (p<0.05)
Town					
Bridgeport	337	21.6	Higher	N/A	N/A
Cheshire	23	8.0	Lower	N/A	N/A
Danbury	82	8.3	Lower	N/A	N/A
Darien	16	5.0	Lower	N/A	N/A
East Haven	25	8.5	Lower	N/A	N/A
Enfield	51	10.3	Lower	N/A	N/A
Fairfield	73	10.9	Lower	N/A	N/A
Hamden	43	8.6	Lower	N/A	N/A
Meriden	223	28.8	Higher	N/A	N/A
Milford	36	6.1	Lower	N/A	N/A
Monroe	13	5.8	Lower	N/A	N/A
New Britain	227	25.5	Higher	N/A	N/A
New Canaan	19	8.1	Lower	N/A	N/A
New Haven	319	22.7	Higher	N/A	N/A
New Milford	28	8.1	Lower	N/A	N/A
Newtown	24	7.7	Lower	N/A	N/A
Shelton	30	7.7	Lower	N/A	N/A
Stamford	293	17.2	Higher	N/A	N/A
Torrington	103	25.6	Higher	N/A	N/A
Trumbull	28	7.9	Lower	N/A	N/A
Vernon	64	20.6	Higher	N/A	N/A
Waterbury	354	23.6	Higher	N/A	N/A
Westport	16	6.2	Lower	N/A	N/A
INTENSIVE PRENATAL CARE (APNCU INDEX)					
See Table V-3					
PREMATURITY					
Connecticut	4,349	10.1	N/A	10.0	-
Health District					
Bristol-Burlington	108	11.9	-	8.5	Increase
Town					
Bristol	96	11.9	-	8.4	Increase
Bridgeport	292	13.1	Higher	-	-
Hamden	68	11.8	-	8.1	Increase
Hartford	324	14.4	Higher	-	-
Norwalk	101	7.6	Lower	10.4	Decrease
Norwich	49	10.2	-	6.4	Increase
West Hartford	39	5.9	Lower	9.1	Decrease

TABLE V-1 (Continued)
Birth Outcomes and Their Risk Factors, Infant Mortality, and Fetal Mortality.

Health District or Town	1998 No. Events	1998 Percent	1998 Significantly Different from State Percent[a] (p<0.01)	1997 Percent	Significant Change from 1997-1998[a] (p<0.05)
SMOKING DURING PREGNANCY					
Connecticut	3,787	9.4	N/A	9.7	-
Health District					
Bristol-Burlington	136	15.7	Higher	-	-
Central Connecticut	18	3.2	Lower	6.0	Decrease
Chesprocott	23	4.4	Lower	-	-
Eastern Highlands	29	5.8	Lower	-	-
Farmington Valley	37	4.2	Lower	-	-
Ledge Light	93	14.0	Higher	-	-
Naugatuck Valley	201	14.3	Higher	-	-
Newtown	15	4.7	Lower	-	-
North Central	217	13.9	Higher	-	-
Northeast	178	19.1	Higher	23.3	Decrease
Quinnipiack Valley	49	5.5	Lower	-	-
Torrington Area	187	15.1	Higher	-	-
Uncas Regional	99	14.9	Higher	-	-
West Htfd—Bloomfield	20	3.0	Lower	-	-
Weston-Westport	4	1.0	Lower	-	-
Town					
Ansonia	47	19.7	Higher	-	-
Bridgeport	257	12.2	Higher	-	-
Bristol	136	17.6	Higher	-	-
Cheshire	10	3.4	Lower	-	-
Darien	2	0.6	Lower	-	-
East Hartford	66	13.1	Higher	-	-
Enfield	64	13.3	Higher	-	-
Fairfield	17	2.3	Lower	-	-
Farmington	6	2.8	Lower	-	-
Glastonbury	8	2.6	Lower	-	-
Greenwich	7	1.0	Lower	-	-
Groton	93	14.0	Higher	-	-
Hamden	31	5.3	Lower	-	-
Hartford	112	7.2	Lower	-	-
Killingly	54	24.2	Higher	-	-
Meriden	136	16.7	Higher	-	-
Monroe	8	3.3	Lower	-	-
Naugatuck	71	19.3	Higher	-	-
New Britain	151	15.0	Higher	9.8	Increase
New Canaan	2	0.8	Lower	-	-
New Haven	253	13.9	Higher	-	-
New London	73	19.1	Higher	-	-
Newtown	15	4.7	Lower	-	-
Norwalk	63	4.7	Lower	-	-
Norwich	88	18.3	Higher	-	-

TABLE V-1 (Continued).
Birth Outcomes and Their Risk Factors, Infant Mortality, and Fetal Mortality

Health District or Town	1998 No. Events	1998 Percent Or Rate[b]	1998 Significantly Different from State Percent or Rate[a] (p<0.01)	1997 Percent Or Rate[a,b]	Significant Change from 1997-1998[a] (p<0.05)
Town					
Ridgefield	8	2.6	Lower	-	-
Stamford	53	3.1	Lower	-	-
Torrington	83	20.6	Higher	-	-
Trumbull	16	3.9	Lower	-	-
Vernon	53	17.6	Higher	-	-
Waterbury	182	13.3	Higher	-	-
West Hartford	16	3.2	Lower	-	-
Westport	3	1.0	Lower	-	-
Wethersfield	3	1.3	Lower	5.4	Decrease
Windham	48	15.1	Higher	-	-
INFANT MORTALITY					
Connecticut	305	7.0	N/A	7.2	-
Health District (None Significant)					
Town					
Bridgeport	31	13.7	Higher	-	-
Hartford	32	14.0	Higher	-	-
New Haven	23	12.5	Higher	-	-
New London	7	18.2	Higher	-	-
FETAL MORTALITY					
Connecticut	298	6.8	N/A	6.1	-
Health District (None Significant)					
Town					
Middletown	9	15.8	Higher	-	-

[a] A dash (-) signifies that the difference was not statistically significant. "N/A" indicates that the comparison was not applicable. A blank space indicates that no analysis was performed.
[b] Fetal and infant deaths are expressed as rates (deaths per 1,000 live births).

TABLE V-2
Statistical Analysis of Birth Outcomes and Their Risk Factors for Racial and Ethnic Groups Connecticut, 1998

Health District or Town	1998 No. Events	1998 Percent	1998 Significantly Different from White non-Hispanic (p<0.01)	1997 Percent	Significant Change from 1997-1998[a] (p<0.05)
LOW BIRTHWEIGHT					
Race/Ethnicity					
White, non-Hispanic	1,838	6.5	N/A	-	-
Black, non-Hispanic	649	13.2	Higher	-	-
Hispanic	602	9.7	Higher	8.3	Increase
VERY LOW BIRTHWEIGHT					
Race/Ethnicity					
White, non-Hispanic	339	1.2	N/A	-	-
Black, non-Hispanic	190	3.9	Higher	-	-
Hispanic	139	2.2	Higher	1.6	Increase
TEEN BIRTHS					
Race/Ethnicity					
White, non-Hispanic	1,148	4.1	N/A	-	-
Black, non-Hispanic	876	17.9	Higher	-	-
Hispanic	1,345	21.8	Higher	-	-
LATE OR NO PRENATAL CARE					
Race/Ethnicity					
White, non-Hispanic	2,397	8.8	N/A	7.2	Increase
Black, non-Hispanic	916	20.7	Higher	-	-
Hispanic	1,211	21.9	Higher	-	-
NON-ADEQUATE PRENATAL CARE (Kessner Index)					
Race/Ethnicity					
White, non-Hispanic	2,833	10.8	N/A	10.1	Increase
Black, non-Hispanic	905	23.2	Higher	-	-
Hispanic	1,264	25.5	Higher	-	-
NON-ADEQUATE PRENATAL CARE (APNCU Index)					
Race/Ethnicity					
White, non-Hispanic	3,098	11.8	N/A		
Black, non-Hispanic	747	19.0	Higher		
Hispanic	1,100	22.2	Higher		

TABLE V-2 (Continued)
Statistical Analysis of Birth Outcomes and Their Risk Factors for Racial and Ethnic Groups
Connecticut, 1998

Health District or Town	1998 No. Events	1998 Percent	1998 Significantly Different from White non-Hispanic (p<0.01)	1997 Percent	Significant Change from 1997-1998[a] (p<0.05)
INTENSIVE PRENATAL CARE (APNCU Index)					
No significant differences					
PREMATURITY					
Race/Ethnicity					
White, non-Hispanic	2,540	9.0	N/A	-	-
Black, non-Hispanic	683	14.2	Higher	-	-
Hispanic	771	12.6	Higher	-	-
SMOKING DURING PREGNANCY					
Race/Ethnicity					
White, non-Hispanic	2,553	9.6	N/A	-	-
Black, non-Hispanic	457	10.3	-	-	-
Hispanic	454	8.5	Lower	-	-

[a] A dash (-) signifies that the difference was not statistically significant. "N/A" indicates that the comparison was not applicable. A blank space indicates that no analysis was performed.

TABLE V-3
Statistical Analysis of Intensive Prenatal Care Utilization (APNCU Index)
Connecticut, 1998

Health District or Town	No. Events	As Percent of Births That Met/Exceeded Guidelines[a]	Significantly Different from State Percent (p<0.01)	As Percent of Total Births[b] (from Table 4)
INTENSIVE PRENATAL CARE (APNCU Index)[c]				
Connecticut	16,185	48.6	N/A	41.6
Health District				
Bristol-Burlington	397	53.8	Higher	47.1
Central Connecticut	223	42.5	Lower	35.6
Eastern Highlands	161	35.6	Lower	30.8
Naugatuck Valley	660	55.2	Higher	49.7
Newtown	177	61.9	Higher	57.1
North Central	513	37.3	Lower	32.0
Pomperaug	170	56.3	Higher	50.4
Torrington Area	403	39.9	Lower	32.2
West Htfd-Bloomfield	252	39.6	Lower	32.7
Weston-Westport	220	61.5	Higher	57.9
Town				
Bridgeport	654	53.6	Higher	42.0
Bristol	360	54.6	Higher	47.9
Danbury	620	68.8	Higher	63.1
Darien	199	66.1	Higher	62.8
East Hartford	171	35.8	Lower	31.0
Enfield	169	37.9	Lower	34.0
Fairfield	345	57.7	Higher	51.4
Glastonbury	111	38.4	Lower	31.7
Hartford	616	41.4	Lower	35.1
Manchester	174	33.0	Lower	28.3
Milford	309	55.5	Higher	52.1
New Britain	254	38.3	Lower	28.5
New Canaan	134	61.8	Higher	56.8
Newington	79	37.4	Lower	31.5
New Milford	197	62.3	Higher	57.3
Newtown	177	61.9	Higher	57.1
Norwalk	614	60.3	Higher	52.7
Ridgefield	163	60.6	Higher	54.7
Shelton	216	60.2	Higher	55.5
South Windsor	86	37.6	Lower	32.2
Stamford	772	54.6	Higher	45.3
Torrington	104	34.8	Lower	25.9
Vernon	83	33.6	Lower	26.7
West Hartford	195	40.3	Lower	33.1
Westport	147	60.2	Higher	56.5
Windham	90	35.2	Lower	29.0
Windsor	103	39.8	Lower	34.0

a The denominator used to calculate these percentages was births to mothers who received 80% or more of the prenatal care visits recommended by the American College of Obstetricians and Gynecology (ACOG), i.e., the sum of those who received adequate care and those who received intensive care.

b These percentages were not used for significance testing.

Appendix VI

1998 PRENATAL CARE UTILIZATION: COMPARISON OF RESULTS USING THE MODIFIED KESSNER AND APNCU INDICES

Comparison of Features

The Kessner and Adequacy of Prenatal Care Utilization (APNCU) indices have several common features. Both are based on the schedule of visits recommended by the American College of Obstetricians and Gynecologists (ACOG).[1] Both consider simultaneously the month in which care is initiated and the number of prenatal care visits, while adjusting for gestational age at delivery. The Kessner Index assigns three levels of care—*adequate*, *intermediate*, and *inadequate*—by taking into account the date of onset of prenatal care and varying the number of expected visits by the length of gestation. The same groupings (plus one additional category) are employed in the APNCU Index.

The APNCU Index differs from the Kessner Index in some important ways. First, the Kessner Index follows ACOG recommendations for clinical visits only through week 36 of gestation, when nine visits are recommended. For longer pregnancies, only nine visits are still considered adequate, even though the ACOG recommends one visit for each additional week of gestation. In contrast, the APNCU Index takes into account the full ACOG recommendations for number of prenatal care visits (see *Adequacy of Prenatal Care Utilization Index* in Appendix III).

Second, the APNCU Index contains an additional category of prenatal care utilization, *intensive* care, to describe women who receive more than the recommended number of clinical visits. Women who receive intensive prenatal care can be regarded as a special class of those who receive adequate care; care is termed "adequate" when 80% to 109% of the recommended number of visits are received, and "intensive" when the actual number of visits is 110% or more of the expected number (see Appendix III). Using the Kessner Index, all births to women who met or exceeded the clinical recommendations for prenatal care are termed adequate.

Comparison of Results for 1998 Births

The high correlation between the Kessner and APNCU prenatal care indices in classifying 1998 Connecticut births is shown in Table VI-1. Overall, 85% of total live births (shaded areas in the table) were assigned to the same categories of prenatal care adequacy by both indices. There was wide variation, however, in the degree of correlation between Kessner and APNCU depending on the level of adequacy. The indices were in agreement for 98% of births rated "unknown" prenatal care and 89% of those rated "adequate." In contrast, only 11% of births

rated “inadequate” and 12% of those rated “intermediate” were assigned to the same group by both methods.[2] Some reasons for the differences are discussed below.

TABLE VI-1
Resident Births by Category of Prenatal Care Utilization
Correlation between Modified Kessner and APNCU Indices[a]
Connecticut, 1998

	Kessner Index				
APNCU Index	***Total***	Adequate	Intermediate	Inadequate	Unknown
Total	***43,741***	***33,217***	***5,293***	***307***	***4,924***
Adequate[b]	***33,288***	31,309	1,900	0	79
Intermediate	***2,782***	1,898	880	0	4
Inadequate	***2,794***	7	2,480	306	1
Unknown	***4,877***	3	33	1	4,840

[a] Shaded areas denote birth records with the same classification by both indices.
[b] To allow comparisons between indices in this table, the APNCU category “adequate” includes both “adequate” and “intensive” levels of care.

Lack of agreement between the different indices for the categories “intermediate” and “inadequate” are explained by differences in adequacy criteria. In the most discrepant cases, the APNCU rating was lower than the Kessner rating (2,480 births were Kessner Intermediate and APNCU Inadequate, and 1,898 births were Kessner Adequate and APNCU Intermediate). This is consistent with the more stringent requirements of the APNCU Index for threshold numbers of visits for particular gestational ages (e.g. one additional visit per week for gestational ages of 37+ weeks). In other cases, however, the APNCU rating exceeded the Kessner rating (1,900 births were APNCU Adequate x Kessner Intermediate). This occurred because of the less exacting APNCU criteria for initiation of prenatal care. The APNCU Index calls prenatal care “adequate” when it is begun in the first 4 months of pregnancy, whereas the Kessner Index classifies prenatal care begun in the fourth month (second trimester) of pregnancy as “intermediate.”

Lack of agreement among births with “unknown” prenatal care is due to different causes. Gestational age is occasionally missing from birth certificates, and such records are assigned to the “unknown” prenatal care category by the Kessner Index; in contrast, the APNCU Index imputes a gestational age equivalent based on birth weight and assigns a level of care.

APNCU Intensive Care

According to the APNCU Index, 41.6% of total Connecticut resident births were to women who obtained more than the clinically recommended number of prenatal visits; these were classified as “intensive” care. This figure was substantially greater than the percentage of women who received intensive prenatal care in the U.S. (31%),[3] and was nearly double the figure for the state of Kansas. [4]

The reasons why women receive intensive prenatal care are not well understood. Intensive prenatal care has been associated with high-risk pregnancies (multiple births, teen mothers, mothers 35+ years of age, etc.). Women with medical problems (hypertension, gynecological disease, etc.) are more likely to utilize intensive prenatal care.[5] Utilization is also correlated with factors other than those related to pregnancy risks. Intensive prenatal care is also used extensively by low-risk women,[6,7] and women with higher socioeconomic status sometimes receive extra prenatal care, regardless of their risk status.[8] Although factors like increased use of diagnostic procedures and more cautious practice patterns among obstetricians may be related to increased intensive care utilization,[9] according to a recent study,[7] a substantial percentage of mothers who received intensive care had no medical or behavioral risk factors that might explain their increased utilization.

Prenatal Care and Birth Outcomes

The positive impact of prenatal care on birth outcomes is well known. In 1998, compared to those who received adequate prenatal care, Connecticut mothers who received inadequate care had 7 times more premature deliveries and 3 times more low birthweight deliveries; however, mothers who received intensive care had higher percentages of prematurity and low birthweight than those who had any other level of care, including inadequate (see table below).

Percent Low Birthweight and Premature Deliveries among Women Who Received Different APNCU Levels of Prenatal Care Connecticut, 1998

	APNCU Level of Care			
Outcome	Intensive	Adequate	Intermediate	Inadequate
Low birthweight (%)	12.0	2.9	2.9	9.3
Prematurity (%)	18.6	1.7	1.9	11.8

Source: *1998 Connecticut Registration Report*, Table 3.

Application of the APNCU Index to national data also shows a pattern consistent with the Connecticut data. Women who receive intensive prenatal care are sometimes more likely than those who receive lower levels of care to have low birthweight and premature deliveries.[10,11] While intensive prenatal care may reduce poor birth outcomes among the higher risk women who usually receive it, it does not reduce the risk to levels experienced by other women.

NOTES:

[1] American College of Obstetricians and Gynecologists. 1985. *Standards for Obstetric-Gynecologic Services, 6th Edition.* Washington, DC: ACOG.

[2] The percentage of births in a given category that were classified the same by both methods was determined by using the equation

$$\frac{A}{(B+C)-A} \times 100$$

where A is the number of births classified in that category by both methods (i.e. the number in the shaded portion of the table), B is the total number of births receiving that classification by the Kessner Index, and C is the total number of births receiving that classification by the APNCU Index.

[3] From 1989 to 1998, the percentage of adequate-or-intensive prenatal care among American women rose from 66% to 74%; most of this increase was represented by intensive prenatal care, which grew from 24% to 31%. Ventura, S.J., et al. 2000. Births: Final data for 1998. *National Vital Statistics Reports* 48(3), 100 pp.

[4] In 1998, 23% of live births were to women who received intensive prenatal care. Kansas Department of Health and Environment, Office of Health Care Information. 2001. *Kansas Adequacy of Prenatal Care Utilization (APNCU) Index*. http://www.kdhe.state.ks.us/hci/kacui.html (accessed 2/05/02).

[5] Clarke, L.L., et al. 1999. The role of medical problems and behavioral risks in explaining patterns of prenatal care use among high-risk women. *Health Services Research* 34: 145-170.

[6] Kogan, M.D. et al. 1998. The changing pattern of prenatal care utilization in the United States, 1981-1995, using different prenatal care indices. *Journal of the American Medical Association* 279: 1623-1628.

[7] Clarke, et al. *Op. cit*.

[8] Kogan, et al. *Op. cit.*

[9] Kogan, et al. *Op. cit.*

[10] Kotelchuck, M. 1994. The adequacy of prenatal care utilization index: Its U.S. distribution and associations with low birthweight. American Journal of Public Health 84: 1486-1489. Kogan et al. *Op. cit.*

[11] Kogan et al. *Op. cit.*