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Cause of Death and Socioeconomic Structures of Towns in Connecticut

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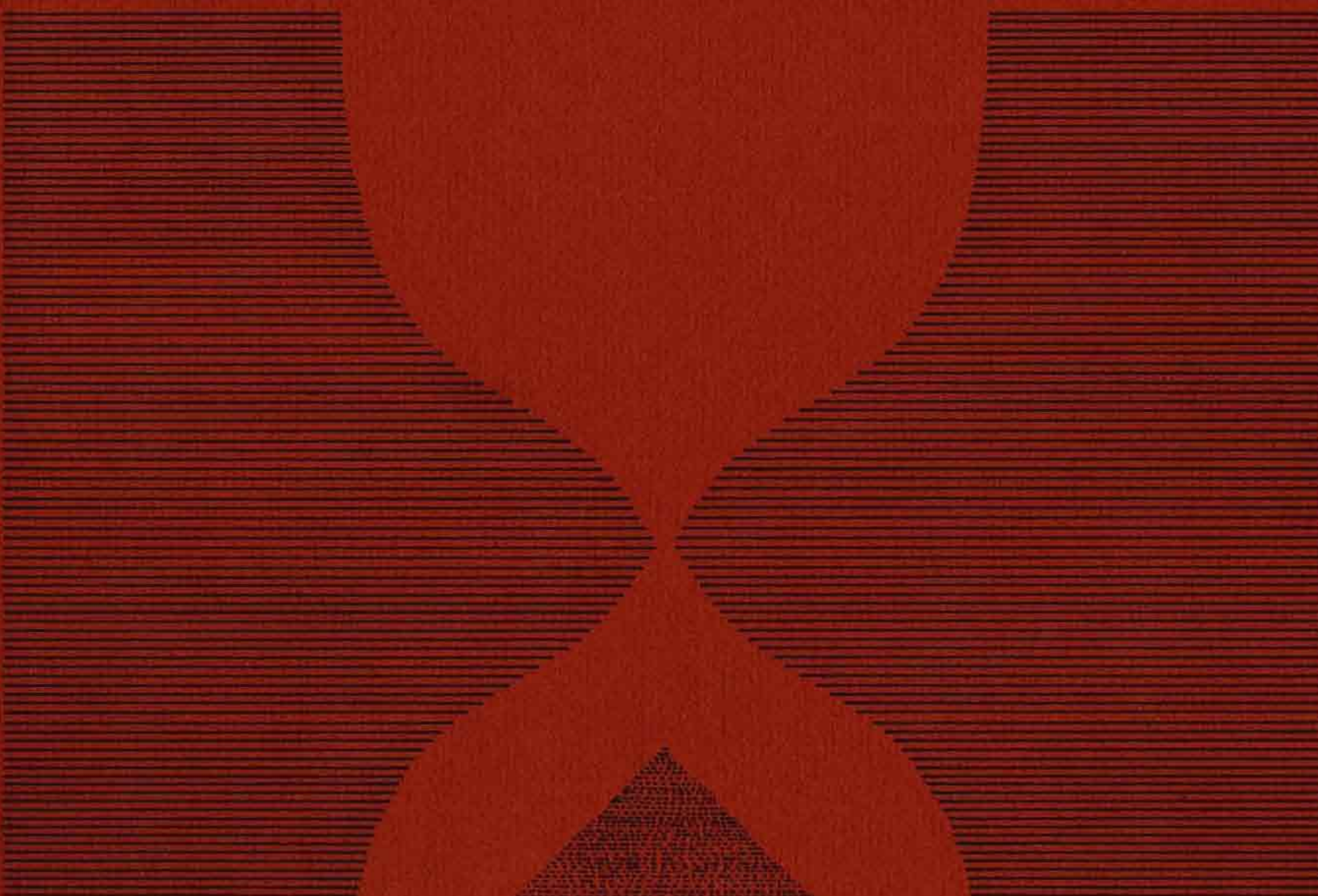

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CAUSE OF DEATH AND SOCIOECONOMIC STRUCTURES OF TOWNS IN CONNECTICUT

by

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INTRODUCTION

The analysis of mortality trends and differentials for the United States is a well established area of research in the fields of medicine, public health, and demography. Such research is in response to the needs of public health agencies in connection with the development, operation, and evaluation of public health programs. In addition such studies are valuable in defining the present status of the nation's population and in providing information about potential future growth. As valuable as these national-level studies are, there is a growing recognition of the equal importance of sub-national mortality analysis. A recent definitive volume on socioeconomic epidemiology in the United States reasserts the value of small area analysis of mortality patterns (Kitagawa and Hauser: 1973, p. 166).

It is the purpose of this report to examine mortality patterns for Connecticut. The analysis utilizes state vital statistics data on the number of deaths in 1970 to residents of the 169 towns in Connecticut. Variations in mortality rates by cause of death will be examined in terms of its relation to selected socioeconomic characteristics of each town as contained in the 1970 Census data. It is the underlying assertion of this report that much of the variation in cause-specific mortality rates for towns in Connecticut can be explained by differences in their demographic and socioeconomic structures.

Morbidity, the distribution and frequency of illness and disease in a population, has been a subject of past research in Connecticut. For example, studies on the relationship between cervical cancer and the social rank of selected metropolitan areas demonstrated the classical inverse relationship between the ranking of these areas in socioeconomic status and the incidence of in situ and invasive cervical cancer (Groff, Pitt, and Christine: 1971; Christine, Groff, Pitt and Chapple: 1972). However, the inverse relationship was not constant when cities were studied separately, possibly because of lack of detection of cervical cancer among the very poor in certain Connecticut cities (Christine, Groff, Pitt, and Chapple: 1972, p. 83). The incidence of cancer of other types has

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been tabulated by state health officials (Connecticut State Department of Health: 1968, 1969) but no equivalent analysis of these data have appeared in the literature.

Other studies have dealt more directly with mortality analysis. Working with the 1949-51 death records for residents of Hartford, Connecticut and Providence, Rhode Island, Stockwell (1963) demonstrated the inverse relationship between socioeconomic status of census tracts and age standardized crude death rates for these two cities. In later research, cause-specific death rates in Connecticut were examined in terms of the impact on work-life expectancy. The effects of heart disease, cancer, vascular lesions, and motor vehicle accidents on the number of years a person can expect to be an active member of the labor force were determined (McKain and Stockwell: 1964).

More recently, infant mortality rates were examined by variations in the socioeconomic status of census tracts in Hartford (Stockwell: 1965). It was found that the highest infant mortality rate occurred in the highest social rank area and the lowest rate in the intermediate status levels. Later research revealed the failure of infant mortality to conform to expectations and be inversely related to socioeconomic status in Hartford was due to the inclusion of occupation as one of the components of the overall socioeconomic index (Stockwell and Gordon: 1966, pp. 97-98).

Such research on mortality and morbidity for sub-national areas has shed light on some important theoretical problems but has been limited to intensive study of selected cities of Connecticut. It is hoped that this report dealing with mortality by cause of death for towns in Connecticut will stimulate the additional research effort required to fully understand these differentials.

MORTALITY TRENDS AND PATTERNS IN CONNECTICUT

Improvements in public health programs, medical delivery systems, general economic progress, and other factors have caused Connecticut's mortality rate to fall to an historic low by 1970. Table 1 shows the total number of deaths and the crude death rate for Connecticut residents from 1960 to 1970. The crude death rate of 8.5 per thousand population in 1970 was the lowest ever recorded for the State. The number of deaths in 1970, 25,953, was greater than in 1960, 23,847, because of the increase in population size during the decade. The most recent data available show a continuation of this trend with crude death rates for Connecticut of 8.5 in 1971, 8.5 in 1972, and 8.6 in 1973.

While these data show an encouraging mortality pattern for the past decade, the concern of this report will center on the 1970 period. Table II divides the total number of deaths to the resident population into seven major categories of cause of death, with three subcategories of cardiovascular disease (including two kinds of heart disease).

Cardiovascular disease (diseases of the circulatory system) was the leading cause of death for Connecticut residents in 1970, claiming 13,858 lives. Within this category, heart disease accounted for most of the deaths (10,188 or 73.5 percent) and, in particular, ischemic heart disease (9,544 or 68.9 percent of all deaths from cardiovascular disease). The

Table I: Total Number of Deaths and Crude Death Rate for Connecticut Residents, 1960 to 1970

Year	Total Deaths	Crude Death Rate
1960	23,847	9.4
1961	23,839	9.2
1962	24,758	9.3
1963	25,632	9.5
1964	25,195	9.1
1965	25,623	9.1
1966	26,065	9.1
1967	26,054	8.9
1968	26,688	9.0
1969	26,193	8.7
1970	25,953	8.5

Source: The State Department of Health, State of Connecticut, Registration Report of Births, Marriages, Divorces, and Deaths, the 113th (1960) through the 123rd (1970) Reports.

two other subcategories of cardiovascular disease, cerebrovascular disease and arteriosclerosis, accounted for 2,751 and 412 deaths, respectively.

Malignant neoplasms (cancer) were the second leading cause of death with 5,116 persons dying from this cause. The other five major causes of death were, in order of magnitude, all accidents (1,073), pneumonia (805), cirrhosis of the liver (566), diabetes mellitus (499), and emphysema (279). The remaining 3,757 deaths resulted from various causes and were grouped into a residual category of "all other causes".

Deaths recorded in the State Registration Report are those occurring to residents of Connecticut and are allocated to the town of residence of the decedent. Thus, deaths to Connecticut residents are included whether or not they occurred in the State. Deaths occurring to non-residents are not included in the data. Cause-specific deaths, as described above for Connecticut, were transformed into cause-specific rates for each town by the Department of Vital Statistics. For each cause of death, the rate was computed as the number of deaths from that cause per 100,000 population. The constant of 100,000 was used so that small numbers of deaths would be transformed into rates large enough for analysis. In addition, for each cause of death, rates were only calculated for towns of 10,000 or more population reporting deaths from that cause. If there were no deaths from that cause or if there were some deaths from that cause but the total population was less than 10,000 rates were not calculated and the town omitted from the analysis. Thus, there may be a different number of towns (units of analysis) for each cause of death under examination. Table III shows the number of towns not in the regression analysis by cause of death and

Table II: Number of Deaths from Selected Causes to the Resident Population of Connecticut, 1970

Cause of Death[a]	Number	Percent
All Causes	25,953	100.0
Cardiovascular Disease (390-448)	13,858	53.4
Heart Disease (390-98,402,404,410-14,420-29)	10,188	73.5*
Ischemic Heart Disease (410-414)	9,544	68.9*
Rheumatic Heart Disease (390-398)	232	1.7*
All Other Heart Disease[b]	412	3.0*
Cerebrovascular Disease (430-438)	2,751	19.8*
Arteriosclerosis (440)	417	3.0*
All Other Cardiovascular Disease[c]	501	3.6*
Malignant Neoplasms (140-209)	5,116	19.7
All Accidents (E800-E949)[d]	1,073	4.1
Pneumonia (480-486)	805	3.1
Cirrhosis of Liver (571)	566	2.2
Diabetes Mellitus (250)	499	1.9
Emphysema (492)	279	1.1
All Other Causes[e]	3,757	14.5

Source: State Department of Health, State of Connecticut, Registration Report of Births, Marriages, Divorces, and Deaths, the 123rd Report (1970).

a. The numbers in parentheses refer to disease categories of the International Classification of Disease, Vol. I, Eighth Revision, 1967.

b. For example, cardiomyopathy and pulmonary heart disease.

c. Includes mainly diseases of arteries, arterioles, and capillaries (except arteriosclerosis).

d. Includes motor vehicle accidents, drownings, poisonings, falls, etc., but not homicide or suicide.

e. For example, homicide, suicide, congenital anomalies, diseases of childhood.

* Percentages based on the number of deaths from cardiovascular disease.

Table III: Number of Deaths by Cause for Towns of Less than 10,000 Population that Were Excluded from Regression Analysis, Connecticut, 1970

Cause of Death	Connecticut Total Deaths	Deaths in Towns of Less than 10,000 Population: Number	Deaths in Towns of Less than 10,000 Population: Percent of Total*	Number of Towns of Less than 10,000 Population Reporting Deaths+
Cardiovascular Disease	13,858	1,654	11.9	92
Heart Disease	10,188	1,230	12.1	92
Ischemic Heart Disease	9,544	1,150	12.0	92
Rheumatic Heart Disease	232	34	14.6	26
Cerebrovascular Disease	2,751	300	10.9	82
Arteriosclerosis	417	61	14.6	33
Malignant Neoplasms	5,116	621	12.1	91
All Accidents	1,073	183	17.5	71
Pneumonia	805	97	12.1	50
Cirrhosis of Liver	566	47	8.3	33
Diabetes Mellitus	499	48	9.6	37
Emphysema	279	48	17.2	37

* Percent based on total deaths in Connecticut from that cause.

\+ For each cause of death, there may have been a few towns of more than 10,000 population that reported no deaths from that cause. Such towns were also excluded from the analysis.

the percentage of all deaths from that cause accounted for by those towns. The reason for excluding small towns was that rates based on small populations tend to fluxuate radically from year to year and this unstable pattern may cause unreliable results to appear in the statistical analysis.

As shown in Table III, the proportion of cause-specific deaths excluded from this analysis ranged from a high of 17.5 percent for deaths from all accidents to a low of 8.3 percent for deaths from cirrhosis of the liver. The average percentage of deaths excluded for all twelve causes of death was 12.7 percent. Although the number of towns with less than 10,000 population reporting deaths by cause may be substantial, the proportion these deaths are of all deaths by cause is small. Therefore the results of this analysis should not be significantly altered with the exclusion of such towns.

It should also be noted that each cause-specific death rate was not standardized for differences in age structures of towns. One problem with standardization, either direct or indirect, is that the resulting rate is a hypothetical figure showing what mortality would be under a certain set of assumptions. It tells one nothing about the actual levels of mortality in a town. For this reason it was decided to use unstandardized cause-specific death rates as the dependent variable and to include the age structure in the list of independent variables. If age was the most important variable in explaining differences in death rates it would be entered into the analysis and thus controlled for statistically. The unexplained variance would then be subjected to further regression analysis.

Table IV presents data on the average death rate for each cause of death and measures of variability for every town in Connecticut reporting deaths for each cause. It may be seen that there was a great deal of variation in mortality rates for towns in the State. The rate of death from all causes combined ranged from a high of 17.5 per thousand for Kent to a low of 2.2 per thousand for Eastford. The mean crude death rate for the 169 towns in 1970 was 8.0 per thousand. The standard deviation around the mean crude death rate was 2.6 points which yields a coefficient of variability of 3.1. The coefficient of variability is the mean death rate divided by the standard deviation and it provides a comparable measure of variability for data sets with different means and standard deviations. High coefficients of variability indicate a data set with relatively greater internal variation than other data sets.

Mortality rates for malignant neoplasms have the highest coefficient of variability (3.6) of all causes of death. Malignant neoplasm death rates ranges from a high of 230.0 per 100,000 population in Bridgeport to a low of 59.7 per 100,000 population in Ridgefield. The mean death rate from this cause for all 76 towns of 10,000 or more population reporting such deaths was 156.8 per 100,000 population.

The average death rate for cardiovascular disease for the 76 towns reporting deaths from this cause in 1970 was 415.2. The range was from a high of 676.5 for Waterbury to a low of 123.1 for Monroe and the coefficient of variability (3.4) ranked second highest. Thus, the two leading causes of death to Connecticut residents in 1970, malignant neoplasms and cardiovascular disease, showed the greatest variation in their rates for the towns reporting deaths from those causes.

Table IV: Cause Specific Mortality Rates for Connecticut Residents, Measures of Total Averages and Variability, for Towns, 1970

Cause of Death	1970 Death Rate	Mean Death Rate	Range High	Range Low	Standard Deviation	Coefficient of Variation
All Causes	8.5	8.0	17.5	2.2	2.6	3.1
Cardiovascular Disease	455.2	415.2	676.5	123.1	120.9	3.4
Heart Disease	334.7	300.9	495.1	82.0	88.4	3.4
Ischemic Heart Disease	313.5	282.9	452.5	73.8	83.6	3.4
Rheumatic Heart Disease	7.6	9.2	29.3	1.7	5.9	1.6
Cerebrovascular Disease	90.4	85.2	182.8	16.4	33.3	2.6
Arteriosclerosis	13.7	15.2	58.7	2.8	9.5	1.6
Malignant Neoplasms	168.1	156.8	230.0	59.7	43.0	3.6
All Accidents	35.2	34.6	107.8	4.7	20.7	1.7
Pneumonia	26.4	25.4	67.4	5.4	12.9	2.0
Cirrhosis of Liver	18.6	19.0	54.4	3.2	10.5	1.8
Diabetes Mellitus	16.4	17.3	58.8	2.2	11.0	1.6
Emphysema	9.2	9.9	31.0	2.2	5.6	1.8

Source: Same as Table II.

The remaining major categories of cause of death showed considerably less variation across towns in 1970. The pneumonia death rate had a coefficient of variability of 2.0 followed by the death rate for cirrhosis of the liver (1.8), emphysema (1.8), all accidents (1.7), and the death rate for diabetes mellitus (1.6).

These patterns demonstrate the complexity of mortality variation in Connecticut's towns and defines the problem of this analysis. Town by town variation in the death rate for each cause of death will be examined in terms of its relationship to selected socioeconomic characteristics of those towns. These variables, as described in the following section, were not intended to be exhaustive of all possible correlates of mortality. Factors such as the number of hospital beds or physicians per town (Hamilton: 1955), or the amount and type of water pollution and air pollution (Rubino: 1975, Keever, 1975; Kramar, 1975) may also be associated with mortality differentials and may account for some of the unexplained variation of the present study.

MEASURES OF SOCIOECONOMIC STRUCTURE

For each of the 169 towns in Connecticut, measures of the demographic and economic structure were based on the 1970 United States Census publications (United States Census: 1970). The variables selected are known, on the basis of national studies, to have a relationship to different levels of mortality (Benjamin: 1965). One purpose of this step in our analysis is to determine which of the variables in the set possess the strongest relationship to Connecticut mortality variation and to quantify the strength of such relationships for the 1970 period. Future research may then determine if these relationships have changed over time and to what degree the change occurred. In addition, possible areas of more detailed research may be suggested by the results of this analysis.

Age and Sex Structure

The age structure of a population is known to be strongly related to mortality levels (Shryock; Siegel; and Associates: 1973, pp. 389-461). The age structure of the population of each town was measured as the percent of the population less than 15 years of age, the percent in five ten-year age intervals between 15 to 64 years of age, and the percent of the population 65 years of age and over. One additional combined category, the percent of persons between 15 to 64 years of age, was used.

To further measure the age structure of the population, three age dependency ratios were calculated. The youth dependency ratio is the number of persons under 15 years of age per 100 persons 15 to 64 years of age. The aged dependency ratio is the number of persons 65 years of age and over per 100 persons 15 to 64 years of age. The total dependency ratio is the number of persons under 15 years of age and over 65 years of age per 100 persons 15 to 64 years of age.

The sex composition of the population was measured as the percentage of males and females in the total population. The age and sex structure of the population was therefore measured by a total of thirteen indicators.

Racial Structure

The number of nonwhite persons in each town was converted to a percentage of the total town population. In 1970 the Census Bureau defined nonwhite as including Negro, Indian, Japanese, Chinese, Filipino, Korean, Hawaiin and other races. There is considerable evidence that nonwhites have significantly higher death rates than whites in the United States (Bogue: 1969, pp. 594-597) and it may be suggested that such patterns could also account for some of the town variations in mortality.

Marital Structure

For each town the number of persons 14 years of age and over was converted into the percent single (never married), now married, and a category of separated, widowed, and divorced. Marital status has been shown to be an important characteristic in understanding mortality differentials (Bogue: 1969, pp. 605-606) and, although the theoretical reasons for it are not understood, it is possible that town variations in mortality are also a function of marital structure.

Levels of Living

Broadly defined, differentials in levels of living or general quality of life may be related to variations in mortality. An inverse relationship was found when several indexes were grouped into one summary measure of socioeconomic status. Due to difficulties in the interpretation of one combined index, this research utilized four categories of indicators separately. First, the educational structure was measured as the percent of the town's population 25 years of age and over completing 12 years of school or more and the percent completing less than 12 years of school. Secondly, income was measured in terms of median family income and the median income of individuals. Thirdly, the extent of poverty was measured by the percentage of all families below the poverty level. Fourthly, the extent of overcrowded housing was measured by the percentage of all occupied housing units containing 1.01 or more persons per room. These provided a total of six indicators of levels of living for each town.

Occupational Structure

For each town, the population 14 years of age and over was categorized by the percent employed in each of the twelve major occupational categories as defined by the Census Bureau. National studies have shown occupation to have a strong influence on mortality (Guralnick: 1962; Benjamin: 1965). For purposes of interpretation in this analysis, the twelve occupational categories were further grouped as follows:

General Designation	Occupational Category
White Collar Occupations	Professional, Technical and Kindred Workers; Managers and Administrators, except Farm; Sales Workers; Clerical and Kindred Workers

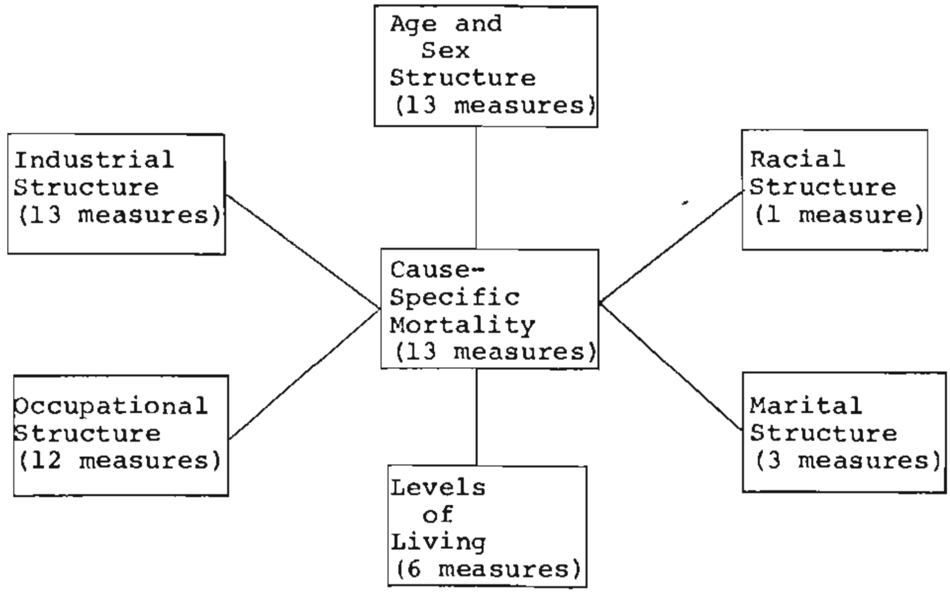
General Designation	Occupational Category
Blue Collar Occupations	Craftsmen and Kindred Workers; Operatives, except Transport; Transport Equipment Operatives; Laborers, except Farm
Farming Occupations	Farmers and Farm Managers; Farm Laborers and Farm Foremen
Service Occupations	Service Workers, except Private Household (includes cleaning service workers, food service workers, health service workers, personnel service workers, etc.); and Private Household Service Workers.

Industrial Structure

The industrial structure of each town was measured by the percent of the population 14 years of age and over employed in each of the thirteen major industrial categories as defined by the Census Bureau. National data for cause of death by industrial categories have revealed significant differences (Guralnick; 1963; Benjamin: 1965). These thirteen categories were also grouped as follows for purposes on interpretation:

General Designation	Industrial Category
Primary Industries	Agriculture, Forestry and Fisheries; Mining
Secondary Industries	Construction; Manufacturing, Durable Goods; Manufacturing, Nondurable Goods
Tertiary Industries	Transportation, Communication, and Other Utilities; Wholesale and Other Retail Trade
Service Industries	Finance, Insurance and Real Estate; Business and Repair Services; Personal Services; Entertainment and Recreation Services; Professional and Related Services; and Public Administration.

The above measures of socioeconomic structure and demographic structure are viewed as the explanatory or independent variables used to account for variation in the dependent variables of cause specific death rates. In summary, the methodological approach may be conceptualized as:



For these six categories of factors hypothesized to be related to cause-specific mortality in Connecticut towns, there were a total of forty-eight separately measured indicators. Our analysis would reveal which category had the strongest correlation with the particular death rate and which specific indicator had the highest correlation. From these patterns, interpretations are attempted in explaining each death rate variation by town.

Interpretation of the broad occupational or industrial categories that were entered into the regression analysis was particularly difficult because of the wide variety of specific occupations or specific industries within these crude categories. In order to aid in interpretation, a second analysis was performed using more detailed occupational and industrial classifications.

For example, if the percent of the population employed as professional and technical workers was entered as an explanatory variable, a second regression analysis was performed using the more detailed occupational categories of technical engineers; physicians, dentists and related practitioners; medical and other health workers; teachers in elementary and secondary schools; technicians, except health; and other professional workers. This more detailed analysis was performed for each cause of death and for each broad occupation and industry category initially entered into the regression equation.

The purpose of this analysis was to identify the specific occupation or industry that may be responsible for the broader occupational category being entered into the regression equation. In addition, the pattern of partial correlations for all the specific occupations can be examined for clues in interpreting the total relationship.

STATISTICAL METHOD OF ANALYSIS

The basic statistical procedure utilized to determine the strength and direction of the relationship between the dependent and independent variables described previously was multiple linear regression analysis. The model may be summarized as:

$$Y_i = a + b_1 x_1 + b_2 x_2 + b_3 x_3 \ldots\ldots + b_n x_n + e$$

where Y_i is a cause-specific mortality rate,

x_n is a certain index for one of the six categories of factors, and

a is the intercept, b the slope of the regression line, and

e is the error term.

In the event of some theoretical justification, it is possible to specify the order in which the set of independent variables are entered into the regression equation. Since pre-selection of the independent variables was not possible in this study a step-wise multiple regression program was used in which the variables are entered into the equation in order of their correlation with the unexplained variance (Nie: 1975).

After the independent variables have been entered into the analysis, a multiple correlation coefficient R is determined. Conceptually, the process is one of entering the first independent variable to explain all the variance in the dependent variable it can. The second variable is then entered to explain the portion of the variation left unexplained by the first. This basic process may continue until all the independent variables have been entered into the equation. The multiple correlation coefficient R indicates the total correlation between the dependent and all independent variables in the equation. The total amount of explained variance in the dependent variables is indicated by R^2, which may vary from zero (no relationship) to unity (all the variance has been explained).

The regression coefficients for each variable, the b values, indicate the slopes of the regression lines or, in other words, the amount of change in the dependent variable associated with a given unit of change in the independent variables. However, the b values reflect the scale of measurement of the particular variable, for example percent nonwhite and percent of poverty families. If each variable is standardized by dividing by its standard deviation, adjusted slopes are obtained which are comparable from one variable to the next. These standardized coefficients, Beta coefficients, indicate how much change in the dependent variable is produced by a standardized change in one of the independent variables when others are controlled. A more complete discussion of regression analysis and other statistical assumptions involved in this procedure is contained in most statistical texts (Blalock: 1972).

At this point it is advisable to caution against imputing causation from correlations alone. A strong or even perfect correlation, in itself, does not mean that one variable "causes" the other. In addition to covariation, a causal interpretation between variables requires some theoretical foundation, a treatment of alternative causal factors, and determination of some time ordering of the variables.

In addition to the statistical analysis described above, the relationship between each dependent variable and the first independent variable entered into the regression equation is graphically presented by a scattergram. This device allows visual examination of the degree of linearity of the relationship between the variables and also an intuitive judgment of the strength of the relationship by comparison of the slopes of the two regression lines.

MAJOR FINDINGS BY CAUSE OF DEATH

Summaries of the regression analysis are presented in each table on the relationship between each mortality rate by cause of death and the indicated independent variables. For each dependent variable, the number of variables entered into the equation was determined by the extent to which each additional variable produced a significant increase in the multiple correlation coefficient. If this increase was not substantial, additional variables were ignored.

Crude Death Rate

The first regression analysis was performed on the crude death rate from all causes combined and the results are shown in Table V. After three independent variables were entered it can be seen that this combination of variables has a strong multiple correlation of .78 with the crude death rate. This explains 61 percent (R^2 = .61) of the variation in the crude death rate among the 169 towns of Connecticut in 1970.

The first variable entered, the one with the highest correlation with the crude death rate, was the percent of the population 65 years of age and over. The correlation was .73 and accounted for 53 percent of the variation in the crude death rate. This indicates that towns with higher proportions of elderly populations tend to have higher crude death rates. The degree of this relationship may be seen in Figure 1. Before the percent of the population 65 years of age and over was entered into the analysis, the other indicators of age structure were also relatively highly correlated with the crude death rate. After the percent 65 years of age and over was entered, the partial correlations of the other age structure indicators with the unexplained variation in the crude death rate fell to much lower levels. This pattern is interpreted to mean that the age structure of a population is the most important of our categories of variables for understanding town differences in the crude death rate. Specifically, the percentage of the elderly population is the most important single index of the age structure in relation to the crude death rate and the other measures are very weakly correlated with the crude death rate after the first step of the analysis because of the high intercorrelations of all the indicators of age structure. The importance of the age structure in explaining differences in the crude death rate could be expected because age is known to have a strong relationship to mortality and the crude death rates by town were not standardized for age before the analysis.

Table V: Relation Between Crude Death Rate and Selected Socio-economic Indicators, Connecticut Towns, 1970

Cause of Death[1]	Multiple Correlation R	Explained Variation R^2	Regression Coefficients b	Beta
Crude Death Rate (169)				
1. Percent Age 65 and Over	.73	.53	.5617	.7006
2. Percent Completing 12 or More Years of School	.76	.58	-.0526	-.2396
3. Percent Employed as Farmers and Farm Managers	.78	.61	-.4900	-.1523
(Intercept = 6.1683)				

1. The number in parentheses beside the crude death rate indicates the number of towns used in the analysis.

The percentage of the population completing 12 or more years of school was the second variable entered and increased the multiple correlation to .76, or 58 percent of the variation in the dependent variable was explained by the two independent variables combined. Since the standardized Beta coefficient was negative (-.2396), increases in the crude death rates for towns tend to be associated with decreases in the percent of the population completing 12 or more years of school. In other words, the more well educated a population is the lower the crude death rate tends to be, after the effects of age structure have been controlled.

The third variable entered, a measure of the occupational structure, was the percent of the population employed as farmers and farm managers. This additional variable increased the multiple correlation coefficient to .78, explaining 61 percent of the variation in the crude death rate. The standardized Beta coefficient was negative (-.1523) indicating that decreases in the crude death rate tend to be associated with rises in the percent employed as farmers and farm managers, after the effects of age structure and educational structure have been controlled. Some indirect evidence supporting this negative relationship involves two national studies showing relatively low age-standardized mortality ratios for farmers and farm laborers in 1950 (Guralnick: 1962, p. 84) and low age-standardized mortality ratios for agricultural occupations (farmers and farm managers and farm laborers and farm foremen) in 1960 for the United States (Kitagawa and Hauser: 1973, p. 42). Both studies utilized different methodologies than this research report but the general conclusions were similar in terms of the negative relationship.

Examination of the partial correlations for measures of the occupational structure with the dependent variable revealed that farming occupations generally were negatively correlated but that white collar and blue collar occupations had a weak positive correlation at this step. Thus, most of the variation in the crude death rate for towns in Connecticut may be explained in terms of their differences in elderly populations, levels of education, and proportions employed in farming occupations.

Additional variables entered into the regression equation did not result in a significant increase in the multiple correlation coefficient. The multiple indicators of the industrial structure, racial composition, and marital structure were not significant in accounting for 40 percent of the variation in the dependent variable left unexplained.

Cardiovascular Disease Death Rate

The number of deaths from cardiovascular disease, including heart disease, cerebrovascular disease, arteriosclerosis, and other cardiovascular diseases, ranked highest for deaths by cause for Connecticut in 1970. The rate of mortality from cardiovascular disease was determined for the 76 towns in Connecticut over 10,000 population reporting deaths from that cause. The other 93 towns were either too small in terms of population or reported deaths for reliable rates to be calculated for a single year or did not report deaths due to cardiovascular disease.

It may be seen in Table VI that after three independent variables were entered into the regression equation, the multiple correlation coefficient reached .91, meaning that 83 percent of the variation in death rates from this cause was explained.

The percentage of the population 65 years of age and over was the first variable entered because it had the highest zero-order correlation with the dependent variable of all forty-eight indicators. For the reasons discussed in the preceding section, the age structure measures may be expected to have high correlations with the cardiovascular disease death rate; in this case .87 with the dependent variable. Prior to the entry of the first variable into the equation, the other indicators of the age structure were also highly correlated with the dependent variable but these relationships fell to very low levels after the first step in the analysis was completed. The pattern of co-variation between the percent of the population 65 years or more of age and the cardiovascular disease death rate may be seen in Figure 2. As a category of variables, the measures of occupational structure were generally highly correlated with the dependent variable, with white collar occupations showing negative partial correlations and blue collar occupations showing positive partial correlations. The percent of the population employed in professional and technical occupations had the strongest negative partial correlation (-.43) and was entered as the second variable in the analysis. The Beta coefficient was negative (-.2220) meaning that towns with relatively high percentages of persons in professional occupations tended to have relatively low cardiovascular disease death rates, after the effects of age structure were controlled. Evidence based on a study of socioeconomic differentials in mortality by cause of death for Chicago in 1960 suggests that there is an inverse relationship between age-standardized death rates from cardiovascular disease and socioeconomic status (Kitagawa and Hauser: 1973, p. 91). This finding for Chicago may explain the negative relationship between white collar occupations, especially the percent in professional and technical occupations, and the cardiovascular disease rate, controlling for age structure. Connecticut towns may

Table VI: Relation Between Cardiovascular Disease Death Rate and Selected Socioeconomic Indicators, Connecticut Towns, 1970

Cause of Death[1]	Multiple Correlation R	Explained Variation R^2	Regression Còefficents b	Beta
Cardiovascular Disease Death Rate (76)				
1. Percent Age 65 and Over	.87	.76	39.1884	.8001
2. Percent Employed as Professional and Technical Workers	.90	.81	-8.7223	-.2220
3. Percent Employed in Public Administration	.91	.83	-18.8441	-.1106
(Intercept = 202.7474)				

1. The number in parentheses beside each cause of death indicates the number of towns with 10,000 or more population reporting deaths from that cause.

also reflect this inverse relationship between socioeconomic ranking and cardiovascular disease death rates.

Examination of the partial correlations of the specific professional and technical occupations with the cardiovascular disease death rate after the percent elderly was entered revealed that the percent employed as technical engineers had the highest negative partial correlation followed by the percent employed as elementary and secondary school teachers. While all of the specific professional and technical occupations had a negative relationship, technical engineers and school teachers were the two occupations most responsible for the negative correlation.

The final variable entered was the percent of the population employed in public administration (postal service, federal, state, and local public administration). This indicator of the service industrial structure had the highest partial correlation (-.25) with the dependent variable and increased the multiple correlation to .91, explaining 83 percent of the total variation in the cardiovascular disease death rate. The Beta coefficient was also negative (-.1106) indicating that towns with relatively high percentages of persons employed in public administration tended to have relatively low cardiovascular disease death rates, after the effects of age structure and occupational structure were controlled. Death rates for the more detailed cardiovascular diseases are analyzed separately later in this report.

Examination of the partial correlations with the dependent variable of the other specific industrial categories within the service industries as defined previously revealed that only two, the percent employed in public administration and in finance, insurance, and real estate, had negative relationships. The rest of the service industries had a weak positive relation to the dependent variable. Since only two of the six service industries were negatively related, the pattern typical of service industries as a whole was a low positive relationship. It may be due to the variable nature of the cardiovascular death rate, e.g., including a wide variety of different diseases.

Malignant Neoplasms Death Rate

Following the pattern described for the preceding two cause-specific death rates, the percentage of the population 65 years of age and over had the highest correlation (.70) with variations in the malignant neoplasms death rate. This correlation was based on the 76 towns over 10,000 population reporting deaths from this cause. The shape of this relationship may be seen in Figure 2.

Unlike the previous two mortality rates, the effects of the age structure were still important after the percent elderly had been taken into account. The second variable entered was the percent of the population 45 to 54 years of age since it had the highest partial correlation (.26) with the unexplained variation in the dependent variable. These two age structure measures accounted for 52 percent of the total variation in the malignant neoplasms death rate, as shown in Table VII.

Table VII: Relation Between Malignant Neoplasms Death Rate and Selected Socioeconomic Indicators, Connecticut Towns, 1970

Cause of Death[1]	Multiple Correlation R	Explained Variation R^2	Regression Coefficients b	Regression Coefficients Beta
Malignant Neoplasms Death Rate (76)				
1. Percent Age 65 and Over	.70	.49	6.4788	.3720
2. Percent Age 45-54 Years	.72	.52	7.5732	.3687
3. Percent Completing Less than 12 Years of School	.77	.59	1.0870	.3132
4. Percent Nonwhite (Intercept = -43.8372)	.78	.61	1.0977	.1392

1. The number in parentheses beside each cause of death indicates the number of towns with 10,000 or more population reporting deaths from that cause.

In terms of the remaining unexplained variation, one measure of the general level of living, the percent of the population completing less than 12 years of school, had the highest partial correlation (.38) and was entered as the third variable. The fourth and final variable entered was the percent of the population nonwhite and its Beta coefficient indicates a positive relationship with the dependent variable. Together, those four variables accounted for 61 percent of the total variation in the malignant neoplasms death rate. This pattern suggests that once the effects of age structure have been statistically taken into account, towns with relatively low levels of living (as indicated by higher proportions with low educational achievement) and relatively high proportions of nonwhite persons also tend to report higher death rates from malignant neoplasms. Interestingly, the measures of the occupational and industrial structures were not strongly correlated with the dependent variable at the final step of the analysis.

Data from the 1950 Chicago study of socioeconomic differentials by cause of death also revealed that age-standardized death rates from malignant neoplasms was higher for the lower socioeconomic groups (Kitagawa and Hauser: 1973, p. 91). This may explain why, after the effects of age structure are controlled, towns in Connecticut with relatively low levels of living and higher proportions of nonwhites reported higher death rates from malignant neoplasms.

All Accidents Death Rate

This mortality rate includes deaths from motor vehicle accidents, drownings, poisonings, etc., but excludes homicides or suicides. In 1970 there were 76 towns of 10,000 or more population that reported deaths from this cause.

For the first time in our analysis, a measure of the age structure of the population was not the first variable entered into the equation. Table VIII lists the variables entered for this cause of death. In fact, examination of the zero-order correlations of the age structure with the dependent variable shows all of the age indicators had a very low relationship. The indicators of the occupational structure, as a group, revealed the highest correlations at this initial stage of the analysis.

The percent of the population employed as farm laborers and farm foremen was the first variable entered with a correlation of .40 with the all accident death rate. Figure 2 shows the shape of this relationship. It should be noted that the data points on the scattergram reveal a poor linear relationship between the two variables. Moreover, the scale of measurement for the percent employed as farm laborers and farm foremen is very narrow, i.e., ranging from 0.0 to 1.0 percent. Within that narrow range, however, the towns with the higher percentage figures tended to have the higher death rates from all accidents. This positive relationship was also true for the other farming occupations.

The pattern is difficult to understand but it may be due to the complex nature of this death rate. In 1970 there were 1,073 deaths by accidents of which 485 or 45.2 percent were in motor vehicles and 279 or 26.0 percent in home accidents (with falls being the most common type). In other words, the death rate from all accidents has a complex set of causes and a full understanding of its variation by towns would require

Table VIII: Relation Between All Accidents Death Rate and Selected Socioeconomic Indicators, Connecticut Towns, 1970

Cause of Death[1]	Multiple Correlation R	Explained Variation R^2	Regression Coefficients b	Beta
All Accidents Death Rate (76)				
1. Percent Employed as Farm Laborers and Farm Foremen	.40	.16	49.6355	.3889
2. Percent Employed as Service Workers, except Private Household	.51	.26	7.8298	.4274
3. Percent Employed in Manufacturing Durable Goods	.57	.33	-1.0981	-.3128
4. Percent Employed in Public Administration	.60	.36	-6.1607	-.2115
(Intercept = 15.7579)				

1. The number in parentheses beside each cause of death indicates the number of towns with 10,000 or more population reporting deaths from that cause.

detailed analysis of each specific cause. Perhaps persons employed in farming occupations, particularly farm laborers and farm foremen, have higher rates of non-motor vehicle accidents than do other occupational categories, but the present analysis does not provide a test of this type of hypothesis.

The second variable entered, also a measure of occupational structure, was the percent employed as service workers, except private household. The partial correlation (.34) with the dependent variable increased the multiple correlation to .51. In other words, these two measures of occupational structure accounted for 26 percent of the variation in the death rate from all accidents.

The partial correlations of specific occupations within the service worker category with the all accident death rate after the percent employed as farm laborers and farm foremen was entered revealed that health service workers and food service workers were the two specific occupations with the highest positive partial correlations. The other service worker occupations had very weak correlations with the dependent variable and were not important in understanding the total positive correlation of service workers (except private household) with the all accident death rate.

The third and fourth variables entered in the analysis were measures of the industrial structure; the percent employed in manufacturing durable goods and the percent employed in public administration. The Beta coefficients for these two variables (-.3128 and -.2115) indicate a negative relationship with the dependent variable at the last step in the equation. The four variables in combination could account for only 36 percent of the variation in the death rate from all accidents and suggests the use of other variables and more refined measures of accidental deaths would be appropriate.

The partial correlations of the specific industries within the category of manufacturing durable goods with the all accident death rate after the farming and service occupations were entered into the analysis revealed that the percent employed in manufacturing machinery, except electrical, had the highest negative partial correlation. The other specific industries within manufacturing durable goods category had very weak correlations at this step of the analysis.

However, the pattern of correlations for the death rate from all accidents presented here suggests that the percent of persons employed in farming occupations is directly related to increases in the death rate from this cause. Following that occupation, the percent employed as service workers (especially as health service workers and food service workers) was also positively correlated with the accident death rate. The next most important factor involved the secondary industries, with two of the three industries (construction and manufacturing of durable goods) showing negative correlations. The percent employed in manufacturing machinery, except electrical, had the strongest negative relation. The last factor involved the service industries and all of the specific industries in this category had a negative correlation with the accident death rate. Public administration (including postal service, federal, state, and local public administration) service industries had, however, the strongest negative relationship.

Pneumonia Death Rate

The analysis of pneumonia death rate is based upon the 74 towns of 10,000 or more population reporting deaths from that cause. There were 805 deaths from pneumonia for the entire state in 1970 representing 3.1 percent of deaths from all causes.

The first two variables entered into the analysis were measures of the age structure, with the aged dependency ratio entered first and the percent of the population 45-54 years of age entered second, see Table IX. Examination of the leading causes of death in certain age groups for Connecticut in 1970 reveals that the influenza and pneumonia death rate ranked as the fourth leading cause of death for persons 65 years of age and over (Vital Registration Report: 1970, p. 35). In view of this, the age dependency ratio for towns had the highest zero order correlation (.45) with the dependent variable and was entered first. See Figure 2 for the scattergram of this relationship. The percent of the population 65 years of age and over correlated .43 at the first step but fell to -.11 after the age dependency ratio was entered. The percent of the population 45-54 years of age was negatively related (Beta =-.4149) to the dependent variable after the first step, as were each of the other ten-year age intervals from 35 years and up. The remaining age intervals had very weak positive partial correlations. The negative relationship

Table IX: Relation Between Pneumonia Death Rate and Selected Socioeconomic Indicators, Connecticut Towns, 1970

Cause of Death[1]	Multiple Correlation R	Explained Variation R^2	Regression Coefficients b	Beta
Pneumonia Death Rate (74)				
1. Age Dependency Ratio	.45	.20	1.8536	.5685
2. Percent Age 45-54 Years	.53	.28	-2.5533	-.4149
3. Percent Employed in Public Administration	.55	.30	-5.4236	-.2981
4. Percent Employed as Clinical and Kindred Workers	.59	.35	1.4725	.2629
(Intercept = 28.0482)				

1. The number in parentheses beside each cause of death indicates the number of towns with 10,000 or more population reporting deaths from that cause.

of the percent 45-54 years of age with the dependent variable may have occurred because the seven leading causes of death from this age group did not include the pneumonia death rate for Connecticut as a whole (Vital Registration Report: 1970, p. 35). In other words, towns with relatively high percentages of 45 to 54 year olds tended to have relatively low pneumonia death rates, after the effects of the age dependency ratio were controlled. Together these two measures of the age structure accounted for 28 percent of the variance in this death rate.

One measure of the industrial structure, the percent of the population employed in public administration, entered as the third variable with a negative relation (Beta = -.2981) to the dependent variable. The fourth variable entered was the percent employed as clerical and kindred workers, an indicator of occupational structure, with a positive relationship (Beta = .2629) with the dependent variable. Together the four variables had a multiple correlation of .59 with the dependent variable and accounted for 35 percent of the variation in the pneumonia death rate.

The reason for the negative relationship of persons employed in public administration in the third step of the analysis is not clearly apparent. Examination of the partial correlation coefficients of the other industries within the service category revealed four of six had negative relationships. Percent employed in public administration had the strongest relationship (-.18) and was selected as the third variable in the equation. The partial correlation coefficients of the other occupations within the white collar category at the third step in the analysis showed a positive relationship for two of the four occupations. The percent employed as clerical and kindred workers had the strongest partial correlation (.24) with the dependent variable and was entered as the final variable. Examination of the partial correlations of the specific occupations within the clerical and kindred worker category with the pneumonia death rate at the fourth step in the analysis revealed that only one occupation, other clerical workers (including bank tellers, cashiers, miscellaneous clerical workers, etc.), was responsible for the clerical and service worker category being positively related to the dependent variable. The reasons for this pattern are not clear but suggests that service industries and white collar occupations exert different influences upon the pneumonia death rate, after the effects of age structure are controlled.

Cirrhosis of the Liver Death Rate

There were 66 towns of 10,000 or more population reporting deaths from this cause in 1970. For this group of towns, the percent of the population completing 12 or more years of education was negatively related (-.42) to variations in the death rate for cirrhosis of the liver. Figure 3 reveals the overall correlation not to be strongly linear. Interestingly, the measures of the age structure were not highly correlated with this death rate before the initial step in the analysis. After the first variable was entered, the partial correlations of the age structure measures fell even lower. In general it may be said that towns with relatively well education populations tend to report relatively lower death rates from cirrhosis of the liver, as indicated in Table X.

Table X: Relation Between Cirrhosis of Liver Death Rate and Selected Socioeconomic Indicators, Connecticut Towns, 1970

Cause of Death[1]	Multiple Correlation R	Explained Variation R^2	Regression Coefficients b	Beta
Cirrhosis of Liver Death Rate (66)				
1. Percent Completing 12 or More Years of School	.42	.18	-.7335	-.7849
2. Percent Employed as Private Household Worker	.56	.31	10.0517	.3636
3. Percent Employed as Service Workers, Except Private Household	.61	.37	-3.3592	-.3373
4. Percent Single, Never Married	.64	.41	.7088	.1923
(Intercept = 55.5996)				

1. The number in parentheses beside each cause of death indicates the number of towns with 10,000 or more population reporting deaths from that cause.

The second and third variables entered were measures of the occupational structure, with the percent employed as private household workers being positively related (Beta = .3636) and the percent employed as service workers, except private household, being negatively related (Beta = .3373) to the dependent variable. The partial correlation of the percent employed as private household workers with the dependent variable at the second step was .41, a relatively strong association after the effects of education were controlled. Deaths from cirrhosis of the liver include those with mention of alcohol or alcoholism and those without mention of alcohol. In 1970 for Connecticut as a whole, deaths from this cause ranked fourth for persons 25 to 64 years of age. The partial correlation found in this study suggests that towns with relatively high percentages of private household workers tend to report relatively high death rates from cirrhosis of the liver, after the effects of educational levels of the population were controlled.

The percent employed as service workers, except private household, had relatively high negative partial correlation (-.29) with the dependent variable at the third step in the analysis. Eight other measures of occupational structure had a negative but weaker partial correlation with the dependent variable at this step. The explanation for this rather unexpected pattern is not clear from the present analysis. The partial correlations of the specific service occupations with the cirrhosis of the liver death rate, after the educational level and private household workers had been entered, revealed that personal service workers and health service workers were the two occupations with the strongest negative correlations. All of the specific service occupations also had a negative partial correlation with the exception of cleaning service workers.

The fourth variable entered was a measure of the marital structure of the population, with the percent of the population single (never married) having a relatively high partial correlation of .24 with the dependent variable at this step. Combined, these four variables accounted for 41 percent (R = .64) of the variation in death rates from cirrhosis of the liver. The above analysis suggest the need for a more detailed study of this cause of death; perhaps a separate study of deaths with mention of alcohol or alcoholism and of deaths without mention of alcohol. Such analysis might shed light on possible reasons for the particular combination of variables entered into the regression equation when deaths from cirrhosis of the liver are treated as a unitary phenomenon.

Diabetes Mellitus Death Rate

There were 67 towns with 10,000 or more population reporting deaths from this cause in 1970. The percent of the population classified as separated, widowed, or divorced had the highest correlation (.44) with variations in the dependent variable and was entered first in the equation, see Table XI. Zero-order correlations between this measure of marital structure and the percent of the population 65 years of age and over (.83) and the age dependency ratio (.83) were high. But after the marital structure variable was entered, the partial correlation coefficients of the percent elderly population and the age dependency ratio with the dependent variable fell to .06 and .05 respectively. This pattern is interpreted to mean that the percent of the population separated, widowed or divorced reflects the elderly age composition as well as some

Table XI: Relation Between Diabetes Mellitus Death Rate and Selected Socioeconomic Indicators, Connecticut Towns, 1970

Cause of Death[1]	Multiple Correlation R	Explained Variation R^2	Regression Coefficients: b	Beta
Diabetes Mellitus Death Rate (67)				
1. Percent Separated, Widowed or Divorced	.44	.19	2.2271	.5683
2. Percent Males	.48	.23	3.1690	.3359
3. Percent of Families Below Poverty Level	.52	.27	-.8072	-.2004
4. Percent Age 55-64 Years (Intercept = -167.8578)	.53	.28	1.0911	.1861

1. The number in parentheses beside each cause of death indicates the number of towns with 10,000 or more population reporting deaths from that cause.

independent influence of marital dissolution. The shape of this relationship may be seen in Figure 3.

The second variable entered was the percent of the population male, with a partial correlation of .21 with the dependent variable. This means that towns with relatively high percentages of men tend to report higher death rates from diabetes mellitus, after the effects of marital status have been controlled. This pattern may be expected on the basis that men generally have higher rates of deaths from diabetes mellitus than do women (Connecticut Vital Statistics: 1970, p. 35), particularly over the age of 45 years.

For the first time in our analysis of mortality by cause of death, the measure of level of living as indicated by the percent of families with incomes below the poverty line had the strongest partial correlation with the dependent variable (-.23). After the effects of marital status and percent males have been controlled, towns with lower proportions of poverty families tended to report higher rates of death from diabetes mellitus. The reasons for this negative relationship are not clear.

The fourth and final variable entered into this analysis was the percent of the population 55-64 years of age, with a partial correlation coefficient of .15 with the dependent variable. This age structure measure might be expected on the basis that diabetes mellitus death rate ranked as the seventh leading cause of death for persons 45-64 years of age in Connecticut in 1970 (Department of Vital Statistics: 1970, p. 35). In combination, these four variables explained 28 percent (R = .53) of the variation in the town by town death rate from this cause. None of the measures of occupational or industrial structures were strongly related to the diabetes mellitus death rate.

Emphysema Death Rate

There were 65 towns of 10,000 or more population in 1970 reporting deaths from emphysema. None of the forty-eight measures of the six conceptual categories had a high initial correlation with variations in the emphysema death rate. The percent of the population employed as craftsmen and foremen had the highest (.29) correlation and was entered first, as shown in Table XII. This relatively low level of relationship may be seen in Figure 3. All of the other occupations within the blue collar category also had a positive correlation with the emphysema death rate.

The partial correlations of the specific craftsmen and foremen occupations with the emphysema death rate revealed that the percent employed as mechanics and repairmen, except auto, and the percent employed as auto mechanics and body repairmen had the highest positive correlations. The other specific occupations were not strongly related to the dependent variable.

After the effects of the first variable were statistically controlled, the percent of the population employed in the mining industry had the highest partial correlation (.27) with the dependent variable and was entered second. The other primary industries (agriculture) also had a positive partial correlation at this step. The third variable entered,

Table XII: Relation Between Emphysema Death Rate and Selected Socioeconomic Indicators, Connecticut Towns, 1970

Cause of Death[1]	Multiple Correlation R	Explained Variation R^2	Regression Coefficients b	Beta
Emphysema Death Rate (65)				
1. Percent Employed as Craftsmen and Foremen	.29	.08	.8138	.3517
2. Percent Employed in Mining	.39	.15	15.9617	.3521
3. Percent Employed as Clerical Workers	.43	.18	.8123	.3318
4. Percent Employed in Wholesale and Retail Trade	.46	.21	-.7537	-.2231
(Intercept = .9480)				

1. The number in parentheses beside each cause of death indicates the number of towns with 10,000 or more population reporting deaths from that cause.

a measure of the white collar occupational structure, was the percent employed as clerical and kindred workers, with a partial correlation of .21 at this step of the analysis. The fourth variable entered, a measure of the tertiary industrial structure, was the percent employed in wholesale and retail trade industries with a partial correlation of -.19 with the dependent variable at this step. The other tertiary industries were also negatively related to the dependent variable.

The partial correlations of the specific industries within the wholesale and retail trade category with the emphysema death rate, after the variables of craftsmen, mining, and clerical workers were entered into the analysis, revealed that the percent employed in food, bakery and dairy stores had the strongest negative relationship. The other specific industrial categories were not strongly related and some had a low positive correlation.

In combination, these four variables accounted for 21 percent of the variation in the emphysema death rate (R = .46). Interestingly, only measures of the occupational and industrial structures were entered into the analysis while none of the other indicators correlated highly with this death rate. The reasons why towns with relatively high proportions in blue collar occupations (craftsmen and foremen) and as clerical workers in their white collar occupational structures, in addition to relatively high proportions in primary industries (mining), should tend to have high emphysema death rates are unclear from this analysis.

Varieties of Cardiovascular Diseases

As indicated in the preceding analysis of cardiovascular diseases, each separate cause in this category of deaths is analyzed as a dependent variable. As seen in Table II, the largest number of cardiovascular disease deaths occur from heart disease. The results of the regression analysis for this heart disease rate is discussed first.

Heart Disease Death Rate. There were 76 towns of 10,000 or more population in 1970 that reported deaths from heart disease. For this group of towns, the percent of the population 65 years of age and over had the highest correlation (.85) with variations in heart disease death rates. See Figure 3 for the form of this relation. This pattern may be expected since diseases of the heart are the leading cause of death for persons 65 years of age and over (Connecticut Vital Statistics: 1970, p. 35). Since most deaths from cardiovascular diseases occur from heart disease, the first variable entered in our analysis of cardiovascular disease death rate was also the percent elderly population.

After the effects of the elderly population had explained all the variation in heart disease death rates it could, the percent employed in farming occupations as farm laborers and farm foremen had the highest negative partial correlation (-.40) with the unexplained variation and was entered into the equation as the second variable.

The partial correlations of the percent employed as farm laborers, unpaid family workers, and the percent employed as farm laborers except unpaid family workers and all others revealed both occupational groups had a substantial negative correlation with the heart disease death rate, after the elderly population had been entered into the analysis.

The third variable entered was also an indicator of the occupational structure (the white collar occupations), the percent employed as sales workers, and exhibited a negative partial correlation (-.37) with the dependent variable. All the white collar occupations had a negative partial correlation with the dependent variable at this step of the analysis. Together the three variables accounted for 81 percent (R = .90) of the variation in the heart disease death rate, as shown in Table XIII.

The partial correlations of the specific occupations within the sales worker category with the heart disease death rate, after the proportion elderly and farming occupations had been entered, revealed that all were negatively related with the category of other sales workers having the strongest correlation.

This pattern suggests that towns with relatively high proportions of persons employed in white collar (sales workers) and farm occupations also report relatively low rates of heart disease, after the effects of the elderly have been controlled.

Table XIII: Relation Between Heart Disease Death Rate and Selected Socioeconomic Indicators, Connecticut Towns, 1970

Cause of Death[1]	Multiple Correlation R	Explained Variation R^2	Regression Coefficients b	Beta
Heart Disease Death Rate (76)				
1. Percent Age 65 and Over	.85	.72	28.0692	.7833
2. Percent Employed as Farm Laborers and Foremen	.88	.77	-117.3332	-.2149
3. Percent Employed as Sales Workers	.90	.81	-13.0174	-.1758
(Intercept = 130.7380)				

1. The number in parentheses beside each cause of death indicates the number of towns with 10,000 or more population reporting deaths from that cause.

Ischemic Heart Disease Death Rate. The largest number of heart disease deaths are from ischemic heart disease and there were a total of 76 towns of 10,000 or more populations reporting deaths from this cause in 1970. Similar to the pattern described for the total heart disease death rate, the percent of the population 65 years of age and over had the highest correlation (.83) with the variation in ischemic heart disease death rate. This strong relation between the elderly structure and ischemic heart disease explains why the aged population was also highly correlated with the total heart disease death rate. The form of the correlation between the percent elderly and ischemic heart disease death rate may be seen in Figure 4.

All of the measures of the service industrial structure were negatively related to the dependent variable after the first step in the analysis. The percent employed in finance, insurance, and real estate had the highest partial correlation (-.37) with the dependent variable and was the second variable entered in the analysis. After this second step, all of the farming occupations had negative partial correlations with the dependent variable. The percent employed as farm laborers and farm foremen had the highest partial correlation (-.29) and was entered as the third variable. Together the three independent variables explained 76 percent (R = .87) of the variation in ischemic heart disease death rates, as shown in Table XIV.

The partial correlations of the specific industries within the finance, insurance, and real estate category with the ischemic heart disease

Table XIV: Relation Between Ischemic Heart Disease Death Rate and Selected Socioeconomic Indicators, Connecticut Towns, 1970

Cause of Death[1]	Multiple Correlation R	Explained Variation R^2	Regression Coefficients b	Beta
Ischemic Heart Disease Death Rate (76)				
1. Percent Age 65 and Over	.83	.69	26.7721	.7898
2. Percent Employed in Finance, Insurance and Real Estate	.86	.74	-5.8072	-.1615
3. Percent Employed as Farm Laborers and Foremen	.87	.76	-84.8526	-.1643
(Intercept = 84.8730)				

1. The number in parentheses beside each cause of death indicates the number of towns with 10,000 or more population reporting deaths from that cause.

death rate, after the elderly population had been entered, revealed that the percent employed in insurance, real estate, and other finance industries had the strongest negative correlation. The other industrial categories of banking and credit agencies were not significantly related to the dependent variable at this step of the analysis.

This analysis suggests that after the effects of the aged population have been controlled, towns with relatively high percentages employed in finance, insurance and real estate (service industries) and relatively high percentages employed as farm laborers and foremen (farming occupations) also tend to report relatively low rates of death from ischemic heart disease.

Rheumatic Heart Disease Death Rate. Deaths from rheumatic heart disease ranked second among all heart disease deaths but, in comparison to ischemic heart disease, involved relatively few deaths. In 1970 there were only 52 towns of 10,000 or more population reporting deaths from this cause. Interestingly, the percent employed in wholesale and retail trade industries had the strongest correlation (-.44) with the rheumatic heart disease death rate; as shown in Table XV. Other measures of the tertiary industrial structure also had a negative correlation.

The correlations of the specific industries within the category of wholesale and retail trade with the rheumatic heart disease death rate revealed that wholesale trade had the highest negative correlation

Table XV: Relation Between Rheumatic Heart Disease Death Rate and Selected Socioeconomic Indicators, Connecticut Towns, 1970

Cause of Death[1]	Multiple Correlation R	Explained Variation R^2	Regression Coefficients b	Regression Coefficients Beta
Rheumatic Heart Disease Death Rate (52)				
1. Percent Employed in Wholesale and Retail Trade	.44	.19	-1.4104	-.3873
2. Percent Employed as Private Household Workers	.54	.29	-8.3128	-.4827
3. Percent Age 15-24 Years	.62	.38	-1.0299	-.4567
4. Percent Employed as Craftsmen and Foremen	.68	.46	-1.6765	-.5994
5. Percent Employed as Operatives Except Transport	.72	.52	.5679	.3741
(Intercept = 52.7127)				

1. The number in parentheses beside each cause of death indicates the number of towns with 10,000 or more population reporting deaths from that cause.

followed by the percent employed in general merchandise retailing and in motor vehicle retailing and service stations. All of the relationships were negative.

Measures of the age structure were not strongly related to the dependent variable at this stage in the analysis. The form of the correlation between employment in wholesale and retail trade and rheumatic heart disease death rate may be seen in Figure 4. However, the reasons why the tertiary industrial category should be entered first require additional analysis.

It should also be noted that unlike the analysis of ischemic heart disease, more independent variables were entered into the analysis and the increase in the explained variation of the dependent variable was significant with each additional independent variable. This pattern suggests that deaths from rheumatic heart disease are related to a more complicated set of factors than is the case for deaths from ischemic heart disease, at least in terms of socioeconomic variables.

The second variable entered, a measure of the service occupational structure, was the percent employed as private household workers - with a partial correlation of -.34 with the dependent variable. The percent of the population 15 to 24 years of age had this strongest partial correlation (-.37) after the second step in the regression analysis and was entered as the third variable. The fourth variable was a measure of the blue collar occupational structure, the percent employed as craftsmen and foremen, with a high negative partial correlation (-.36).

The partial correlations of the specific occupations within the craftsmen and foremen category with the rheumatic heart disease death rate at this step in the analysis revealed that the percent employed construction craftsmen, except carpenters, and as machinists had the highest negative correlation. The other specific occupational categories were not strongly related to the dependent variable.

The fifth variable entered also reflected the blue collar occupational structure in terms of the percent employed as operatives, except transport, but unlike the other indicators it was positively correlated (.31) with the dependent variable at that stage.

The partial correlations of the specific occupations within the category of operatives, except transport, with the dependent variable at the step in the analysis revealed that manufacturing durable goods had the highest positive relationship. The other specific occupations were also positively related but at lower levels.

The pattern described above is difficult to interpret. It suggests that towns with high proportions of persons employed in the wholesale and retail trade industries (particularly wholesale trade) and with relatively high percentages of workers in private household and craftsmen and foremen occupations and with a relatively young age structure (15 to 24 years of age) also tend to report low death rates from rheumatic heart disease. It seems that the most apparent conclusion would be that the service industrial and blue collar occupational structures have the strongest relationship with rheumatic heart disease but the specific pattern remains difficult to interpret. In contrast, death rates from ischemic heart disease correlated very strongly with the percent elderly population.

Cerebrovascular Disease Death Rate. The number of deaths from cerebrovascular disease ranked second to heart disease as the major cause of death from cardiovascular diseases generally. There were 76 towns of 10,000 or more population in 1970 that reported deaths from cerebrovascular disease. Similar to the pattern described for heart disease rates, variations in cerebrovascular disease death rates correlated most strongly (.70) with the age dependency ratio as shown in Table XVI. This may be expected since deaths from this cause rank as the third leading cause of death for persons 65 years of age and over (Vital Statistics: 1970, p. 35). The form of this correlation may be examined in Figure 4.

Once the effects of the elderly proportions have been taken into account, the percent of the population employed as laborers, except farm, had the highest partial correlation (.24) with the dependent variable. All of the other measures of the blue collar occupational structure also had positive partial correlations at this stage of the analysis. In contrast, most of the measures of the industrial structure had negative partial correlations with the dependent variable.

The third variable entered into the analysis was a measure of the tertiary industrial structure: the percent employed in transportation, communication and other public utilities. This characteristic was negatively related (-.27) to the dependent variable at this step, as were the majority of the other industrial categories but at a lower level.

The partial correlations of the specific industries within the category of transportation, communication and public utilities with the

Table XVI: Relation Between Cerebrovascular Disease Death Rate and Selected Socioeconomic Indicators, Connecticut Towns, 1970

Cause of Death[1]	Multiple Correlation R	Explained Variation R^2	Regression Coefficients b	Beta
Cerebrovascular Disease Death Rate (76)				
1. Aged Dependency Ratio	.70	.49	4.4839	.5260
2. Percent Employed as Laborers, Except Farm	.73	.53	17.8832	.2559
3. Percent Employed in Transportation, Communication and Other Public Utilities	.75	.56	-6.0366	-.1787
4. Percent Age 25-34 Years	.77	.59	-3.0227	-.1961
(Intercept = 46.5481)				

1. The number in parentheses beside each cause of death indicates the number of towns with 10,000 or more population reporting deaths from that cause.

dependent variable at this step in the analysis revealed that the percent employed in other transportation (including taxicab service, water and air transportation, etc.) and in utilities and sanitary services had the highest negative correlations. The other specific industries were also negatively related but at lower levels.

The final variable utilized was the percent of the population 25-34 years of age, which had a relatively high negative partial correlation (-.26) with the dependent variable. Together these four variables accounted for 59 percent (R = .77) of the variation in cerebrovascular disease death rates, see Table XVI.

With the exception of the age dependency ratio, the specific pattern of variables entered into the equation is difficult to explain. Perhaps certain types of cerebrovascular disease, such as cerebral hemorrhage, cerebral thrombosis, or cerebral embolism, are more frequent with persons employed in blue collar labor occupations than for other occupational categories. The negative relationship of percent employed in transportation, communication and other public utilities industries at the third step suggest this component of the industrial structure has an effect independent of age and occupational structure. Moreover, once the effects of the elderly, occupational, and industrial structures are controlled, the age factor once again assumes importance, i.e., percent 25-34 years of age was negatively related, as may be expected for this group.

<u>Arteriosclerosis Death Rate</u>. For the state as a whole, there were a total of 417 deaths from arteriosclerosis in 1970 and 64 towns of 10,000 or more population reported deaths from this cause. For this group of towns, the percent employed in the manufacture of non-durable goods had the highest correlation (.42) of all the variables with variation in the arteriosclerosis death rate as shown in Table XVII. This secondary industrial category includes manufacturing food products, tobacco, textile mill products, petroleum and coal products, rubber and plastic products, and leather products. The form of this correlation may be seen in Figure 4 and shows that towns with relatively high percentages of persons employed in the manufacture of non-durable goods also report relatively high death rates from arteriosclerosis. Deaths from this cause and the rheumatic heart disease death rate were the only two cause-specific mortality rates for which any measure of the industrial structure had the strongest initial correlations.

The partial correlations of the specific industries within the category of manufacturing non-durable goods with the arteriosclerosis death rate revealed that the percent employed in textile mill and other fabricated textile products had the highest positive relationship; with a .59 correlation coefficient. This initial correlation was higher than the .42 for the category of manufacturing non-durable goods because other detailed industries had negative relationships with the arteriosclerosis death rate and when they are combined into a single broad industrial category the total relationship is lowered.

The second variable entered was a measure of the age structure, the percent of the population 25-34 years of age, and it had a negative (-.32) partial correlation with the dependent variable. This relationship may be expected since arteriosclerosis is not a major cause of death for persons in that age structure.

Table XVII: Relation Between Arteriosclerosis Death Rate and Selected Socioeconomic Indicators, Connecticut Towns, 1970

Cause of Death[1]	Multiple Correlation R	Explained Variation R^2	Regression Coefficients b	Beta
Arteriosclerosis Death Rate (64)				
1. Percent Employed in Manufacturing, Non-Durable Goods	.42	.18	1.2364	.4039
2. Percent Age 25-34 Years	.51	.26	-2.0045	-.4633
3. Percent Employed in Business and Repair Service	.58	.34	-3.5333	-.3039
4. Percent Employed as Farmers and Farm Managers	.63	.40	17.8641	.2587

1. The number in parentheses beside each cause of death indicates the number of towns with 10,000 or more population reporting deaths from that cause.

The percent employed in business and repair service industries was relatively highly correlated (-.32) with the dependent variable at the third step of the analysis and was entered as the next variable. All of the other industries within the service category were also negatively correlated.

The partial correlations of the specific industries within the category of business and repair services with the dependent variable at this step of the analysis revealed that the percent employed in business services had the highest negative correlation.

The final factor, the percent employed as farmers and farm managers had a positive (.31) partial correlation with the dependent variable. All of the farming occupations were also positively correlated at this step of the analysis. Together these four variables accounted for 40 percent (R = .63) of the variation in the arteriosclerosis death rate.

Again, the specific pattern of variables entered and their specific relationships are difficult to explain. However, the steady and significant increase in the explained variation with the addition of each variable in the equation suggest that each factor is important in relation to the arteriosclerosis death rate.

SUMMARY AND DISCUSSION

Before discussing the major findings of this report, a cautionary word is necessary in the interpretation of the occupational and industrial correlates of cause of death data; the two categories of variables most frequently entered, after those for the age structure.

In the case of occupational differences in mortality, there are a variety of reasons why such differentials may exist. There may be a selection process involved in terms of health reasons for persons entering certain occupations and this preselection may be responsible for differential mortality rates. Changes in health status during a person's working life may likewise result in a shift to a less strenuous occupation and this selective process may result in different mortality rates by occupation, e.g., moving from policeman to clerical worker due to failing health. A similar type of selective process may be related to marital status which would result in mortality differentials by occupation. In addition to these factors, the physical location of various occupational categories may influence the occupation-specific mortality rates. Finally, there may be a concentration of persons from one ethnic group in an occupation making it difficult to know if the mortality rates are due to the occupation or to some characteristic of the population entering the occupation. In view of these difficulties, the use of occupational data to examine mortality differentials is only a crude diagnostic technique but it does illuminate gross differences which may warrant closer examination with more precise methods.

In the case of industrial differences in mortality, all of the problems of interpretation mentioned with occupational data also apply to the industrial categories. Differences in mortality by specific industries may be the result of selective processes (in terms of health, marital status, and ethnic factors) and the impact of geographic location on different industries. The separation of these factors from the basic affects of the industry itself on cause-specific mortality rates can not be made in this research. Therefore, this analysis may be regarded as only suggestive for possible future research into mortality levels by type of industry.

It should also be understood that, unlike some of the previous research (Guralnick: 1963, 1962; Kitagawa and Hauser: 1973), this study does not deal with data derived from mortality classified by occupation or industry of the decedent. Such analysis requires that either the occupation/industry be indicated on the death certificate or that death certificates be individually matched with a different data source containing the required information. The procedure employed in this research was to relate cause-specific death rates for the town of residence of the decedent from vital statistics data to selected socioeconomic indicators for that town from Census data. This ecological or aggregate-level analysis avoids the problems associated with matching death certificate data but introduces the difficulty of not knowing the town in which the decedent worked. The interpretation of the occupational/industrial correlations with cause-specific death rates is further confounded to the extent there is a difference between the town of residence and town of work of the decedent.

Table XVIII summarizes the results of the analysis in terms of the cause-specific death rates and the category of explanatory variables by order of entry into the regression analysis. For example, variations in the crude death rate were most strongly correlated with measures of the age structure (1st category entered) measures of level of living (2nd category entered), and measures of the occupational structure (3rd category entered).

As anticipated because the cause-specific death rates were not standardized for town differences in age structure, the age indicators were entered first or second in the regression analysis for all death rates except for rheumatic heart disease, all accidents, cirrhosis of the liver, and the emphysema death rate. The age factor was entered as the third category of variables for the rheumatic heart disease death rate but was not related to the death rate from all accidents, cirrhosis of the liver, and the emphysema death rate.

In the case of the death rate from all accidents, measures of the occupational structure were entered first, followed by measures of the industrial structure. The death rate from emphysema exhibited a similar pattern. However, the death rate from cirrhosis of the liver was most strongly correlated with a measure of level of living, followed by measures of the occupational structure and marital structure.

Measures of the marital structure were also the most important variables in relation to the diabetes mellitus death rate, followed by measures of the age structure and levels of living. That particular sequence of categories of variables was not reported for any other cause of death.

The emphysema death rate was most strongly related to measures of the occupational structure and the industrial structure but was not related to any of the other categories of variables. The only other death rate to follow a similar pattern was the all accident death rate.

The death rate from malignant neoplasms exhibited a unique pattern with measures of the age structure entered first, followed by measures of levels of living and the racial structure. This was the only death rate that was related to the measure of the racial structure.

Measures of the occupational and industrial structures were related to all the cause-specific death rates except the malignant neoplasms death rate and the diabetes mellitus death rate. In addition, the occupational measures were not related to the pneumonia death rate while the industrial measures were. The reverse pattern was the case for death rates from cirrhosis of the liver, heart disease, and the crude death rate.

The total multiple correlation coefficient for each cause-specific death rate showed considerable variation, ranging from a high of .91 for the cardiovascular disease death rate to a low of .46 for the emphysema death rate. However, the multiple correlation coefficient for most of the cause-specific death rates was high considering the rather limited number of independent variables entered into the analysis. This pattern suggests that a substantial amount of the town by town variation in cause-specific death rates can be explained by their differences in selected socioeconomic variables.

Table XVIII: Cause Specific Mortality Rate and Categories of Explanatory Variables, By Order of Entry Into Regression Analysis, by Towns, Connecticut, 1970

Cause Specific Mortality Rate	Age and Sex Structure	Racial Structure	Marital Structure	Level of Living	Occupational Structure	Industrial Structure
Crude Death Rate	1st			2nd	3rd	
Cardiovascular Disease	1st				2nd	3rd
Heart Disease	1st				2nd	
Ischemic Heart Disease	1st				3rd	2nd
Rheumatic Heart Disease	3rd				2nd	1st
Cerebrovascular Disease	1st				2nd	3rd
Arteriosclerosis	2nd				3rd	1st
Malignant Neoplasms	1st	3rd		2nd		
All Accidents					1st	2nd
Pneumonia	1st					2nd
Cirrhosis of Liver			3rd	1st	2nd	
Diabetes Mellitus	2nd		1st	3rd		
Emphysema					1st	2nd

Note: See text tables for the specific indicator of each category of variables entered into the analysis and Table II for the definition of cause of death categories.

Additional research is needed to fully understand some of the relationships discovered in this study. Perhaps a more detailed cause of death analysis would clarify some of the correlations. Also, classification of towns by their socioeconomic ranking may reveal and explain the inverse relationship by cause of death implied by some of the correlations. In any event, the results of this research have raised more questions than answers and will hopefully provide the stimulus for the needed future research on Connecticut mortality patterns.

INTERCORRELATIONS BETWEEN THE CRUDE DEATH RATE AND PERCENT OF POPULATION 65 YEARS OF AGE AND OVER, CONNECTICUT TOWNS, 1970

ALL CAUSES

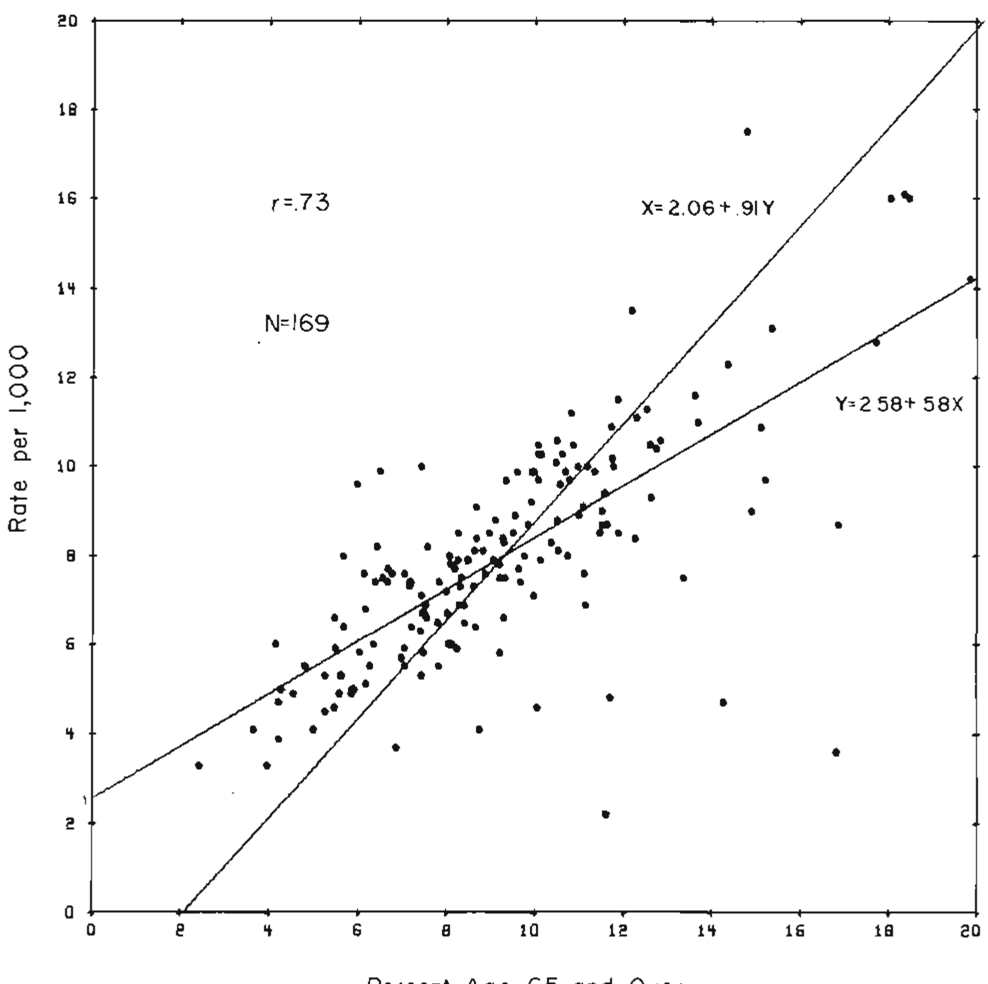


Figure I

INTERCORRELATIONS BETWEEN CAUSES OF DEATH AND SELECTED VARIABLES, CONNECTICUT TOWNS, 1970

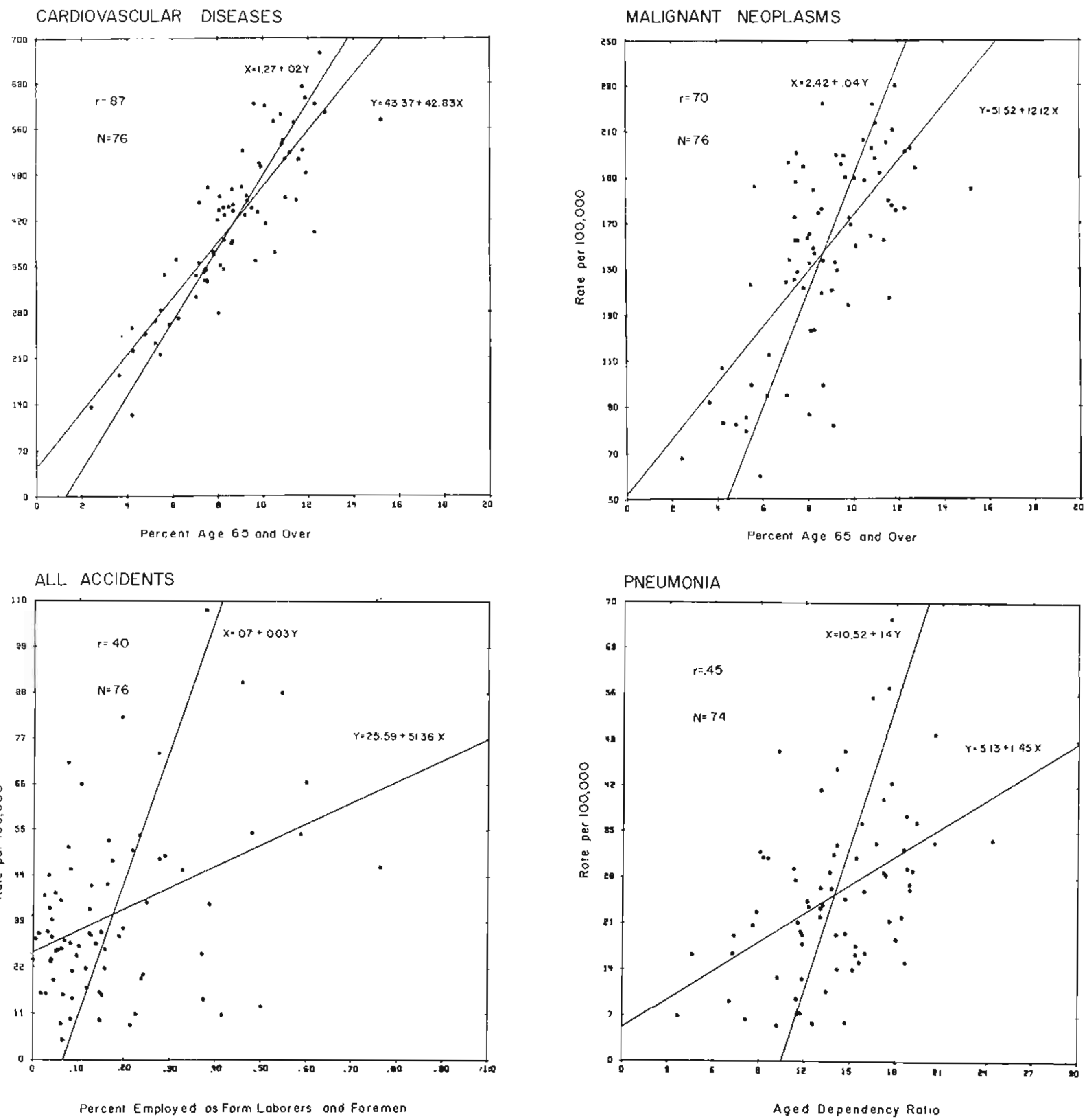


Figure 2

INTERCORRELATIONS BETWEEN CAUSES OF DEATH AND SELECTED VARIABLES, CONNECTICUT TOWNS, 1970 (CONTINUED)

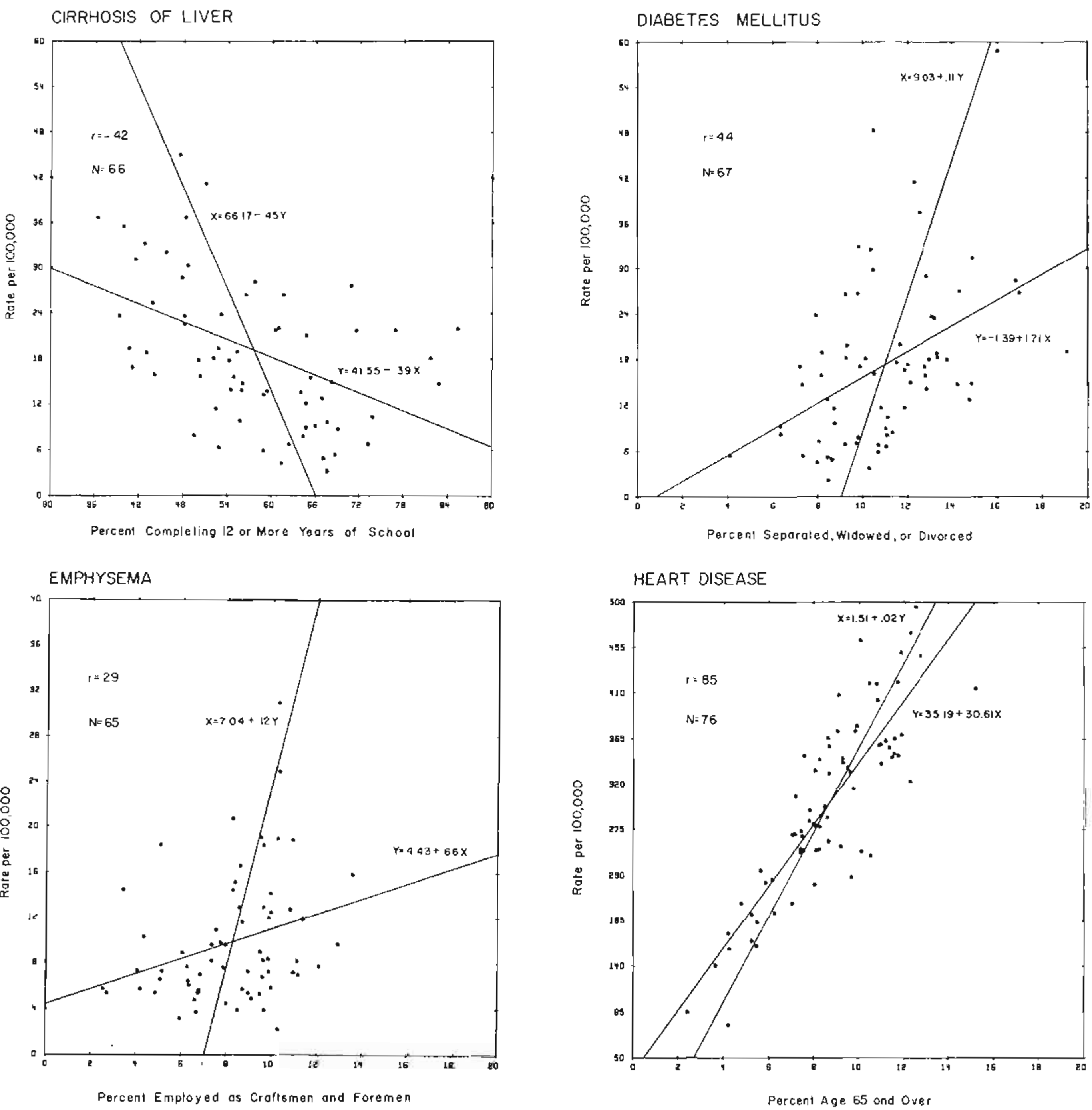


Figure 3

INTERCORRELATIONS BETWEEN CAUSES OF DEATH AND SELECTED VARIABLES, CONNECTICUT TOWNS, 1970 (CONTINUED)

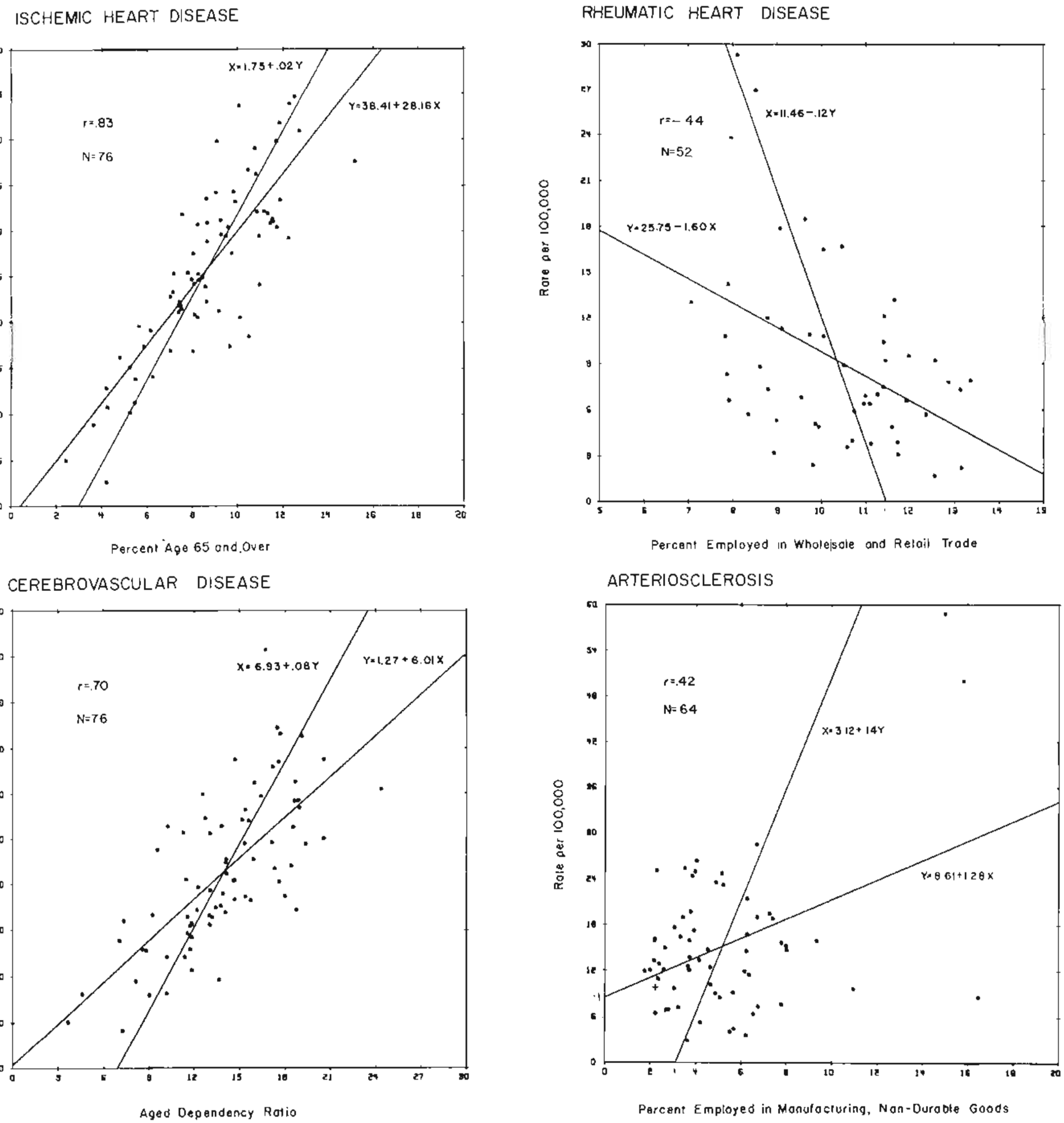


Figure 4

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