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Occupational Characteristics of Cancer Victims in Massachusetts 1971-1973

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OCCUPATIONAL CHARACTERISTICS OF CANCER VICTIMS IN MASSACHUSETTS 1971-1973

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ABSTRACT

This study examines cancer mortality patterns by occupation for white males in the state of Massachusetts using death records for the years 1971-1973. Its purpose is to identify occupation-cancer associations which, when interpreted in conjunction with results from other studies and hypotheses about potential occupational carcinogens, can serve as leads for more definitive etiological investigations.

Sixty-two malignancy categories (including grouped categories) were investigated for each of 397 occupational categories (including grouped categories) using an age-standardized mortality odds ratio approach. Results were adjusted for the effects of social class.

The results were compared with those of eleven other similar surveillance type studies, as well as with other studies from the literature. The most significant finding was the confirmation of lung cancer excesses among a large number of occupations for which there are reasonable hypotheses as to possible carcinogenic exposures, including truck drivers, painters, machinists, automobile mechanics, plumbers, cooks, fishermen, heated metal workers, sheet metal workers, and brickmasons, stonemasons, and tile setters.

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CONTENTS

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INTRODUCTION

This study examines cancer mortality patterns by occupation for white males in the state of Massachusetts using death records for the years 1971-1973. Its purpose is to identify occupation-cancer associations which, when interpreted in conjunction with results from other studies and hypotheses about potential occupational carcinogens, can serve as leads for more definitive etiological investigations.

A number of similar studies, which provide information on occupation-cancer associations, based on either vital records data or cancer registry data, have been published over the past twenty years (1-11). Table 1 summarizes some of the basic features of these studies. (In the subsequent text these studies will be referred to by the geographic base listed in the first column of Table 1. The England and Wales studies will be distinguished by referring to the years of the study (third column of Table 1) as well. The reader should refer to Table 1 for the references for these studies.) The repetition of this type of study is important for a number of reasons:

1) Many of the associations seen in any one study will be chance associations. Any time a large number of statistical comparisons are made, a certain number will achieve statistical significance by chance alone. In addition, some of the associations will be artifacts resulting from problems in the particular method of analysis or data base used. (For example, there is always the possibility of selective occupational and/or disease misclassification due to biases in the collection of information on death certificates). However, if the same association is reproduced in several different studies, the probability that the association is real is enhanced. Of course, further investigation is necessary to determine whether the association is causal or is due to a separate factor which is associated with the occupation - such as socioeconomic status, ethnicity, cigarette smoking, or consumption of alcoholic beverages.

2) For rare occupations, rare forms of cancer, or weak associations, the numbers in any one study may not be sufficient to show statistical significance. But if the same association is seen consistently from study to study, even if it is statistically significant in none of them, it may point to an occupational hazard.

3) Occupational cancer risks may change as a function of time. As old processes or materials are replaced by new ones, exposure patterns to occupational carcinogens may change. Thus an occupation-cancer association may be observed in a study using a 1970 data base, but not in a study using a 1950 data base.

4) Certain occupations and industries are found concentrated in some geographical areas, but not in others. For example, the Washington State study has a large number of plywood workers and atomic energy workers, but very few textile workers and no shoe factory workers. The present study of

TABLE 1

OCCUPATIONAL MORTALITY AND MORBIDITY STUDIES*

Geographic Base of Study	Data Base	Years	Total Number of White Male Subjects&	Number of Malignant Neoplasms	Age Range	Mortality/+ Incidence Index	Occupation	Reference
Washington State	Death Certificates	1950-71	∿ 300,000	∿ 50,000	20+	PMR	Usual	(1)
California	Death Certificates	1959-61	∿ 199,000	∿ 33,000	20+	PMR	Latest	(2)
England and Wales	Death Certificates, Census	1970-72	550,297	142,874	15-74	SMR, PMR$	Latest	(3)
United States	Death Certificates, Census	1950	277,798	43,133	20-64	SMR, PMR%	Usual	(4)
Third National Cancer Survey#	10% Interview Survey of all incident cancer cases	1969-71	3,539	3,539	15+	IOR	Usual	(5)
Los Angeles County	Cancer Surveillance Program	1972-77	21,682	21,682	20-64	PIR	Latest	(6)
Roswell Park Memorial Institute¢	Hospital Registry	1956-65	Not Stated	6,434	15+	IOR	Ever employed and employed at least 5 years	(7)

TABLE 1 (continued)

OCCUPATIONAL MORTALITY AND MORBIDITY STUDIES*

Geographic Base of Study	Data Base	Years	Total Number of White Male Subjects[&]	Number of Malignant Neoplasms	Age Range	Mortality/Incidence Index[+]	Occupation	Reference
Rhode Island	Death Certificates, Census	1968-72	23,276	4,879	16+	SMR, PMR[++]	Usual	(8)
England and Wales	Death Certificates, Census	1959-63	846,847	204,200	15-74	SMR, PMR[$]	Latest	(9)
England and Wales	National Cancer Registry	1966-67	113,918	113,918	15-74	PIR	Latest	(10)
England and Wales	National Cancer Registry	1968-70	184,887	184,887	15-74	PIR	Latest	(11)
Massachusetts	Death Certificates	1971-73	34,879	16,629	20+	MOR	Usual	

Footnotes to Table 1

*Several proportional morbidity ratio studies, based upon Social Security disability records (12,13) and a national Health Interview Survey (14) have also been published. However, these studies are not well-suited to the identification of occupation-cancer associations. This is because there are several common disabling conditions, such as diseases of the musculoskeletal system and connective tissue and accidents, which occur much more frequently among blue collar workers (especially certain categories of blue collar workers) than white collar workers. Because a proportional method is used in these studies, this creates a bias in the results for cancer, overstating cancer morbidity among white collar workers and understating it among blue collar workers.

In addition, an occupational mortality study from New Zealand vital records data has been published (15). However, this study is of limited value with respect to the study of occupational cancer because it only examined the broad cause of death category "malignant neoplasms" and didn't examine specific forms of cancer. A United States occupational mortality study based upon life insurance records also failed to examine specific forms of cancer (16).

&Third National Cancer Survey and England and Wales studies present results for all males only, without distinguishing race. The United States study does this in many instances as well.

+PMR - proportionate mortality ratio; SMR - standardized mortality ratio; IOR - incidence odds ratio; PIR - proportionate incidence ratio; MOR - mortality odds ratio.

$SMR was calculated for ages 15-64, PMR for ages 65-74 (PMR results for ages 65-74 were not presented for the detailed occupational categories - the occupational units - in the 1959-63 study, however). Significant PMR results, ages 15-64, are also presented in the 1970-72 study. PMR results for the occupational orders (the broader classification) for ages 25-75 in the 1959-63 study are presented in reference (17).

%Only SMR results are presented, but significance testing was done on the PMRs. For significantly elevated PMRs, the corresponding SMR was underlined in the tables.

#Survey areas included Colorado and the Standard Metropolitan Statistical Areas of Atlanta, Birmingham, Dallas-Fort Worth, Detroit, Minneapolis-St. Paul, Pittsburgh, San Francisco-Oakland.

Footnotes to Table 1 (continued)

[¢] A major cancer treatment and research center located in Buffalo, New York.

[++] SMR and PMR were calculated for ages 16-64, PMR for ages 65+.

Massachusetts complements the Washington State study in this respect, having a large number of textile workers and shoe factory workers, but no plywood workers or atomic energy workers.

5) Occupational cancer risks may be a function of geography. A given industry may have its older plants concentrated in one geographical region, and its more modern facilities in another. Differences between the processes or materials used in the older versus the newer plants may result in differences in exposure patterns to occupational carcinogens.

6) Finally, each of these studies has its own particular strengths and limitations both with respect to the quality and quantity of the data, and the methods of analysis used. These complement each other to some extent. It is beyond the scope of this report to review the strengths and limitations of the other studies - they are discussed to a greater or lesser degree in the individual publications (See (3) and (8) in particular). One example will suffice:

The quality of occupation information obtained from death certificates is known to be mediocre, and disease information has its shortcomings (see "DEATH CERTIFICATE DATA" section). This is a deficiency in the present study, as well as in the Washington State, California, United States, Rhode Island, and England and Wales 1970-72 and 1959-63 studies. On the other hand, the quality of disease information is high in the studies which used cancer registries as their data base (Third National Cancer Survey, Roswell Park, Los Angeles County, England and Wales 1966-67 and 1968-70). The Third National Cancer Survey and Roswell Park studies also have high quality occupational information which was obtained from detailed personal interviews and questionnaires, respectively. However, these are the two smallest studies; many of the associations found are based on small numbers and are therefore relatively unstable.

It was in the context of the need for multiple ongoing occupational cancer surveillance studies that the present study of Massachusetts was undertaken. Some of the distinguishing features of this study are:

1) The use of the age-standardized mortality odds ratio (sMOR) as the basic measure of relative mortality. This has certain advantages over the more commonly used proportionate mortality ratio (PMR), which are discussed in the "METHODS OF ANALYSIS" section.

2) Analysis for occupation-cancer associations in a variety of age groupings. This was done because some occupational cancers may concentrate in a particular age grouping, and because possible inaccuracy of reporting of cause of death and occupation for older subjects could serve to dilute out real association when looking at all ages grouped together.

3) Control for potential confounding by social class. This was done using a social class classification scheme based upon occupation. Because a whole range of potential confounding factors - such as diet, cigarette smoking, alcohol consumption, stress, and ethnicity - are related to social class, controlling for social class has the effect of at least partially controlling for these factors.

4) An analysis of social class-cancer associations.

5) Control for potential confounding by cigarette smoking for the lung cancer results in the major occupational groupings. This was done by a method which utilized independent data on smoking habits in the major occupational groupings and on lung cancer death rates among smokers, ex-smokers, and never smokers.

6) A comprehensive comparison of the positive results in this Massachusetts study with the other studies in Table 1.

DEATH CERTIFICATE DATA

The initial data source for this study was the entire death file for Massachusetts for the years 1971 to 1973. All adult males (20 years of age or older) whose underlying cause of death was coded by the state nosologist as a malignant neoplasm (International Classification of Diseases (eighth revision) (18) codes 140-209) or as cirrhosis of the liver (ICD code 571) were chosen for the study. (Because a number of industrial chemicals are potential liver toxins, cirrhosis of the liver was studied as well. Cirrhosis of the liver also serves as a good indicator of alcohol consumption, which is known to be related to certain forms of cancer (19)).

In addition, a sample of every fourth adult male death was chosen. The deaths other than malignant neoplasms and cirrhosis of the liver from this sample were used as the auxiliary disease group in the age-standardized mortality odds ratio analyses (see "METHODS OF ANALYSIS" section). Because of the small percentage of non-whites (3 percent), they were omitted from the analysis to avoid confounding by race, and were not analyzed separately. Thus all results are for adult white males only. A total of 34,879 adult white males were in the final data base, including 16,629 who died from malignant neoplasms and 2177 who died from cirrhosis of the liver.

The items of information used from the death certificates to perform the analysis were:

1) age at death.
2) underlying cause of death as coded by the state nosologist according to the ICD (eighth revision) code.
3) usual occupation. The instruction on the death certificate reads, "Kind of work done during most of working life."
4) industry or business.

CAUSE OF DEATH INFORMATION

Although no data is available from Massachusetts, several studies have been published in the United States and Great Britain which assess the accuracy of cause of death certification for specific forms of cancer. For most forms of cancer, the accuracy of the cause of death statement has been found to be between 70 and 90 percent when compared with hospital diagnoses (20,21), although it has been found to be somewhat lower when compared with autopsy findings (22-24).

The quality of cause of death certification presents problems for occupational cancer mortality studies. At best, if misclassification of cause of death occurs randomly across occupations, the magnitude of any real occupation-cancer association will be diluted. However, it would not be surprising if the accuracy of cause of death certification were social class, and therefore occupation, dependent. This could be particularly true for cancer types, such as pancreatic cancer, which are difficult to diagnose. One

would expect that they would be more likely to be diagnosed accurately in individuals who had access to the best diagnostic facilities, thus introducing biases in the results.

Another problem with the use of death certificates for occupational cancer studies is that ideally one would want to know about all incident cancer cases, not just those whose underlying cause of death was stated to be cancer on the death certificate. Using mortality data, as opposed to incidence data, introduces potential biases with respect to differential cure rates for various types of cancer across occupations - again, due to unequal access to high quality medical treatment.

A related problem is the assignment of underlying cause of death in a patient with more than one major medical problem. Often, such an assignment is arbitrary. However, if the probability of assigning a cancer as opposed to another cause is the same from occupation to occupation, no bias will result from this problem. No attempt was made in this study, or in any of the previous studies which used death certificate data, to utilize information on the death certificates with regard to secondary causes of death. This would be a worthwhile project for future studies.

OCCUPATIONAL INFORMATION

No systematic attempt was made to assess the accuracy of the occupational statement on Massachusetts death certificates. However, some limited information is available from previous work done by the authors:

1) Ninety-one percent of the 423 death certificates for all of the active and retired workers from a single large manufacturing plant who died from 1971 to 1973 in Massachusetts listed the correct name of the employer as the industry or business (unpublished data).

2) In a study of oat cell lung cancer, 75 percent of the death certificate statements of usual occupation corresponded with the information obtained from interviews of next of kin (25).

The England and Wales 1959-63 and 1970-72 studies and the United States study did direct comparisons, for a sample of the study population, between the occupation reported on the death certificate and that reported in the census. The United States study of deaths in 1950 found 71 percent to be reported in the same major occupational group on the death certificate and the 1950 census report, with only 61 percent in the same detailed occupational category. However, some of the discrepancy would be explained by the fact that the death certificate lists the decedent's usual occupation while the census lists the last or current occupation.

In the British studies, both the death certificate and the census listed the last or current occupation. A sample of deaths occurring shortly after the census was used. The 1959-63 study reported that 74 percent were assigned to the same occupational order on the death certificate and the census report, and only 63 percent were assigned to the same occupational unit (the more

detailed classification). Another 9 percent were assigned to related occupations. The most common discrepancy was thought to be individuals who had at some point in their working life changed their occupation. In the 1970-72 study, 62 percent were assigned to the same order and 51 percent to the same unit.

The Washington State study examined the accuracy of death certificate occupational statements for men dying from Hodgkin's disease and bladder cancer. Interviews with next of kin indicated that the death certificates were accurate in 75 percent of the cases, and gave a related occupation in another 10 percent of the cases. In addition, the occupational information on the death certificates of 25 smelter workers known to have died from lung cancer from smelter records was sufficient to identify 24 of them as smelter workers.

Finally, a comparison of the death certificate statement of occupation with comprehensive occupational histories obtained from interviews, primarily of lung cancer patients, was performed in California in 1949-52 (26). Seventy-eight percent of the death certificates stated an occupation which was given in the occupational history, although only 52 percent stated the usual occupation as determined from the history.

Synthesizing the above information, we would conservatively postulate that the statements of usual occupation in the present study are at least 60 percent accurate. In another 20-25 percent of the cases, the occupation listed is probably related to the actual usual occupation of the decedent or is an occupation in which the decedent worked at some point in his life, although not the usual occupation.

The limited accuracy of the occupational statement on death certificates should not be surprising. Firstly, the informant, especially if not a next of kin, may not have detailed knowledge of the decedent's work history. It would be especially difficult to assign a usual occupation in the case of a decedent with a varied work history. Secondly, there seems to be a tendency for relatives to "promote" the decedent into a higher level occupation than he had in reality (3,27). Finally, the mortician as interviewer has no published guidelines by which to collect this information.

If misclassification of occupation were random, the effect would be to dilute the magnitude of any real occupation-cancer association, but no biases would be introduced into the results. Most likely, however, some occupations are selectively misclassified into others, creating biases. Such selective misclassification is described in the 1970-72 England and Wales study.

Aside from the question of accuracy, there is an additional problem with using the usual occupation statement. Many individuals have more than one occupation during their working life time. Ideally, in an occupational cancer study one would want to have a complete work history to use in the analysis. For example, even short term employment is of significance if it exposed the subject to a potent carcinogen.

On the positive side, for studies of occupational cancer usual occupation is preferred to current or last occupation (used in the California, Los Angeles County, and British studies). This is because of the long latent period (in most cases 20 years or greater) between initial exposure to carcinogens and the onset of clinical diseases. Thus, if a subject worked as a plumber for 30 years, and then as a truck driver for the last five years of his life, plumber would be the main occupation of interest in occupational cancer studies.

In this section, we have concentrated on pointing out limitations in the use of death certificates as the data base for occupational cancer studies. These limitations must be kept in mind when interpreting the results from these studies. An additional limitation should be noted - there is no information on death certificates with regard to potential confounding factors such as smoking habits, alcohol consumption habits, and dietary habits. (While ethnicity can be inferred from death certificate information on the decedent's birth place and the mother's and father's birth places and names, no attempt was made in any of the studies to examine for confounding by ethnicity. Another major confounding factor for which it is possible to control using death certificate data is social class. This was done in the 1959-63 and 1970-72 British studies. We have controlled for social class in the present Massachusetts study using a social class classification scheme based upon occupation).

Yet, in spite of all of these caveats, a death certificate data base presents the overriding advantage of easy accessibility to large numbers of death records, with information on occupation and cause of death, which can be analyzed relatively simply and cheaply. In the absence of cancer registries in the United States which collect information on occupation and potential confounding variables, which would represent a qualitative advance in the field, death certificate analysis will most likely remain the principle means for doing this type of broad-based occupational cancer surveillance.

CLASSIFICATION SCHEMES

CAUSE OF DEATH CATEGORIES

Sixty-two malignancy categories (including overlapping categories) and cirrhosis of the liver were investigated. All other causes of death were grouped together into the "auxiliary causes of death" category, which was used as the auxiliary cause of death group in the mortality odds ratio analyses (see "METHODS OF ANALYSIS" section). Appendix E presents the cause of death categories by their International Classification of Diseases (eighth revision) codes.

We felt that it was desirable to do as detailed an investigation as possible with respect to type and anatomic site of cancer. This is because many carcinogens are known to have a high degree of target specificity. Thus the classification system used in this study is as detailed as that used in any of the other studies. At the same time, information would be lost by not collapsing the most specific categories into broader categories, so this was done as well. For example, reticulum cell sarcoma, lymphosarcoma, and Hodgkin's disease were investigated individually, and were also collapsed, along with unspecified and other lymphomas into the broader category of lymphomas.

For some of the more specific cause of death categories, the potential for bias is particularly noteworthy. For example, of the 1674 subjects who are classified into the broader category large intestine, except rectum (ICD 153.0-153.8) only 536 are classified into the more specific categories of cecum, appendix, and ascending colon (ICD 153.0), transverse colon (ICD 153.1), descending colon (ICD 153.2), or sigmoid colon (ICD 153.3). The remainder are classified into the non-specific category large intestine (including colon), part unspecified (ICD 153.8).

We do not know what factors determine whether a death certificate cause of death statement will give the more specific or less specific diagnosis. However, we would postulate that the probability of receiving a more specific diagnosis would be social class, and therefore, occupation, dependent.

OCCUPATIONAL CODE

In designing the occupational code, we attempted to make the occupational categories as homogeneous as possible, so as not to dilute or cancel out possible effects. At the same time, we created grouped codes of occupations which are likely to have similar exposures. These provide the advantage of larger numbers for analysis.

Every subject is classified into one of 321 individual occupational categories (Appendix F). (This includes industrial classifications (e.g., rubber workers, shoe factory workers, fabricated metal products workers not elsewhere classified (NEC)) as well as strictly occupational classifications such as machinists. For simplicity, we are including "industrial" within the term

"occupational"). In addition, individual occupations are collapsed into 70 grouped categories of similar occupations (Appendix G). An individual occupation can appear in more than one grouped category. Finally, we coded six large employers who are named on the death certificates with sufficient frequency to permit analysis (Appendix H). Subjects classified into one of the large employer categories are also classified into an individual occupation category.

The individual occupation classification is based on the modification of the 1960 U.S. Bureau of the Census classification used in the Washington State study, with significant additional modifications. New categories added to the classification include our own additions, additions taken from the 1970 Bureau of the Census classification, and a number of industrial categories. The 1970 Census of Population Alphabetical Index of Industries and Occupations (28) was relied on extensively as an aid in assigning occupational codes (those from the 1960 classification as well as the additions).

Many death certificates list the name of the employer in the "industry or business" entry. The 1974-75 Industrial Directory of Massachusetts Manufacturers (29), which classifies Massachusetts manufacturing firms by their Standard Industrial Classification (SIC) code (30), also proved to be invaluable in assigning codes. Not only are a number of our categories strictly industrial, but in the Bureau of the Census classification system the assignment of codes is often dependent on both the occupation and the industry. There was enough information on the death certificates to classify 96.4 percent of the subjects into a category other than "not stated, unknown, none" (code 321).

For convenience, we assigned code numbers by consecutive numbering (1 to 321) of the individual occupational categories. Appendix F shows the corresponding Bureau of the Census and SIC codes. The grouped codes are further consecutively numbered (322 to 391), as are the large employer codes (392 to 397).

All subjects were also grouped into ten major occupational groupings:

professional, technical and kindred workers
managers, officials, proprietors, except farm
clerical and kindred workers
sales workers
craftsmen, foremen, and kindred workers
operatives
service workers
laborers, except farm
farmers
unknown

These groupings are mainly by individual occupational category, as indicated in Appendix F. However, a number of individual occupational categories are mixed with respect to major occupational grouping. For example, the category fabricated metal product workers NEC includes foremen, operatives, and laborers. In these situations subjects were coded into major occupational groupings independently from their individual occupational codes.

The major grouping "unknown" is with respect to the other nine major groupings, and not absolute. There is sufficient information on the death certificates of many of the subjects to classify them into individual occupational codes 316-320 (railroad workers NEC, government workers NEC, postal workers NEC, public utility workers NEC, and public works employees NEC), but insufficient information to classify many of them into a major occupational grouping. For example, the following could be classified into major occupational groupings:

Usual Occupation	Industry or Business
Signal man	B and M Railroad
Laborer	City of Boston
Laborer	Post Office
Inspector	Boston Edison Company
Foreman	Massachusetts Department of Public Works

The following could not be classified into major occupational groupings:

Usual Occupation	Industry or Business
Worker	Railroad
City Employee	Malden
Postal Worker	Post Office
None	Brockton Gas Company
None	Cambridge Public Works

SOCIAL CLASS CLASSIFICATION

The social class classification scheme was based upon occupation. Subjects in the major occupational groupings "farmers" and "unknown" were not assigned to a social class. All other subjects were assigned to one of four social classes, based primarily upon their major occupational grouping, and secondarily upon the rating of their individual occupation in Duncan's socioeconomic index of occupations (31) (Appendix I). This is a widely used socioeconomic rating system for occupations, based upon U.S. Census education and income data. The index was first calculated using data from the 1950 census (31). Recently, an updated version, based upon 1970 census data, has been published (32). While the 1950 and 1970 versions were generally in good agreement, there were a few significant changes in ratings of occupations. We relied primarily on the 1950 index. Although the subjects in this study died in 1971-73, because of the generally long latent period of cancer, their social class in 1950 is more relevant than that in 1970. However, some of the occupational categories were given ratings in the 1970 version, but did not appear in the 1950 version. For these we used the 1970 ratings.

The socioeconomic index was detailed enough so that, between the 1950 and 1970 versions, only 19 of our occupational categories could not be given any rating. We were able to rate fully most of the categories which were mixed with respect to major occupational grouping. For example, the 1950 index had

separate ratings for foremen in the textile industry, operatives in the textile industry, and laborers in the textile industry. However, a small number of these categories could only be partially rated.

Subjects who could not be rated were assigned to a social class solely on the basis of the social class to which their major occupational grouping was primarily assigned. The social class classification scheme is presented in Appendix I. The social class assignments of the individual occupational categories is presented in Appendix F.

METHODS OF ANALYSIS

MORTALITY ODDS RATIO

The age-standardized mortality ratio (SMR) is a preferred index for measuring occupational mortality. This index compares the death rate for a specific cause in a given occupation with the death rate for that cause in the study group as a whole. In practice it is very difficult to obtain accurate SMRs using death certificate data. In the studies in which this has been done (3,4,8,9,15), census data has been used to obtain age-specific number of persons at risk of death in each occupation (the denominator in the rates). However, the relatively poor correspondence between occupational statements on death certificates and census records leads one to interpret the SMR results with a great degree of caution. The 1970-72 British study presents an analysis of the complex biases between death certificates and census data which must be considered in interpreting the results.

Because of the problems in obtaining accurate SMRs, we felt that the extra costs involved in incorporating census data into the analysis were not warranted. Instead, we chose to use the age-standardized mortality odds ratio (sMOR) as the measure of relative mortality in this study (33). The death certificate data alone is sufficient for calculation of sMORs.

The MOR is the ratio of mortality odds between the cancer of interest and other (auxiliary) diseases for the occupation of interest compared with a non-exposed comparison group (Appendix J). The MOR approach is essentially equivalent to a case-control approach, where the cases are all of the deaths from the cancer of interest, the controls are the auxiliary causes of death, and the exposure of interest is occupation. The exposure odds ratio - the ratio of the exposure odds between the occupation of interest and the non-exposed comparison group for the cancer of interest compared with the auxiliary diseases - is equal to the MOR (Appendix J).

sMOR can be interpreted as the SMR on the assumption that the mortality rate for the auxiliary causes of death is the same in the occupation of interest and the comparison group (Appendix J). Thus the choice of the auxiliary diseases and the comparison group should be a considered one. We performed the sMOR analyses using two different comparison groups - all other individuals within the same social class (social class adjusted analysis) and all other individuals in the entire population (standard or social class unadjusted analysis). In both analyses, causes of death other than malignant neoplasms and cirrhosis of the liver were used as the auxiliary causes of death.

Generally, it has been found that there is less variation in overall mortality (and mortality from the grouped auxiliary causes of death) among occupations within the same social class or major occupational grouping than among occupations from different social classes or major occupational groupings (34). This is because, apart from direct effects of the work environment itself, there are other major determinants of mortality which are

relatively closely associated with social class and occupational level. These include cigarette smoking habits, dietary habits, alcohol consumption habits, stress, and ethnicity. In this sense, members of the same social class serve as a better comparison group than all other individuals in the study population.

Table 2 shows SMRs as a function of major occupational grouping (or social class grouping based on occupation) from five previous studies (1950 United States (4), 1970-72 and 1959-63 England and Wales (3,9), 1949-51 California (27), and 1960 United States Matched Records Study (34)). These studies calculated SMRs using death certificate data to obtain numerators and census data to obtain denominators. The pitfalls of this approach have been discussed. However, the SMRs calculated for major occupational groupings using this approach should be more accurate than those calculated for detailed occupational categories because there is a greater degree of correspondence between death certificate data and census data for the major occupational groupings (71 percent in the 1950 United States study, 83 percent in the 1959-63 British study, 73 percent in the 1970-72 British study, and 77 percent in the 1949-51 California study). In the 1960 United States Matched Records Study, the problem of discrepant reporting of occupation in the census and on the death certificate was resolved by matching all the records, and using the occupation stated on the census report.

For the 1950 United States study and the British studies, SMRs are shown for the grouped auxiliary causes of death. This information was not available from the 1960 Matched Records Study, so the SMRs for all causes combined are shown. However, the other three studies revealed a close parallel between the SMRs for all causes and that for the auxiliary diseases. The SMRs for all causes except violent causes and certain cancer sites are presented from the 1949-51 California study.

These and other studies consistently reveal an inverse relationship between mortality and occupational level (or social class) (34). Generally, there tend to be relatively small differences among the upper and middle occupational levels (or social classes), and a wider gap between the upper and middle versus the lower levels. Professional, technical and kindred workers; managers, officials, and proprietors, except farm; and farmers and farm laborers consistently have the lowest SMRs, while laborers (except farm) consistently have the highest SMRs. Differences in mortality among occupational levels decrease with increasing age, and tend to disappear in the older age groups (not shown in table) (34). Comparison of the 1950 and 1960 United States studies are consistent with the assertion that class differences in mortality have narrowed over time (34). These considerations should be kept in mind when interpreting the results of the standard analysis. To the extent that these relationships between mortality and occupational level exist in the Massachusetts study population, the results will be biased toward systematically overestimating cancer mortality in the higher occupational levels and farmers, and systematically underestimating it in the lower occupational levels, especially in the younger age groups.

TABLE 2

SMRs OF INTEREST FOR MAJOR OCCUPATIONAL GROUPINGS
AND SOCIAL CLASS GROUPINGS FROM OTHER STUDIES

For the 1950 United States study (4) and the two England and Wales studies (3, 9), the SMRs are for the auxiliary causes of death (all causes of death other than malignant neoplasms and cirrhosis of the liver). They were calculated by subtracting the observed and expected deaths from malignant neoplasms and cirrhosis of the liver from the observed and expected deaths for all causes combined. It was found that the SMRs for the auxiliary causes of death fairly closely approximated the SMRs for all causes of death combined in these three studies. Since information on specific causes of death was not available from the 1960 United States Matched Records Study (34), SMRs presented from this study are for all causes of death combined - a reasonable approximation of the SMRs for the auxiliary causes of death. The SMRs presented from the 1949-51 California Study (27) are for all causes except cancers of the upper alimentary tract, stomach cancer, lung cancer, accidents, suicide, and homicide.

TABLE 2

SMRs FOR MAJOR OCCUPATIONAL GROUPINGS
AND SOCIAL CLASS GROUPINGS FROM OTHER STUDIES

Major Occupational Grouping	SMR 1950 U.S. study[+]	SMR U.S. 1960 Matched Records Study[#]
professional, technical, and kindred workers	84	88
managers, officials, and proprietors, except farm	87	91
clerical and kindred workers	81	102*
sales workers	95	
craftsmen, foremen, and kindred workers	96	98
operatives and kindred workers	94	108
service workers, except private household	97	116
laborers, except farm and mine	127	116
farmers and farm laborers	85	82

Social Class	SMR England and Wales 1959-63[¢]	SMR England and Wales 1970-72[¢]	SMR California 1949-52[++]
I professional, etc. occupations	77	77	94
II intermediate occupations	81	82	89
IIIN skilled occupations (non-manual)	99[##]	102	97[**]
IIIM skilled occupations (manual)		103	
IV partly skilled occupation	102	113	98
V unskilled occupations	145	139	120

[+] white males, age 20-64. Most of the SMRs are less than 100 because non-white males, who have a higher mortality rate, were included in the comparison group.

[#] white males, age 25-74.

[*] SMR for clerical and sales workers combined.

[¢] males, age 15-64.

[++] males, age 20-64.

[##] IIIN and IIIM combined.

[**] sales, clerical, skilled workers.

Aside from the general relationships between mortality and occupational level, the possibility must be considered that a specific occupation has a high mortality rate from the auxiliary causes of death due primarily to hazards associated with the occupation. For example, many asbestos workers die from asbestosis. For such occupations, cancer mortality will be systematically underestimated in this study.

Even when the assumption that the mortality rate for the auxiliary diseases is independent of occupation is valid, there are still numerous confounding variables which can result in an occupation having an elevated sMOR for reasons other than an occupational exposure.

There are both advantages and disadvantages to the standard analysis versus the social class adjusted analysis with respect to the problem of confounding. Smoking related cancers, such as lung cancer, provide a good example. On the one hand, since there tends to be an inverse relationship between smoking and occupational level, the standard analysis will bias the results toward systematically underestimating lung cancer due to occupational exposures in the higher occupational levels, and systematically overestimating it in the lower levels. The social class adjusted analysis will control for differences in smoking patterns, at least partially. On the other hand, it is not unlikely that a measurable percent of lung cancer in Social Classes 3 and 4 is occupationally related. If this is the case, narrowing the comparison group to the same social class will systematically underestimate occupationally related lung cancer in Social Classes 3 and 4. Using all other individuals in the study population as the comparison group serves to dilute out the proportion of occupationally related lung cancers in the comparison group and thus lessens this effect.

It would be attractive to refine the choice of both the auxiliary diseases and comparison group further in order to increase the validity of the results. One possibility might be the exclusion of accidents from the auxiliary causes of death, since many occupationally related deaths are due to accidents. Ideally, one would like to be able to give individualized consideration to the most valid comparison group and auxiliary diseases for each occupation-cancer type combination. However, this approach would be inordinately complex for a multi-occupation, multi-disease surveillance type study such as this one, although it could be a fruitful approach for selected occupations and cancer types. A problem with overly restricting the auxiliary diseases or the comparison group is the loss of stability due to smaller numbers.

The MOR approach is superior to the more commonly used proportionate mortality ratio (PMR) approach (see (33) for a full discussion of this point). The MOR has a clear quantitative interpretation as an SMR, with appropriate assumptions. The PMR can be interpreted as an SMR only when the number of deaths from the cause of interest is small in relation to the number of deaths from the auxiliary causes. Thus, for a given cause, the PMR is dependent on the size of the auxiliary cause of death group. The MOR, in contrast, is independent of this factor. This has important practical implications. In this study, we chose the auxiliary cases from a one in four sampling of male deaths for the period under study. Because of the restriction of the size of

the auxiliary group, the interpretation of a PMR analysis on this data would have been seriously compromised. The PMR approach would have necessitated including all male deaths in the study, resulting in a considerable increase in costs.

AGE STANDARDIZATION

Age-standardized MOR analyses were performed for the entire matrix of 397 x 63 occupation-disease combinations, for the ten major occupational groupings, and for the four social classes. The comparison group in the major occupational grouping and social class analyses was all other individuals in the study population. Age stratification was done by five year age groups (20-24, 25-29, etc.). sMORs (33) were calculated for the following age groups: 20-54, 55-64, 65-74, 75+, as well as for the summary age groups 20-64, 20-74, and 55-74 and for the total age range. This was done in order to facilitate looking at occupation-cancer associations as a function of age. This could be valuable for several reasons:

1) Some occupational cancers may occur at an earlier than average age because of a high intensity of exposure.

2) On the other hand, some occupational cancers may concentrate in the 55-74 age group, and not appear at younger ages, because of a long latent period or a long duration of exposure necessary for cancer induction.

3) The accuracy of the cause of death statement and the occupational statement on death certificates has been reported to decrease with increasing age past retirement (9). Thus including the older age groups (especially 75+) in the analysis could dilute out the magnitude of real occupation-cancer associations. On the other hand, if, in fact, the death certificates in the older age groups are not less accurate for many occupations and cancers, excluding them from the analysis would mean a loss of information.

4) Some occupational cancers may occur selectively among younger or older workers due to changes in exposures over the years.

One cannot predict a priori which age grouping would be optimal to examine for a given occupation-cancer combination based on the above considerations. Thus we deemed it valuable to examine the range of age groupings systematically.

In the social class adjusted analysis, summary odds ratios (33) were calculated for mixed social class occupations by summing over the classes.

SIGNIFICANCE TESTING

Significance testing was done using the chi-square test, applying the Mantel-Haenszel principle (35). Significance testing was done for each age grouping studied, but only if four or more deaths were observed in the grouping.

EVALUATION OF CONFOUNDING BY CIGARETTE SMOKING

An evaluation of the effect of confounding by cigarette smoking for cancer of the trachea, bronchus, and lung was done for the major occupational groupings, using a method suggested by Axelson (36) (Appendix K). This method utilizes independently collected data on smoking rates in the major occupational groupings (37) and on lung cancer risk ratios for smokers and ex-smokers (38) to calculate sMORs adjusted for differences in cigarette smoking among the major occupational groupings. Certain limitations of this analysis should be pointed out:

1) This is an indirect method. The smoking rates used were not determined from the population under study, and therefore could be erroneous.

2) Age-specific data for the risk ratios for smokers and ex-smokers was not available. Therefore the same risk ratios were used for all 5-year age groups.

3) Reliable age-specific smoking rates were not available for ages 65 and over, so the analysis was restricted to ages 20-64.

4) The analysis is relatively simplistic, not taking into account factors such as number of cigarettes smoked per day, degree of inhalation, age began smoking, years since last smoked for ex-smokers, etc.

On the positive side, this analysis is relatively simple to perform, and given the data at hand, is the only practical way to attempt to adjust for the effect of cigarette smoking. It can be a valuable exercise if the results are interpreted with the limitations kept in mind.

RESULTS

The basic occupational mortality tables are furnished in the microfiche enclosed in the jacket on the back cover of this report. Complete tables are presented for the following:

1) The standard analysis of the 397 occupational categories (321 individual occupational categories, 70 grouped categories, and 6 large employer categories).
2) The social class adjusted analysis of the 397 occupational categories.
3) The standard analysis of the ten major occupational groupings.
4) The standard analysis of the four social classes.

Observed and expected deaths and sMORs are presented by cause of death for each age grouping. Table 3 is the first page of the printout and illustrates the layout of the tables. Cause of death lines were printed only if there was an observed death. Expected deaths in each age grouping were rounded to the nearest whole number before printing (although they were kept exact for all of the calculations) for convenience of the reader. sMORs are presented as percentages. A dash (-) was printed in place of the sMOR value if the number of observed deaths was one and the number of expected deaths was less than one. This was done to avoid meaninglessly large sMORs. A dash was also printed in the sMOR entry if the expected number of deaths was zero (before rounding). sMOR values (four or more observed deaths) which were significantly elevated or lowered were flagged with asterisks - a single asterisk (*) if $p \leq .05$ (chi-square ≥ 3.84) and a double asterisk (**) if $p \leq .01$ (chi-square ≥ 6.63). N (top right of table) is the number of deaths in the occupational category.

Appendix A presents significant occupation-cancer associations, as well as associations of borderline significance, for the 397 occupational categories and the 10 major occupational groupings. The definition (an arbitrary one) of borderline significance is given in Appendix A. Appendix A also gives an indication of how closely the social class adjusted and unadjusted results corresponded (see explanation of "SC" column in Appendix A). Finally, Appendix A compares the results with the results from the other studies listed in Table 1. The comparison is a qualitative one, using symbols, so that one can quickly assess to what degree a finding in this study is supported by results from other studies (see Appendix A for details).

Appendix B presents by cancer type the highly significant ($p \leq .01$ in the age groupings 20-54, 20-64, 20-74, 55-74, or 20+) occupation-cancer associations for the 397 occupational categories. Occupational categories are listed in the table if the social class unadjusted or social class adjusted results were highly significant. A comparison of the adjusted versus the unadjusted results is presented.

Appendix C shows the mortality patterns, for selected cancer types, of the individual occupational categories which comprise selected grouped categories. Finding similar cancer mortality elevations in occupations with similar exposures is suggestive of a causal association.

TABLE 3

1 ACCOUNTANTS AND AUDITORS N= 385

CANCER		AGE AT DEATH 20-54	55-64	65-74	75+	SUMMARY AGE GROUPS 20-64	20-74	55-74	TOTAL
MALIGNANT NEOPLASMS	OBS	40	39	44	40	79	123	83	163
	EXP	32	62	69	59	94	163	131	222
	MOR	123	63*	64*	68	84	75*	63**	73**
BUCCAL CAVITY AND PHARYNX	OBS	1	1	0	2	2	2	1	4
	EXP	2	3	2	2	5	7	5	9
	MOR	61	34	0	122	43	29	19	46
TONGUE	OBS	0	1	0	0	1	1	1	1
	EXP	1	1	1	0	1	2	1	2
	MOR	0	-	0	0	79	53	72	44
MOUTH	OBS	1	0	0	0	1	1	0	1
	EXP	0	1	1	0	1	2	1	2
	MOR	-	0	0	0	-	65	0	53
PHARYNX	OBS	0	0	0	2	0	0	0	2
	EXP	1	1	1	1	2	3	2	4
	MOR	0	0	0	283	0	0	0	51
DIGESTIVE ORGANS AND PERITONEUM	OBS	11	12	12	7	23	35	24	42
	EXP	9	18	21	20	26	48	39	68
	MOR	127	69	56	35**	88	74	62*	62**
ESOPHAGUS	OBS	0	1	2	1	1	3	3	4
	EXP	1	2	2	1	3	5	4	6
	MOR	0	50	97	68	36	62	74	64
STOMACH	OBS	1	1	2	1	2	4	3	5
	EXP	2	3	4	4	5	9	7	12
	MOR	57	32	53	28	41	46	44	41*
LARGE INTESTINE AND RECTUM	OBS	7	5	5	5	12	17	10	22
	EXP	4	8	11	10	12	23	19	33
	MOR	184	62	47	50	101	75	53	67
LARGE INTESTINE, EXCEPT RECTUM	OBS	4	2	3	1	6	9	5	10
	EXP	3	5	7	7	8	15	13	22
	MOR	159	37	40	15	76	58	39*	45*
CECUM, APPENDIX AND ASCENDING COLON	OBS	1	1	0	0	2	2	1	2
	EXP	0	1	1	1	1	2	1	2
	MOR	-	-	0	0	223	121	70	81

Appendix D presents bar graphs of sMORs as a function of social class for each cause of death category.

Appendix L presents the results of adjusting the lung cancer sMORs for the effects of cigarette smoking in the major occupational groupings.

DISCUSSION

In interpreting the results of this study, numerous factors need to be taken into account. For a given occupation-cancer association, these include:

1) The level of significance of the association.
2) The effects of social class adjustment on the association.
3) The possibility of other confounding factors or biases explaining the association.
4) Whether occupations with similar exposures have an excess of the cancer of interest.
5) The degree to which the association is supported by the studies in Table 1.
6) The degree to which the association is supported by other studies from the literature.
7) Whether reasonable hypotheses can be made as to possible carcinogenic exposures associated with the occupation of interest.

Appendices A-C are presented as aids in interpreting the complete results, which are on the microfiche. Appendix A addresses points 1), 2) and 5); Appendix B addresses points 1), 2), and 4); and Appendix C addresses point 4).

Table 4 presents occupation-cancer associations (other than lung cancer) from this study, which are supported by other studies from the literature, thus addressing point 6). (Table 4 was not based upon a thorough literature search, but upon the authors' current knowledge of the literature.) In addition, Table 5 lists occupational categories which had excess cancer of the trachea, bronchus, and lung in this study, which had substantial support from the studies in Table 1 and other studies from the literature, and for which there are reasonable hypotheses as to possible occupational carcinogens. It thus addresses points 5), 6), and 7).

General principles for assessing the possibility of confounding and biases (point 3)) are presented in the "DEATH CERTIFICATE DATA" and "METHODS OF ANALYSIS" sections. Confounding of the lung cancer results by cigarette smoking is assessed for the major occupational groupings in Appendix L.

We will not attempt to do an exhaustive interpretation of the results in this section, as this would basically duplicate what is already presented in the Appendices and Tables. However, we would like to highlight some results from this study which, in our opinion, are particularly noteworthy.

LUNG CANCER - SMOKING OR OCCUPATION?

In our opinion, the most significant result of this study is the confirmation of an association between cancer of the trachea, bronchus, and lung and a large number of occupations for which there are reasonable hypotheses as to possible occupational carcinogens (Table 5). These include the well established lung cancer elevations among asbestos workers, shipyard workers,

TABLE 4

SOME OCCUPATION-CANCER ASSOCIATIONS (OTHER THAN LUNG CANCER)

SUPPORTED BY STUDIES IN THE LITERATURE OTHER THAN THOSE IN TABLE 1*

Occupation	Cancer	References
11 chemists	pancreas	(39)
131 compositors and typesetters	prostate	(40)
148 jewelers, watchmakers, silversmiths	pancreas	(41)#
202 chemical workers	bladder	(42-44)
243 rubber workers	myeloid leukemia	(45)
249 shoe factory workers	leukemia and aleukemia	(46)
251 leather workers, tanners	bladder	(43)
285 hairdressers and cosmetologists	bladder	(44,47-49)
331 medical workers	bladder	(44,49)
344 carpenters (expanded)	stomach, leukemia, multiple myeloma	(50)
347 plumbers (expanded)	esophagus, lymphatic and hematopoietic tissue	(51)
350 machinists and related occupations	stomach, large intestine, and other digestive system	(27,52,53)
	bladder	(44,48,49)
351 printing trades	buccal cavity and pharynx	(54,55)
359 welders (expanded)	prostate	(56)
389 farmers	multiple myeloma	(57)
393 large employer B - abrasives products	large intestine and rectum	(58)#

* This table was not based upon a thorough literature search, but upon the author's current knowledge of the literature (February, 1982).

The death certificate data used in these studies and this report overlap.

TABLE 5

OCCUPATIONAL CATEGORIES WITH LUNG CANCER EXCESSES, SUPPORT FROM OTHER STUDIES,[#] AND POSSIBLE CARCINOGENIC EXPOSURES*

Occupation	Possible Carcinogenic Exposures[$]	Other Studies[+]
121 bakers	combustion products	
123 boilermakers	asbestos, welding fumes	(59)
125 brickmasons, stonemasons, tile setters	asbestos, cement dust	(60)**
138 heavy equipment, construction equipment operators	gasoline and diesel engine exhaust	(60-62)
154 machinists NEC	cutting fluids, abrasives, metal fumes and dusts	(27,60,63,64)**
158 mechanics and repairmen, automobile;	asbestos, oil mists, gasoline and	(63)**
159 mechanics and repairmen NEC[++]	diesel engine exhaust	(63)**
185 shoemakers and repairers	dyes and glues, leather dust	(63)
190 tinsmiths, coppersmiths, sheet metal workers	welding fumes, asbestos	**
192 tool and die makers, tool makers, etc.	cutting fluids, abrasives, metal fumes and dusts	
211 asbestos and insulation workers	asbestos	(65)
217 bus drivers	gasoline and diesel engine exhaust	
219 clothing pressers	asbestos	(63)
220 conductors, bus and street railway	gasoline and diesel engine exhaust	

TABLE 5 continued

OCCUPATIONAL CATEGORIES WITH LUNG CANCER EXCESSES, SUPPORT FROM OTHER STUDIES,# AND POSSIBLE CARCINOGENIC EXPOSURES*

Occupation		Possible Carcinogenic Exposures$	Other Studies+
244	steelworkers, wire workers	coke oven emissions, oil mists	(66)
255	truck and tractor drivers	gasoline and diesel engine exhaust	(63,67)**
273	cooks, chefs (except private household)	combustion products	(60,63)**
303	fishermen and oystermen	diesel engine exhaust	(27,68)**
306	longshoremen and stevedores	asbestos, pesticides	(63)
344	carpenters (expanded)	asbestos, wood dust	(27,50)
346	painters (expanded)	solvent and paint fumes, asbestos	(60,63)**
347	plumbers (expanded)	asbestos, welding fumes	(27,51,63)**
358	foundry workers (expanded)	silica, polycyclic aromatic hydrocarbons	(69)
360	heated metal workers	metal fumes and dusts	**
372	vehicle drivers	gasoline and diesel engine exhausts	(25,63)**
382	bar workers	smoke filled rooms	(63)
384	custodial, maintenance, cleaning workers	cleaning chemical fumes, asbestos	(63)
395	shipyards	asbestos	(70)

TABLE 5 continued

OCCUPATIONAL CATEGORIES WITH LUNG CANCER EXCESSES, SUPPORT FROM OTHER STUDIES,[#] AND POSSIBLE CARCINOGENIC EXPOSURES*

[#] Studies in Table 1, as well as other studies from the literature.

* Certain largely redundant categories (e.g., "painters, construction and maintenance" is largely redundant with respect to "painters (expanded)") are omitted from the Table for the sake of brevity.

[$] Not a comprehensive list.

[+] Numbers in parentheses are references for studies other than those in Table 1. ** indicates that the association received particularly strong support from the studies in Table 1.

[++] Many or most of these are probably automobile mechanics and repairmen.

and steelworkers. In addition, support for the lung cancer elevations among vehicle drivers (especially truck drivers); painters; heated metal workers; brickmasons, stonemasons, and tilesetters; tinsmiths, coppersmiths, and sheet metal workers; automobile mechanics and repairmen; cooks; machinists; fishermen; and plumbers was particularly strong from the studies in Table 1.

The critical question which must be answered with regard to occupational excesses in lung cancer mortality is whether the excesses are the result of occupational exposures, or whether they can be explained by differences in cigarette smoking habits among occupations. Given the large number of occupations with potential carcinogenic exposures which have consistently shown lung cancer elevations from study to study, and given the large number of workers in these occupations, this is a pressing question. It has not yet been adequately addressed, especially given that the scanty evidence which does exist indicates that much of the excesses cannot be explained by cigarette smoking. For example, in the Third National Cancer Survey and Roswell Park studies, which had smoking histories for each subject, most associations between occupation and lung cancer remained unchanged upon controlling for cigarette smoking. In addition, about half the occupation-lung cancer associations in the 1970-72 England and Wales study could not be explained by social class adjustment, which should at least partially control for cigarette smoking.

In the present study, social class adjustment uniformly weakened significant and borderline significant occupation-lung cancer associations with likely occupational exposures (those in Table 5 as well as others). However, the social class adjusted sMORs remained either significantly or borderline significantly elevated in about 80 percent of the cases.

At least two factors can contribute to the effects of social class adjustment on lung cancer sMORs. First, since virtually all of the occupations with likely exposures are in Social Classes 3 and 4, which tend to have higher smoking rates than Classes 1 and 2, social class adjustment should lower the lung cancer sMORs by at least partially controlling for cigarette smoking. Secondly, occupations with likely occupational exposures which have exhibited lung cancer elevations in this and/or other studies include well over half the total number of subjects in Social Classes 3 and 4. If, in fact, an appreciable number of the lung cancer deaths in these occupations are contributed to in some way by occupation, concentrating them in the comparison group through the social class adjusted analysis would lower the sMORs as well.

There is no way, with the data available, to determine the relative importance of these two factors. However, adjusting for differences in smoking habits among the major occupational groupings does not explain most of the differences in lung cancer sMORs among these groupings (Appendix L), suggesting that these differences could be due to occupational exposures. Except for clerical and kindred workers, the major occupational groupings which one would expect to have little occupational exposure (professional, technical, and kindred workers; managers, officials, proprietors, except farm; sales workers; service workers; and farmers) had low sMORs after smoking adjustment. And excluding laborers (except farm), the major occupational

groupings which might have substantial occupational exposures (craftsmen, foremen, and kindred workers; operatives) had high sMORs after smoking adjustment. The discrepancy for laborers (except farm) could be explained if all of the results for this group were generally underestimated due to a high mortality rate in the auxiliary disease group, as discussed earlier. In fact, many of the results for this grouping seemed to be lower than one might expect. The discrepancy for clerical and kindred workers is not readily explainable.

A similar exercise in smoking adjustment was performed on data from California deaths 1949-51 (27). Managers, and possibly professional and clerical workers had fewer lung cancer deaths than expected by their smoking habits, while laborers and service workers (mainly due to cooks) had more lung cancer deaths than expected.

Doll and Peto have estimated that roughly 15 percent of the cases of lung cancer in the United States can be attributed to occupational factors, although they think that this estimate might be on the high side (71). They propose a large scale national case-control study of lung cancer to address this issue. We strongly support this proposal.

COMMENTS ON SELECTED ASSOCIATIONS

Truck and tractor drivers

Truck and tractor drivers (the vast majority being truck drivers) exhibited cancer excesses over the entire respiratory system and upper alimentary tract - buccal cavity and pharynx; esophagus; nose and nasopharynx; larynx; and trachea, bronchus, and lung. The excesses for esophagus; nose and nasopharynx; and trachea bronchus and lung were highly significant in both the social class adjusted and unadjusted analyses (Appendix B), and the chi-square value for respiratory cancers was the highest for any occupation-cancer combination in the study with five or more observed deaths. The generalized lung cancer excesses among other vehicle drivers (Appendix C.13), although not as extreme, provides additional support for the association.

These excesses can be due to lifestyle (cigarette smoking and alcohol consumption), occupational exposure to gasoline and diesel engine exhaust, or a combination of the two. Cigarette smoking is causally related to all of the above cancers, and truck drivers have been reported to be heavy cigarette smokers (37). Alcohol consumption is causally related to cancers of the buccal cavity and pharynx and esophagus. The excess of cirrhosis of the liver seen in this study suggests excessive alcohol consumption among truck drivers. On the other hand, diesel exhaust has been reported to contain carcinogenic substances (72). Furthermore, the excess of lung cancer among truck drivers seen in the Third National Cancer Survey study remained unchanged after controlling for cigarette smoking based upon smoking histories for each subject. Given the highly significant excesses and the support that these results have from other studies (especially for the lung cancer excess) (Appendix A, Table 5), further investigation is clearly needed.

Machinists and related occupations

The excesses of cancers of the stomach (see Appendix C.5), large intestine, rectum, trachea, bronchus and lung, and bladder, as well as leukemia and aleukemia, are supported by other studies in Table 1 (see 154 "machinists" and 192 "tool and die makers, tool makers, etc." in Appendix A). The excesses of stomach, colorectal, lung and bladder cancer are also supported by other studies from the literature (Tables 4 and 5). Possible etiologic agents include cutting fluids and synthetic abrasives.

Of special interest are the results in the 20-54 age group. The excess of lung cancer was concentrated in this group (Appendix C.5), as was the excess of colorectal cancer among machinists, the dominant individual occupational category in this group. In addition, colorectal cancer in the 20-54 age group was highly significantly elevated among workers employed by large employer A, whose manufacturing facilities include a large proportion of machining operations. This elevation is largely independent of the excess among machinists, with only three of the 12 large employer A's and the 15 machinists' colorectal cancers overlapping.

Printing trades and cancers of the buccal cavity and pharynx

The highly significant excess of cancers of the buccal cavity and pharynx found in the printing trades (Appendix C.6) was confirmed by other studies in Table 1, and by other more in-depth studies from the literature (Table 4). Printing workers have a variety of exposures, including oil and ink mists and solvents. The highly significant excess of cancers of the buccal cavity and pharynx among artists and art teachers, who also have exposure to inks, lends added weight to this association.

Prostate cancer and exposure to cadmium

Three of the occupational categories with highly significant excesses of cancer of the prostate (Appendix B) - compositors and typesetters; painters, construction and maintenance; and welders (expanded) - have potential exposure to cadmium. Cadmium exposure has been linked to prostate cancer (56,73). While there was no support for the association between these occupations and prostate cancer from the other studies in Table 1, studies from the literature support the prostatic cancer excesses for compositors and typesetters (40) and welders (56).

Malignant neoplasms

The significant excess of all malignant neoplasms among chemical workers; heated metal workers (Appendix C.8); and chemists (expanded) is of interest because of the large number of potential carcinogenic exposures in each of these groups.

Cirrhosis of the liver

Cirrhosis of the liver is a disease highly associated with alcoholism. Cancers of the buccal cavity and pharynx, esophagus, larynx, and biliary passages and liver are also known to be associated with an excesive use of alcohol (19). Alcohol is thought to act synergistically with cigarette smoke in causing cancers of the buccal cavity and pharynx, esophagus, and larynx. Thus bar workers and cooks and chefs, both of whom have ready access to alcoholic beverages, and have been reported to be heavy smokers (37) have excesses of all of these alcohol-related diseases.

Occupations with excess cirrhosis of the liver which have potential exposure to liver toxins are laundry and dry cleaning workers; paper and pulp mill workers; and leather workers and tanners. The excess among laundry and dry cleaning workers is supported by other studies in Table 1. Among the solvents used in dry cleaning operations are carbon tetrachloride, perchloroethylene, and trichloroethylene - known liver toxins.

SOCIAL CLASS AND CANCER MORTALITY

Appendix D shows mortality from all malignant neoplasms combined to be largely social class independent, except for a small but highly significant elevation in Social Class 3. However, for a number of specific cancer categories, social class mortality gradients were seen.

Gradients increasing from Social Class 1 to Social Class 4 were seen for buccal cavity and pharynx; esophagus; stomach; rectum; larynx; trachea, bronchus, and lung; acute and chronic lymphatic leukemia; polycythemia vera; and cirrhosis of the liver. The gradients for buccal cavity and pharynx; larynx; trachea, bronchus, and lung; polycythemia vera; and cirrhosis of the liver were particularly pronounced.

Gradients decreasing from Social Class 1 to Social Class 4 were seen for large intestine, except rectum; connective and soft tissue; malignant melanoma; prostate; eye; brain and nervous system; lymphomas; multiple myeloma; myeloid leukemia; morocytic leukemia; and acute erythremia. All of these gradients, except for prostate and multiple myeloma, were pronounced.

The gradients for esophagus; stomach; larynx; trachea, bronchus, and lung; and brain and nervous system had strong support from other similar studies (3,4,9,27,34).

COMMENTS ON METHODOLOGY

Social class adjustment

In general, the social class adjusted and unadjusted results were surprisingly similar. Seventy-seven percent of the associations presented in Appendix A were significant or borderline significant in both the social class adjusted and unadjusted analyses. Sixty-seven percent of the associations presented in Appendix B were significant at the $p \leq .01$ level in both analyses, with ninety-six percent significant at either the $p \leq .01$ or $p \leq .05$ level in both

analyses. As one might expect, social class adjustment generally made the greatest difference in the cancer categories which exhibited the steepest social class mortality gradients.

Analysis by age groupings

Forty-three percent of the associations listed in Appendix B were significant at the $p \leq .01$ level in the age groupings 20-54, 20-64, 20-74, and/or 55-74, but not in the 20+ age grouping. Twenty-five percent of the associations listed in Appendix B were significant at the $p \leq .01$ level in the age groupings 20-54, 20-64, 20-74, and/or 55-74, but were significant neither at the $p \leq .01$ nor the $p \leq .05$ level in the 20+ age grouping. Thus many associations would have been missed if the analyses had been restricted to the all 20+ age grouping. Undoubtedly, many of the associations found only in the narrower age groupings were due to chance. However, a number of associations with reasonable hypotheses as to possible occupational carcinogens and/or with support from other studies were found to be highly significant in narrower age groupings, but not significant at all in the all 20+ age grouping. For example, the results for machinists and related occupations in the 20-54 age grouping were discussed in the "DISCUSSION, OTHER SELECTED ASSOCIATIONS, Machinists and related occupations" section.

Codes

Having detailed cause of death and occupational codes proved to be worthwhile, as associations of interest were found which would have been missed if the codes were less detailed. Two examples are the highly significant excesses of myeloid leukemia among rubber workers and prostate cancer among compositors and typesetters. The associations, which are supported by the literature, and for which there are reasonable hypotheses as to possible carcinogenic exposures, would have been missed if myeloid leukemia had not been examined separately from leukemia and aleukemia and if compositors and typesetters had not been examined separately from other printing trades.

On the other hand, significant associations of interest were seen in grouped categories which were not significant in any of the individual categories which make up the grouped categories. For example, while stomach cancer was significantly elevated in grouped code 350 "machinists and related occupations," it was not significantly elevated in any of the eight individual occupational categories which make up this group.

Possible biases

Several occupational categories had surprisingly low or surprisingly high mortality rates for all malignant neoplasms. In these cases, low or high mortality rates for the auxiliary causes of death could be creating artifactually high or low cancer mortality rates. Occupational categories with surprisingly low cancer rates include fuel oil truck drivers and laborers; stationary firemen; constuction laborers NEC; and roofers and slaters. Occupational categories with surprisingly high cancer rates include teachers and administrators, college and university; lawyers, judges, and attorneys; and agricultural scientists.

REFERENCES

1. Milham, S. 1976. NIOSH Research Report: Occupational Mortality in Washington State 1950-1971. Vol. 1-3. National Institute for Occupational Safety and Health (HEW Publication No. (NIOSH) 76-175), Cincinnati.

2. Petersen, G.R., Milham S. 1980. NIOSH Research Report: Occupational Mortality in the State of California 1959-1961. National Institute for Occupational Safety and Health (DHEW (NIOSH) Publication No. 80-104), Cincinnati.

3. Registrar General. 1978. Decennial Supplement for England and Wales, 1970-72: Occupational Mortality. Her Majesty's Stationery Office, London.

4. Guralnick, L. 1963. Mortality by Occupation and Cause of Death Among Men 20 to 64 Years of Age, United States, 1950. Public Health Service (Vital Statistics - Special Reports 53: numbers 1-5), Washington, D.C.

5. Williams, R.R., Stegens, N.L., Goldsmith, J.R. 1977. Associations of cancer site and type with occupation and industry from the Third National Cancer Survey Interview. J. Natl. Cancer Inst. 59:1147-1185.

6. Menck, H.R., Mack, T.M. 1979. A proportional analysis of the anatomic site distribution of cancer by occupation, males - Los Angeles County 1972-1977. Unpublished.

7. Decoufle, P., Stanislawczyk, K., Houten, L. Bross, I.D.J., Viadana, E. 1977. NIOSH Research Report: A Retrospective Survey of Cancer in Relation to Occupation. National Institute for Occupational Safety and Health (DHEW (NIOSH) Publication No. 77-178), Cincinnati.

8. Gute, D.M. 1981. The Association of Occupation and Industry with Mortality in Rhode Island (1968-1972). Rhode Island Department of Health (Technical Report No. 23, Health Planning and Development), Providence.

9. Registrar General. 1971. Decennial Supplement, England and Wales, 1961: Occupational Mortality Tables. Her Majesty's Stationery Office, London.

10. Registrar General. 1972. Statistical Review of England and Wales for the Two Years 1966-67. Supplement on Cancer. Her Majesty's Stationery Office, London.

11. Registrar General. 1975. Statistical Review of England and Wales for the Three Years 1968-70. Supplement on Cancer. Her Majesty's Stationery Office, London.

12. Kendrick, M., Fuentes, R. 1967. Occupational Characteristics of Disabled Workers, by Disabling Condition: Disability Insurance Benefit Awards Made in 1959-1962 to Men Under Age 65. Public Health Service and Social Security Administration (PHS Publication No. 1531), Washington, D.C.

13. Kennedy J, Fischbach TJ, Green JH, Leihy RF. 1980. NIOSH Research Report. Occupational Characteristics of Disabled Workers: Analysis of Social Security Disability Benefit Awards to Workers During 1969-1972. National Institute for Occupational Safety and Health (DHHS (NIOSH) Publication No. 80-145), Cincinnati.

14. Kaminski, R., Spirtas, R. 1980. NIOSH Research Report: Industrial Characteristics of Persons Reporting Morbidity During the Health Interview Surveys Conducted in 1969-1974: An Exploratory Review. National Institute for Occupational Safety and Health (DHHS (NIOSH) Publication No. 80-123), Cincinnati.

15. Copplestone, J.F. 1967. Occupational Mortality Among Male Population, Other Than Maori, 20 to 64 Years of Age (Based on Deaths, 1959-63 and Population Census, 1961). National Health Statistics Centre (Special Report No. 28), Wellington, New Zealand.

16. Society of Actuaries. 1967. 1967 Occupation Study. Society of Actuaries, Chicago.

17. Adelstein, A.M. 1972. Occupational mortality: cancer. Ann. Occup. Hyg. 15:53-57.

18. U.S. Department of Health, Education and Welfare. 1967. International Classification of Diseases, Eighth Revision, Adapted for Use in the United States. U.S. Government Printing Office (PHS Publication No. 1693), Washington, D.C.

19. Rothman, K.J. 1975. Alcohol. In: Fraumeni, J.F., Ed. Persons at High Risk of Cancer: An Approach to Cancer Etiology and Control. pp. 139-150. Academic Press, New York.

20. Gittelsohn A., Senning J. 1979. Studies on the reliability of vital and health records: I. Comparison of cause of death and hospital record diagnoses. Am. J. Public Health 69:680-689.

21. Percy C., Stanek E., Gloeckler L. 1981. Accuracy of cancer death certificates and its effect on cancer mortality statistics. Am. J. Public Health 71:242-250.

22. Bauer F.W., Robbins S.L. 1972. An autopsy study of cancer patients I. Accuracy of the clinical diagnoses (1955 to 1965) Boston City Hospital. J. Am. Med. Assoc. 221:1471-1474.

23. Engel, L.W., Strauchen, J.A., Chiazze, L., Heid, M. 1980. Accuracy of death certification in an autopsied population with specific attention to malignant neoplasms and vascular disease. Am. J. Epidemiology 111:99-112.

24. Heasman, M.A., Lipworth, L. 1966. Accuracy of Certification of Cause of Death. Her Majesty's Stationery Office (Studies on Medical and Population Subjects No. 20.), London.

25. Wegman, D.H., Peters, J.M. 1978. Oat cell lung cancer in selected occupations: a case-control study. J. Occupational Medicine 20:793-796.

26. Buechley, R., Dunn, J.E., Linden, G., Breslow, L. 1956. Death certificate statement of occupation: its usefulness in comparing mortalities. Pub. Health Reports 71:1105-1111.

27. Buell, P., Dunn, J.E., Breslow, L. 1960. The occupational-social class risks of cancer mortality in men. J. Chron. Dis. 12:600-621.

28. U.S. Bureau of the Census. 1971. 1970 Census of Population Alphabetical Index of Industries and Occupations. U.S. Government Printing Office, Washington, D.C.

29. Bureau of Research and Statistics, Massachusetts Department of Commerce and Development. 1974. Industrial Directory of Massachusetts Manufacturers, 1974-1975 edition. Commonwealth of Massachusetts, Boston.

30. Office of Management and Budget. 1972. Standard Industrial Classification Manual. U.S. Government Printing Office, Washington, D.C.

31. Duncan, O. 1961. A socioeconomic index for all occupations. In: Reiss, A.J., Ed. Occupations and Social Status. Free Press, New York.

32. Stevens, G., Featherman, D.L. 1981. A revised socioeconomic index of occupational status. Social Sciences Research 10:364-395.

33. Miettinen, O.S., Wang, J.D. 1981. An alternative to the proportionate mortality ratio. Am. J. Epidemiology 114:144-148.

34. Kitagawa, E.M., Hauser, P.M. 1973. Differential Mortality in the United States: A Study in Socioeconomic Epidemiology. Harvard University Press, Cambridge.

35. Mantel, N., Haenszel, W. 1959. Statistical aspects of the analysis of data from retrospective studies of disease. J. Natl. Cancer Inst. 22:719-748.

36. Axelson, O. 1978. Aspects of confounding in occupational health epidemiology. Scand. J. Work Environ. Health 4:85-89.

37. Sterling, T.D., Weinkam, J.J. 1976. Smoking characteristics by type of employment. J. Occupational Medicine 18:743-754.

38. Kahn, H.A. 1966. The Dorn study of smoking and mortality among U.S. veterans: report on eight and one-half years of observation. In: Haenzel, W., Ed. Epidemiological Approaches to the Study of Cancer and Other Chronic Diseases. pp. 1-125. National Cancer Institute (Monograph 19), Bethesda.

39. Li, F.P., Fraumeni, J.F., Mantel, N., Miller, R.W. 1969. Cancer mortality among chemists. J. Natl. Cancer Inst. 43:1159-1164.

40. Ernster, V.L., Selvin, S., Brown, S.M., Sacks, S.T., Winkelstein, W., Austin, D.F. 1979. Occupation and prostatic cancer: a review and retrospective analysis based on death certificates in two California counties. J. Occupational Medicine 21:175-183.

41. Sparks, P.J., Wegman, D.H. 1980. Cause of death among jewelry workers. J. Occupational Medicine 22:733-736.

42. Hueper, W.C. 1969. Occupational and Environmental Cancers of the Urinary System. Yale University Press, New Haven.

43. Cole, P., Hoover, R., Friedell, G.H. 1972. Occupation and cancer of the lower urinary tract. Cancer 29:1250-1260.

44. Howe, G.R., Burch, J.D., Miller, A.B., Cook, G.M., Esteve, J., Morrison, B., Gordon, P., Chambers, L.W., Fodor, G., Winsor, G.M. 1980. Tobacco use, occupation, coffee, various nutrients, and bladder cancer. J. Natl. Cancer Inst. 64:701-713.

45. McMichael, A.J., Spirtas, R., Kupper, L.L., Gamble, J.F. 1975. Solvent exposure and leukemia among rubber workers: an epidemiologic study. J. Occupational Medicine 17:234-239.

46. Aksoy, M., Erdem, S., DinCol, G. 1974. Leukemia in shoeworkers exposed chronically to benzene. Blood 44:837-841.

47. Wynder, E.L., Onderdonk, J., Mantel, N. 1963. An epidemiological investigation of cancer of the bladder. Cancer 16:1388-1407.

48. Dunham, L.J., Rabson, A.S., Stewart, H.L., Frank, A.S., Young, J.L. 1968. Rates, interview, and pathology study of cancer of the urinary bladder in New Orleans, Louisiana. J. Natl. Cancer Inst. 41:683-709.

49. Anthony, H.M., Thomas, G.M. 1970. Tumors of the urinary bladder: an analysis of the occupations of 1,030 patients in Leeds, England. J. Natl. Cancer Inst. 45:879-895.

50. Milham, S. 1978. NIOSH Research Report: Mortality Experience of the AFL-CIO United Brotherhood of Carpenters and Joiners of America 1969-1970 and 1972-1973. National Institute for Occupational Safety and Health (DHEW (NIOSH) Publication No. 78-152), Cincinnati.

51. Kaminski, R., Geissert K.S., Dacey, E. 1980. Mortality analysis of plumbers and pipefitters. J. Occupational Medicine 22:183-189.

52. Decoufle, P. 1978. Further analysis of cancer mortality patterns among workers exposed to cutting oil mists. J. Natl. Cancer Inst. 61:1025-1030.

53. Jarvholm, B., Lillienberg, L., Sallsten, G., Thiringer, G., Axelson, O. 1981. Cancer morbidity among men exposed to oil mist in the metal industry. J. Occupational Medicine 23:333-337.

54. Nicholson, W.J., Seidman, H., Hoos, D., Selikoff, I.J. 1981. The mortality experience of New York City newspaper pressmen 1950-1976. In: Kraybill, H.F., Blackwood, I.C., Freas, N.B., Eds. Proceedings of the Second NCI/EPA/NIOSH Collaborative Workshop: Progress on Joint Environmental and Occupational Cancer Studies. pp. 218-140. National Cancer Institute, Rockville, MD.

55. Lloyd, J.W., Decoufle, P., Salvin, L.G. 1977. Unusual mortality experience of printing pressmen. J. Occupational Medicine 19:543-550.

56. Kolonel, L., Winkelstein, W. 1977. Cadmium and prostatic carcinoma. Lancet 2:566-567.

57. Milham, S. 1971. Leukemia and multiple myeloma in farmers. Am. J. Epidemiology 94:307-310.

58. Wegman, D.H., Eisen, E.A. 1981. Causes of death among employees of a synthetic abrasive product manufacturing company. J. Occupational Medicine 23:748-754.

59. Beaumont, J.J., Weiss, N.S. 1980. Mortality of welders, shipfitters, and other metal trades workers in Boilermakers Local No. 104, AFL-CIO. Am. J. Epidemiology 112:775-786.

60. Breslow, L., Hoaglin, L., Rasmussen, G., Abrams, H.K. 1954. Occupations and cigarette smoking as factors in lung cancer. Am. J. Public Health 44:171-181.

61. Tsuchiya, K. 1965. The relation of occupation to cancer, especially cancer of the lung. Cancer 18:136-144.

62. Decoufle, P., Lloyd, J.W., Salvin, L.G. 1977. Causes of death among construction machinery operators. J. Occupational Medicine 19:123-128.

63. Menck, H.R., Henderson, B.E. 1976. Occupational differences in rates of lung cancer. J. Occupational Medicine 18:797-801.

64. Waldron, H.A. 1975. The carcinogenicity of oil mist. Brit. J. Cancer 32:256-257.

65. Selikoff, I.J., Churg, J., Hammond, E.C. 1964. Asbestos exposure and neopasia. J. Am. Med. Assoc. 188:22-26.

66. Redmond, C.K., Wieand, H.S., Rockette, H.E., Sass, R., Weinberg, G. 1981. NIOSH Research Report: Long-Term Mortality Experience of Steelworkers. National Institute for Occupational Safety and Health (DHHS (NIOSH) Publication No. 81-120), Cincinnati.

67. Luepker, R.V., Smith, M.L. 1978. Mortality in unionized truck drivers. J. Occupational Medicine 20:677-682.

68. Frazier, T.M., Wegman, D.H. 1979. Exploring the use of death certificates as a component of an occupational health surveillance system. Am. J. Public Health 69:718-720.

69. Palmer W.G., Scott W.D. 1981. Lung cancer in ferrous foundry workers: a review. Am. Ind. Hyg. Assoc. J. 42:329-340.

70. Blot, W.J., Harrington, J.M., Toledo, A., Hoover, R., Heath, C.W., Fraumeni, J.F. 1978. Lung cancer after employment in shipyards during World War II. New England J. Med. 299:620-624.

71. Doll, R., Peto, R. 1981. The causes of cancer: quantitative estimates of avoidable risks of cancer in the United States today. J. Natl. Cancer Inst. 66:1191-1308.

72. Schenker, M.B. 1980. Diesel exhaust - an occupational carcinogen? J. Occupational Medicine 22:41-46.

73. Lemen, R.A., Lee, J.S., Wagoner, J.K., Blejer, H.P. 1976. Cancer mortality among cadmium production workers. Ann. N.Y. Acad. Sci. 271:273-279.

74. Bailar, J.C., Ederer, F. 1964. Significance factors for the ratio of a Poisson variable to its expectation. Biometrics 20:639-643.

APPENDIX A

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES

This table presents significant occupation-cancer associations, as well as associations of borderline significance (defined below), for the 397 occupational categories and the 10 major occupational groupings. It also compares these results with the results from the other studies listed in Table 1. The comparison is a qualitative one using symbols, so that one can quickly assess to what degree a finding in the present study is supported by results from other studies. "+" indicates that the result was significant in the other study; "=" indicates that the result was of borderline significance; "-" indicates that the result was elevated, although not significant or borderline significant; and "0" indicates that there was no support for the finding in the other study. If the particular occupation- cancer combination was not examined in the other study or if there were no observed deaths, the entry was left blank. The entry was also left blank if there was one observed death and a mortality ratio greater than 100. Results are presented in occupational code order. The results for the major occupational groupings are presented at the end of the table. The number directly after the occupational category title is the number of subjects who are classified into that category.

To be eligible for this table, an occupation-cancer association had to be significant ($p \leq .05$) or borderline significant in one or more of the age groupings 20-54, 20-64, 20-74, 55-74, and 20+ in either the standard or the social class adjusted analysis. [A small number of entries in the table did not fit these criteria. They were sub-classifications of broader cancer classifications which did meet these criteria. (For example, leukemia and aleukemia is a sub-classification of lymphatic and hematopoietic tissue). They were included in the table because their sMORs were also raised and were directly comparable to cancer categories in some of the other studies which did not present data for the broader classification. Such entries are enclosed in parentheses (e.g., (bladder) under code 36 "engineers NEC").]

For the sake of brevity, under a given occupational code, redundant results were omitted from the table. For example, both "brain and nervous system" and "brain" are significantly elevated under individual code 1 "accountants and auditors". The results for cancer of the brain were omitted from the table. In these situations, the authors used their judgement as to which results would be of most interest.

Borderline significance is defined (arbitrarily) as follows:

Observed deaths	sMOR
4-6	$\geq$ 300, but not significant
7-9	$\geq$ 200, but not significant
10-19	$\geq$ 150, but not significant
$\geq$ 20	$\geq$ 120, but not significant

In the "MORTALITY ODDS RATIO" columns, the number in parentheses indicates the number of observed deaths, and a "+" indicates p $\leq$.05.

The "SC" column indicates whether the association was seen in the unadjusted analysis (u), the social class adjusted anaylsis (a), or both (b). An association was considered to be seen in both analyses if the results were at least borderline significant in both. The results presented when the association was seen in both analyses are the unadjusted results.

The other studies to which the results were compared are as follows:

1. Washington State 1950-71 (1)
2. California 1959-61 (2)
3. England and Wales 1970-72 (3)
4. United States 1950 (4)
5. Third National Cancer Survey 1969-71 (5)
6. Los Angeles County 1972-77 (6)
7. Roswell Park 1956-65 (7)
8. Rhode Island 1968-72 (8)
9. England and Wales 1959-63 (9)
10. England and Wales 1966-67 (10)
11. England and Wales 1968-70 (11)

Frequently, a comparable occupational category was not examined in some or all of the other studies. Also, some of the cancer categories were not examined in some of the other studies. This accounts for the many blanks in the "OTHER STUDIES" columns of the table.

In many cases, the occupational title of the category in this study and that in the study to which it was being compared did not exactly correspond. (For example, code 138, "heavy equipment, construction equipment operators" was compared with "operators of earth moving and other construction machinery n.e.c." in the 1970-72 England and Wales study). In a few cases, comparison was made with more than one category from another study. (For example, individual code 202 "chemical workers" was compared with two categories from the United States study: "operators and kindred workers (n.e.c.), chemical

and allied products" and "laborers (n.e.c.), chemical and allied products"). In these cases, the symbol entered in the "OTHER STUDIES" column was for the comparison which yielded the most positive result.

In a few cases, more than one category from this study was compared with a single category from another study. (For example, the category "carpenters and joiners" from the 1970-72 England and Wales study was compared with individual code 129 "carpenters" and grouped code 344 "carpenters (expanded)"). Documentation on specific comparisons which were made is available upon request.

The meaning of the symbols in the "OTHER STUDIES" columns is as follows:

"+" - the association was indicated to be significant in the other study, for four or more observed deaths. The criteria for significance in the other studies were as follows:

1. Washington State: chi-square, $p \leq .05$. The test was performed if there were six or more observed deaths.

2. California: chi-square, $p \leq .05$. The test was performed if there were six or more observed deaths.

3. England and Wales 1970-72: Poisson (74), or ranked chi-square (an a posteriori test) (3), $p < .01$. The test was performed on the PMR results for ages 15-64. It is not clear from the text which test was used. In addition, the ranked chi-square test was performed on SMR results for the occupational orders (the broader classification) for ages 15-64.

4. United States: chi-square, $p \leq .05$. The test was performed on the PMR results, 20 or more observed deaths.

5. Third National Cancer Survey: chi-square, $p < .05$ for the summary relative odds in any of the six stratification sets used (age and race; education, age and race; smoking, age and race; smoking, age, race, and education; alcohol, smoking, age, race, and education; or age, race, education, smoking, alcohol, and geographic location); or summary relative odds > 2.0 based on five or more exposed patients with at least one significant chi-square in any of the 27 strata subtotal results.

6. Los Angeles County: not tested. For the purposes of this comparison, we applied the Poisson test (74), $p \leq .05$, to these results.

7. Roswell Park: chi-square, $p < .05$. The test was performed on the results for men ever employed in the occupation, men employed at least five years, and on the smoking-adjusted results. If the association was significant in any one of these three analyses, a "+" was assigned.

8. Rhode Island: Poisson, $p < .05$. The test was performed on both the SMR and PMR results, ages 16-64, and the PMR results, ages 65+. If the association was significant in any one of these cases, a "+" was assigned.

9. England and Wales 1959-63: ranked chi-square, $p < .05$. The test was performed on the PMR results, ages 25-75, for the occupational orders (broader classification) only (17). In addition, a chi-square test (chi-square > 6.25) was performed on the SMR results, ages 15-64, for the occupational orders only. No statistical test was performed on the occupational unit (more detailed classification) results. We did not apply the Poisson test to these results, as we did to the Los Angeles County results, because for ages 15-64 SMR results are presented, and SMRs generally are not as reliable as PMRs in this type of study for the occupational units.

10. England and Wales 1966-67: chi-square, $p < .01$. A few results were indicated as $p < .05$, but a complete analysis for $p < .05$ was not presented. It is not clear from the text whether the test was a standard a priori test or a ranked chi-square a posteriori test (3).

11. England and Wales 1968-70: chi-square, $p < .01$. A few results were indicated as $p < .05$, but a complete analysis for $p < .05$ was not presented. It is not clear from the text whether the test was a standard a priori test or a ranked chi-square a posteriori test (3).

"=" - the association was of borderline significance for four or more observed deaths according to the criteria listed above. Since the statistical testing in the England and Wales 1970-72, 1966-67, and 1968-70 studies was at the $p < .01$ level, some of the results assigned to borderline significance from these studies would have been found to be significant if they had been tested at the $p < .05$ level. Since statistical testing was not done on the occupational units in the England and Wales 1959-63 study, borderline significance is the highest rating these results could achieve in this comparison.

The Washington State and California studies presented results for the age grouping 20-64, although no significance testing was done on this age grouping. If the criteria for borderline significance were met for either the 20+ age grouping or the 20-64 age grouping, a "=" was assigned.

The England and Wales 1970-72 and 1959-63 studies presented SMR results for ages 15-64, and PMR results for ages 65-74. If the criteria for borderline significance were met for either age grouping, or for the weighted average of the two results, a "=" was assigned.

As noted above, the Roswell Park study presents results for men ever employed in the occupation, men employed at least five years, and smoking-adjusted results. The Rhode Island study presents SMR and PMR results, ages 16-64, and PMR results, ages 65+. In both of these studies, if the criteria for borderline significance were met for any one of the three analyses, a "=" was assigned. In the Rhode Island study, if the weighted average of either the SMR or PMR results for ages 16-64 and the PMR results for ages 65+ was borderline significant, a "=" was assigned as well.

"-" - the association was not significant or borderline significant, but the mortality index was $\geq$ 110 for four or more observed deaths, or $\geq$ 120 for two or three observed deaths.

In the Washington State and California studies, if the results for the 20+ age grouping did not meet these criteria, but the PMR for age group 20-64 was $\geq$ 120 with four or more observed deaths, while not being borderline significant, a "-" was assigned.

In the England and Wales 1970-72 and 1959-63 studies, the weighted average of the 15-64 and 65-74 age group results had to meet the criteria in order for a "-" to be assigned. If either the 15-64 or 65-74 age group result was $\geq$ 120, but not borderline significant or significant, a "-" was assigned as well.

In the Roswell Park study, the weighted average of the results for men ever employed, men employed at least five years, and the smoking adjusted results had to meet the criteria in order for a "-" to be assigned. If any one of the three results was $\geq$ 120, but not borderline significant or significant, a "-" was assigned as well.

In the Rhode Island study, the weighted average of either the SMR or PMR results for age group 16-64 and the PMR results for age group 65+ had to meet the criteria in order for a "-" to be asigned. If any one of the three results was $\geq$ 120, but not borderline significant or significant, a "-" was assigned as well.

"0" - there was one or more observed death, and the criteria for "+", "=", and "-" were not met.

While most of the cancer categories were directly comparable with those from the other studies, a few adjustments had to be made. These are shown in Table A-1.

The cases in which a cancer category from this study was compared with more than one category from another study (see Table A-1) were handled as follows: If the result for any one of the categories from the other study met the criteria for significance or borderline significance, a "+" or "=" was assigned, respectively. If the weighted average of the results for the categories from the other study was borderline significant, a "=" was assigned. Otherwise, if the result for any of the categories was $\geq$ 120 or the weighted average was $\geq$ 110, a "-" was assigned.

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES

Individual occupational codes 1-20

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
1 accountants and auditors 385																	
rectum and rectosigmoid junction		193(5)	136(7)	113(5)	160(11)	a	0	0	=		0	0					
rectosigmoid junction			708(4)+		596(5)+	b											
brain and nervous system	370(6)+	219(8)+	173(8)		180(9)	b	=	0		=		0				-	+
2 analysts and consultants NEC 25																	
malignant neoplasms	325(5)	84(7)	91(11)	57(6)	93(12)	b											
7 artists and art teachers 64																	
buccal cavity and pharynx					364(4)+	b		-									
9 chiropodists 10																	
digestive organs and peritoneum			1058(4)+	1058(4)+	300(4)	b											
11 chemists 46																	
malignant neoplasms	752(5)	107(8)	134(20)	105(15)	121(25)	b	0	0	0	-							
pancreas					362(4)+	b	=	-									
13 clergymen 124																	
sigmoid colon					411(4)+	b											
(large intestine, except rectum)			105(4)	130(4)	130(8)		=	0		+	0	-					
biliary passages and liver					408(4)+	b	-	0									
malignant melanoma of skin					653(4)+	b	=					=					
20 professors/instructors, nonsci-																	
entific subjects 22																	
digestive organs and peritoneum			425(6)+	676(5)+	240(7)	b											

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 21-30

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
21 professors/instructors, subject not																	
specified 42																	
malignant neoplasms	125(6)	251(12)	196(19)	265(13)	198(26)+	b											
large intestine, except rectum		996(4)+	635(6)+	920(5)+	522(7)+	b											
26 draftsmen 74																	
malignant neoplasms	169(12)	161(18)	137(29)	120(17)	122(36)	b	=	+	0	0					0		
stomach			342(4)+		236(4)	b	-	0	0			0			0		
trachea, bronchus, and lung		183(5)	187(10)	190(7)	161(11)	a	-	-	0			0			0		
cirrhosis of the liver	340(6)+	302(7)+	261(8)+		278(9)+	a	-	0	0						0		
27 editors and reporters, journalists 45																	
trachea, bronchus, and lung		360(4)	79(4)		77(5)	a	0	-									
28 engineers, chemical 28																	
malignant neoplasms		196(7)	242(12)	326(9)	273(19)+	b											
large intestine and rectum			618(4)+	1044(4)+	581(6)+	b						0					
trachea, bronchus, and lung					305(5)+	a						0					
bladder					1805(4)+	b											
30 engineers, electrical 153																	
malignant neoplasms	174(28)	131(48)	133(71)	115(43)	131(86)	b	0	0	=	0					0		
large intestine, except rectum		139(4)	129(6)		165(10)	u	-	-				0					
kidney		432(4)+	322(4)+	491(4)+	277(4)+	b		-				0					
lymphatic and hematopoietic tissue	392(8)+	341(12)+	292(14)+	219(6)	280(16)+	b	-	0									
lymphomas		319(6)+	252(6)+		300(8)+	b	-	0				+					
(lymphosarcoma)					294(2)		=										
leukemia and aleukemia	538(4)+	400(5)+	289(5)+		228(5)	b	-	0	-			-			0		

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 30-40

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
(myeloid leukemia)					283(3)			=									
31 engineer, industrial 65																	
lymphatic and hematopoietic tissue			231(6)	383(6)+	214(7)	b											
(lymphomas)					136(2)							Q					
(leukemia and aleukemia)					238(3)				-			Q					
32 engineers, mechanical 121																	
digestive organs and peritoneum		127(8)	130(15)	127(12)	128(22)	b	-	-									
esophagus			420(5)+	396(4)+	316(5)+	b		Q									
prostate			319(6)+	223(4)	160(8)	b	Q	+				=					
brain and nervous system		479(4)+	365(4)+		344(4)+	b	-	-									
36 engineers NEC 199																	
urinary organs		350(6)+	225(8)+	245(7)+	181(9)+	b											
(bladder)			213(4)	239(4)	169(5)		Q	-				-					
kidney		405(4)+	246(4)		206(4)	b	Q	Q				Q					
leukemia and aleukemia	463(5)+	315(5)+	233(6)+		181(6)	b	=	=	Q			Q			-		
myeloid leukemia	570(4)+	411(4)+	292(4)+		253(4)	b	Q	-									
38 foresters and conservationists 7																	
trachea, bronchus, and lung					455(4)+	b	-	-									
40 lawyers and judges, attorneys 216																	
malignant neoplasms	162(20)	121(43)	133(87)	126(67)	133(121)+	b	Q	Q	Q	Q					Q		
large intestine, except rectum		166(5)	143(9)	131(7)	152(14)	u	+	=		+		-					
pancreas		206(4)	228(8)+	252(7)+	228(11)+	b	-	-	+			-					
trachea, bronchus, and lung	137(4)	101(9)	120(20)	117(16)	105(22)	a	Q	Q	Q	Q		Q			Q		

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 40-50

OCCUPATION / CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
brain and nervous system		380(5)+	411(7)+	357(4)+	489(9)+	b	=	-				-					
brain			425(5)+		556(7)+	b	+	-									
lymphatic and hematopoietic tissue	297(4)	237(7)+	213(11)+	183(7)	198(14)+	b	=	+									
(lymphomas)			206(5)		198(6)		-	-	+			-					
(leukemia and aleukemia)					143(4)		-	+	=			0			=		
(myeloid leukemia)					167(2)		+	-									
42 musicians and music teachers 75																	
stomach					252(5)+	b	0	0				0					
cirrhosis of the liver		171(6)	185(8)	392(6)+	173(8)	b	-	+		=							
43 agricultural scientists 15																	
trachea, bronchus, and lung			642(5)+		929(8)+	b											
45 miscellaneous natural scientists and																	
researchers 21																	
malignant neoplasms	391(6)	456(7)+	342(10)+	288(4)	235(13)	b			0								
50 physicians and surgeons 167																	
large intestine, except rectum			143(8)	138(7)	202(16)+	b	+	0	=	0		+				+	=
biliary passages and liver			488(4)+		328(4)+	b	0	-				0					
bladder			242(4)		252(7)+	b	0	0				0					
kidney			324(4)+		260(4)	u	-	0				0					
lymphatic and hematopoietic tissue			180(8)	187(7)	184(11)	b	=	-									
lymphomas			295(6)+	366(6)+	278(7)+	b	-	0				-					
(leukemia and aleukemia)					168(4)		=	-	-						0		

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 61-69

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
61 school adminstrators, elementary and																	
secondary school 53																	
pancreas			563(6)+	604(5)+	503(7)+	b						0					
62 teachers, elementary and secondary																	
school 204																	
brain and nervous system	322(4)+	374(8)+	317(8)+	312(4)+	336(9)+	b	-	+	=	=		-					
63 technicians, medical and dental 39																	
large intestine, except rectum			362(4)+		235(4)	u	-	-				0					
64 technicians, electrical and elec-																	
tronic 54																	
large intestine, except rectum			190(4)	324(4)+	180(4)	u						0					
cirrhosis of the liver	244(5)	238(8)	220(8)		218(8)	a									0		
65 technicians, other engineering and																	
physical sciences 70																	
malignant neoplasms	114(12)	178(26)	166(35)	216(23)	123(38)	b											
large intestine, except rectum		345(4)+	216(4)		135(4)	u						-					
pancreas			351(4)+	732(4)+	240(4)	b											
respiratory system		103(5)	139(10)	207(8)	116(11)	b						0					
69 students 90																	
malignant neoplasms	130(26)	130(26)	130(26)		130(26)	u	+	+	0						0		
testis	430(6)	430(6)	430(6)		430(6)	a	+	0									

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 71-78

OCCUPATION / CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
71 treasurers, financial managers, bank																	
officers 264																	
malignant neoplasms	123(15)	144(51)	136(91)	139(76)	122(136)	b	+										
buccal cavity and pharynx		291(5)+	214(6)	275(6)+	171(7)	b	-					Q					
trachea, bronchus and lung		100(12)	112(25)	124(23)	112(35)	b	=					Q					
kidney		464(4)+	278(4)+		278(6)+	b	Q					-					
brain and nervous system		497(7)+	490(9)+	594(7)+	482(10)+	b	-					-					
brain		395(4)+	387(5)+	466(4)+	347(5)+	b	+										
lymphatic and hematopoietic tissue		264(8)+	185(10)	199(8)	147(13)	b	=										
lymphomas		320(5)+	282(7)+	337(6)+	252(9)+	b	-					-					
Hodgkins disease					505(4)+	b	-					Q					
cirrhosis of the liver	90(5)	102(10)	132(16)	166(11)	119(16)	b	Q										
73 buyers, shippers, farm products 104																	
prostate			371(7)+	383(7)+	196(10)+	b	Q	-									
74 conductors, railroad 48																	
bladder					458(4)+	b	Q	Q									
76 funeral director 31																	
digestive organs and peritoneum		416(4)+	294(5)		119(5)	b											
77 health administrators 31																	
malignant neoplasms	123(4)	184(11)	196(14)	256(10)	108(15)	b											
lymphatic and hematopoietic tissue					373(4)+	b											
78 hotel, motel owners, managers etc. 39																	
malignant neoplasms		215(9)	104(15)	100(13)	135(23)	b	Q		Q						=		

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 79-83

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
79 inspectors, investigators, public																	
administration 94																	
trachea, bronchus, and lung		186(8)	171(12)	151(9)	134(14)	a		0				0					
lymphatic and hematopoietic tissue			245(5)	303(5)+	175(6)	u		=									
80 managers and superintendents,																	
building 63																	
malignant neoplasms	-(7)+	256(14)	255(27)+	189(20)	238(42)+	b	0	0									
large intestine and rectum			265(4)	265(4)	254(7)†	b											
large intestine, except rectum					271(5)+	u	0	0				0					
(rectum)					311(2)		-	-				0					
pancreas					554(5)+	b	0	0									
trachea, bronchus, and lung		257(5)	330(12)+	248(9)+	284(14)+	b	-	=				-					
81 newspaper owners, publishers,																	
managers, etc. 14																	
malignant neoplasms		442(5)	303(7)	510(6)	144(8)	b	=										
82 officers - pilots - pursers -																	
engineers, ship 20																	
malignant neoplasms			437(6)	365(5)	575(16)+	b			=						-		
digestive organs and peritoneum			1023(4)+		1145(10)+	b											
large intestine and rectum					1398(6)+	b			=								
83 officials and administrators NEC,																	
public administration 151																	
lymphatic and hematopoietic tissue	684(4)+	343(8)+	213(10)+	146(6)	195(12)+	b	=	0									
lymphomas	1273(4)+	401(5)+	277(6)+		230(6)	b	0	0				-					

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 83-90

OCCUPATION CANCER	MORTALITY ODDS RATIO					OTHER STUDIES										
	20-54	20-64	20-74	55-74	20+	SC	1	2	3	4	5	6	7	8	9	10	11
(leukemia and aleukemia)			236(4)	267(4)	209(5)		-	-	+			-			=		
84 officials, lodge, society, union,																	
etc. 34																	
trachea, bronchus, and lung			219(8)	276(8)+	202(9)	b	-	0	=								
86 postmasters 90																	
malignant neoplasms	355(4)	172(23)	114(30)	104(26)	91(42)	b	0										
large intestine, except rectum		454(5)+	242(6)+	210(5)	147(7)	b	0					+					
87 public relations men 6																	
malignant neoplasms			-(4)		219(4)	b											
88 public utility supervisors,																	
officials, managers, etc. 111																	
large intestine, except rectum			202(8)	212(7)	173(9)	b											
rectum			307(4)+	367(4)+	355(6)+	b											
trachea, bronchus, and lung	246(7)	128(8)	114(16)	81(9)	117(19)	b											
89 purchasing agents and buyers;																	
brokers NEC 123																	
large intestine, except rectum			160(8)	154(7)	155(10)	u	+	-				-					
respiratory system		102(6)	120(17)	128(16)	121(20)	a	=	+				0					
90 sales managers 138																	
pharynx					313(4)+	b											
rectum and rectosigmoid junction			218(4)	313(4)+	152(4)	b			0			0					
trachea, bronchus, and lung		107(9)	114(16)	166(15)	121(21)	a			0			0			0		

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 91-93

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
91 restaurant and cafe owners,																	
managers 250																	
digestive organs and peritoneum	188(7)	147(19)	140(35)	132(28)	123(49)	b	0										
large intestine, except rectum		129(5)	161(13)	170(12)	129(17)	u	-		-			=					
(rectum and rectosigmoid junction)			128(4)		162(8)		0					-					
92 cocktail, bar, tavern owners,																	
managers 20																	
malignant neoplasms			265(9)	649(9)+	249(13)	b			=						=		
digestive organs and peritoneum			625(6)+	1422(6)+	445(7)+	b											
93 managers, administrators, officials																	
and proprietors NEC;																	
supervisors NEC 1733																	
stomach	81(5)	108(17)	134(39)	148(34)+	100(48)	b	0	0	0	0		0		-	0		
small intestine					542(5)+	b	-	0									
large intestine, except rectum	145(11)	137(33)	139(71)+	138(60)+	140(116)+	u	+	+	+	+		+		0		+	+
pancreas	158(9)	133(21)	143(41)+	139(32)	132(57)	b	+	+	+	-		-					
trachea, bronchus, and lung	132(29)	116(83)	106(148)	101(119)	107(202)	a	0	0	0	0		0		0	0	+	-
connective and other soft tissue		334(4)+	255(5)+		158(5)	u	-	0				-					
prostate		145(10)	135(38)	140(38)	106(82)	u	-	0	-	0		-					
kidney		66(5)	125(15)	151(14)	107(18)	u	-	=	=	=		+					
lymphatic and hematopoietic tissue	103(13)	94(25)	124(56)	132(43)	131(87)+	u	+	+									
lymphomas	121(8)	100(14)	127(27)	130(19)	149(41)+	u	=	+	+	0		0					
reticulum cell sarcoma		210(7)	254(13)+	291(11)+	256(16)+	b	-	+									
Hodgkins disease	129(4)	83(4)	151(9)	175(5)	159(11)	u	-	=	=	0		0					
leukemia and aleukemia	85(4)	107(10)	127(21)	144(17)	126(34)	u	+	-	+	+		0			=		
cirrhosis of the liver	129(30)	117(58)	115(79)	108(49)	109(83)	a	0	0	+	+				c	=		

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 95-102

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
95 garage and gas station owners,																	
foremen, managers 123																	
large intestine and rectum			91(5)	113(5)	154(12)	u											
(large intestine except rectum)			109(4)	134(4)	154(8)				=								
prostate			382(6)+	411(6)+	234(9)+	b											
bladder		556(4)+	586(6)+	571(5)+	400(7)+	b											
cirrhosis of the liver		96(7)	129(10)	212(8)+	123(10)	a			-						=		
97 grocers and market managers 265																	
malignant neoplasms	222(15)	119(34)	103(72)	91(57)	94(124)	b	0			+					0		
digestive organs and peritoneum		112(9)	111(23)	106(20)	122(51)	u	0										
kidney			345(5)+	313(4)+	240(6)+	b	0			-							
98 bank clerks, tellers, etc. 42																	
lymphatic and hematopoietic tissue			591(4)+		345(5)+	b											
100 cashiers 19																	
trachea, bronchus, and lung			662(8)+	580(7)+	448(8)+	b						0					
101 dispatchers and starters,																	
vehicle 63																	
stomach			268(4)		302(6)+	b	-	-	0			0			0		
102 adjustors, examiners,																	
investigators, estimators 57																	
malignant neoplasms	184(7)	227(18)+	177(28)	175(21)	234(39)+	b	=										
large intestine and rectum					300(7)+	b											
large intestine except rectum					314(5)+	u	-					-					

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 102-110

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
(rectum and rectosigmoid junction)					334(2)		0					+					
trachea, bronchus, and lung		226(6)	226(12)+	243(10)+	312(17)+	b	=					0					
104 mail carriers 156																	
buccal cavity and pharynx			239(5)	348(5)+	190(5)	b	0	0				0					
lymphatic and hematopoietic tissue		151(4)	114(5)	147(4)	173(10)	b	=	-									
lymphomas					240(6)+	u	+	0				-					
cirrhosis of the liver	114(7)	137(11)	153(14)	232(7)	155(15)	a	0	0		0							
105 messengers and office boys 23																	
digestive organs and peritoneum			194(5)		251(8)+	b											
106 payroll and timekeeping clerks 29																	
malignant neoplasms		168(5)	179(12)	216(11)	136(16)	b											
respiratory system			218(5)	275(5)	203(7)	b											
107 postal clerks 219																	
rectum and rectosigmoid junction			237(6)+	248(5)+	264(9)+	b	0	+				-					
trachea, bronchus, and lung	142(9)	151(22)	124(30)	117(21)	122(35)	b	0	0				0					
brain		278(4)+	296(5)+		286(5)+	b	-	+				-					
cirrhosis of the liver	83(8)	134(19)	135(22)	211(14)+	130(22)	b	0	0									
109 shipping and receiving clerks 359																	
pharynx			187(5)	242(5)+	157(5)	u											
110 stock clerks and storekeepers 174																	
large intestine, except rectum			180(11)	237(11)+	166(13)	b	-	0	0								
prostate			132(4)	141(4)	172(10)	b	=	-	0								

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 110-115

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
lymphatic and hematopoietic tissue	207(5)	259(10)+	185(11)	170(6)	183(13)+	b	0	0									
multiple myeloma					491(4)+	b	0	-	0								
leukemia and aleukemia		280(4)+	181(4)		179(5)	u	-	0	-						0		
112 railroad clerks 61																	
malignant neoplasm		94(8)	176(24)	198(21)	161(34)	b			0						-		
large intestine, except rectum			323(4)+		239(5)	u			0								
rectum and rectosigmoid junction					527(4)+	b											
trachea, bronchus and lung			174(8)	220(8)	147(9)	b			0						0		
cirrhosis of the liver		201(5)	242(7)+	298(4)	225(7)	b			-						0		
113 clerical and kindred workers NEC 434																	
mouth			274(4)+		219(4)	b	-	-									
esophagus		321(4)+	197(5)	259(5)	118(5)	a	-	=	0			0					
large intestine, except rectum		197(11)+	73(12)	68(10)	68(16)	b	-	-	0	+		=				+	+
trachea, bronchus and lung	93(7)	122(28)	98(55)	99(48)	92(64)	b	-	0	0	0		0			0		
malignant melanoma of skin	619(4)+	401(4)+	259(4)		258(5)+	b	-	=	=			0				+	+
brain and nervous system	450(5)+	234(6)+	149(6)		136(6)	b	0	=	=	0		0				+	+
leukemia and aleukemia	378(4)+	187(4)	161(8)	102(4)	138(10)	b	=	0	0	0		-			0		
115 manufacturers and sales representa-																	
tives 98																	
digestive organs and peritoneum		85(5)	132(15)	127(12)	165(23)+	b	0										
large intestine and rectum			166(9)	154(7)	194(13)+	b											
(large intestine, except rectum)			190(7)	161(5)	198(9)		-		+								
(rectum and rectosigmoid junction)					234(4)		=		=								

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 116-120

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
116 insurance agents, brokers, under-																	
writers, executives, managers 301																	
large intestine, except rectum		137(6)	96(10)	108(10)	127(20)	u	=	-		=	-	=				0	+
brain			254(5)+		235(5)	u	-	-									
(brain and nervous system)			177(5)		162(5)		=	-				-					
lymphatic and hematopoietic tissue	321(5)+	166(7)	94(8)		124(15)	u	0	=									
(leukemia and aleukemia)					147(7)		0	=	-		-	-			0		
117 car salesmen, dealers, managers 161																	
trachea, bronchus, and lung	100(5)	101(13)	123(22)	132(17)	122(27)	a	0			-							
myeloid leukemia					365(4)+	b	0										
118 real estate agents, brokers,																	
developers, executives 186																	
trachea, bronchus, and lung		119(8)	117(18)	132(17)	128(26)	a	0	0		=	+	0					
prostate			116(4)	119(4)	155(13)	u	0	+		=		0					
119 stock and bond salesmen, counsellors,																	
etc. 74																	
trachea, bronchus, and lung		303(4)	122(7)	115(6)	87(7)	a	-		0			0			0		
120 sales clerks and salesmen NEC 928																	
large intestine, except rectum		101(15)	118(39)	124(36)	116(55)	u	-	-	0	=	-	0					
malignant melanoma of skin	342(5)+	245(6)+	177(6)		167(7)	u	0	=		=	0	0					
prostate			115(21)	117(21)	126(46)	a	0	-	0	0	0	0					
bladder			92(9)	99(9)	129(21)	b	-	+	0	=	0	-					
kidney	334(4)+	141(6)	108(8)	64(4)	95(9)	b	0	0		0	+	0					
brain		193(9)	193(12)+	224(10)+	180(12)	b	0	0	0	=		0					

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 120-125

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
lymphomas		155(12)	149(19)	182(17)+	134(21)	b	0	=		+		=					
reticulum cell sarcoma			187(6)	234(6)+	187(7)	b	0	=									
121 bakers 178																	
trachea, bronchus, and lung	96(5)	187(17)	132(25)	145(20)	123(32)	b	=	=	=	=		0	0		=		
122 blacksmiths 36																	
bladder					737(5)+	b	0	0	=				-				
123 boilermakers 45																	
large intestine and rectum					253(6)+	u											
(large intestine, except rectum)					255(4)		0	-				0					
(rectum and rectosigmoid junction)					320(2)		0	0				-					
trachea, bronchus, and lung		216(4)	149(6)	137(5)	215(10)+	b	+	=		=		-	=				
125 brickmasons, stonemasons, tile-																	
setters 271																	
malignant neoplasms	139(14)	121(37)	128(74)	126(60)	137(144)+	b	+	+	=	-					-		
buccal cavity and pharynx			164(4)		211(8)+	u	0	-				-	-				
tongue					405(4)+	b	-	-									
large intestine and rectum		161(6)	89(7)	59(4)	124(20)	u				0			=				
(large intestine, except rectum)		204(5)	112(6)	86(4)	120(13)		0	-	0			0					
(rectum and rectosigmoid junction)					172(7)		0	0	=			0					
trachea, bronchus, and lung	128(4)	86(9)	123(24)	122(20)	143(41)+	b	+	+	+	=		0	=		=	+	+
brain	1253(4)+	469(4)+	355(4)+		314(4)+	b	0										
cirrhosis of the liver	221(9)	151(12)	148(15)	99(6)	158(18)	b	=	0	0	=							

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 126-129

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
126 building contractors, construction																	
contractors 244																	
pancreas			153(7)	133(5)	186(12)+	b	0		=		-						
127 boatbuilders; carpenters,																	
shipyard 31																	
respiratory system		951(4)+	269(7)	275(6)	251(8)	b	-										
128 cabinetmakers 74																	
digestive organs and peritoneum		387(6)+	259(8)+	196(6)	125(12)	b											
cirrhosis of the liver			346(5)+		260(5)	b									-		
129 carpenters 837																	
stomach		121(7)	143(17)	166(15)	169(36)+	b	+	=	0	0	0	0	=	0	0		
biliary passages and liver			257(8)+	240(6)+	193(12)+	b	0	0		-		=					
liver			295(4)+	349(4)+	259(7)+	b	-	-								+	-
pancreas	183(5)	205(12)+	136(16)	121(11)	98(19)	b	0	0	0	0	-	-	0				
trachea, bronchus, and lung	106(16)	124(45)	113(83)	115(67)	111(114)	u	0	0	+	+	0	+	=	0	0	+	+
prostate			96(10)	99(10)	124(43)	a	-	-	-	0	=	0	=				
kidney		146(4)	146(7)	200(7)	154(11)	b	=	-	0			0	0				
brain and nervous system	285(7)+	203(9)+	165(10)		161(11)	b	0	0	=	=		-					
lymphomas		175(7)	171(11)	196(8)	133(13)	a	=	0	0	0		0	0				
multiple myeloma			263(6)+	277(5)+	260(10)+	b	=	-	-				0				
leukemia and aleukemia		167(6)	162(11)	216(10)+	173(21)+	b	0	+	-	0		0	0		0		
lymphatic leukemia, chronic					251(5)+	u	-	-									

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 130-138

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
130 cement and concrete finishers;																	
cement workers 33																	
malignant neoplasms	250(5)	148(9)	181(11)	147(6)	117(15)	b	0	0	=	=					=		
131 compositors and typesetters 57																	
malignant neoplasms	224(4)	323(19)+	196(27)	192(23)	215(40)+	b			0	=					0		
digestive organs and peritoneum			122(5)	111(4)	174(10)	b											
(large intestine and rectum)					180(5)					=							
(large intestine, except rectum)					159(3)							-				+	0
trachea, bronchus, and lung		359(7)+	195(9)	194(8)	216(12)+	b			0	=		-			0		
prostate			525(4)+	539(4)+	376(6)+	b											
132 cranemen, derrickmen, and																	
hoistmen 73																	
larynx					613(4)+	b	0						0				
134 electricians 326																	
lymphomas		189(5)	222(10)+	255(8)+	176(10)	b	=	+	-	=		0	0				
lymphosarcoma			518(6)+	689(6)+	385(6)+	b	=	=	-								
137 engravers, except photengravers 25																	
malignant neoplasms		139(5)	278(10)	293(8)	124(13)	b											
138 heavy equipment, construction equip-																	
ment operators 64																	
malignant neoplasms	124(9)	255(29)+	241(34)+	364(25)+	173(37)	b	0	0	0	0					0		
trachea, bronchus, and lung	241(5)	426(15)+	379(17)+	496(12)+	295(18)+	b	+	+	0	-		0	0		0		

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 139-150

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
139 railroad foremen 62																	
malignant neoplasms		263(10)	196(24)	188(21)	172(37)+	b											
trachea, bronchus, and lung		301(4)	226(9)	221(8)	219(13)+	b							0				
141 foremen NEC 223																	
digestive organs and peritoneum		131(14)	127(28)	129(25)	103(36)	u	-	0		0							
trachea, bronchus, and lung	132(4)	151(20)	132(33)	132(29)	115(38)	b	0	+	0	+		0	0	0			
142 forgemen and hammermen 26																	
digestive organs and peritoneum			676(5)+	540(4)+	284(5)	b											
trachea, bronchus, and lung		-(6)+	967(7)+	829(6)+	613(9)+	b			=	+					-		
143 furriers 16																	
digestive organs and peritoneum			471(4)+	471(4)+	394(5)+	b	-										
145 heat treaters, annealers, temperers 31																	
trachea, bronchus, and lung		385(6)+	151(6)	129(5)	133(6)	b			0			-			=		
146 inspectors, railroads 30																	
buccal cavity and pharynx					924(4)+	b											
148 jewelers, watchmakers, silversmiths 160																	
pancreas		281(4)+	190(5)		146(6)	a	-	0				-					
150 linemen, servicemen, and installers-																	
telegraph, telephone, power																	

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 150-155

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
150 (cont'd) (utility and gas)																	
esophagus			333(4)+		233(4)	b	0	0									
large intestine, except rectum			96(4)	119(4)	153(10)	b	+	0	=	=		0	0				
larynx					369(4)+	b	0	-				-	-				
151 locomotive engineers (railroad) 53																	
large intestine, except rectum					290(6)+	b	+		=	0							
cirrhosis of the liver		278(4)	262(5)		283(6)+	b	-		0								
153 precision machine operators 113																	
pancreas		462(5)+	262(6)+	251(5)	276(8)+	b			=								
trachea, bronchus, and lung		127(9)	101(15)	92(12)	128(22)	u			=						0		
154 machinists NEC 1148																	
esophagus		131(7)	150(16)	158(15)	137(21)	b	=	0	=			0	-				
stomach		138(13)	134(26)	137(23)	122(39)	u	=	0	=	=		=	0		-		
large intestine, except rectum	311(11)+	153(23)	116(41)	94(30)	108(62)	b	0	=	=	+	+	0	0				
rectum and rectosigmoid junction	305(4)+	127(8)	118(16)	98(12)	91(20)	u	0	=	=		-	0					
rectosigmoid junction			371(5)+		306(7)+	b											
trachea, bronchus, and lung	184(27)+	108(68)	101(126)	90(99)	95(155)	b	=	+	+	=	0	+	-		=	+	+
connective and other soft tissue			352(4)+		206(4)	u	-	0				-					
bladder		220(7)	113(13)	107(12)	87(20)	a	0	0	=	=		0	-				
brain and nervous system	260(6)+	145(10)	115(11)	69(5)	114(12)	b	0	=	=	=		0	-				
leukemia and aleukemia	201(4)	210(11)+	151(16)	139(12)	129(23)	b	-	0	=	=	-	0	+		-		
myeloid leukemia	343(4)+	241(7)+	176(9)	127(5)	153(11)	b	=	0	=								
155 machinists, shipyard 58																	
trachea, bronchus, and lung		511(5)+	261(12)+	218(10)	270(18)+	b											

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 156-163

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
156 mechanics and repairmen, air conditioning, heating, refrigeration appliances 42																	
trachea, bronchus, and lung		362(8)+	505(13)+	717(13)+	412(13)+	b						-					
urinary organs					669(4)+	b						-					
157 mechanics and repairmen, airplane 15																	
trachea, bronchus, and lung		387(5)	387(5)	821(4)+	387(5)	b		=				-					
158 mechanics and repairmen, automobile 258																	
buccal cavity and pharynx			207(8)+	201(6)	176(8)	u	-	=		=		0					
stomach		173(5)	196(10)+	207(8)+	179(12)	b	0	0	0	0	-	-					
trachea, bronchus, and lung	153(9)	131(23)	135(42)	131(33)	138(50)	b	+	=	+	+	0	-				+	+
lymphatic and hematopoietic tissue	236(5)	201(8)	143(10)	103(5)	160(14)	a	0	0									
lymphomas		247(5)+	166(5)		168(6)	a	-	-		0		=					
160 mechanics and repairmen, radio, television 27																	
cirrhosis of the liver	444(5)+	287(7)+	319(8)+		312(8)+	b		0	-						-		
162 loom fixers 96																	
trachea, bronchus, and lung		247(6)	152(11)	138(10)	108(13)	u											
prostate			303(4)+	303(4)+	162(9)	a											
163 mechanics and repairmen NEC 334																	
malignant neoplasms	122(33)	139(92)	126(137)	127(104)	127(175)+	b	+	+	0	+							
buccal cavity and pharynx	345(4)+	196(6)	154(7)		130(7)	b	0	0		0		0					

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 163-169

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
stomach		145(5)	122(7)	116(5)	159(12)	b	=	=	-	+		-					
large intestine, except rectum	208(4)	208(11)+	132(13)	113(9)	130(17)	b	0	-	+	0		0					
larynx			288(6)+	385(6)+	285(7)+	b	0	0				-					
trachea, bronchus, and lung	79(6)	153(33)	143(51)	160(45)+	142(59)+	b	+	+	0	+		0				+	+
prostate			183(9)	150(7)	174(17)+	b	0	-	0	0		0					
brain		194(4)	161(4)	284(4)+	155(4)	b	+	-	0	0		0					
cirrhosis of the liver	119(13)	121(22)	134(29)	149(16)	129(29)	b	0	0	-	0							
164 millers, grain 5																	
malignant neoplasms					-(5)+	b	0										
167 motion picture projectionists 16																	
prostate					801(4)+	b	0	-									
168 opticians; lens grinders and																	
polishers 30																	
malignant neoplasms		1922(6)	305(13)	304(12)	206(18)	b			0								
digestive organs and peritoneum			403(5)+	411(5)+	219(6)	b											
169 painters, construction and																	
maintenance 588																	
buccal cavity and pharynx		194(8)	182(14)+	231(13)+	154(15)	b	=	=		=		0	=				
esophagus		213(5)	147(8)	179(8)	155(11)	u	0	0	=	0			+		0	0	0
stomach		137(6)	129(13)	140(11)	158(23)+	b	=	=	0	=	0	0	+		-	0	0
larynx			172(6)	190(5)	204(9)+	u	0	-	=	+		0	-		0	-	0
trachea, bronchus and lung	71(9)	132(37)	115(72)	127(63)	124(94)	b	+	+	+	+	+	+	+		=	+	+
skin, other malignant neoplasms					534(4)+	b	0	0	-				0		=	0	0
prostate			91(10)	96(10)	150(34)+	b	-	-	0	0	0	0	-		0	0	0

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 169-179

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
lymphomas		251(7)+	176(9)	198(7)	167(11)	a	0	0	0	=		0	0		0	0	0
cirrhosis of the liver	120(19)	119(28)	140(44)+	161(25)+	138(46)+	b	=	+	0	=	0				0		
172 painters, shipyard 25																	
trachea, bronchus, and lung			203(6)	276(6)	261(9)+	b											
176 plasterers and lathers 43																	
stomach					423(4)+	b	+	-	0						0		
large intestine and rectum			341(4)+	416(4)+	289(7)+	b											
(large intestine, except rectum)					185(3)		+	0	-			0					
(rectum and rectosigmoid junction)					492(3)		0	0	=			0					
178 steamfitters 94																	
esophagus					493(5)+	b											
large intestine and rectum		354(4)+	193(6)	185(5)	204(11)+	b											
respiratory system		151(5)	151(12)	149(10)	182(20)+	b											
179 plumbers and pipefitters 305																	
stomach		201(5)	208(10)+	216(9)+	142(11)	b	0	0	=	=		-	-	0	=		
biliary passages and liver			315(4)+	353(4)+	185(4)	b	-	-				0					
respiratory system	139(5)	101(18)	123(40)	121(35)	125(52)	u	+	+									
larynx		409(4)+	354(6)+	340(5)+	313(7)+	b	-	-				-	-				
(trachea, bronchus, and lung)	119(4)	79(13)	105(32)	103(28)	109(42)		+	=	+	+	0	0	=	-	=	+	+
lymphomas	531(4)+	233(5)	236(8)+	152(4)	181(8)	b	-	-		0		0	0				
cirrhosis of the liver	219(11)+	128(15)	134(20)	91(9)	124(20)	b	0	0	0	=				0	0		

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 181-190

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
181 pressmen and plate printer,																	
printing 222																	
buccal cavity and pharynx			268(7)+	336(7)+	257(9)+	b						-					
digestive organs and peritoneum		115(10)	113(22)	129(21)	105(32)	u											
183 roofers and slaters 84																	
prostate			348(4)+	355(4)+	150(5)	b	0	-									
184 riggers and steeplejacks 59																	
malignant neoplasms		46(5)	98(22)	129(22)	99(29)	u											
185 shoemakers and repairers 61																	
trachea, bronchus, and lung			150(4)	150(4)	159(11)	u	-	0	=	=		-	-		=	+	+
186 stationary engineers 159																	
malignant neoplasms	75(7)	133(25)	134(59)	150(52)	123(83)	b			0	+					0		
lymphatic and hematopoietic tissue			265(9)+	353(9)+	251(13)+	b											
leukemia and aleukemia			327(4)+	422(4)+	383(8)+	b			0				-		0		
189 tailors 109																	
trachea, bronchus, and lung		254(5)	148(7)	160(6)	192(20)+	b	0		=	+		0			0		
190 tinsmiths, coppersmiths, and sheet																	
metal workers 134																	
malignant neoplasms	56(8)	113(30)	129(51)	170(43)+	114(68)	b	=	=	=	+					-		
digestive organs and peritoneum		140(10)	170(19)	215(16)+	145(26)	b	=	=									
large intestine, except rectum		190(4)	201(7)	250(6)+	191(11)+	b	0	0	=	-		0	0				
rectum and rectosigmoid junction			294(4)+	426(4)+	230(5)	b	=	-	=			0					

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 190-202

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
pancreas			236(5)	303(4)+	157(5)	b	=	-	=			0					
trachea, bronchus, and lung		127(11)	139(18)	172(15)	122(21)	b	+	=	+	+		=	0		=	+	+
191 floor layers, installers,																	
workers 20																	
digestive organs and peritoneum			274(5)	346(4)	246(6)	b	0										
192 tool and die makers,																	
toolmakers, etc. 201																	
digestive organs and peritoneum		127(12)	141(24)	166(24)+	149(41)+	b	0	0									
large intestine, except rectum			185(10)	213(10)+	190(17)+	b	0	=	=	-	-		0				
trachea, bronchus, and lung	269(8)+	110(13)	121(24)	95(16)	120(31)	b	+	+	=	0	0		0		0		
bladder			259(4)	283(4)+	187(6)	u		+	=		+		0				
197 officers and enlisted men,																	
Airforce 43																	
lymphatic and hematopoietic tissue		317(4)+	260(4)		237(4)	b											
198 officers and enlisted men, Navy 84																	
trachea, bronchus, and lung		74(5)	150(14)	222(11)	180(18)+	b	+										
urinary organs			306(4)+		259(4)	b	=										
200 Merchant Marine 48																	
cirrhosis of the liver		106(4)	165(7)	281(6)+	158(7)	b											
202 chemical workers 94																	
malignant neoplasms	143(7)	117(17)	139(36)	138(29)	173(57)+	b	0		0	=					=		
esophagus					552(5)+	b			=				-				

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 202-209

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
trachea, bronchus, and lung		106(5)	130(11)	154(11)	140(14)	u	=		=	0			=		=		
prostate					364(9)+	b	-		0								
bladder					460(5)+	b			=	=			0				
203 instrument workers NEC 27																	
malignant neoplasms		159(11)	124(12)	133(11)	90(12)	b			=						0		
204 fabricated metal products workers																	
NEC 397																	
large intestine, except rectum		99(6)	109(13)	105(10)	121(21)	a				+	-		0				
pancreas		179(8)	171(13)	175(10)	147(15)	b					-		-				
lymphatic and hematopoietic tissue		115(9)	138(17)	176(14)+	123(20)	b											
lymphosarcoma			275(4)+		269(5)+	b					+						
205 electrical and electronic																	
machinery, equipment, supplies																	
workers NEC 141																	
large intestine, except rectum	418(5)+	199(7)	155(8)	75(3)	140(9)	b				+							
urinary organs			147(4)	187(4)	201(7)	a											
207 apparel workers NEC 25																	
respiratory system			236(5)		215(6)	u	0										
(trachea, bronchus, and lung)			281(4)		193(5)		0		0	+					0		
209 oil and related industries workers																	
NEC 38																	
malignant neoplasms		164(4)	150(11)	175(11)	115(18)	b				+							
cirrhosis of the liver			382(4)+		307(4)	b				0							

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 210-220

OCCUPATION / CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
210 abrasive workers 72																	
large intestine and rectum			187(7)	202(7)	199(10)	b											
rectum					358(4)+	b											
respiratory system		235(8)	86(8)	82(7)	74(8)	b											
urinary organs			299(4)+	322(4)+	215(4)	b											
211 asbestos and insulation workers 41																	
respiratory system		248(5)	164(9)	138(7)	201(12)+	b	+										
trachea, bronchus, and lung			137(7)	127(6)	180(10)	b	+					+					
215 brewery workers 22																	
respiratory system		253(4)	305(6)	254(5)	314(9)+	b	0		=						0		
217 bus drivers 131																	
large intestine except rectum			218(8)+	172(6)	161(8)	a	0	0	0	=		0	-				
trachea, bronchus, and lung		183(15)	127(20)	122(18)	132(24)	b	+	+	=	0		0	-		0	+	+
218 checkers, examiners, and inspectors																	
manufacturing 83																	
brain					557(4)+	b	-	+	=								
219 clothing pressers 56																	
malignant neoplasms	268(6)	127(15)	154(20)	139(14)	144(32)	b			=						-		
trachea, bronchus, and lung		175(7)	183(8)	133(5)	223(14)+	b			=			-			=		
220 conductors, bus and street																	
railway 45																	
digestive organs and peritoneum			208(5)	208(5)	208(10)	b	0	=									

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUAPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 220-231

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
trachea, bronchus, and lung		1031(5)+	301(8)+	263(7)	259(10)+	b		0	=			-			0	+	+
224 filers, grinders, and polishers,																	
metal; metal cutters 130																	
bladder			323(4)+	379(4)+	206(4)	b						-	0				
lymphatic and hematopoietic tissue		296(5)+	198(6)	213(5)	178(7)	a							0				
226 dairy workers, dairymen 49																	
trachea, bronchus, and lung			169(7)	215(7)	161(10)	b	0										
227 winding operatives NEC 21																	
digestive organs and peritoneum			744(4)+		178(4)	b											
228 foundry workers NEC 66																	
digestive organs and peritoneum		354(5)	297(10)+	341(8)+	203(17)+	b											
large intestine and rectum			371(6)+	343(4)+	242(10)+	b											
trachea, bronchus, and lung		412(7)+	240(9)	276(7)	135(9)	b			=						=		
230 laundry and drycleaning operatives,																	
owners, managers 115																	
kidney			565(5)+	676(5)+	446(5)+	b	0	0				-					
cirrhosis of the liver		84(5)	159(11)	216(10)+	150(11)	b	+	-	-	+							
231 meat cutters, except slaughter and																	
packing house 184																	
larynx			408(4)+	533(4)+	359(5)+	b		-									
trachea, bronchus, and lung		175(16)	131(23)	140(20)	126(30)	b		0		=							
bladder			272(4)+		163(5)	b		0									

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 232-240

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
232 slaughter house butchers 101																	
stomach					245(6)+	b				-							
large intestine and rectum			158(7)	138(5)	208(13)+	b				0							
bladder					276(4)+	b											
kidney					432(4)+	b											
234 machine operators NEC 118																	
malignant neoplasms	177(12)	104(27)	96(43)	82(31)	81(49)	b											
cirrhosis of the liver	145(4)	160(10)	158(12)	166(8)	162(13)	u											
235 maintenance, railroad 27																	
large intestine and rectum		552(4)+	189(4)	190(4)	150(4)	b											
236 optical workers NEC 35																	
malignant neoplasms		310(14)	420(19)+	661(18)+	154(20)	b											
digestive organs and peritoneum		397(5)+	476(6)+	781(6)+	169(7)	b											
respiratory system		317(5)	443(7)+	668(7)+	200(7)	b											
238 packers and wrappers NEC 25																	
digestive organs and peritoneum		260(4)	216(7)	154(5)	208(8)	b	0	=									
239 pest control workers 8																	
malignant neoplasms			182(5)	-(4)	182(5)	b											
240 paper, pulp mill workers 276																	
malignant neoplasms	127(13)	138(46)	120(91)	119(78)	93(124)	b	0		0	0					0		
digestive organs and peritoneum		139(13)	138(31)	142(28)	105(44)	b	0										
large intestine and rectum		190(7)	154(15)	150(13)	107(20)	a	-			-			=				

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 240-249

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
brain and nervous system			298(4)+		257(4)	a	0										
cirrhosis of the liver	171(7)	160(13)	170(19)+	170(12)	165(21)+	b	0		0						0		
242 plastic workers 72																	
stomach			305(5)+	421(5)+	337(7)+	b			=						0		
243 rubber workers 250																	
large intestine, except rectum		132(4)	149(10)	169(10)	106(12)	b				=			0				
rectum and rectosigmoid junction		316(4)+	271(7)+	267(6)+	189(8)	b											
trachea, bronchus, and lung	191(7)	163(21)	155(37)+	149(30)	131(42)	b			0	-	0		0		0		
myeloid leukemia			416(4)+	554(4)+	289(4)+	b											
244 steelworkers, wire workers 127																	
malignant neoplasms	106(4)	170(25)	149(45)	155(41)	141(71)	b			=	+					=		
trachea, bronchus, and lung		197(10)	195(20)+	198(18)+	173(25)+	b			=	+					-		
247 sewers and stitchers, manufacturing;																	
cutters 43																	
large intestine and rectum			261(4)	303(4)	173(4)	b											
respiratory system		180(5)	162(7)	165(6)	211(11)+	b			0						0		
248 shipyard workers NEC 122																	
trachea, bronchus, and lung		164(8)	133(19)	130(18)	141(27)	b											
249 shoe factory workers 563																	
stomach		180(5)	111(7)	71(4)	137(20)	b			=			-			=		
large intestine, except rectum		221(10)+	103(12)	95(10)	97(25)	b			=	+							
liver					321(6)+	b											

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 249-257

OCCUPATION / CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
larynx			220(5)	252(5)+	132(5)	u											
trachea, bronchus, and lung	114(5)	153(29)	137(55)	140(50)	117(74)	b			0	-		-			0		
prostate			131(9)	134(9)	130(38)	b			=								
leukemia and aleukemia			122(4)	139(4)	178(14)+	b			0						0		
251 leather workers, tanners 212																	
trachea, bronchus, and lung		157(11)	136(22)	135(19)	128(31)	b			=	=			0		0		
bladder			368(5)+	398(5)+	191(7)	b							+				
cirrhosis of the liver		236(12)+	232(17)+	319(15)+	213(18)+	b									0		
254 taxicab drivers and chauffeurs 215																	
lymphatic and hematopoietic tissue		133(4)	171(10)	153(7)	152(11)	a	0	0									
cirrhosis of the liver	186(11)	113(13)	116(17)	68(6)	111(17)	u	-	=	0	=					0		
255 truck and tractor drivers 808																	
buccal cavity and pharynx		119(10)	124(15)	155(13)	142(19)	u	=	-		0	0	=	=				
esophagus	320(5)+	292(13)+	232(18)+	209(13)+	234(21)+	b	=	=	0		0	-	0				
sigmoid colon		205(4)	210(8)+	218(7)+	168(8)	b											
nose and nasopharynx			598(5)+	1028(4)+	539(5)+	b	0	0				0	-				
larynx	275(4)	251(9)+	258(14)+	252(10)+	229(14)+	b	=	0	=		-	=	=				
trachea, bronchus, and lung	165(37)+	177(101)+	175(160)+	178(123)+	173(176)+	b	+	+	+	+	+	+	0		=	+	+
bone			268(4)+		292(5)+	b	0	-	-			-					
prostate		109(4)	141(17)	142(16)	130(25)	b	0	=	0		0	0	-				
bladder		207(7)	144(10)	137(8)	150(14)	b	+	-	-	0	0	0	=				
cirrhosis of the liver	136(45)	144(75)+	146(88)+	158(43)+	147(91)+	b	0	0	0	-					0		
257 drivers NEC 137																	
stomach			234(6)+	171(4)	152(6)	b											

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 257-266

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	 20-64	 20-74	 55-74	 20+	 SC	OTHER STUDIES 1	 2	 3	 4	 5	 6	 7	 8	 9	 10	 11
cirrhosis of the liver		192(10)	138(10)	129(7)	128(10)	u											
258 fork lift drivers 32																	
respiratory system		286(7)	155(7)	129(4)	155(7)	b						+					
259 movers, moving truck drivers 41																	
cirrhosis of the liver	331(7)+	282(8)+	243(9)+		235(9)	b											
260 weavers, textile 199																	
digestive organs and peritoneum		412(4)	102(10)	94(9)	95(30)	b											
respiratory system		380(5)	120(13)	123(13)	80(20)	b			0						0		
261 welders and flame cutters 148																	
prostate			150(4)	163(4)	244(9)+	b		-	-			0	0				
263 welders, shipyard 29																	
malignant neoplasms		175(8)	205(17)	204(16)	229(19)+	b											
digestive organs and peritoneum		326(4)	335(8)+	346(8)+	335(8)+	b											
264 woodworkers, millworkers, furniture																	
workers 211																	
rectum and rectosigmoid junction		422(4)+	164(4)		136(6)	b		-				-					
pancreas		273(4)	203(7)	196(6)	172(10)	b		=									
prostate			197(7)	201(7)	123(15)	a		0			=	0					
266 textile workers NEC 834																	
buccal cavity and pharynx	359(4)+	200(10)+	131(12)	100(8)	104(15)	b											
large intestine and rectum		82(11)	129(41)	138(40)	118(76)	b					=						

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 266-273

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
cecum, appendix, and ascending																	
colon					288(11)+	b											
rectum and rectosignmoid junction		108(4)	184(15)+	202(15)+	135(22)	b											
267 attendants, hospital 118																	
trachea, bronchus, and lung		115(9)	139(20)	159(18)	142(23)	b	=	-	0	-					0	+	-
270 barbers 179																	
pancreas		527(5)+	213(5)		146(6)	b											
trachea, bronchus, and lung		145(9)	121(18)	128(18)	134(29)	b						-	-				
271 bartenders 195																	
buccal cavity and pharynx		438(9)+	340(9)+	435(7)+	322(10)+	b	+	+		+		+					
biliary passages and liver			627(5)+	929(5)+	430(5)+	b	0	-				0					
larynx	1057(4)+	613(5)+	549(6)+		532(7)+	b	+	+				-					
trachea, bronchus, and lung	95(6)	113(16)	112(22)	120(16)	130(30)	u	0	-	=	=		=			=	+	+
cirrhosis of the liver	241(20)+	273(33)+	286(38)+	359(18)+	297(41)+	b	+	+	+	+					=		
272 cleaners 36																	
malignant neoplasms	532(6)+	59(8)	75(11)	37(5)	83(17)	b			0						0		
273 cooks, chefs (except private household) 372																	
buccal cavity and pharynx		202(6)	268(12)+	307(11)+	206(12)+	b	+	-				=					
stomach		229(7)+	181(10)	196(9)	143(12)	b	=	0	=	=		+			=		
large intestine and rectum		153(10)	131(17)	122(14)	103(21)	a	0	0	-	=		0					
biliary passages and liver					232(6)+	b	0	+				-					
trachea, bronchus, and lung	75(4)	124(26)	121(43)	129(39)	111(51)	u	+	=	=	=		=			=	+	+

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 273-278

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
prostate			179(10)	166(9)	153(20)	b	-	0				0					
lymphatic and hematopoietic tissue		82(4)	134(11)	157(10)	127(15)	b	0	0									
cirrhosis of the liver	406(27)+	294(41)+	272(47)+	189(20)+	256(48)+	b	+	+	+	+					=		
274 dishwashers 24																	
large intestine and rectum					326(4)	b	-					-					
276 housekeepers and stewards, except																	
private households 33																	
prostate					445(4)+	b	-										
cirrhosis of the liver			290(5)+	295(4)+	276(5)+	b	-		-						=		
277 window cleaners 13																	
malignant neoplasms			441(6)	441(6)	460(10)+	b	0		0						0		
trachea, bronchus, and lung					632(4)+	b	-		+						-	+	+
278 janitors, sextons, maintenance																	
workers 1129																	
pharynx		203(9)+	146(11)	122(8)	139(13)	u	+	=									
cecum, appendix and ascending																	
colon		286(4)	219(7)	206(6)	135(7)	a											
pancreas	305(8)+	191(20)+	136(29)	112(21)	129(38)	b	0	-	=		-	0					
trachea, bronchus, and lung	141(21)	122(84)	117(160)	114(139)	109(183)	b	0	0	+	0	+	+		+	-		
leukemia and aleukemia		211(9)+	138(15)	135(13)	116(19)	a	0	=	0		0	0			-		
cirrhosis of the liver	182(34)+	149(68)+	128(79)	105(45)	129(85)	b	0	0	0	0				=	0		

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 279-288

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
279 kitchen workers, restaurant employ-																	
ees NEC 171																	
buccal cavity and pharynx		162(4)	201(7)	210(5)	168(7)	u		-				0	-				
280 school custodians 252																	
buccal cavity and pharynx		142(5)	168(8)	209(8)+	148(8)	u											
urinary organs		144(5)	166(9)	172(8)	159(11)	b											
brain and nervous system			210(5)	223(4)	244(6)+	a											
285 hairdressers and cosmetologists 22																	
bladder			1995(4)+	2330(4)+	1156(4)+	b											
286 firemen and fire protection 284																	
trachea, bronchus and lung	115(8)	130(23)	89(29)	82(21)	98(41)	u	=	+	0	=		0			0		
lymphatic and hematopoietic tissue	241(6)+	151(7)	99(8)		112(13)	u	+	-									
287 guards, watchmen and doorkeepers,																	
correction officers 407																	
cecum, appendix and ascending																	
colon			311(5)+	267(4)+	248(6)+	b											
malignant melanoma of skin					311(4)+	a	0	0				0					
288 policemen, detectives, marshalls,																	
constables, sheriffs, court																	
officers, 354																	
large intestine and rectum	242(5)	168(14)	114(20)	97(15)	112(29)	b				=							
(large intestine, except rectum)		124(7)	92(11)	85(9)	91(16)		+	=	=			0		0		0	+
rectum and rectosignmoid junction		277(6)+	157(7)	126(5)	169(11)	b	0	-	=			0					

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 288-305

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	 20-64	 20-74	 55-74	 20+	OTHER STUDIES SC	 1	 2	 3	 4	 5	 6	 7	 8	 9	 10	 11
biliary passages and liver			401(7)+	464(7)+	315(9)+	b	-	0				0					
trachea, bronchus, and lung	272(15)+	115(26)	88(37)	60(22)	94(49)	b	0	0	0	=		0		0	-		
290 waiters 38																	
digestive organs and peritoneum			151(4)	250(4)	241(10)+	b	0	=									
trachea, bronchus, and lung			195(6)	309(6)	198(8)	u	0	0	=						0		
293 farm owners, managers, foremen 159																	
multiple myeloma					581(4)+		=	-	=								
295 dairy farmers 53																	
malignant neoplasms		368(5)	93(11)	76(9)	65(20)		0										
301 garbage collectors, sewerage																	
workers 40																	
malignant neoplasms		87(6)	165(16)	170(14)	160(21)	b	=										
respiratory system		160(4)	198(7)	192(6)	206(9)	b	-										
cirrhosis of the liver	836(5)+	433(7)+	372(7)+		351(7)+	b	+										
303 fishermen and oystermen 138																	
trachea, bronchus, and lung		196(10)	150(21)	158(21)	137(26)	b	+	+	=	=		0		+	=		
305 gardeners (exept farm), grounds-																	
keepers, greenskeepers, land-																	
scapers 282																	
buccal cavity and pharynx		269(6)+	208(8)	185(6)	177(9)	u	-	0				-					

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 306-313

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
306 longshoremen and stevedores 85																	
digestive organs and peritoneum		121(5)	167(16)	173(14)	176(20)+	b	0	=									
esophagus			554(5)+	513(4)+	685(7)+	b	0	0	=			-					
trachea, bronchus, and lung		142(7)	151(16)	165(15)	137(16)	u	0	0	+	=		0			=	+	+
307 freight and material handlers 84																	
cirrhosis of the liver	295(8)+	202(10)	231(13)+	171(5)	220(13)+	b											
308 grocery clerks 53																	
cirrhosis of the liver	458(4)+	215(5)	220(6)		202(6)	b											
309 scrap metal, salvage, junk dealers, workers 27																	
malignant neoplasms		280(7)	135(9)	108(6)	124(14)	b	0										
310 lumbermen 66																	
digestive organs and peritoneum		129(4)	178(9)	178(9)	151(12)	u		0									
large intestine, except rectum			306(5)+	306(5)+	192(5)	b		0		-		-					
respiratory system			173(11)	157(10)	147(12)	b		0		0		-					
lymphatic and hematopoietic tissue			320(4)+		210(4)	u		0									
312 warehousemen NEC 89																	
esphagus					340(4)+	b			0								
large intestine and rectum		136(4)	178(7)	223(7)	125(7)	b			0			0					
313 laborers NEC 587																	
buccal cavity and pharynx	307(5)+	146(7)	159(11)	105(6)	134(13)	u	+	+				-					
large intestine, except rectum	207(4)	155(10)	96(13)	78(9)	92(20)	a	0	0	=			0		0			

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 313-317

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
trachea, bronchus, and lung	163(15)	101(33)	95(54)	82(39)	108(80)	u	0	0	=			=		=	=	+	+
testis			295(4)+		277(4)+	b	0	0				0					
bladder		251(5)+	176(8)	143(6)	142(13)	u	0	0	=			0		0			
cirrhosis of the liver	309(43)+	249(64)+	227(71)+	161(28)+	214(72)+	b	+	+	=					+	=		
314 construction laborers NEC 316																	
gallbladder, ducts, ampulla																	
of vater					328(4)+	b	0										
315 road construction and maintenance																	
workers 105																	
respiratory system		116(9)	154(20)	171(18)	140(23)	b											
316 railroad workers NEC 177																	
digestive organs and peritoneum		109(4)	112(13)	132(13)	123(30)	b											
large intestine and rectum			109(5)	121(5)	158(15)	a			0	=							
rectum and rectosigmoid junction					260(6)+	a			0								
trachea, bronchus, and lung		135(5)	127(15)	134(14)	127(23)	a			0	=					0		
prostate			249(6)+	257(6)+	124(11)	b			0								
bladder					244(6)+	a											
cirrhosis of the liver	247(6)	246(9)	229(13)+	216(7)	194(13)	b			0	=					0		
317 government workers NEC 248																	
pharynx		623(4)+	442(6)+		309(6)+	b	0										
digestive organs and peritoneum		159(10)	84(17)	82(14)	81(28)	a	=										
larynx			286(4)+		194(4)	u	0				0						
trachea, bronchus, and lung	157(7)	193(8)+	86(22)	71(15)	76(27)	b	0			+	0			-			
cirrhosis of the liver	154(9)	244(20)+	183(22)+	211(13)	179(24)+	b	0			+				+			

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Individual occupational codes 318-320
Grouped occupational codes 322-323

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
318 postal workers NEC 96																	
rectum					364(4)+	a											
cirrhosis of the liver	186(5)	181(10)	150(10)	126(5)	155(11)	b											
320 public works employees NEC 158																	
trachea, bronchus, and lung	126(5)	132(11)	123(21)	122(16)	133(29)	b											
cirrhosis of the liver	105(7)	146(13)	145(16)	206(9)	137(16)	u											
322 architects and draftsmen 103																	
digestive organs and peritoneum	206(5)	201(8)	121(11)	90(6)	114(16)	u											
lymphatic and hematopoietic tissue	482(6)+	366(6)+	207(6)		176(7)	b											
cirrhosis of the liver	243(6)	247(8)+	200(9)		208(10)	a											
323 engineers 782																	
pharynx			221(7)	212(5)	201(9)	a											
large intestine and rectum	175(12)	147(28)	139(51)+	131(39)	125(67)	b											
gallbladder, ducts, ampulla of																	
vater			254(5)+	269(4)+	194(6)	b											
prostate	1209(5)+	240(8)+	151(19)	115(14)	120(36)	b											
bladder		226(7)+	157(11)	145(9)	172(21)+	b											
kidney		201(8)	128(8)	155(7)	114(9)	u											
brain and nervous system	164(6)	162(11)	152(13)	144(7)	155(14)	u											
lymphatic and hematopoietic tissue	203(16)+	207(30)+	171(40)+	155(24)+	152(47)+	b											
lymphomas	116(5)	153(12)	132(15)	141(10)	146(20)	u											
leukemia and aleukemia	362(10)+	298(15)+	217(18)+	144(8)	157(19)	b											
myeloid leukemia	341(6)+	341(10)+	235(10)+	161(4)	188(10)	b											

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Grouped occupational codes 324-325

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
324 architects, draftmen, and																	
engineers 885																	
large intestine, except rectum	190(10)	160(22)+	137(38)	124(28)	127(52)	b											
rectum		217(7)	137(10)	106(7)	123(14)	a											
gallbladder, ducts, ampulla of																	
vater		386(4)+	331(7)+	308(5)+	235(8)+	b											
prostate	1038(5)+	224(8)+	148(21)	117(16)	120(41)	b											
bladder		241(8)+	167(13)	145(10)	167(23)+	b											
kidney		207(9)+	130(9)	162(8)	114(10)	u											
lymphatic and hematopoietic tissue	248(22)+	227(36)+	177(46)+	140(24)	156(54)+	b											
lymphomas	162(8)	173(15)+	141(18)	128(10)	150(23)	u											
leukemia and aleukemia	436(13)+	334(18)+	229(21)+	130(8)	171(23)+	b											
myeloid leukemia	418(8)+	380(12)+	257(12)+	145(4)	203(12)+	b											
325 mathematical professions 1333																	
large intestine and rectum	164(21)+	128(45)	115(77)	103(56)	104(102)	b											
rectosigmoid junction			381(6)+	308(4)+	287(7)+	b											
gallbladder, ducts, ampulla of																	
vater		225(4)	201(7)	187(5)	141(8)	b											
prostate	912(7)+	212(13)+	130(30)	103(23)	112(60)	b											
bladder	267(4)	156(9)	117(15)	97(11)	131(29)	b											
kidney		169(12)	117(13)	137(11)	106(15)	b											
brain and nervous system	182(12)+	163(20)+	143(22)	114(10)	147(24)	b											
lymphatic and hematopoietic tissue	204(28)+	161(42)+	129(54)	92(26)	119(66)	b											
leukemia and aleukemia	352(16)+	240(21)+	170(25)+	88(9)	141(30)	b											
myeloid leukemia	307(9)+	255(13)+	173(13)	87(4)	138(13)	b											

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Grouped occupational codes 326-329

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
326 life and physical sciences 96																	
malignant neoplasms	239(17)+	157(24)	174(42)+	147(25)	176(58)+	b											
digestive organs and peritoneum			159(11)	158(8)	191(19)+	b											
large intestine, except rectum					219(7)	u											
pancreas			304(4)+	449(4)+	279(5)+	b											
trachea, bronchus, and lung	246(5)	141(7)	178(14)	155(9)	175(17)	b			0						0		
lymphatic and hematopoietic tissue		411(6)+	329(7)+	400(5)+	287(8)+	b											
lymphomas		490(4)	465(5)+	705(4)+	389(5)+	b											
327 chemists (expanded) 88																	
malignant neoplasms	317(9)	145(18)	159(36)	136(27)	159(51)+	b											
digestive organs and peritoneum		174(6)	227(15)+	222(13)+	223(22)+	b											
large intestine and rectum		254(4)	285(9)+	284(8)+	268(13)+	b											
trachea, bronchus, and lung		196(6)	173(10)	134(7)	162(12)	a											
bladder					349(4)+	b											
328 technicians 194																	
large intestine, except rectum	177(4)	191(8)	212(13)+	233(9)+	160(13)	b			=				.			=	+
cirrhosis of the liver	68(9)	112(19)	108(20)	209(11)+	105(20)	b			0						-		
329 mathematical, scientific, and technical professions 1623																	
large intestine and rectum	161(27)+	128(55)	120(95)	109(68)	109(125)	b											
rectosigmoid junction			317(6)+	269(4)	241(7)+	b											
gall bladder, ducts, ampulla of vater		234(5)	196(8)	162(5)	151(10)	b											
prostate	670(7)+	175(13)	116(31)	94(24)	108(66)	b											
urinary organs	116(7)	151(24)	119(34)	120(27)	116(50)	b											

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Grouped occupational codes 329-331

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
brain and nervous system	142(13)	139(22)	135(26)	129(13)	148(30)+	u											
lymphatic and hematopoietic tissue	177(34)+	162(54)+	130(67)	102(33)	121(81)	b											
lymphomas	118(13)	124(23)	109(28)	102(15)	108(33)	u											
leukemia and aleukemia	282(18)+	222(25)+	160(29)+	94(11)	137(35)	b											
myeloid leukemia	264(11)+	257(17)+	181(17)+	115(6)	147(17)	b											
330 physicians, dentists, and related																	
practicioners 408																	
large intestine, except rectum		105(6)	137(19)	142(17)	151(31)+	b					0						
biliary passages and liver			293(6)+	228(4)	248(8)+	b											
urinary organs		186(6)	179(13)+	176(11)	167(19)+	b											
lymphatic and hematopoietic tussue	136(4)	132(8)	153(18)	159(14)	149(24)	u											
lymphomas		123(4)	202(11)+	234(9)+	176(12)	b											
reticulum cell sarcoma			288(4)+		243(4)	u											
lymphosarcoma			279(4)+		209(4)	b											
331 medical workers 582																	
large intestine, except rectum		89(8)	134(27)	141(24)	141(40)+	b				0	-						
biliary passages and liver			200(6)	158(4)	201(9)+	b											
pancreas	166(4)	100(6)	105(12)	88(8)	133(20)	b					-						
bladder			172(10)	172(9)	165(16)	b					-						
kidney		268(7)+	243(11)+	226(8)+	193(11)+	b											
lymphatic and hematopoietic tissue	94(5)	130(13)	128(23)	142(18)	132(31)	u											
lymphomas		110(6)	153(13)	179(10)	147(15)	b				=							
lymphosarcoma			265(5)+	315(4)+	187(5)	a											

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Grouped occupational codes 332-335

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
332 teachers and administrators,																	
college and university 88																	
digestive organs and peritoneum	186(4)	377(11)+	357(20)+	463(16)+	249(24)+	b	=	Q									
large intestine, except rectum		582(5)+	442(8)+	591(7)+	347(11)+	b	-	0	+								
pancreas			478(5)+	671(4)+	300(5)+	b	=	-									
malignant melanoma of skin					1265(4)+	b	-	=									
lymphomas			526(4)+	1152(4)+	577(6)+	b	+	-									
333 teachers and administrators,																	
elementary and secondary school 266																	
digestive organs and peritoneum	161(10)	109(19)	111(31)	96(21)	106(43)	b											
malignant melanoma of skin			336(4)+		286(4)+	u											
brain and nervous system	271(4)	288(8)+	246(8)+	225(4)	262(9)+	b											
334 school professions 444																	
stomach	339(5)	202(7)	165(9)	101(4)	133(11)	a											
large intestine, except rectum	161(5)	210(14)+	176(20)+	182(15)+	165(28)+	u											
pancreas		160(7)	182(12)+	203(9)+	153(14)	b											
malignant melanoma of skin	393 (5)+	442(7)+	502(9)+	767(4)+	486(10)+	b											
testis	209(8)	207(8)	206(8)		203(8)	b											
brain and nervous system	224(8)+	242(12)+	216(12)+	202(4)	224(13)+	b											
lymphatic and hematopoietic tissue	98(13)	110(18)	133(26)	210(13)+	138(32)	b											
lymphosarcoma		337(4)+	259(4)		256(5)	b											
multiple myeloma					297(5)+	b											
335 religious workers (expanded) 142																	
sigmoid colon					342(4)+	b											
biliary passages and liver					334(4)+	b											

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Grouped occupational codes 335-343

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
malignant melanoma of skin					549(4)+	b											
336 artists (expanded) 154																	
buccal cavity and pharynx					305(6)+	a											
337 writers (expanded) 65																	
malignant neoplasms	226(9)	138(13)	72(18)	43(9)	90(31)	b			0	=					0		
338 musical workers 88																	
cirrhosis of the liver		161(6)	174(8)	330(6)+	160(8)	b											
339 entertainers (expanded) 102																	
cirrhosis of the liver		123(7)	150(10)	326(8)+	141(10)	b			=						=		
341 financial workers 771																	
large intestine and rectum	168(10)	102(19)	90(34)	75(24)	88(52)	u											
rectosigmoid junction			409(4)+		317(5)+	b											
prostate		226(8)+	106(15)	96(13)	99(34)	u											
kidney	341(4)+	226(8)+	191(11)+	152(7)	195(15)+	b											
brain and nervous system	308(8)+	282(16)+	243(18)+	208(10)+	248(20)+	b											
lymphatic leukemia, chronic					301(4)+	a											
342 funeral workers 39																	
malignant neoplasms	392(6)	235(10)	242(16)	197(10)	141(21)	b	0	0									
digestive organs and peritoneum	1129(4)+	539(6)+	378(7)+		150(7)	b	0	-									
343 postal workers (all) 561																	
pharynx			167(6)	228(6)+	134(6)	b											

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Grouped occupational codes 343-346

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	 20-64	 20-74	 55-74	 20+	 SC	OTHER STUDIES 1	 2	 3	 4	 5	 6	 7	 8	 9	 10	 11
rectum and rectosigmoid junction		199(7)	212(14)+	222(12)+	185(18)+	b			0								
gallbladder, ducts, ampulla of																	
vater					266(5)+	a											
trachea, bronchus, and lung	93(13)	122(45)	95(60)	96(47)	92(72)	b			0	0				0	-	+	-
brain		218(7)+	204(8)+	211(5)	192(8)	u			0	-							
cirrhosis of the liver	107(21)	132(42)	127(48)	148(27)	125(50)	b			0	0				0	=		
344 carpenters (expanded) 942																	
stomach		114(7)	132(17)	151(15)	156(37)+	b	+	=	0	+	0	0	=	0	0		
rectum and rectosigmoid junction		131(5)	152(13)	140(10)	140(22)	b	=	+	0	+	0	0					
biliary passages and liver			267(9)+	256(7)+	187(13)+	b	0	0		-		=					
liver			341(5)+	405(5)+	265(8)+	b	-	-								+	-
pancreas	215(6)	210(13)+	141(18)	121(12)	103(22)	b	0	0	0	0	-	-	0				
trachea, bronchus, and lung	110(17)	124(48)	116(92)	117(75)	113(127)	u	0	0	+	+	0	+	=	0	0	+	+
prostate		191(4)	95(11)	99(11)	122(49)	a	-	-	-	0	0	=	0	=			
kidney		209(6)	175(9)	236(9)+	166(13)	b	=	-	0			0	0				
brain and nervous system	274(7)+	190(9)	154(10)		149(11)	b	0	0	=	+		-					
lymphomas		158(7)	154(11)	171(8)	119(13)	a	=	0		0							
multiple myeloma			286(7)+	306(6)+	286(12)+	b	=	-	0	0		0	0				
leukemia and aleukemia		182(7)	163(12)	197(10)+	169(23)+	b	0	+	-	0		0	0		0		
lymphatic leukemia, chronic					317(7)+	b	-	-									
cirrhosis of the liver	90(19)	106(35)	106(45)	122(26)	102(48)	u	0	0	0	0				0	0		
345 electricians (expanded) 367																	
lymphosarcoma			436(6)+	565(6)+	331(6)+	b	=	=	-								
346 painters (expanded) 643																	
buccal cavity and pharynx		194(9)	175(15)+	222(14)+	149(16)	b	=	=		=		0	=				

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Grouped occupational codes 346-348

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
stomach		122(6)	116(13)	125(11)	144(23)	b	=	=	0	=	0	0	+		+	0	0
larynx			179(7)	202(6)	205(10)+	u	0	-	-	+		0	-		0	-	0
trachea, bronchus, and lung	65(9)	123(39)	117(81)	130(72)	131(110)+	u	+	+	+	+	+	+	+		+	+	+
skin, other malignant neoplasms					492(4)+	b	0	0	-				0		=	0	0
prostate			83(10)	87(10)	146(36)+	b	-	-	0	0	0	0	-		0	0	0
brain and nervous system		224(6)	169(7)	230(6)+	185(8)	a	-	0	0	=		0			0	0	0
lymphomas		261(8)+	178(10)	206(8)+	166(12)	a	0	0	0	=		0	0		0	0	0
cirrhosis of the liver	123(21)	118(31)	135(47)	147(26)	133(49)	b	=	+	0	=	0				0		
347 plumbers (expanded) 426																	
buccal cavity and pharynx		160(5)	157(8)	165(7)	162(11)	b	=	0		=	-	0	-				
esophagus					197(10)+	b	-	-			-						
stomach		210(7)	203(13)+	220(12)+	153(16)	b	0	0	=	=		-	-	0	=		
larynx		381(5)+	305(7)+	309(6)+	290(9)+	b	-	-				-	-				
trachea, bronchus, and lung	117(6)	86(19)	117(48)	117(42)	122(65)	u	+	=	+	+	0	0	=	-	=	+	+
prostate			139(9)	142(9)	126(22)	u	0		0								
lymphatic and hematopoietic tissue	262(5)+	150(8)	156(15)	130(10)	125(18)	u	0										
lymphomas	403(4)+	179(5)	178(8)	114(4)	134(8)	b	-	-		0		0	0				
cirrhosis of the liver	181(13)	113(18)	133(27)	107(14)	123(27)	b	0	0	0	=				0	0		
348 mechanics and repairmen,																	
vehicle 356																	
buccal cavity and pharynx		105(4)	216(12)+	240(10)+	187(12)+	b	-	=		=		0					
stomach		133(6)	179(13)+	189(10)	161(15)	b	0	0	0	0	-	-					
rectum and rectosigmoid junction	488(4)+	149(4)	129(6)		133(8)	b	0	0	=		0	=					
trachea, bronchus, and lung	151(14)	132(36)	131(58)	126(44)	136(69)+	b	+	=	+	+	0	-				+	+

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Grouped occupational codes 349-351

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
349 mechanics and repairmen (all) 1015																	
buccal cavity and pharynx	257(8)+	145(13)	178(24)+	155(16)	156(26)+	b				0			0				
stomach	143(6)	116(12)	143(25)	143(19)	137(34)	b				0			=				
large intestine, except rectum	111(6)	133(21)	92(28)	88(22)	97(42)	b				0			0				
rectum and rectosigmoid junction	253(5)+	92(6)	77(9)	41(4)	79(13)	u				0							
biliary passages and liver		256(6)+	155(7)	137(5)	128(9)	b				0							
larynx		177(7)	160(10)	211(10)+	169(13)	b				0			0				
trachea, bronchus, and lung	125(26)	142(90)+	137(147)+	140(121)+	136(177)+	b				+			-				
prostate		161(7)	149(23)	134(20)	120(42)	b				0			+				
cirrhosis of the liver	124(41)	111(62)	117(77)	110(36)	116(80)	u				0							
350 machinists and related occupations 1757																	
esophagus		119(10)	147(24)	154(22)	131(30)	b											
stomach	131(6)	114(17)	124(37)	123(31)	131(62)+	b											
large intestine, except rectum	212(13)+	145(34)+	121(65)	110(52)	114(97)	b											
rectum and rectosigmoid junction	262(6)+	144(14)	121(25)	104(19)	95(31)	u											
pancreas	83(4)	103(16)	117(35)	124(31)	117(51)	b											
trachea, bronchus, and lung	171(44)+	109(108)	106(201)	95(157)	105(256)	b											
corrective and other soft tissue			285(5)+	338(4)+	172(5)	u											
testis			285(4)+		240(4)	b											
bladder		168(10)	136(21)	140(20)	108(33)	b											
leukemia and aleukemia	184(6)	171(14)	129(21)	115(15)	109(29)	b											
myeloid leukemia	259(5)+	198(9)	153(12)	119(7)	130(14)	b											
351 printing trades 370																	
buccal cavity and pharynx		230(6)	233(11)+	248(10)+	252(15)+	b	-	0		-	+	-	+				
prostate		275(4)+	132(9)	135(9)	137(20)	b	0	-		0	-						

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Grouped occupational codes 352-356

OCCUPATION CANCER	MORTALITY ODDS RATIO						OTHER STUDIES										
	20-54	20-64	20-74	55-74	20+	SC	1	2	3	4	5	6	7	8	9	10	11
352 crane operators (expanded) 132																	
larynx			407(4)+	529(4)+	420(5)+	b											
353 stationary engineers 301																	
esophagus			251(6)+	291(6)+	204(8)+	b	0	-									
stomach			207(9)+	193(7)	131(11)	u	-	0									
lymphatic and hematopoietic tissue		125(4)	156(10)	199(10)+	134(15)	b	=	0									
354 railroad workers (on train) 107																	
large intestine and rectum		275(4)	155(5)	177(5)	162(11)	u		0					0				
urinary organs					288(6)+	u		-					-				
lymphomas					291(4)+	u		-					=				
cirrhosis of the liver		197(5)	209(7)	186(4)	213(8)	a		0							0		
355 railroad workers (off train) 431																	
buccal cavity and pharynx	676(5)+	394(9)+	246(11)+	161(6)	260(17)+	b	0										
large intestine, except rectum		157(6)	117(12)	119(11)	125(23)	a	0										
rectum and rectosigmoid junction		310(5)+	172(7)	166(6)	193(14)+	b	0										
respiratory system	76(4)	107(19)	119(47)	125(43)	119(67)	b	0										
cirrhosis of the liver	171(11)	147(18)	159(27)+	152(16)	152(29)	b	+										
356 railroad workers (all) 538																	
buccal cavity and pharynx	557(5)+	317(9)+	222(12)+	156(7)	224(18)+	b				=	0						
esophagus			154(6)	144(5)	161(10)	b					-						
large intestine, except rectum		180(9)	122(16)	129(15)	133(32)	b				-	-						
rectum and rectosigmoid junction		249(5)+	142(7)	137(6)	167(15)	b					0						
bladder			103(4)	108(4)	150(13)	a				-	0						
Hodgkins disease					265(4)+	b											
cirrhosis of the liver	170(14)	148(23)	161(34)+	156(20)	156(37)+	b											

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Grouped occupational codes 357-360

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
357 assemblers (expanded) 95																	
rectum and rectosigmoid junction			399(5)+	460(5)+	312(5)+	b											
respiratory system		98(9)	124(16)	135(15)	146(21)	b											
358 foundry workers 154																	
tongue			1049(4)+		663(4)+	b											
large intestine and rectum			169(8)	122(5)	183(18)+	b											
respiratory system		188(15)	162(20)	169(18)	139(26)	b											
cirrhosis of the liver		157(8)	182(11)	205(8)	175(12)	u											
359 welders (expanded) 222																	
tongue					354(4)+	b											
large intestine,except rectum			132(9)	144(8)	161(13)	a											
rectum and rectosigmoid junction		283(6)+	222(7)+	236(6)+	193(7)	b											
prostate			186(7)	198(7)	256(14)+	b											
360 heated metal workers 486																	
malignant neoplasms	124(34)	115(108)	111(169)	108(135)	121(253)+	b	0		+						+		
tongue			422(7)+	308(4)+	385(8)+	b			-						0		0
large intestine, except rectum		76(6)	120(17)	116(14)	150(31)+	b	0		0						0	0	0
rectum and rectosigmoid junction		289(9)+	205(11)+	173(8)	179(14)+	b	-		=						+	0	0
larynx		259(5)+	172(5)		192(7)	u	0		0						=	0	0
trachea, bronchus, and lung	145(12)	150(48)+	124(63)	120(51)	129(80)	b	+		+						+	+	+
prostate			95(7)	98(7)	121(21)	b	-		-						0	0	0
bladder			124(5)	139(5)	196(14)+	b	0		=						=	0	0
reticulum cell sarcoma					277(4)+	a	-										
cirrhosis of the liver	88(10)	109(26)	114(32)	132(22)	118(35)	u	-		=						0		

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Grouped occupational codes 361-364

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
361 metal workers 3071																	
tongue	157(4)	160(11)	149(16)	147(12)	143(20)	b											
esophagus	127(5)	109(17)	131(37)	132(32)	131(51)	u				+							
large intestine, except rectum	163(20)	118(52)	116(107)	109(87)	120(172)+	b			0	=				-			
rectum and rectosigmoid junction	196(9)	160(28)+	128(45)	118(36)	114(62)	b			0	+							
pancreas	127(12)	122(35)	130(67)+	131(55)	118(88)	b				=							
trachea, bronchus, and lung	144(73)+	116(212)	109(359)	102(286)	110(459)	b			+	+				+	-		
bladder		124(14)	121(32)	125(30)	127(64)	b				=				0			
myeloid leukemia	205(8)	149(12)	127(18)	98(10)	112(22)	a											
362 paper workers (expanded) 312																	
digestive organs and peritoneum	112(5)	131(16)	133(36)	138(31)	107(51)	b											
cirrhosis of the liver	111(7)	127(14)	138(20)	159(13)	136(22)	u				0							
363 leather product workers 635																	
stomach	507(4)+	195(6)	113(8)	64(4)	125(21)	b											
large intestine, except rectum		199(10)+	101(13)	94(11)	97(29)	b											
liver					275(6)+	b											
trachea, bronchus, and lung	103(5)	144(30)	132(59)	136(54)	117(85)	b											
prostate			118(9)	121(9)	120(41)	b											
leukemia and aleukemia			135(5)	157(5)	164(15)	b											
364 leather and leather product																	
workers 847																	
stomach	435(5)+	194(8)	104(10)	59(5)	117(26)	b			0						0	0	0
large intestine, except rectum		163(11)	85(15)	82(13)	94(37)	b			0	+					0	0	0
pancreas			104(10)	121(10)	139(26)	b			0						0	-	
trachea, bronchus, and lung	114(8)	148(41)	133(81)+	136(73)+	120(116)	b			0	0					0	0	0

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Grouped occupational codes 364-368

OCCUPATION / CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
prostate			156(14)	160(14)	122(53)	a			=						0	0	-
urinary organs		156(6)	150(13)	156(12)	106(24)	a			=		.				=	0	0
leukemia and aleukemia			119(6)	140(6)	159(19)	b			0						-	-	
myeloid leukemia			185(4)	241(4)	204(8)	a			0								-
cirrhosis of the liver	104(9)	128(25)	124(34)	133(25)	117(38)	u			0	0					0		
365 textile workers (expanded) 1200																	
buccal cavity and pharynx	300(4)+	180(11)	105(13)	81(9)	98(20)	u							=		=	-	-
cecum, appendix, and ascending																	
colon					187(13)+	b											
rectum and rectosigmoid junction		89(4)	141(16)	152(16)	110(26)	b			0		=				+	0	0
366 apparel workers (expanded) 242																	
respiratory system	126(5)	173(15)	128(26)	128(21)	146(46)+	b		0	0	+					0	0	0
367 glass workers 91																	
digestive organs and peritoneum		347(8)+	256(12)+	349(11)+	137(14)	b											
large intestine and rectum			223(5)	325(5)+	119(6)	b											
trachea, bronchus, and lung		191(5)	214(11)	314(11)+	142(12)	b											
cirrhosis of the liver	238(5)	269(7)	218(7)		191(7)	b											
368 food workers 1475																	
buccal cavity and pharynx	180(4)	151(18)	161(31)+	156(23)+	142(37)+	b											
esophagus	248(5)+	155(11)	126(17)	104(12)	128(25)	b											
stomach		133(17)	126(31)	149(29)+	115(46)	b											
large intestine, except rectum	134(9)	143(29)	113(50)	110(41)	94(68)	b											
biliary passages and liver		194(6)	153(10)	147(8)	179(21)+	b											
testis		272(4)+	258(4)		222(4)	u											

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Grouped occupational codes 368-372

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
myelofibrosis			503(4)+	503(4)+	271(4)+	b											
cirrhosis of the liver	140(51)	121(78)	110(89)	85(38)	106(94)	u											
369 wood workers 1219																	
stomach		98(8)	116(20)	129(18)	143(45)+	b			-						0	0	0
rectum and rectosigmoid junction	316(5)+	177(9)	147(17)	120(12)	138(29)	b			0						0	0	0
biliary passages and liver		203(4)	243(11)+	238(9)+	196(18)+	b											
pancreas	222(7)+	221(18)+	159(27)+	145(20)	123(35)	b			0						0	0	0
prostate		155(5)	111(18)	115(18)	122(67)	a			=						=	-	0
kidney		185(7)	145(10)	185(10)	133(14)	b			0						0	0	0
brain and nervous system	245(7)+	165(10)	154(13)	107(6)	145(14)	b			=						+	-	0
multiple myeloma			212(7)	218(6)	233(13)+	b			-						0	0	-
leukemia and aleukemia	161(4)	187(9)	167(16)+	169(12)	157(28)+	b			0						0	0	
lymphatic leukemia, chronic					236(7)+	u			0								=
370 armed forces 241																	
malignant melanoma of skin					309(4)+	a	-	-	=			-			-	0	-
371 sailors 329																	
digestive organs and peritoneum	112(7)	123(20)	104(32)	102(25)	97(44)	b	0	0									
trachea, bronchus, and lung	53(4)	104(21)	131(46)	152(42)+	143(62)+	b	-				0						
372 vehicle drivers 1579																	
esophagus	210(5)	170(14)	157(25)+	147(20)	145(28)	b				0	-	-	0				
nose and nasopharynx			404(6)+	470(4)+	352(6)+	b						0	-				
larynx	228(5)	210(13)+	190(20)+	180(15)+	178(22)+	b				=	-	=	=				
trachea, bronchus, and lung	167(56)+	163(164)+	146(267)+	141(211)+	145(305)+	b				+	+	+	0	+			
prostate		126(7)	132(31)	132(30)	106(50)	a				0	0	0	0				

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Grouped occupational codes 372-377

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
bone	341(4)+	206(4)	180(5)		173(6)	u						0					
bladder	261(4)	162(10)	115(17)	98(13)	113(25)	u				0	0.	0	=	-			
lymphosarcoma		246(6)+	204(8)	273(7)+	162(8)	a					0						
cirrhosis of the liver	144(75)+	144(126)+	139(149)+	133(74)+	139(155)+	u				0				0			
373 meat processing workers 285																	
stomach			108(5)		167(12)	b	0		0			-			0		
larynx			244(4)	324(4)+	228(5)	b	-					0					
trachea, bronchus, and lung	140(8)	136(21)	121(35)	117(27)	126(47)	b	0		=			=			=	+	+
bladder		427(4)+	258(6)+	240(5)	200(9)+	b	0		0			-					
kidney			213(4)		234(6)+	b	0					0					
374 gas station, garage workers 165																	
prostate			246(6)+	262(6)+	193(10)	b	0										
bladder		373(4)+	453(7)+	442(6)+	330(8)+	b	+		=								
lymphatic and hematopoietic tissue	238(4)+	130(6)	106(6)		87(6)	a	0										
375 oil exposure 231																	
prostate			200(10)+	209(10)+	112(13)	b											
376 oil and gasoline exposure 396																	
prostate			217(16)+	228(16)+	137(23)	b											
bladder		242(5)	267(11)+	272(10)+	168(12)	b											
lymphatic and hematopoietic tissue	200(7)	134(11)	100(13)	63(6)	87(15)	b											
377 asbestos exposure 962																	
tongue		208(4)	178(6)	186(5)	212(9)+	b											
mouth		282(4)+	182(5)	211(5)	170(6)	b											

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Grouped occupational codes 377-380

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	9	9	10	11
stomach		162(12)	135(22)	151(21)	105(26)	b											
larynx		233(7)+	153(9)	140(7)	157(12)	u											
trachea, bronchus, and lung	127(16)	113(56)	135(138)+	136(122)+	142(183)+	b											
pleura and mediastinum			524(4)+	570(4)+	565(5)+	b											
leukemia and aleukemia		169(7)	160(14)	154(11)	147(20)	b											
cirrhosis of the liver	155(25)	110(39)	121(58)	104(33)	118(61)	b											
378 chemical exposure (operatives) 969																	
stomach		134(10)	148(22)	173(21)+	136(34)	b											
rectum and rectosigmoid junction		145(7)	148(15)	149(13)	125(21)	b											
pancreas		103(8)	141(21)	157(19)	131(30)	b											
trachea, bronchus, and lung	112(16)	122(59)	119(111)	120(95)	110(137)	u											
urinary organs		200(13)+	159(22)+	157(19)	135(34)	b											
lymphosarcoma			255(5)+	261(4)	150(5)	a											
myeloid leukemia			229(9)+	337(9)+	176(10)	b											
cirrhosis of the liver	90(18)	124(46)	131(62)+	160(44)+	125(65)	b											
379 silica exposure 124																	
respiratory system		155(11)	142(16)	144(15)	143(23)	b											
cirrhosis of the liver		161(6)	193(9)	179(7)	208(11)+	b											
380 barbers (expanded) 201																	
pancreas		396(5)+	179(5)		128(6)	b		0									
trachea, bronchus, and lung		123(10)	113(20)	116(19)	124(31)	u		0	0	=		-	-		0		
bladder		758(4)+	328(5)+	342(5)+	165(6)	b		0	=	=		-	-				
lymphatic and hematopoietic tissue			172(6)	191(6)	161(10)	a		=									

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Grouped occupational codes 381-384

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
381 hospital workers (expanded) 135																	
trachea, bronchus, and lung		94(10)	130(24)	150(22)	133(27)	b											
urinary organs			257(7)+	224(5)	238(8)+	b											
382 bar workers 215																	
buccal cavity and pharynx		420(9)+	323(9)+	422(7)+	304(10)+	b	+	+		+		+					
sigmoid colon			475(4)+	626(4)+	336(4)+	b											
biliary passages and liver			710(6)+	1076(6)+	479(6)+	b	0	-				0					
larynx	932(4)+	577(5)+	512(6)+		493(7)+	b	+	+				-					
trachea, bronchus, and lung	86(6)	115(17)	115(24)	130(18)	139(34)	b	0	-	=	=		=			=	+	+
cirrhosis of the liver	217(20)+	261(34)+	279(40)+	390(20)+	289(43)+	b	+	+	+	+					=		
383 restaurant workers (expanded) 855																	
buccal cavity and pharynx	211(6)	173(14)	200(24)+	197(18)+	161(25)+	b				+	+						
esophagus	413(5)+	167(8)	148(12)	101(7)	152(17)	b											
stomach		164(14)	133(20)	152(18)	120(27)	b				=	-						
large intestine and rectum	129(7)	129(25)	123(46)	122(39)	107(63)	a				=	0						
biliary passages and liver		243(5)	206(8)+	186(6)	245(16)+	b											
leukemia and aleukemia		78(4)	130(11)	166(10)	109(14)	b				=							
cirrhosis of the liver	157(37)+	135(58)	126(65)	100(28)	123(68)	b				+							
384 custodial, maintenance, cleaning																	
workers 1526																	
buccal cavity and pharynx	208(7)	155(22)	126(29)	112(22)	123(35)	b	0	+		-		0					
rectum and rectosigmoid junction		75(8)	114(22)	128(22)	114(30)	b	+	-	0			-					
pancreas	242(9)+	159(25)+	128(37)	111(28)	125(49)	b	0	-	=		-	0					
larynx	370(5)+	163(10)	133(14)	98(9)	129(17)	u	0	0			-	+					
trachea, bronchus, and lung	152(32)+	108(112)	113(211)	108(179)	109(247)	b	0	0	+	0	+	+		+	-		

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Grouped occupational codes 384-387

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	 20-64	 20-74	 55-74	 20+	 SC	OTHER STUDIES 1	 2	 3	 4	 5	 6	 7	 8	 9	 10	 11
Hodgkins disease	284(4)+	117(4)	127(6)		129(7)	b	-	0				0					
leukemia and aleukemia		179(11)	119(17)	119(15)	110(23)	a	0	=	0		0	0			-		
myeloid leukemia		203(6)	131(8)	142(7)	152(12)	a	0	=									
cirrhosis of the liver	170(44)+	134(90)+	123(107)	104(63)	122(113)	b	0	0	0	0				=	0		
385 construction workers, management 381																	
large intestine and rectum	217(5)	113(9)	126(23)	113(18)	95(28)	u											
pancreas	335(4)+	142(5)	129(7)	86(5)	158(16)	b											
386 construction workers (expanded) 482																	
gallbladder, ducts, ampulla of																	
vater			310(4)+	487(4)+	306(6)+	b											
cirrhosis of the liver	85(21)	94(33)	102(41)	127(20)	102(43)	u											
387 construction trades (all) 3445																	
cecum, appendix and ascending colon		74(4)	123(13)	152(13)	105(19)	b											
rectum and rectoisigmoid junction	192(12)+	98(18)	109(41)	93(29)	106(63)	b					-						
biliary passages and liver		54(4)	160(23)+	187(21)+	139(35)	b											
peritoneum and retroperitoneal																	
tissue			451(4)+	514(4)+	296(5)+	b											
larynx		102(12)	125(25)	148(22)	145(38)+	b					-						
pleura and mediastinum			245(6)+	227(5)	272(8)+	b											
bone	280(5)+	204(6)	150(7)		122(9)	u											
skin, other malignant neoplasms			287(6)+	273(5)+	196(9)	b											
breast					320(6)+	b											
brain and nervous system	131(16)	123(28)	117(35)	107(19)	116(38)	b				=	-						
lymphomas	115(18)	132(36)	134(56)+	146(38)+	120(65)	b				-							
lymphosarcoma		104(7)	141(15)	176(13)	129(19)	b					0						

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Grouped occupational codes 387-391

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
Hodgkins disease	152(11)	165(16)	154(19)	156(8)	142(20)	b					+						
multiple myeloma		105(5)	99(11)	90(8)	130(21)	b					0						
lymphatic leukemia, chronic			187(6)	212(6)	170(13)	u											
monocytic leukemia					511(4)+	a											
388 material handlers (expanded) 305																	
esophagus		268(5)+	283(9)+	223(6)	307(12)+	b											
large intestine, except rectum		72(4)	137(14)	167(14)	118(16)	b								-			
larynx		288 (4)+	185(4)	240(4)	155(4)	u											
lymphatic leukemia, chronic					720(4)+	b											
cirrhosis of the liver	207(21)+	176(32)+	171(37)+	140(16)	164(37)+	b								-			
389 farmers 447																	
malignant neoplasms	168(12)	75(33)	82(82)	76(70)	78(181)					θ	=						
cecum, appendix, and ascending																	
colon					236(7)+												
multiple myeloma					313(7)+								0				
390 plant and tree workers 726																	
buccal cavity and pharynx		193(9)	176(14)+	158(11)	137(17)												
stomach	354(4)+	78(4)	77(8)	43(4)	99(21)												
multiple myeloma					231(8)+												
391 animal workers 122																	
malignant neoplasms	155(4)	135(20)	81(32)	76(28)	69(49)												

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Large employer codes 392-394

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
392 large employer A - electrical equip-																	
ment; engines and turbines 591																	
esophagus	646(4)+	159(6)	162(10)	108(6)	139(11)	b											
stomach	317(5)+	104(7)	120(13)	86(8)	110(17)	b											
large intestine and rectum	393(12)+	143(23)	136(38)	105(26)	124(50)	b											
prostate			124(12)	117(11)	128(28)	b											
bladder			128(7)	138(7)	162(15)	b											
kidney		189(6)	151(7)	154(6)	173(10)	b											
brain and nervous system	424(6)+	124(6)	117(7)		109(7)	b											
lymphosarcoma		350(5)+	236(5)	231(4)	184(5)	b											
myeloid leukemia	604(5)+	329(7)+	266(8)+		239(9)+	b											
393 large employer B - abrasive																	
products 112																	
digestive organs and peritoneum		340(9)+	307(24)+	321(24)+	245(32)+	b											
large intestine, except rectum		496(4)+	387(10)+	402(10)+	273(12)+	b											
rectum and rectosigmoid junction			515(5)+	540(5)	498(8)+	b											
respiratory system		254(9)	105(10)	88(8)	101(13)	b											
urinary organs			295(4)+	306(4)+	161(4)	b											
lymphatic and hematopoietic tissue		623(4)+	313(6)+	325(6)+	291(9)+	b											
leukemia and aleukemia			585(4)+	597(4)+	395(5)+	b											
394 large employer C - electrical and																	
electronic machinery, equipment																	
and supplies 153																	
trachea, bronchus, and lung	171(11)	161(26)	131(32)	116(21)	119(32)	b											

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Large employer codes 395-397
Major occupational groupings

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	SC	OTHER STUDIES 1	2	3	4	5	6	7	8	9	10	11
395 shiphards 496																	
tongue			267(5)+	340(5)+	256(6)+	b	0										
rectum		242(6)+	140(8)	119(6)	135(11)	u	-										
trachea, bronchus, and lung	126(9)	131(34)	144(83)+	147(74)+	151(108)+	b	=			+							
396 large employer D - mass transit 247																	
respiratory system		129(22)	133(38)	145(35)	135(49)	b											
bladder			239(5)	263(5)+	178(7)	b											
397 large employer E - telephone																	
company 153																	
large intestine and rectum		156(4)	207(11)+	261(9)+	174(16)	b											
prostate			276(5)+	302(5)+	124(7)	b											
lymphatic and hematopoietic tissue			127(5)	288(5)+	159(9)	b											
cirrhosis of the liver	71(5)	86(7)	126(12)	288(7)+	119(12)	b											
MAJOR OCCUPATIONAL GROUPINGS																	
professional, technical and kindred																	
workers 3234																	
large intestine, except rectum	152(31)+	130(68)	129(130)+	123(99)	126(186)+				+	+	0	+		+	+	+	+
biliary passages and liver	338(9)+	238(17)+	164(24)+	125(15)	130(31)					0		0				-	
liver	541(4)+	216(7)	135(9)	85(5)	103(11)				0		-				+		0
gall bladder, ducts, ampulla of vater	281(5)+	239(9)+	186(14)+	156(9)	151(19)				0		-						-
malignant melanoma of skin	195(17)+	182(21)+	172(24)+	133(7)	171(28)+				+	0	0	+			+	+	+

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Major occupational groupings

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	OTHER STUDIES SC	1	2	3	4	5	6	7	8	9	10	11
prostate	401(8)+	146(20)	113(59)	102(51)	115(142)				=	0	0	+			+	+	+
testis	166(13)	157(13)	154(13)		159(14)				=		+	0			+	+	+
bladder	166(6)	151(19)	127(36)	122(30)	118(60)				0	0	=	0		0	0	0	0
kidney	99(7)	125(20)	132(32)	146(25)	122(38)				=	+	0	0			+	=	=
brain and nervous system	167(27)+	165(46)+	167(57)+	167(30)+	184(66)+				+	=	0	-			+	+	+
lymphatic and hematopoietic tissue	140(58)+	138(93)+	127(130)+	119(72)	125(166)+												
lymphomas	120(28)	127(47)	127(64)	133(36)	126(76)				+	+		-			+	=	-
lymphosarcoma	206(7)	176(13)	140(16)	112(9)	127(19)						-						
multiple myeloma	158(4)	175(9)	180(19)+	186(15)+	151(23)				0		-				+	+	+
leukemia and aleukemia	174(26)+	154(37)+	122(46)	89(20)	119(63)				+	+	-	-			+	-	0
myeloid leukemia	129(14)	143(22)	125(26)	121(12)	119(30)				=								-
managers, officials, proprietors,																	
except farm 4211																	
large intestine, except rectum	117(21)	135(78)+	149(179)+	154(158)+	143(279)+				+	+	=	+		0	+	+	+
pancreas	135(18)	119(46)	121(85)	118(67)	113(119)				+	=	-				+	0	+
nose and nasopharynx	339(4)+	146(4)	127(5)		98(5)							0					
sinuses		924(5)+	465(5)+	372(4)+	327(6)+				0						0	0	-
connective and other soft tissue		229(6)	178(8)	184(5)	152(11)				0		-	-			=	0	-
malignant melanoma of skin	126(9)	141(15)	137(19)	149(10)	127(23)				+	0	0	0			+	+	+
prostate		185(30)+	152(101)+	156(99)+	113(209)				-	0	0	+			-	-	0
kidney	117(7)	112(20)	142(40)+	149(33)+	126(50)				+	0	-	+			+	=	=
brain		60(13)	86(23)	126(22)	90(26)				+	-	0	-			+	+	+
lymphomas	184(24)+	138(43)	147(71)+	133(47)	156(98)+				+	+		0			=	=	+
reticulum cell sarcoma	144(4)	124(10)	135(17)	132(13)	136(21)												
lymphosarcoma	138(4)	94(8)	110(15)	103(11)	129(24)						0						
Hodgkins disease	187(11)	176(17)+	213(26)+	239(15)+	228(32)+				0	+	=	0			=	0	+
leukemia and aleukemia	95(9)	132(27)	127(48)	137(39)	119(75)				+	+	0	0			+	-	=

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Major occupational groupings

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	OTHER STUDIES SC	1	2	3	4	5	6	7	8	9	10	11
myeloid leukemia	101(6)	159(18)	148(27)	170(21)+	142(36)				=								=
clerical and kindred workers 1837																	
buccal cavity and pharynx	58(4)	108(18)	126(35)	149(31)+	111(38)					0	-	0					
pharynx		116(9)	146(18)	171(16)+	119(18)				0						=	0	0
stomach	110(8)	125(22)	92(33)	87(25)	89(45)				0	0	0	+		-	0	0	0
transverse colon			335(4)+	371(4)+	239(4)												
rectosigmoid junction			257(6)+	312(6)+	172(6)												
connective and other soft tissue			177(4)	299(4)+	192(6)				0		-	0			0	0	0
brain and nervous system	190(12)+	143(19)	122(22)	85(10)	119(23)				-	0	-	0			=	+	+
lymphomas	139(11)	141(22)	122(31)	114(20)	134(41)				0	+		0			=	-	0
reticulum cell sarcoma	294(4)+	222(8)+	126(8)	80(4)	138(10)												
lymphosarcoma		151(6)	149(10)	162(8)	192(16)+						0						
leukemia and aleukemia	199(11)+	150(16)	129(26)	103(15)	124(35)				0	0	-	=			0	0	0
sales workers 1748																	
stomach	197(10)+	94(15)	86(29)	66(19)	90(45)				0	0	0	0		0	0	0	0
connective and other soft tissue					225(7)+				0		0	=			0	0	=
malignant melanoma of skin	303(8)+	207(9)+	145(9)		141(11)				=	=	-	-			=	=	=
brain	122(4)	169(14)	170(19)+	189(15)+	157(19)				0	0	0	=			=	-	0
supra-renal gland			667(4)+		568(4)+												
lymphomas	64(4)	123(17)	125(29)	147(25)	116(34)				-	=		-			=	0	0
reticulum cell sarcoma		114(4)	153(9)	172(8)	159(11)												
craftsmen, foremen, and kindred																	
workers 8922																	
malignant neoplasms	100(511)	118(1577)+	115(3005)+	118(2494)+	114(4475)+				0	+					0		
buccal cavity and pharynx	75(20)	113(74)	112(123)	124(103)	114(166)					0	-	0					

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Major occupational groupings

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	OTHER STUDIES SC	1	2	3	4	5	6	7	8	9	10	11
tongue	56(5)	114(21)	110(33)	133(28)	116(45)				0						0		
salivary glands		216(4)	209(8)	266(6)	213(14)+							0			0		
pharynx	104(11)	124(37)	122(59)	127(48)	120(76)				0						0		
esophagus	44(6)	118(45)	119(90)	135(84)+	114(123)				0		0	0			0		
stomach	89(26)	115(81)	129(174)+	140(148)+	125(274)+				-	+	0	+			0		
small intestine			281(6)	424(5)+	112(6)				0						0		
cecum, appendix and ascending colon		89(12)	107(29)	131(29)	113(51)												
rectum and rectosigmoid junction	177(22)+	138(59)+	123(114)	115(92)	110(166)				0		0	0			0		
liver		117(9)	181(26)+	194(24)+	132(37)				0		0	0			0		
peritoneum and retroperitoneal tissue		345(4)	201(5)	226(5)	145(7)				0			0			0		
larynx		112(32)	108(55)	136(52)	123(81)				0		0	0			0		
trachea, bronchus, and lung	115(171)	129(565)+	126(1070)+	129(899)+	125(1375)+				-	+	+	+			0		
pleura and mediastinum		187(6)	177(11)	178(10)	190(14)+				=			0			0		
breast			118(4)	187(4)	228(10)+												
prostate	70(4)	117(37)	99(144)	101(140)	113(415)+				0	0	+	0			0		
bladder	81(6)	114(32)	121(85)	125(79)	124(172)+				=	+	0	0			0		
kidney	94(12)	125(41)	107(62)	111(50)	118(92)				0	0	0	0			0		
brain	138(23)	125(48)	103(54)	86(31)	95(55)				0	-	0	0			0		
lymphatic and hematopoietic tissue	108(64)	123(144)+	115(247)	117(183)	113(358)+												
lymphomas	123(38)	141(85)+	126(125)+	128(87)	111(149)				0	+		0			0		
reticulum cell sarcoma	74(5)	115(18)	124(31)	143(26)	115(36)												
lymphosarcoma	135(8)	142(21)	134(34)	133(26)	112(42)						-						
Hodgkins disease	151(21)	158(32)+	133(37)	114(16)	126(41)				0		0	0			0		
lymphatic leukemia, chronic			101(9)	97(8)	151(28)				0								
monocytic leukemia			244(4)	413(4)+	215(8)												

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Major occupational groupings

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	OTHER STUDIES SC	1	2	3	4	5	6	7	8	9	10	11
operatives 6817																	
mouth		154(17)	138(26)	152(23)	132(33)												
tonsils		180(10)	140(12)	120(9)	128(13)												
esophagus	155(13)	120(40)	130(80)+	126(67)	124(106)				0		0	+					
stomach	152(31)	108(67)	103(120)	93(89)	103(188)				=	0	=	=		=			
larynx	183(13)	118(29)	134(54)	124(41)	133(70)+				=		+	0					
trachea, bronchus, and lung	120(139)	120(469)+	117(834)+	117(695)+	114(1043)+				=	+	0	+		0			
kidney	161(14)	123(35)	113(53)	102(39)	109(70)				0	+	+	0					
polycythemia vera					240(7)												
cirrhosis of the liver	113(185)	111(343)	114(437)+	115(252)	115(470)+				0	0				0			
service workers 3627																	
buccal cavity and pharynx	151(15)	153(50)+	147(76)+	146(61)+	142(93)+					+	0	-					
tongue		119(11)	136(19)	159(17)	126(22)				=						+	=	+
mouth	216(4)	160(11)	169(19)+	160(15)	180(25)+										=	+	-
pharynx	194(18)	171(26)+	148(35)+	138(27)	143(42)+				=						=	=	=
tonsils		222(8)+	192(10)	177(8)	185(11)												
cecum, appendix and ascending colon	305(4)+	97(7)	139(18)	120(14)	110(22)												
biliary passages and liver		126(11)	138(24)	147(22)	143(40)+					=		-				+	+
(liver)		180(7)	110(9)	108(8)	136(17)				=						=		=
gall bladder, ducts, ampulla of																	
vater			133(12)	166(12)	134(20)				=								0
larynx	316(11)+	125(18)	120(29)	87(18)	120(37)				=	-	+	+			+	0	+
trachea, bronchus, and lung	121(74)	99(242)	104(447)	101(373)	102(546)				+	+	0	+			+	0	0
leukemia and aleukemia	70(6)	103(21)	109(40)	121(34)	98(54)				0	0	0	0			0	0	0
cirrhosis of the liver	157(127)+	139(234)+	126(270)+	108(143)	127(289)+				+	+					+		

ELEVATED AGE-STANDARDIZED MORTALITY ODDS RATIOS BY OCCUPATION COMPARED WITH OTHER STUDIES (continued)

Major occupational groupings

OCCUPATION CANCER	MORTALITY ODDS RATIO 20-54	20-64	20-74	55-74	20+	OTHER STUDIES SC	1	2	3	4	5	6	7	8	9	10	11
laborers, except farm 2333																	
buccal cavity and pharynx	261(17)+	149(29)+	154(46)+	124(29)	156(61)+					+	0	+					
tongue	370(7)+	213(11)+	176(14)+	116(7)	186(19)+				0						+	0	0
mouth		118(5)	135(9)	112(6)	162(14)										-	=	0
pharynx	168(5)	118(11)	131(18)	120(13)	131(23)				=						+	=	-
esophagus	228(7)+	129(15)	125(26)	107(19)	131(38)				+	+	-	=			+	+	0
descending colon			419(5)+	479(5)+	244(5)												
sigmoid colon		104(5)	124(13)	117(11)	130(22)												
biliary passages and liver		111(6)	106(11)	95(8)	138(24)					0		0			+	0	
(liver)		163(4)	129(6)	127(5)	127(10)				=						=		0
gall bladder, ducts, ampulla of vater			93(5)		154(14)				=		-						0
larynx	372(9)+	244(19)+	208(27)+	170(18)+	184(32)+				+	+	0	-			+	0	0
trachea, bronchus, and lung	125(52)	96(133)	98(235)	92(183)	101(310)				+	=	+	-			+	+	+
testis	159(7)	173(8)	192(9)		202(10)+				0		0	0			0	0	0
lymphatic leukemia, chronic			234(5)	261(5)+	156(8)				0								0
cirrhosis of the liver	227(129)+	191(200)+	177(227)+	137(98)+	168(232)+				0	+					+		
farmers 454																	
malignant neoplasms	161(12)	72(34)	81(83)	75(71)	78(183)+					0	=						
cecum, appendix and ascending colon					233(7)+												
multiple myeloma					309(7)+								0				
unknown 1696																	
breast					349(4)+												
eye					751(4)+												

TABLE A-1

CANCER CATEGORY COMPARISONS FOR CATEGORIES WHICH DID NOT EXACTLY CORRESPOND

Massachusetts Cancer Category*	Other Studies	Comparison Cancer Categories*
mouth (143-145)	Washington State California	floor of mouth (7-143) other parts of mouth ((7-144)
pharynx (146-149)	Washington State California	oral mesopharynx (7-145) nasopharynx (7-146) hypopharynx (7-147) pharynx, unspecified (7-148)
	England and Wales 1970-1972	oropharynx (146) nasopharynx (147) hypopharynx (148)
	England and Wales 1959-1963 England and Wales 1966-1967	oral mesopharynx (7-145) remainder of pharynx (7-146-148)
	England and Wales 1968-1970	oropharynx (146) pharynx(remainder) (147-149)
large intestine, except rectum (153)	United States Roswell Park	large intestine and rectum (153-154)
large intestine and rectum (153-154)	Washington State California Third National Cancer Survey Los Angeles County England and Wales (all four studies)	large intestine, except rectum (153) rectum (154)
	Rhode Island	large intestine, except rectum (153)

TABLE A-1 continued

CANCER CATEGORY COMPARISONS FOR CATEGORIES WHICH DID NOT EXACTLY CORRESPOND

Massachusetts Cancer Category*	Other Studies	Comparison Cancer Categories*
trachea, bronchus, and lung (162)	Washington State California parts of United States	trachea, bronchus and lung, specified as primary (7-162) lung and bronchus, unspecified as to whether primary or secondary (7-163)
respiratory system (160-163)	most of United States Third National Cancer Survey Los Angeles County Roswell Park Rhode Island England and Wales (all four studies)	trachea, bronchus, and lung (162,7-162 and 163) larynx (161) nose, middle ear, and accessory sinuses (160)
	Washington State California parts of United States	trachea, bronchus, and lung, specified as primary (7-162) lung and bronchus, unspecified as to whether primary or secondary (7-163) larynx (161) nose, middle ear, and accessory sinuses (160)
urinary organs (188-189)	all	bladder (188,7-181) kidney (189,7-180)
lymphomas (200-202)	Washington State California Third National Cancer Survey England and Wales (all four studies)	lymphosarcoma and reticulum cell sarcoma (200) Hodkins Disease (201)

TABLE A-1 continued

CANCER CATEGORY COMPARISONS FOR CATEGORIES WHICH DID NOT EXACTLY CORRESPOND

Massachusetts Cancer Category*	Other Studies	Comparison Cancer Categories*
lymphomas (200-202)	Los Angeles County	Hodgkins Disease (201) other lymphomas (ICD's not given)
	United States	lymphosarcoma and other neoplasms of lymphatic and hematopoietic tissue (7-200-203,205)#
chronic lymphatic leukemia (204.1)	Washington State California England and Wales 1970-1972 England and Wales 1968-1970	lymphatic leukemia (204,7-204.0)$

*Numbers in parentheses are the International Classification of Diseases Codes. "7+" indicates that the code is from the seventh revision, if the seventh revision code number differs from that of the eighth revision.

#lymphomas, multiple myeloma (7-203), and mycosis fungoides (7-205).

$This should approximate chronic lymphatic leukemia since in adults this is the predominant type of leukemia.

APPENDIX B

HIGHLY SIGNIFICANT OCCUPATION-CANCER ASSOCIATIONS BY CANCER TYPE

This table presents occupation-cancer associations for which $p \leq .01$ in the age groupings 20-54, 20-64, 20-74, 55-74, and/or 20+ (highly significant associations) for the 397 occupational categories. The result presented is the largest age grouping for which $p \leq .01$. The size ranking of the age groupings are, in descending order: 20+, 20-74, 55-74, 20-64, 20-54. Occupational categories are listed in the table if the unadjusted and/or social class adjusted results were highly significant. For the sake of brevity, under a given cancer type, redundant occupational category entries were omitted from the table. For example, under biliary passages and liver, individual code 271 "bartenders" and grouped code 382 "bar workers" were both highly significant. For the unadjusted results, bartenders had five observed deaths, sMOR = 430, and bar workers had six observed deaths, sMOR = 479. Bartenders therefore were omitted from the table.

In the table, the entry for age group was left blank if the result was for the 20+ age grouping. All of the results in the table are not significant at $p \leq .01$ because for each occupational category, both the unadjusted and social class adjusted results are presented, and only one of these must have $p \leq .01$ for the occupational category to be eligible for the table. In the MOR columns, "+" indicates $p \leq .05$, and "-" indicates that the result was not significantly elevated. The footnote "a" indicates that $p \leq .01$ in a lower age grouping, and the footnote "b" indicates that $p \leq .05$ in a lower age grouping.

HIGHLY SIGNIFICANT OCCUPATION-CANCER ASSOCIATIONS BY CANCER TYPE

CANCER OCCUPATION		AGE GROUP	OBSERVED	MOR UNADJUSTED	 ADJUSTED
Malignant Neoplasms N = 16629					
80	managers and superintendents, building		42	238	253
82	officers-pilots-pursers-engineers, ship		16	575	597
102	adjustors, examiners, investigators, estimators		39	234	249
125	brickmasons, stonemasons, tile setters		144	137	129+
131	compositors and typesetters		40	215	199+
138	heavy equipment, construction equipment operators	55-74	25	364	327
142	forgemen and hammermen		19	353	334+[a]
202	chemical workers		57	173	168+
236	optical workers NEC	20-74	19	420	420+[a]
255	truck and tractor drivers		418	127	127
326	life and physical scientists		58	176	177
332	teachers and administrators, college and university	20-74	42	218	216
367	glass workers	20-74	39	240	234+[a]
392	large employer A - electrical equipment; engines and turbines	20-54	61	213	210
393	large employer B - abrasives products	20-64	27	290	291+
Buccal Cavity and Pharynx N = 624					
7	artists and art teachers		4	364	641
71	treasurers, financial managers, bank officers		7	171-[b]	279
104	mail carriers	55-74	5	348	397
146	inspectors, railroad		4	924	862
163	mechanics and repairmen NEC	20-54	4	345+	599
169	painters, construction and maintenance	55-74	13	231	193+
181	pressmen and plate printers, printing		9	257	243+[a]
271	bartenders		10	322	257
273	cooks, chefs (except private household)	20-74	12	268	217+[a]
348	mechanics and repairmen, vehicle	20-74	12	216	186+
349	mechanics and repairmen (all)	20-74	24	178	169+[a]
351	printing trades		15	252	245
355	railroad workers (off train)		17	260	246

HIGHLY SIGNIFICANT OCCUPATION-CANCER ASSOCIATIONS BY CANCER TYPE (continued)

CANCER OCCUPATION	AGE GROUP	OBSERVED	MOR UNADJUSTED	MOR ADJUSTED
358 foundry workers (expanded)	20-74	5	337	276+
383 restaurant workers (expanded)	20-74	24	200	173+
Tongue N = 166				
125 brickmasons, stonemasons, tile setters		4	405	381
273 cooks, chefs (except private household)	55-74	4	431	352
355 railroad workers (off train)		6	354	314
358 foundry workers (expanded)		4	663	537
359 welders (expanded)		4	354	291+
360 heated metal workers		8	385	319
395 shipyards	55-74	5	340	311+
Salivary Gland N = 34				
349 mechanics and repairmen (all)		4	519	489
Mouth N = 138				
273 cooks, chefs (except private household)	20-74	4	409	308+
305 gardeners (except farm), groundkeepers, greenkeepers, landscapers		4	351	256-
347 plumbers (expanded)	20-74	4	365	563
Pharynx N = 276				
71 treasurers, financial managers, bank officers		5	280+[a]	352
90 sales managers		4	313+	411
271 bartenders		7	511	435
317 government workers NEC		6	309	312
348 mechanics and repairmen, vehicle		8	276	244+[a]
351 printing trades		9	347	337
355 railroad workers (off train)		8	281	286
384 custodial, maintenance, cleaning workers	20-54	5	372	297+

HIGHLY SIGNIFICANT OCCUPATION-CANCER ASSOCIATIONS BY CANCER TYPE (continued)

CANCER OCCUPATION	AGE GROUP	OBSERVED	MOR UNADJUSTED	MOR ADJUSTED
Digestive Organs and Peritoneum N = 5094				
9 chiropodists	20-74	4	1058	967+
82 officers-pilots-pursers-engineers, ship		10	1145	1239
92 cocktail, bar, tavern owners, managers	20-74	6	625	591
142 forgemen and hammermen	20-74	5	676	619+
178 steamfitters		22	200	189+
236 optical workers NEC	55-74	6	781	834
327 chemists (expanded)		22	223	204
332 teachers and administrators, college and university		24	249	233
342 funeral workers	20-74	7	378	348
367 glass workers	55-74	11	349	331
392 large employer A - electrical equipment; engines and turbines	20-54	25	346	340
393 large employer B - abrasives products		32	245	242
Esophagus N = 460				
32 engineers, mechanical		5	316+[a]	362
178 steamfitters		5	493	444
202 chemical workers		5	552	480
255 truck and tractor drivers		21	234	217
306 longshoremen and stevedores		7	685	661
353 stationary engineers (expanded)	55-74	6	291	257+
383 restaurant workers (expanded)	20-54	5	413	325+
388 material handlers (expanded)		12	307	289
392 large employer A - electrical equipment; engines and turbines	20-54	4	645	567
Stomach N = 945				
26 draftmen	20-74	4	342+	384
93 managers, administrators, officials and proprietors NEC; supervisors NEC	20-74	39	134-[b]	171
101 dispatchers and starters, vehicle		6	302	361

HIGHLY SIGNIFICANT OCCUPATION-CANCER ASSOCIATIONS BY CANCER TYPE (continued)

CANCER OCCUPATION	AGE GROUP	OBSERVED	MOR UNADJUSTED	MOR ADJUSTED
129 carpenters		36	169	160+
176 plasterers and lathers		4	423	432
242 plastic workers		7	337	329
347 plumbers (expanded)	55-74	12	220	184-
363 leather product workers	20-54	4	507	518
Small Intestine N = 22				
93 managers, administrators, officials, and proprietors NEC; supervisors NEC		5	542	735
Large intestine and Rectum N = 2479				
28 engineers, chemical		6	581	424
82 officers-pilots-pursers-engineers, ship		6	1398	1393
86 postmasters	20-64	7	410	366
88 public utility supervisors, official, managers, etc.		17	223	204+
112 railroad clerks		10	326	272
154 machinists NEC	20-54	15	285	260
190 tinsmiths, coppersmiths, and sheet metal workers	55-74	10	282	282
228 foundry workers NEC		10	242+[a]	269
232 slaughter house butchers		13	208+	225
235 maintenance, railroad	20-64	4	552	649
327 chemists (expanded)		13	268	222+
332 teachers and administrators, college and university		14	297	252
356 railroad workers (all)	20-64	16	214	212
358 foundry workers (expanded)		18	183+	207
360 heated metal workers		48	157	173
392 large employer A - electrical equipment; engines and turbines	20-54	12	393	400
393 large employer B - abrasives products		21	325	342
Large Intestine, Except Rectum N = 1674				
28 engineers, chemical		4	565	378+

HIGHLY SIGNIFICANT OCCUPATION-CANCER ASSOCIATIONS BY CANCER TYPE (continued)

CANCER OCCUPATION		AGE GROUP	OBSERVED	MOR UNADJUSTED	MOR ADJUSTED
50	physicians and surgeons		16	202	158-
82	officers-pilots-pursers-engineers, ship		4	1396	1324
86	postmasters	20-64	5	454	377
93	managers, administrators, officials, and proprietors NEC; supervisors NEC		116	140	113-
110	stock clerks and storekeepers	55-74	11	237+	244
154	machinists NEC	20-54	11	311	330
205	electrical and electronic machinery, equipment, supplies workers NEC	20-54	5	418	558
228	foundry workers NEC		7	249+	298
249	shoe factory workers	20-64	10	221+	274
327	chemists (expanded)		10	306	229+[a]
332	teachers and administrators, college and university		11	347	271
360	heated metal workers		31	150+	174
361	metal workers		172	120+	127
392	large employer A - electrical equipment; engines and turbines	20-54	9	437	439
393	large employer B - abrasive products		12	273	302
Cecum, Appendix and Ascending Colon N = 190					
266	textile workers NEC		11	228	274
287	guards, watchmen, and doorkeepers, correction officers		6	248+	310
Sigmoid Colon N = 272					
13	clergymen		4	411	358+
243	rubber workers	20-74	4	375	367
382	bar workers	20-74	4	475	440
Rectum and Rectosigmoid Junction N = 630					
88	public utility supervisors, officials, managers, etc.		6	314	308
107	postal clerks		9	264	246
112	railroad clerks		4	527	401

HIGHLY SIGNIFICANT OCCUPATION-CANCER ASSOCIATIONS BY CANCER TYPE (continued)

CANCER OCCUPATION		AGE GROUP	OBSERVED	MOR UNADJUSTED	MOR ADJUSTED
190	tinsmiths, coppersmiths, and sheet metal workers	55-74	4	426	382+
232	slaughter house butchers	55-74	4	429	415
264	woodworkers, millworkers, furniture workers	20-64	4	422	430
266	textile workers NEC	55-74	15	202	202+
325	mathematical professions	20-54	6	190-	497
343	postal workers (all)		18	185+[a]	190
348	mechanics and repairmen, vehicle	20-54	4	488	369
357	assemblers (expanded)	20-74	5	399	383
360	heated metal workers	20-64	9	289	298
393	large employer B - abrasives products		8	498	480
Rectosigmoid Junction N = 69					
1	accountants and auditors		5	596	584
154	machinists NEC		7	306	191-[b]
360	heated metal workers		4	502	639
Rectum N = 561					
88	public utility supervisors, officials, managers, etc.		6	355	366
190	tinsmiths, coppersmiths, and sheet metal workers	55-74	4	470	429
232	slaughter house butchers		5	352	326
266	textile workers NEC	55-74	14	212	205+
288	policemen, detectives, marshalls, constables, sheriffs, court officers	20-64	6	296	263+
348	mechanics and repairmen, vehicle	20-54	4	559	422
355	railroad workers (off train)	20-64	5	334	302+
357	assemblers (expanded)	55-74	4	399	392
369	wood workers	20-54	5	358	351+
393	large employer B - abrasives products		8	561	543
Biliary Passages and Liver N = 276					
13	clergymen		4	408	408
50	physicians ans surgeons	20-74	4	488	509

HIGHLY SIGNIFICANT OCCUPATION-CANCER ASSOCIATIONS BY CANCER TYPE (continued)

CANCER OCCUPATION		AGE GROUP	OBSERVED	MOR UNADJUSTED	MOR ADJUSTED
288	policemen, detectives, marshalls, constables, sheriffs, court officers		9	315	316
330	physicians, dentists, and related practitioners		8	248+[a]	277
344	carpenters (expanded)	20-74	9	267	287
349	mechanics and repairmen (all)	20-64	6	256+	321
368	food workers		21	179+	192
369	wood workers		18	196	189+[a]
382	bar workers		6	479	466
383	restaurant workers (expanded)		16	245	262
387	construction trades (all)	55-74	21	187	184+
Liver N = 123					
249	shoe factory workers		6	321	327
273	cooks, chefs (except private household)		4	350	379
344	carpenters (expanded)		8	265	295
349	mechanics and repairmen (all)	20-64	4	387	427
Gall Bladder, Ducts, Ampulla of Vater N = 147					
288	policemen, detectives, marshalls, contables, sheriffs, court officers		5	330	410
324	architects, draftsmen, and engineers	20-74	7	331	371
382	bar workers		4	579	532
383	restaurant workers (expanded)		9	258	241+
386	construction workers (expanded)		6	306	300
387	construction trades (all)	55-74	12	220+	251
Pancreas N = 874					
40	lawyers and judges, attorneys		11	228	225+
61	school administrators, elementary and secondary school		7	503	502
65	technicians, other engineering and physical sciences	55-74	4	732	777
80	managers and superintendents, building		5	554	600

HIGHLY SIGNIFICANT OCCUPATION-CANCER ASSOCIATIONS BY CANCER TYPE (continued)

CANCER OCCUPATION		AGE GROUP	OBSERVED	MOR UNADJUSTED	MOR ADJUSTED
153	precision machine operatives		8	276	272
270	barbers	20-64	5	527	527
278	janitors, sextons, manintenance workers	20-64	20	191	192
326	life and physical scientists	55-74	4	449	438
332	teachers and administrators, college and university	20-74	5	478	461
369	wood workers	20-64	18	221	220
Peritoneum and Retroperitoneal Tissue N = 22					
387	construction trades (all)	20-74	4	451	437
Respiratory System N = 5178					
43	agricultural scientists		8	861	1025
80	managers and superintendents, building		16	304	331
100	cashiers		9	471	532
102	adjustors, examiners, investigators, estimators		17	292	323
138	heavy equipment, construction equipment operators		19	289	254
142	forgemen and hammermen		9	573	533
145	heat treaters, annealers, temperers	20-64	8	478	401+
155	machinists, shipyard		18	251	231
156	mechanics and repairmen, air conditioning, heating, refrigeration appliances		13	383	330
163	mechanics and repairmen NEC	55-74	51	170	153+
220	conductors, bus and street railway	20-64	5	967	899+
236	optical workers NEC	55-74	7	668	620
255	truck and tractor drivers		191	175	158
288	policemen, detectives, marshalls, constables, sheriffs, court officers	20-54	15	251	228+
346	painters (expanded)		123	137	122-
349	mechanics and repairmen (all)		191	137	123+
367	glass workers	55-74	12	321	300+
372	vehicle drivers		329	146	131
377	asbestos exposure		201	145	132
384	custodial, maintenance, cleaning workers	20-54	39	173	151+

HIGHLY SIGNIFICANT OCCUPATION-CANCER ASSOCIATIONS BY CANCER TYPE (continued)

CANCER OCCUPATION	AGE GROUP	OBSERVED	MOR UNADJUSTED	MOR ADJUSTED
395 shipyards		112	146	134
Nose and Nasopharynx N = 43				
255 truck and tractor drivers		5	539	749
Larynx N = 287				
132 cranemen, derrickmen and hoistmen		4	613	498
150 linemen, servicemen and installers-telegraph, telephone, power (utility and gas)		4	369	336+
163 mechanics and repairmen NEC		7	285	274+[a]
231 meat cutters, except slaughter and packing house		5	359	288+[a]
255 truck and tractor drivers		14	229	163-[b]
271 bartenders		7	532	382
347 plumbers (expanded)		9	290	258
372 vehicle drivers	20-74	20	190	137-
384 custodial, maintenance, cleaning workers	20-54	5	370	188-
Trachea, Bronchus, and Lung N = 4827				
43 agricultural scientists		8	929	1058
80 managers and superintendents, building		14	284	309
100 cashiers		8	448	500
102 adjustors, examiners, investigators, estimators		17	312	344
138 heavy equipment, construction equipment operators		18	295	258
142 forgemen and hammermen		9	613	576
154 machinists NEC	20-54	27	184	162+
155 machinists, shipyard		18	270	251
156 mechanics and repairmen, air conditioning, heating, refrigeration appliances		13	412	357
220 conductors, bus and street railway	20-64	5	1031	953
236 optical workers NEC	55-74	6	617	569+
255 truck and tractor drivers		176	173	158
288 policemen, detectives, marshalls, constables, sheriffs, court officers	20-54	15	272	241+

HIGHLY SIGNIFICANT OCCUPATION-CANCER ASSOCIATIONS BY CANCER TYPE (continued)

CANCER OCCUPATION	AGE GROUP	OBSERVED	MOR UNADJUSTED	MOR ADJUSTED
326 life and physical scientists		17	175-	227
349 mechanics and repairmen (all)		177	136	123+
350 machinists and related occupations	20-54	44	171	155+
372 vehicle drivers		305	145	132
377 asbestos exposure		183	142	130
395 shipyards		108	151	140
Pleura and Mediastinum N = 37				
377 asbestos exposure		5	565	362
387 construction trades (all)		8	272	237+
Malignant Melanoma of Skin N = 158				
13 clergymen		4	653	578
113 clerical and kindred workers NEC	20-64	4	401	269-[b]
120 sales clerks and salesmen NEC	20-54	5	342	170-
332 teachers and administrators, college and university		4	1265	912
334 school professions		10	486	366
Skin, Other Malignant Neoplasms N = 51				
169 painters, construction and maintenance		4	534	552
Breast N = 24				
321 not stated or unknown		4	470	-
387 construction trades (all)		6	320	394
Prostate N = 1493				
32 engineers, mechanical	20-74	6	319	256+
73 buyers and shippers, farm products; produce brokers	20-74	7	371	386
95 garage, gas station owners, foremen, managers	20-74	6	382	385
131 compositors and typesetters		6	376	359

HIGHLY SIGNIFICANT OCCUPATION-CANCER ASSOCIATIONS BY CANCER TYPE (continued)

CANCER OCCUPATION	AGE GROUP	OBSERVED	MOR UNADJUSTED	MOR ADJUSTED
167 motion picture projectionists		4	801	827
169 painters, construction and maintenance		34	150+	164
202 chemical workers		9	364	375
276 housekeepers and stewards, except private household		4	445	417+
323 engineers	20-54	5	1209	993
325 mathematical professions	20-64	13	212	152-[a]
359 welders (expanded)		14	256	275
376 oil and gasoline exposure	20-74	16	217	210
Testis N = 56				
350 machinists and related occupations		4	240-[b]	509
Urinary Organs N = 940				
28 engineers, chemical		4	1042	858
30 engineers, electrical	55-74	6	314	273+
36 engineers NEC	20-64	6	350	325+
50 physicians and surgeons		11	251	228
74 conductors, railroad		5	384	359
122 blacksmiths		5	534	569
156 mechanics and repairmen, air conditioning, heating, refrigeration appliances		4	669	619
232 slaughter house butchers		8	333	341
251 leather workers, tanners	20-74	7	290	308
285 hairdressers and cosmetologists		4	665	686
323 engineers	20-64	15	210	190+
324 architects, draftsmen, and engineers	20-64	17	219	198+
331 medical workers		28	180	172
373 meat processing workers		15	210	221
374 gas station, garage workers		11	265	298
381 hospital workers (expanded)	20-74	7	257+	278

HIGHLY SIGNIFICANT OCCUPATION-CANCER ASSOCIATIONS BY CANCER TYPE (continued)

CANCER OCCUPATION		AGE GROUP	OBSERVED	MOR UNADJUSTED	MOR ADJUSTED
Bladder N = 592					
28	engineers, chemical		4	1805	1440
74	conductors, railroad		4	458	448
122	blacksmiths		5	737	796
202	chemical workers		5	460	442
224	filers, grinders, and polishers, metal; metal cutters	55-74	4	379	417
251	leather workers, tanners	20-74	5	368	395
285	hairdressers and cosmetologists		4	1156	1152
373	meat processing workers	20-64	4	427	406
374	gas station, garage workers		8	330	349
376	oil and gasoline exposure	20-74	11	267	282
Kidney N = 335					
30	engineers, electrical	55-74	4	491	413
36	engineers NEC	20-64	4	405	393+
71	treasurers, financial managers, bank officers	20-64	4	464	409
97	grocers and market managers	20-74	5	345	481
230	laundry and drycleaning operatives, owners, managers		5	446	469
232	slaughter house butchers		4	432	457
331	medical workers	20-74	11	243	216+
344	carpenters (expanded)	55-74	9	236+	247
Brain and Nervous System N = 350					
1	accountants and auditors	20-54	6	370	284+
32	engineers, mechanical	20-64	4	479	378+
40	lawyers and judges, attorneys		9	489	339
62	teachers, elementary and secondary school		9	336	238+[a]
71	treasurers, financial managers, bank officers		10	482	333
113	clerical and kindred workers NEC	20-54	5	450	557
120	sales clerks and salesmen NEC	55-74	12	191+	338
125	brickmasons, stonemasons, tile setters	20-54	4	867	727
129	carpenters	20-64	9	203+[a]	289

HIGHLY SIGNIFICANT OCCUPATION-CANCER ASSOCIATIONS BY CANCER TYPE (continued)

CANCER OCCUPATION		AGE GROUP	OBSERVED	MOR UNADJUSTED	MOR ADJUSTED
218	checkers, examiners and inspectors, manufacturing		4	398	497
334	school professions		13	224	199-[b]
392	large employer A - electrical equipment; engines and turbines	20-54	6	424	494
Brain N = 245					
1	accountants and auditors	20-54	5	453	423
40	lawyers and judges, attorneys		7	556	368
62	teachers, elementary and secondary school		7	371	283
71	treasurers, financial managers, bank officers		5	347	228-[b]
120	sales clerks and salesmen	20-74	12	193+	326
125	brickmasons, stonemasons, tile setters	20-64	4	469	384+[a]
218	checkers, examiners and inspectors, manufacturing		4	557	751
262	operatives and kindred workers NEC		4	326+[a]	441
334	school professions		10	254	246+[a]
392	large employer A - electrical equipment; engines and turbines	20-54	4	420	523
Lymphatic and Hematopoietic Tissue N = 1352					
30	engineers, electrical		16	280	225
31	engineers, industrial	55-74	6	383	317+
83	officials and administrators NEC, public administration	20-64	8	343	280+[a]
98	bank clerks, tellers, etc.	20-74	4	591	576+
110	stock clerks and storekeepers	20-64	10	259	242+
179	plumbers and pipefitters	20-54	5	343	305+
186	stationary engineers		13	251	239
322	architects and draftsmen	20-64	6	366	222+[a]
323	engineers		47	152	125-[b]
326	life and physical scientists		8	287	222+
332	teachers and administrators, college and university		9	356	283
344	carpenters (expanded)		50	152	174
393	large employer B - abrasives products		9	291	305

HIGHLY SIGNIFICANT OCCUPATION-CANCER ASSOCIATIONS BY CANCER TYPE (continued)

CANCER OCCUPATION		AGE GROUP	OBSERVED	MOR UNADJUSTED	MOR ADJUSTED
Lymphomas N = 577					
30	engineers, electrical		8	300	226+
50	physicians and surgeons		7	278	207-[b]
71	treasurers, financial managers, bank officers		9	252	185-[b]
83	officials and administrators NEC, public administration	20-64	5	401	332+[a]
179	plumbers and pipefitters	20-54	4	531	449
326	life and physical scientists		5	389	275+[a]
332	teachers and administrators, college and university		6	577	407
346	painters (expanded)	20-64	8	192-	261
387	construction trades (all)	20-74	56	134+	150
Reticulum Cell Sarcoma N = 136					
93	managers, administrators, officials and proprietors NEC; supervisors NEC		16	256	207+
Lymphosarcoma N = 160					
134	electricians		6	385	358
204	fabricated metal products workers NEC		5	269+	316
392	large employer A - electrical equipment; engines and turbines	20-64	5	350	386
Hodgkins Disease N = 151					
71	treasurers, financial managers, bank officers		4	505	342+
Multiple Myeloma N = 175					
110	stock clerks and storekeepers		4	491	485
344	carpenters (expanded)		12	286	334
389	farmers		7	313	

HIGHLY SIGNIFICANT OCCUPATION-CANCER ASSOCIATIONS BY CANCER TYPE (continued)

CANCER OCCUPATION	AGE GROUP	OBSERVED	MOR UNADJUSTED	 ADJUSTED
Leukemia and Aleukemia N = 544				
30 engineers, electrical	20-64	5	400	307+
36 engineers NEC	20-54	5	463	355
186 stationary engineers		8	383	367
323 engineers	20-74	18	217	189+[a]
324 architects, draftsmen, and engineers	20-74	21	229	208
329 mathematical, scientific and technical professions	20-64	25	222	182+[a]
344 carpenters (expanded)		23	169+	183
392 large employer A - electrical equipment: engines and turbines	20-74	13	216	217
393 large employer B - abrasives products		5	395	410
Lymphatic Leukemia, Chronic N = 83				
344 carpenters (expanded)		7	317	274+
388 material handlers (expanded)		4	720	588
Myeloid Leukemia N = 233				
36 engineers NEC	20-64	4	411	307+[a]
117 car salesmen, dealers, managers		4	365	401
243 rubber workers	20-74	4	416	427
323 engineers	20-74	10	235	178-[b]
324 architects, draftsmen, and engineers	20-74	12	257	202+[a]
329 mathematical, scientific and technical professions	20-64	17	257	199-[b]
378 chemical exposure (operatives)	20-74	9	229+[a]	252
392 large employer A - electrical equipment; engines and turbines	20-74	8	266	263+[a]
Myelofibrosis N = 36				
368 food workers	20-74	4	503	454

HIGHLY SIGNIFICANT OCCUPATION-CANCER ASSOCIATIONS BY CANCER TYPE (continued)

CANCER OCCUPATION		AGE GROUP	OBSERVED	MOR UNADJUSTED	MOR ADJUSTED
Cirrhosis of the Liver N = 2177					
42	musicians and music teachers	20-74	8	185-[a]	286
112	railroad clerks	20-74	7	242+	328
160	mechanics and repairmen, radio, television		8	312+	352
251	leather workers, tanners		18	213	178+[a]
255	truck and tractor drivers		91	147	113-
273	cooks, chefs (except private household)		48	256	211
278	janitors, sextons, maintenance workers	20-64	68	149	122-
301	garbage collectors, sewerage workers	20-54	5	836	658+
313	laborers NEC		72	214	174
317	government workers NEC	20-64	20	244	214
328	technicians	55-74	11	209+	266
372	vehicle drivers		155	139	109-
378	chemical exposure (operatives)	55-74	44	160	143+
382	bar workers		43	289	233
384	custodial, maintenance, cleaning workers	20-54	44	170	127-
388	material handlers (expanded)	20-74	37	171	139-
397	large employer E - telephone company	55-74	7	288+	316

APPENDIX C

MORTALITY PATTERNS OF SELECTED GROUPED

OCCUPATIONAL CATEGORIES AND CANCER TYPES

+ indicates $p \leq .05$

++ indicates $p \leq .01$

The results are for the age group 20+ unless otherwise indicated.

C 1. 343 POSTAL WORKERS

		Rectum and rectosigmoid junction		
Occupation		Observed	Expected	sMOR
86	postmasters	2	2	107
104	mail carriers	3	3	115
107	postal clerks	9	3	264++
318	postal workers NEC	4	2	205
343	postal workers (all)	18	10	185+

C 2. 346 PAINTERS (expanded)

		Respiratory system		
Occupation		Observed	Expected	sMOR
169	painters, construction and maintenance	106	81	130+
170	painters, sign	5	3	157
171	painters, auto	3	2	166
172	painters, shipyard	9	4	244+
346	painters (expanded)	123	90	137++

C 3. 347 PLUMBERS (expanded)

Occupation		Respiratory system Observed	Expected	sMOR
178	steamfitters	20	11	182+
179	plumbers and pipefitters	52	41	125
180	plumbers, shipyard	5	5	104
347	plumbers (expanded)	77	57	135+

C 4. 349 MECHANICS AND REPAIRMEN (all)

Occupation		Respiratory system Observed	Expected	sMOR
150	linemen, servicemen, and installers, telegraph, telephone, power (utility and gas)	24	20	122
156	mechanics and repairmen, air conditioning, heating, refrigeration appliances	13	3	383++
157	mechanics and repairmen, airplane	6	1	432+
158	mechanics and repairmen, automobile	50	39	129
159	mechanics and repairmen, auto body	8	8	102
160	mechanics and repairmen, radio, television	2	4	50
161	mechanics and repairmen, railroad and car shop	8	6	126
162	loom fixers	13	13	101
163	mechanics and repairmen NEC	66	44	148+
175	piano and organ tuners and repairmen	1	2	64
347	mechanics and repairmen (all)	191	139	137++

C 5. 350 MACHINISTS AND RELATED OCCUPATIONS

Occupation	Stomach			Trachea, bronchus, and lung age 20-54		
	Observed	Expected	sMOR	Observed	Expected	sMOR
149 jobsetters and diesetters, metal	-	-	-	1	1	-
153 precision machine operatives	3	3	96	3	2	172
154 machinists NEC	39	32	122	27	15	184++
155 machinists, shipyard	2	1	144	2	0	-
165 millwrights	1	2	61	2	2	107
173 pattern and model makers, metal	2	1	303	0	1	0
192 tool and die makers	9	5	176	8	3	269+
224 filers, grinders and polishers, metal; metal cutters	6	3	181	1	3	29
350 machinists and related occupations	62	47	131+	44	26	171++

C 6. 351 PRINTING TRADES

Occupation	Buccal cavity and pharyx		
	Observed	Expected	sMOR
131 compositors and typesetters	3	1	438
136 electrotypers and sterotypers	1	0	-
177 photoengravers, lithographers, and composers	-	-	-
181 pressmen and plate printers, printing	9	4	257++
208 printing and publishing workers NEC	2	1	186
351 printing trades	15	6	252++

C 7. 359 WELDERS (expanded)

Occupation	Prostate		
	Observed	Expected	sMOR
123 boilermakers	4	1	295
261 welders and flame cutters	9	4	244+
263 welders, shipyard	1	0	-
359 welders (expanded)	14	5	256++

C 8. 360 HEATED METAL WORKERS

Occupation		Malignant neoplasms	Large intestine and rectum	Trachea, bronchus, and lung	Respiratory system, age 20-64
		sMOR*			
122	blacksmiths	117(17)	124(3)	114(4)	- (1)
123	boilermakers	164(26)	253(6)+	215(10)+	200(4)
142	forgemen and hammermen	353(19)++	336(3)	613(9)++	- (6)++
145	heat treaters, annealers, temperers	121(18)	89(2)	133(6)	478(8)++
166	molders, metal	110(42)	140(8)	129(14)	129(8)
228	foundry workers NEC	129(34)	242(10)+	135(9)	385(7)+
229	furnacemen, smelter-men, and pourers	80(8)	130(2)	140(4)	290(3)
261	welders and flame cutters	91(70)	106(11)	83(21)	71(14)
263	welders, shipyard	229(19)+	261(3)	110(3)	122(2)
360	heated metal workers	121(253)+	157(48)++	129(80)	154(53)+

* The numbers in parentheses indicate the number of observed deaths.

C 9. 361 METAL WORKERS

Occupation		Pancreas, age 20-74		
		Observed	Expected	sMOR
137	engravers, except photoengravers	1	0	-
188	structural metal craftsmen	2	1	169
190	tinsmiths, coppersmiths, sheet metal workers	5	2	236
204	fabricated metal product workers NEC	13	8	171
206	primary metal industries workers NEC	1	1	-
225	electroplaters	-	-	-
244	steelworkers, wire workers	2	2	124
350	machinists and related occupations	35	30	117
360	heated metal workers	8	8	99
361	metal workers	67	51	130+

C 10. 364 LEATHER AND LEATHER PRODUCT WORKERS

Occupation		Respiratory system, age 20-74 Observed	Expected	sMOR
185	shoemakers and repairers	4	3	141
249	shoe factory workers	60	43	140+
250	factory workers, other leather goods	-	-	-
251	leather workers, tanners	23	17	133
364	leather and leather product workers	87	65	134+

C 11. 366 APPAREL WORKERS (expanded)

Occupation		Respiratory system Observed	Expected	sMOR
189	tailors	21	11	188+
193	upholsterers	7	9	76
207	apparel workers NEC	6	3	215
233	milliners	1	3	32
247	sewers and stitchers, manufacturing; cutters	11	5	211+
366	apparel workers	46	31	146+

C 12. 371 SAILORS

Occupation		Trachea, bronchus, and lung Observed	Expected	sMOR
82	officers - pilots - pursers - engineers, ship	3	1	421
195	officers and enlisted men, Coast Guard	3	2	160
198	officers and enlisted men, Navy	18	10	180+
200	Merchant Marines	6	8	74
246	sailors and deck hands, seamen NEC	6	4	157
303	fishermen and oystermen	26	19	137
371	sailors	62	43	143+

C 13. 372 VEHICLE DRIVERS

Occupation		Trachea, bronchus, and lung					
		Age group 20+			Age group 20-64		
		Observed	Expected	sMOR	Observed	Expected	sMOR
138	heavy equipment, construction equipment operators*	18	6	295++	15	4	426++
217	bus drivers	24	18	132	15	8	183
220	conductors, bus and street railway	10	4	259+	5	0	1031++
222	deliverymen and routemen	13	12	105	4	5	88
254	taxicab drivers and chauffers	38	32	118	15	15	101
255	truck and tractor drivers	176	102	173++	101	57	177++
256	fuel oil truck drivers and laborers	11	14	81	4	5	73
257	drivers NEC	23	20	115	10	7	141
258	fork lift drivers	6	4	142	6	2	262
259	movers, moving truck drivers	4	7	59	4	2	165
372	vehicle drivers	305	211	145++	164	100	163++

* not included in grouped category 372 vehicle drivers

C 14. 373 MEAT PROCESSING WORKERS

Occupation		Bladder			Kidney		
		Observed	Expected	sMOR	Observed	Expected	sMOR
231	meat cutters, except slaughter and packing house	5	3	163	2	2	121
232	slaughter house butchers	4	1	276++	4	1	432++
373	meat processing workers	9	5	200+	6	3	234+

C 15. 376 OIL AND GASOLINE EXPOSURE

Occupation		Bladder, age 20-74 Observed	Expected	sMOR
94	fuel oil dealers, managers	2	1	154
95	garage, gas station owners, foremen, managers	6	1	586++
158	mechanics and repairmen, automobile#	4	2	162
209	oil and related industries workers NEC	2	0	899
213	attendants, auto service, gas station	1	0	-
237	oilers and greasers, except auto	-	-	-
256	fuel oil truck drivers and laborers	-	-	-
376	oil and gasoline exposure	11	4	267++

not included in grouped category 376 oil and gasoline exposure

C 16. 384 CUSTODIAL, MAINTENANCE, AND CLEANING WORKERS

Occupation		Trachea, bronchus, and lung age 20-54 Observed	Expected	sMOR
80	managers and superintendents, building	3	0	-
272	cleaners	2	0	512
276	housekeepers and stewards, except private household	0	0	0
277	window cleaners	0	0	-
278	janitors, sextons, maintenance workers	21	15	141
280	school custodians	6	6	107
384	custodial, maintenance, cleaning workers	32	21	152+

C 17. 391 ANIMAL WORKERS

Occupation		Lymphatic and hematopoietic tissue		
		Observed	Expected	sMOR
68	veterinarians	-	-	-
295	dairy farmers	5	2	214
296	egg and poultry farmers	2	2	123
299	ranchers, cattle, sheep, etc.	-	-	-
300	animal workers NEC	2	1	208
391	animal workers	9	5	167

C 18. 395 SHIPYARD

Occupation		Trachea, bronchus, and lung		
		Observed	Expected	sMOR
127	boatbuilders; carpenters, shipyard	6	3	201
135	electricians, shipyard	8	9	92
155	machinists, shipyard	18	7	270++
172	painters, shipyard	9	3	261+
180	plumbers, shipyard	5	4	112
248	shipyard workers NEC	27	19	141
363	welders, shipyard	3	3	110
395	shipyards*	108	72	152++

* includes shipyard workers in addition to those in the above individual occupational categories. See Appendix C.

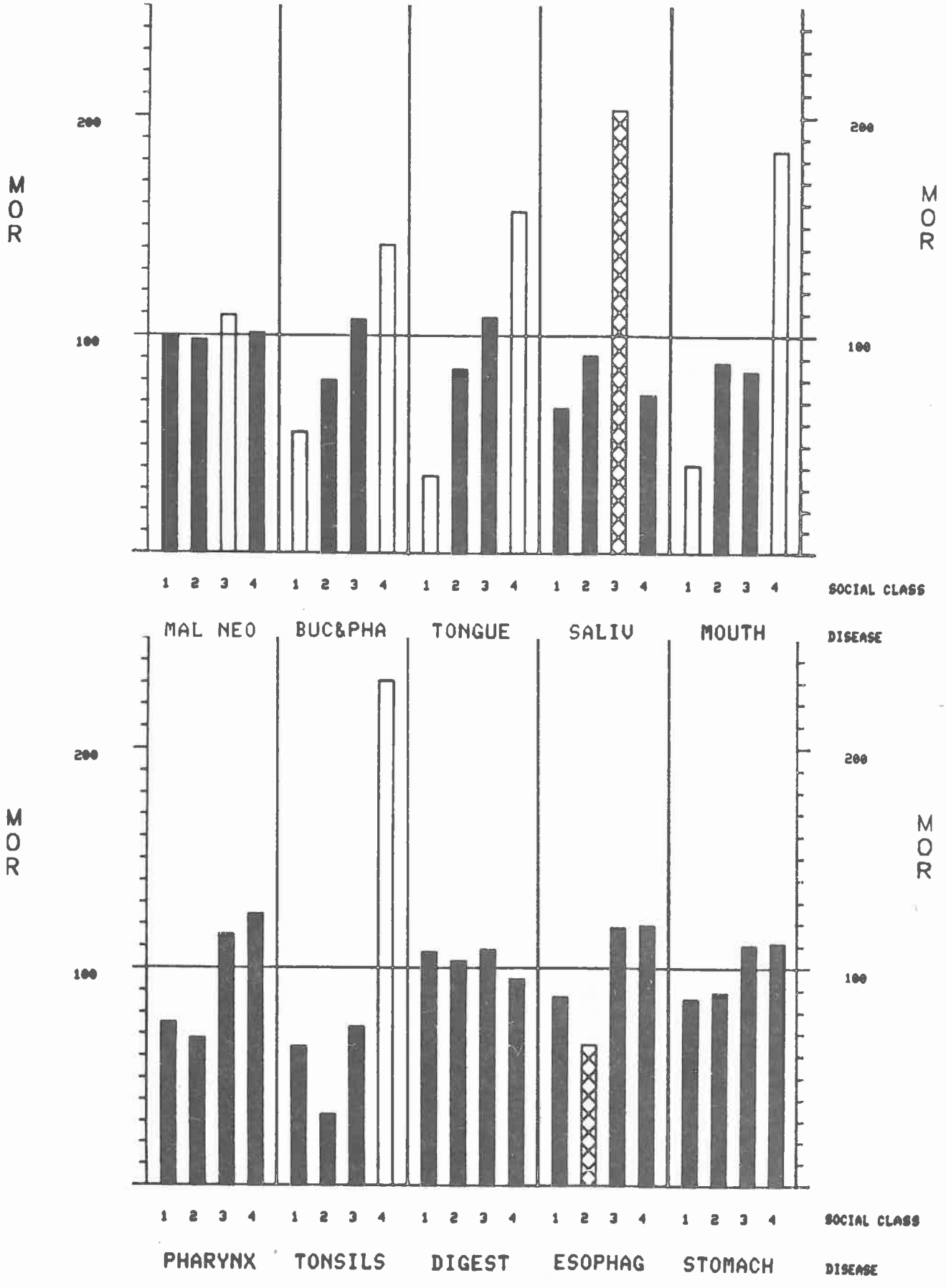
APPENDIX D

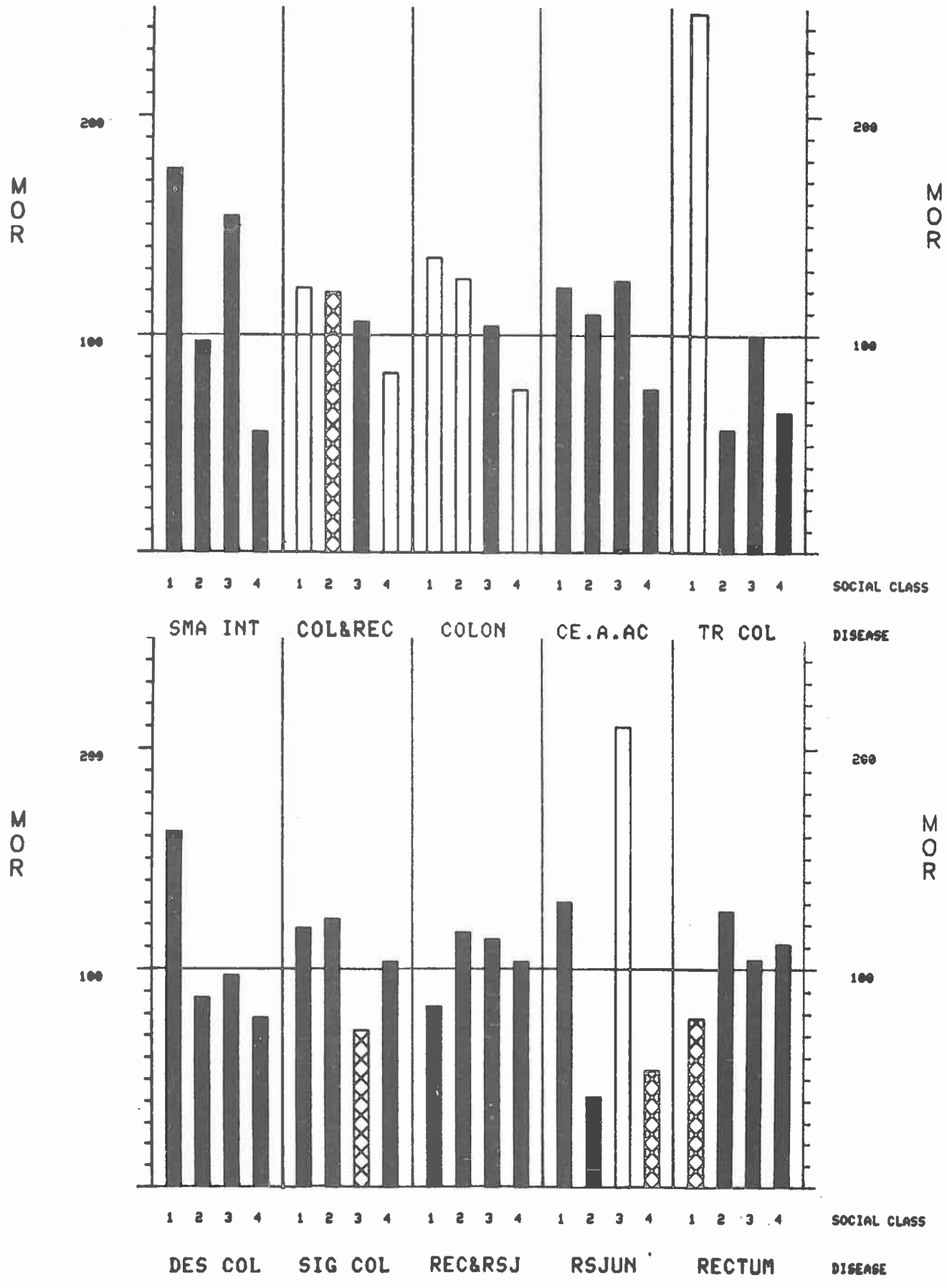
AGE-STANDARDIZED MORTALITY ODDS RATIOS
BY SOCIAL CLASS AND CANCER SITE, AGES 20+

Abbreviation	Cancer Site
MAL NEO	malignant neoplasms
BUC & PHA	buccal cavity and pharynx
SALIV	salivary gland
DIGEST	digestive organs and peritoneum
ESOPHAG	esophagus
SMA INT	small intestine
COL & REC	large intestine and rectum
COLON	large intestine, except rectum
CE,A,AC	cecum, appendix, and ascending colon
TR COL	transverse colon
DES COL	descending colon
SIG COL	sigmoid colon
REC & RSJ	rectum, and rectosigmoid junction
RSJUN	rectosigmoid junction
BIL & LIV	biliary passages and liver
GALLBLA	gallbladder, ducts, ampulla of vater
PANCREA	pancreas
PER & RTP	peritoneum and retroperitoneal tissue
RESPIR	respiratory system
NOSE & NP	nose and nasopharynx
LUNG	trachea, bronchus, and lung
PLEU & MS	pleura and mediastinum
CON & SFT	connective and other soft tissue
MAL MEL	malignant melanoma of skin
OT SKIN	skin, other malignant neoplasms of
PROSTAT	prostate
URINARY	urinary organs
BRA & NER	brain and nervous system
SUP-REN	supra-renal gland
SEC MAL	secondary malignant neoplasms
MUL MAL	multiple malignant neoplasms
LYM & HEM	lymphatic and hematopoietic tissue
LYMPHOM	lymphomas
RET SAR	reticulum cell sarcoma
LYMSARC	lymphosarcoma
HODGKIN	Hodgkin's Disease
MYELOMA	multiple myeloma
LEUKEMI	leukemia
ALL	lymphatic leukemia, acute
CLL	lymphatic leukemia, chronic

Abbreviation	Cancer Site
MYE LEU	myeloid leukemia
MON LEU	monocytic leukemia
AC ERYT	acute erythremia
POL VER	polycythemia vera
MYELOFI	myelofibrosis
CIRRHOS	cirrhosis of the liver

Note: The overall sMORs for the four social classes combined differs from 100 because in the analysis subjects who were not assigned to a social class (farmers and unknowns) were included in the comparison group.


MOR
200
100
1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4
SOCIAL CLASS
MAL NEO
BUC&PHA
TONGUE
SALIV
MOUTH
DISEASE
PHARYNX
TONSILS
DIGEST
ESOPHAG
STOMACH


MOR
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100
1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4
SOCIAL CLASS
SMA INT
COL&REC
COLON
CE.A.AC
TR COL
DISEASE
MOR
200
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SOCIAL CLASS
DES COL
SIG COL
REC&RSJ
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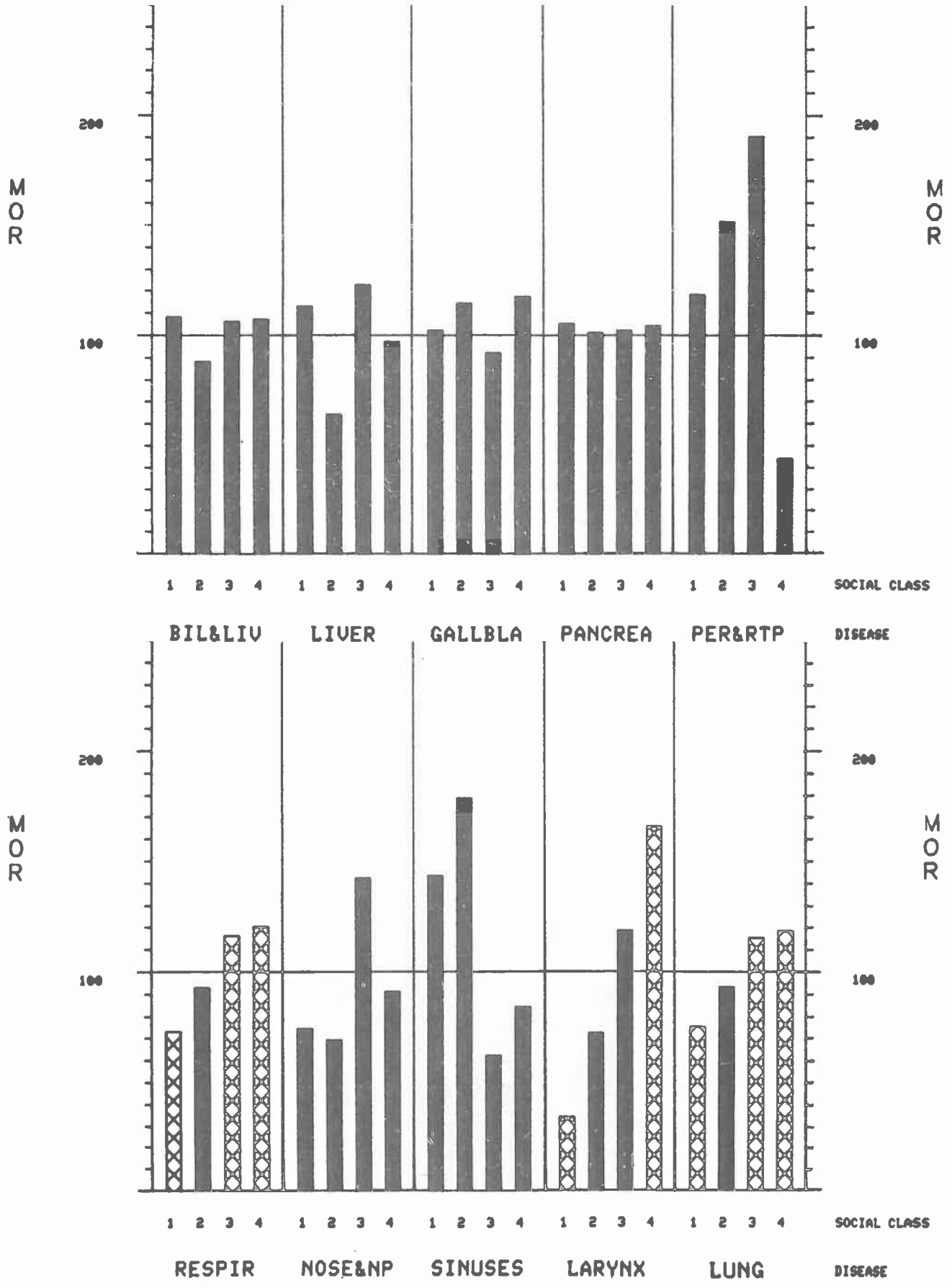
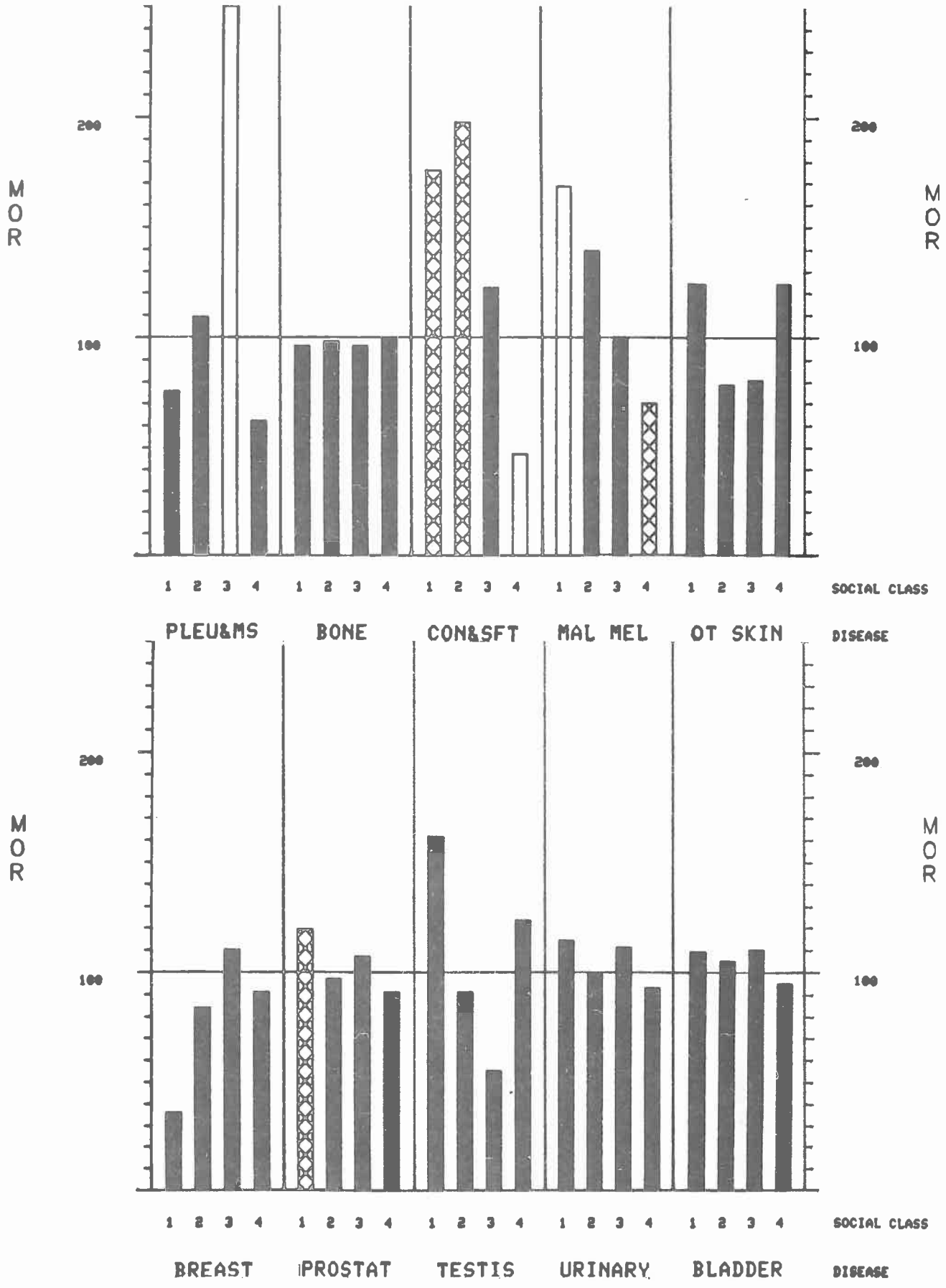
RECTUM
DISEASE


MOR
200
100
1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4
SOCIAL CLASS
BIL&LIV
LIVER
GALLBLA
PANCREA
PER&RTP
DISEASE
MOR
200
100
1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4
SOCIAL CLASS
RESPIR
NOSE&NP
SINUSES
LARYNX
LUNG
DISEASE


MOR
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1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4
SOCIAL CLASS
PLEU&MS
BONE
CON&SFT
MAL MEL
OT SKIN
DISEASE
MOR
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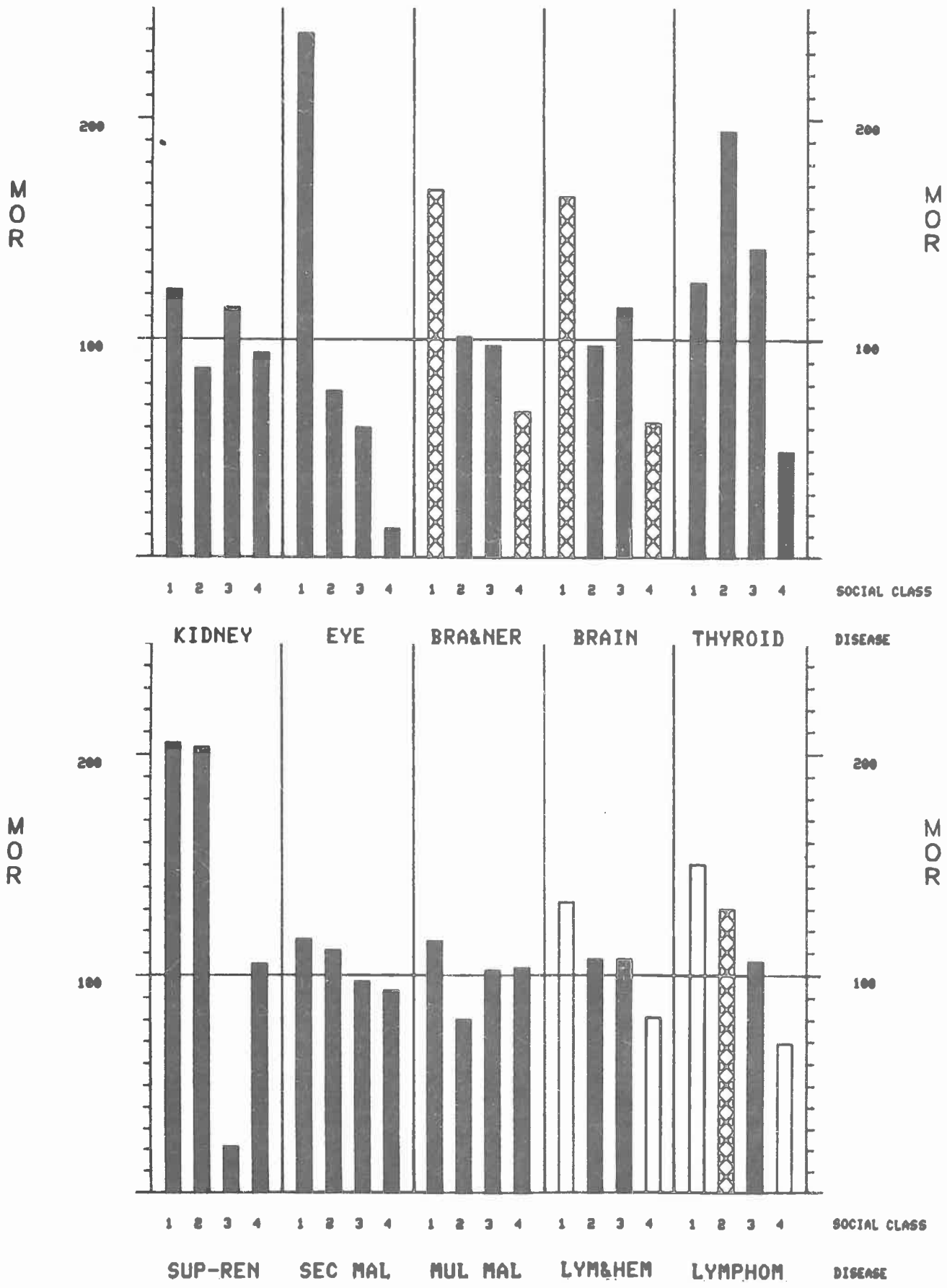
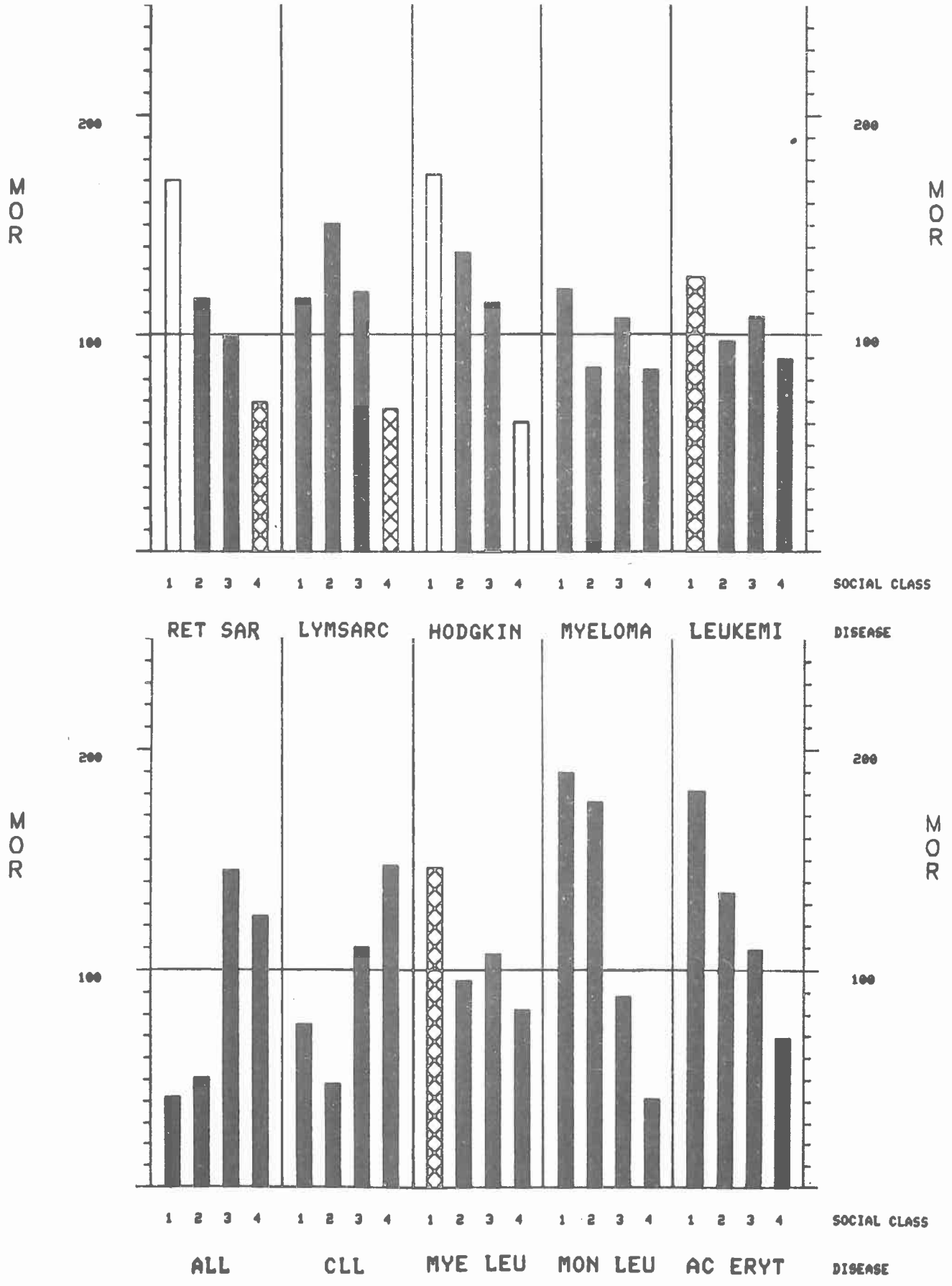
SOCIAL CLASS
BREAST
PROSTAT
TESTIS
URINARY
BLADDER
DISEASE


MOR
200
100
1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4
SOCIAL CLASS
KIDNEY
EYE
BRA&NER
BRAIN
THYROID
DISEASE
SUP-REN
SEC MAL
MUL MAL
LYM&HEM
LYMPHOM


MOR
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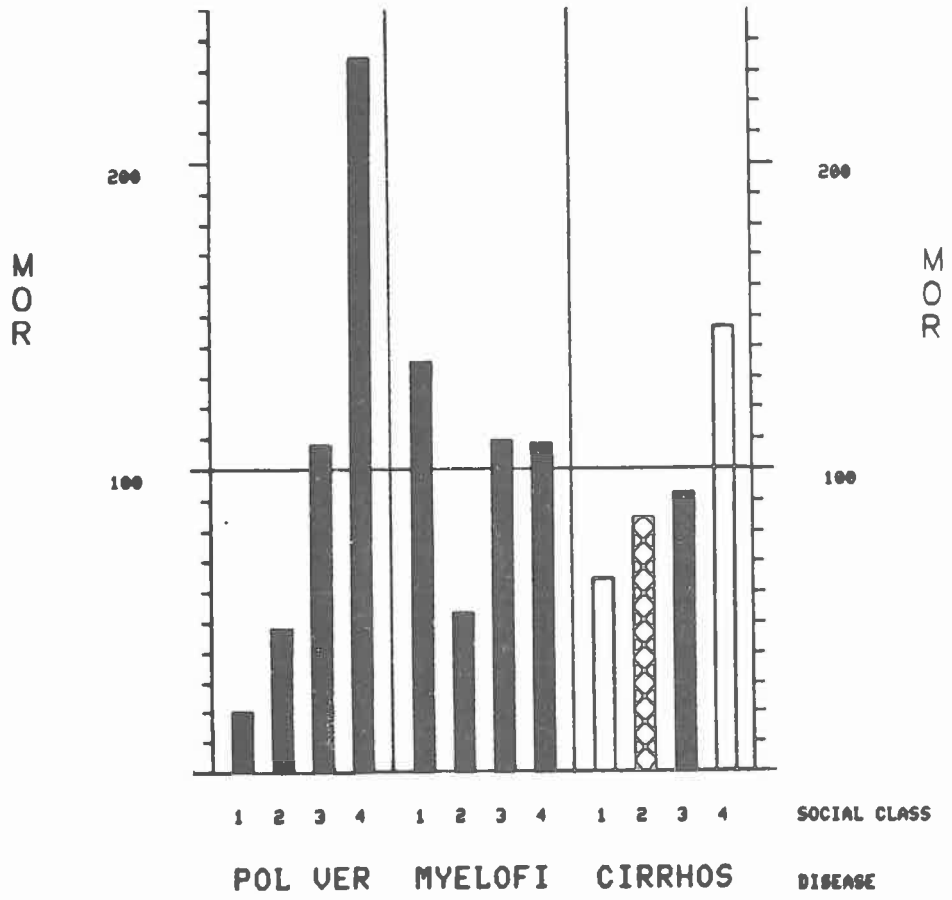
100
1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4
SOCIAL CLASS
RET SAR
LYMSARC
HODGKIN
MYELOMA
LEUKEMI
DISEASE
MOR
200
100
1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4
SOCIAL CLASS
ALL
CLL
MYE LEU
MON LEU
AC ERYT
DISEASE


MOR
200
100
MOR
200
100
1 2 3 4 1 2 3 4 1 2 3 4
SOCIAL CLASS
POL VER MYELOFI CIRRHOS
DISEASE

APPENDIX E

CAUSE OF DEATH CATEGORIES

	CAUSE OF DEATH	ICDA CODES
1	malignant neoplasms	140-209
2	buccal cavity and pharynx	140-149
3	tongue	141
4	salivary gland	142
5	mouth	143-145
6	pharynx	146-149
7	tonsils	146.0
8	digestive organs and peritoneum	150-159
9	esophagus	150
10	stomach	151
11	small intestine	152
12	large intestine and rectum	153-154
13	large intestine, except rectum	153.0-153.8
14	cecum, appendix, and ascending colon	153.0
15	transverse colon	153.1
16	descending colon	153.2
17	sigmoid colon	153.3
18	rectum and rectosigmoid junction	154
19	rectosigmoid junction	154.0
20	rectum	154.1
21	biliary passages and liver	155-156
22	liver	155.0
23	gallbladder, ducts, ampulla of vater	156
24	pancreas	157
25	peritoneum and retroperitoneal tissue	158
26	respiratory system	160-163
27	nose and nasopharynx	147,160.0
28	sinuses	160.2,160.8,160.9
29	larynx	161
30	trachea, bronchus, and lung	162
31	pleura and mediastinum	163.0,163.1
32	bone	170
33	connective and other soft tissue	171
34	malignant melanoma of skin	172
35	skin, other malignant neoplasms of	173
36	breast	174
37	prostate	185
38	testis	186
39	urinary organs	188-189
40	bladder	188
41	kidney	189.0,189.1
42	eye	190
43	brain and nervous system	191-192
44	brain	191
45	thyroid	193
46	supra-renal gland	194.0
47	secondary malignant neoplasms	196-198
48	multiple malignant neoplasms	199.0
49	lymphatic and hematopoietic tissue	200-209
50	lymphomas	200-202

CAUSE OF DEATH		ICDA CODES
51	reticulum cell sarcoma	200.0
52	lymphosarcoma	200.1
53	Hodgkin's disease	201
54	multiple myeloma	203
55	leukemia and aleukemia	204-207
56	lymphatic leukemia, acute	204.0
57	lymphatic leukemia, chronic	204.1
58	myeloid leukemia	205
59	monocytic leukemia	206
60	acute erythremia	207.2
61	polycythemia vera	208
62	myelofibrosis	209
63	cirrhosis of the liver	571
64	auxiliary causes of death	000-136, 210-570, 572-999

APPENDIX F

INDIVIDUAL OCCUPATIONAL CODES

CODE	TITLE	CENSUS CODE[#]	SC[*]
	PROFESSIONAL, TECHNICAL AND KINDRED WORKERS[+]		
1	accountants and auditors	000	1
2	analysts and consultants NEC		1
3	actors, radio announcers, TV announcers	010	1
4	air traffic controllers	011	1
5	airplane pilots and navigators	012	1
6	architects	013	1
7	artists and art teachers	014	1
8	athletes	015	1
9	chiropodists (podiatrists)	016	1
10	authors and writers	020	1
11	chemists	021	1
12	chropractors	022	1
13	clergymen	023	1
14	college presidents, deans, administrators	030	1
15	professors/instructors, biological sciences	032	1
16	professors/instructors, chemistry sciences	034	1
17	professors/instructors, engineering	040	1
18	professors/instructors, mathematics	042	1
19	professors/instructors, physics	045	1
20	professors/instructors, nonscientific subjects	054	1
21	professors/instructors, subject not specified	060	1
22	computer and data processing specialists	(003-005)	1
23	dentists	071	1
24	designers	072	1
25	dieticians and nutritionists	073	2
26	draftsmen	074	1
27	editors and reporters, jounalists	075	1
28	engineers, chemical	081	1
29	engineers, civil and construction	082	1
30	engineers, electrical	083	1
31	engineers, industrial	084	1
32	engineers, mechanical	085	1
33	engineers, marine	086	1
34	engineers, metallurgical	090	1
35	engineers, sales	092	1
36	engineers NEC	093	1
37	entertainers NEC	101	2
38	foresters and conservationists	103	2
39	embalmers	104	1
40	lawyers and judges, attorneys	105	1
41	librarians	111	1
42	musicians and music teachers	120	1
43	agricultural scientists	130	1
44	physicists	140	1
45	miscellaneous natural scientists and researchers	145	1

CODE	TITLE	CENSUS CODE #	SC *
46	nurses, professional	150	2
47	optometrists	152	1
48	pharmacists, druggists	160	1
49	photographers	161	2
50	physicians and surgeons	162	1
51	radio operators	164	1
52	recreation workers	165	1
53	religious workers	170	1
54	social and welfare workers, except group	171	1
55	economists, business consultants, analysts	172	1
56	psychologists, psychiatrists	173	1
57	statisticians and actuaries	174	1
58	sports instructors and officials	180	1
59	surveyors	181	2
60	vocational and educational counsellors	(174)	1
61	school administrators, elementary and secondary school	(240)	1
62	teachers, elementary and secondary school	182	1
63	technicians, medical and dental	185	2
64	technicians, electrical and electronic	190	1
65	technicians, other engineering and physical sciences	191	1
66	technicians NEC	192	1
67	therapists and healers NEC	193	1
68	veterinarians	194	1
69	students	196	1
	MANAGERS, OFFICIALS, PROPRIETORS, EXCEPT FARM		
70	assessors		2
71	treasurers, financial managers, bank officers	(202)	1
72	florists	249	1
73	buyers and shippers, farm products; produce brokers	251	2
74	conductors, railroad	252	1
75	credit men	253	1
76	funeral directors	104	1
77	health administrators	(212)	1
78	hotel, motel owners, managers, etc.	819	1
79	inspectors, investigators, public administration	260	1
80	managers and superintendents, building	262	2
81	newspaper owners, publishers, managers, etc.	076	1
82	officers-pilots-pursers-engineers, ship	265	1
83	officials and administrators NEC, public administration	270	1
84	officials, lodge, society, union, etc.	275	1
85	personnel and labor relations workers	154	1
86	postmasters	280	1
87	public relations men	163	1
88	public utility supervisors, officials, managers, etc.	364	1
89	purchasing agents and buyers; brokers NEC	285	1

CODE	TITLE	CENSUS CODE#	SC*
90	sales managers	285	1
91	restaurant and cafe owners, managers	817	2
92	cocktail bar, tavern owners, managers	816	2
93	managers, administrators, officials, and proprietors NEC; supervisors NEC	290	1
94	fuel oil dealers, managers	291	1
95	garage, gas station owners, foremen, managers	293	2
96	furniture store owners, managers, dealers, salesmen	297	1
97	grocers and market managers	298	2
	CLERICAL AND KINDRED WORKERS		
98	bank clerks, tellers, etc.	305	2
99	bookkeepers	310	2
100	cashiers	312	2
101	dispatchers and starters, vehicle	314	2
102	adjustors, examiners, investigators, estimators	321	2
103	expeditors and production control	(323)	2
104	mail carriers	323	2
105	messengers and office boys	324	3
106	payroll and timekeeping clerks	333	2
107	postal clerks	340	3
108	secretaries	342	1
109	shipping and receiving clerks	343	3
110	stock clerks and storekeepers	350	3
111	ticket, station and express agents	354	2
112	railroad clerks	361	2
113	clerical and kindred workers NEC	370	2
	SALES WORKERS		
114	advertising agents, salesmen, managers, executives	380	1
115	manufacturers and sales representatives	380	2
116	insurance agents, brokers, underwriters, executives, managers	385	1
117	car salesmen, dealers, managers	386	2
118	real estate agents, brokers, developers, executives	393	1
119	stock and bond salesmen, counsellors, etc.	395	1
120	sales clerks and salesmen NEC	396	2
	CRAFTSMEN, FOREMEN AND KINDRED WORKERS		
121	bakers	401	3
122	blacksmiths	402	4
123	boilermakers	403	3
124	bookbinders	404	3
125	brickmasons, stonemasons, tile setters	405	3
126	building contractors, construction contractors	406	3
127	boatbuilders; carpenters, shipyard	407	4

CODE	TITLE	CENSUS CODE[#]	SC[*]
128	cabinetmakers	410	3
129	carpenters	411	4
130	cement and concrete finishers, cement workers	413	4
131	compositors and typesetters	414	3
132	cranemen, derrickmen and hoistmen	415	3
133	decorators and window dressers; interior decorators	420	3
134	electricians	421	3
135	electricians, shipyard	422	3
136	electrotypers and sterotypers	423	3
137	engravers, except photengravers	424	3
138	heavy equipment, construction equipment operators	425,676	3
139	railroad foremen	427	3
140	construction foremen, etc. NEC	429	3
141	foremen NEC	430	3
142	forgemen and hammermen	431	3
143	furriers	387	3
144	glaziers, glass workers	434,I321-323	3
145	heat treaters, annealers, temperers	435	3
146	inspectors, railroad	447	3
147	inspectors NEC	450	3
148	jewelers, watchmakers, silversmiths	451,I387,I391,I396	3
149	jobsetters and die setters, metal	452	3
150	linemen, servicemen and installers-telegraph, telephone, power (utility and gas)	453	3
151	locomotive engineers (railroad)	454	3
152	locomotive firemen	460	3
153	precision machine operatives	(650-653)	3
154	machinists NEC	465	3
155	machinists, shipyard	467	3
156	mechanics and repairmen, air conditioning, heating, refrigeration appliances	470	3
157	mechanics and repairmen, airplane	471	3
158	mechanics and repairmen, automobile	472	4
159	mechanics and repairmen, automobile body	(472)	3
160	mechanics and repairmen, radio, television	474	3
161	mechanics and repairmen, railroad and car shop	475	3
162	loom fixers	(483)	4
163	mechanics and repairmen NEC	480	3
164	millers, grain	490	4
165	millwrights	491	3
166	molders, metal	492	4
167	motion picture projectionists	493	3
168	opticians; lens grinders and polishers	494	3
169	painters, construction and maintenance	495	4
170	painters, sign	694	4
171	painters, auto		4
172	painters, shipyard		4
173	pattern and model makers, metal	502	3
174	paperhangers	501	4
175	piano and organ tuners and repairmen	504	3
176	plasterers and lathers	505	3

CODE	TITLE	CENSUS CODE #	SC *
177	photoengravers, lithographers and composers	(515)	2
178	steamfitters	508	3
179	plumbers and pipefitters	510	3
180	plumbers, shipyard		3
181	pressmen and plate printers, printing	512	3
182	power station operators	701	3
183	roofers and slaters	514	4
184	riggers and steeplejacks		3
185	shoemakers and repairers	515	4
186	stationary engineers	520	3
187	stonecutters and stone carvers	521	3
188	structural metal craftsmen	523	3
189	tailors	524	3
190	tinsmiths, coppersmiths, and sheet metal workers	525	3
191	floor layers, installers, workers	528	3
192	tool and die makers, tool makers, etc.	530	3
193	upholsterers	535	3
194	craftsmen and kindred workers NEC	545	3
	OPERATIVES		
195	officers and enlisted men, Coast Guard	548	4
196	officers and enlisted men, Marine Corps	549	4
197	officers and enlisted men, Air Force	550	4
198	officers and enlisted men, Navy	551	4
199	officers and enlisted men, Army	552	4
200	Merchant Marine	553	4
201	officers and enlisted men, Armed Forces NEC	555	4
202	chemical workers	985,I28 (except I282)	4
203	instrument workers NEC	I38 (except I383, I385, I387)	4
204	fabricated metal products workers NEC	I34 (except I348) I35, I37 (except I373)	4
205	electrical and electronic machinery, equipment, supplies workers NEC	I36	4
206	primary metal industries workers NEC	I333-339	4
207	apparel workers NEC	I23	4
208	printing and publishing workers NEC	I27	3
209	oil and related industry workers NEC	I29	3
210	abrasive workers	I3291	4
211	asbestos and insulation workers	630, I3292	3
212	assemblers NEC	631	4
213	attendants, auto service, gas station	632	4
214	parking attendants	632	4
215	brewery workers	818, I2082	4
216	railroad brakemen	640	3
217	bus drivers	641	4
218	checkers, examiners and inspectors, manufacturing	643	4
219	clothing pressers	(611)	4
220	conductors, bus and street railway	645	4

CODE	TITLE	CENSUS CODE#	SC*
221	cannery and food processing workers	527,I203-209 (except 2041, 2044, 2046 2082)	4
222	deliverymen and routemen	650	3
223	dyers	652	4
224	filers, grinders and polishers, metal; metal cutters	653	4
225	electroplaters	(635)	4
226	dairy workers, dairymen	655,I202	4
227	winding operatives NEC	(681)	4
228	foundry workers NEC	I332	4
229	furnacemen, smeltermen and pourers	670	4
230	laundry and drycleaning operatives, owners, managers	674	4
231	meat cutters, except slaughter and packing house	675	4
232	slaughter house butchers	677,I2011-2016	4
233	milliners	680	3
234	machine operators NEC	(690,692)	4
235	maintenance, railroad	469	4
236	optical workers NEC	I383,I385	4
237	oilers and greasers, except auto	692	4
238	packers and wrappers NEC	693	4
239	pest control workers	986	4
240	paper, pulp mill workers	500,I261-264,I266	4
241	paperboard container and box factory workers	I265	4
242	plastic workers	I282,I307	4
243	rubber workers	I301-306	4
244	steelworkers, wire workers	I331-332	4
245	signmakers	(543)	4
246	sailors and deck hands, seamen NEC	703	4
247	sewers and stitchers, manufacturing; cutters	705	4
248	shipyard workers NEC	507,I373	4
249	shoe factory workers	(664),I313-314	4
250	factory workers, other leather goods	I315-319	4
251	leather workers, tanners	515,I311	4
252	rope makers	711	4
253	stationary firemen	712	4
254	taxicab drivers and chauffeurs	714	4
255	truck and tractor drivers	715	4
256	fuel oil truck drivers and laborers	716	4
257	drivers NEC		4
258	fork lift drivers	(706)	4
259	movers, moving truck drivers	719	4
260	weavers, textile	720	4
261	welders and flame cutters	721	4
262	operatives and kindred workers NEC	722	4
263	welders, shipyard		4
264	woodworkers, millworkers, furniture workers	974,I24,I2511-12, I2517,I2521,I2541	4
265	ordnance plant workers	726,I348	4
266	textile workers NEC	(670-672,674),I22	4

CODE	TITLE	CENSUS CODE#	SC*
	SERVICE WORKERS		
267	attendants, hospital	810	4
268	attendants, professional and personal service NEC	812	4
269	attendants, recreation and amusement (cardroom, poolhall, carnival)	813	4
270	barbers	814	4
271	bartenders	815	4
272	cleaners	824	4
273	cooks, chefs, (except private household)	825	4
274	dishwashers	826	4
275	elevator operators	831	4
276	housekeepers and stewards, except private household	832	3
277	window cleaners	833	4
278	janitors, sextons, maintenance workers	834	4
279	kitchen workers, restaurant employees NEC	835	4
280	school custodians	836	4
281	private household workers, servants, butlers, etc.	(982,984)	4
282	housewives, at home		4
283	porters	841	4
284	practical nurses	842	4
285	hairdressers and cosmetologists	843	4
286	firemen and fire protection	850	3
287	guards, watchmen and doorkeepers, correction officers	851	4
288	policemen, detectives, marshalls, constables, sheriffs, court officers	853,854	3
289	watchmen, crossing and bridge tenders, toll collectors	860	4
290	waiters	875	4
291	service workers NEC	890	4
	FARMERS		
292	farm laborers	902	
293	farm owners, managers, foremen	200,222,901	
294	cranberry farmers, laborers		
295	dairy farmers	204	
296	egg and poultry farmers	206	
297	nurserymen	202	
298	orchardists	201	
299	ranchers, cattle, sheep, etc.	203	
300	animal workers NEC		
	LABORERS, EXCEPT FARM		
301	garbage collectors, sewerage workers	891	4
302	forestry workers; tree farmers, wardens, surgeons, workers, etc.	724	4
303	fishermen and oystermen	962	4

CODE	TITLE	CENSUS CODE#	SC*
304	car washers	963	4
305	gardeners (except farm), groundskeepers, greenskeepers, landscapers	964	4
306	longshoremen and stevedores	965	4
307	freight and material handlers	(753)	4
308	grocery clerks	298	4
309	scrap metal, salvage, junk dealers, workers	892	4
310	lumbermen	970	4
311	teamsters	971	4
312	warehousemen NEC	973	4
313	laborers NEC	980	4
314	construction laborers NEC	982	4
315	road construction and maintenance workers	496	4
	UNKNOWN		
316	railroad workers NEC	981	
317	government workers NEC		
318	postal workers NEC		
319	public utility workers NEC (gas, electric, telephone)	363	
320	public works employees NEC		
321	not stated, unknown, none	997-999	

+ The individual occupational codes are grouped under ten major groupings. However, the actual classification into major occupational groupings is more complex than is indicated in this table. A number of individual occupational categories contain subjects from several major occupational groupings. For example, code 202, "chemical workers," is classified under the major grouping "operatives" in this table. This code includes in it subjects which come under three different major groupings - operatives in the chemical industry, laborers in the chemical industry, and foremen in the chemical industry. The major grouping "unknown" is in relation to the other nine major groupings, and not absolute. There is sufficient information on many of the death certificates to classify them into individual occupational codes 316-320, but insufficient information to assign many of these certificates to a major occupational grouping. See the text (CLASSIFICATION SCHEMES - OCCUPATIONAL CODE) for further discussion of these points.

The census codes listed are from the modification of the 1960 Bureau of the Census code used in the Washington State study. Codes in parentheses are from the 1970 Bureau of the Census code. Codes with the prefix "I" are Standard Industrial Classification (SIC) codes. If no code is listed, the occupation is our own addition to the classification scheme.

* The number indicates the social class into which the occupation has been classified. See the text (CLASSIFICATION SCHEMES - SOCIAL CLASS CLASSIFICATION) and Appendix E for the details of the social class classification scheme.

APPENDIX G

GROUPED OCCUPATIONAL CODES

322 Architects and draftmen

- 6 architects
- 26 draftsmen

323 Engineers

- 17 professors/instructors, engineering
- 28 engineers, chemical
- 29 engineers, civil and construction
- 30 engineers, electrical
- 31 engineers, industrial
- 32 engineers, mechanical
- 33 engineers, marine
- 34 engineers, metallurgical
- 35 engineers, sales
- 36 engineers NEC

324 Architects, draftsmen, and engineers

- 322 architects and draftsmen
- 323 engineers

325 Mathematical professions

- 1 accountants and auditors
- 18 professors/instructors, mathematics
- 22 computer and data processing specialists
- 55 economists, business consultants, analysts
- 57 statisticians and actuaries
- 59 surveyors
- 322 architects and draftsmen
- 323 engineers

326 Life and physical scientists

- 11 chemists
- 15 professors/instructors, biological sciences
- 16 professors/instructors, chemistry sciences
- 19 professors/instructors, physics
- 43 agricultural scientists
- 44 physicists
- 45 miscellaneous natural scientists and researchers

327 Chemists (expanded)

- 11 chemists
- 16 professors/instructors, chemistry sciences

28 engineers, chemical
34 engineers, metallurgical

328 Technicians (all)

4 air traffic controllers
5 airplane pilots and navigators
39 embalmers
51 radio operators
63 technicians, medical and dental
64 technicians, electrical and electronic
65 technicians, other engineering and physical science
66 technicians NEC

329 Mathematical, scientific, and technical professions

325 mathematical professions
326 life and physical sciences
328 technicians

330 Physicians, dentists, and related practitioners

9 chiropodists (podiatrists)
12 chiropractors
23 dentists
25 dieticians and nutritionists
46 nurses, professional
47 optometrists
48 pharmacists, druggists
50 physicians and surgeons
56 psychologists, psychiatrists
67 therapists and healer NEC
68 veterinarians

331 Medical Workers

63 technicians, medical and dental
330 physicians, dentists, and related practitioners
381 hospital workers

332 Teachers and administrators, college and university

14 college presidents, deans, administrators
15 professors/instructors, biological sciences
16 professors/instructors, chemistry sciences
17 professors/instructors, engineering
18 professors/instructors, mathematics
19 professors/instructors, physics
20 professors/instructors, nonscientific subjects
21 professors/instructors, subject not specified

333 Teachers and administrators, elementary and secondary schools

60 vocational and educational counsellors
61 school administrators, elementary and secondary school
62 teachers, elementary and secondary school

334 School professions

69 students
332 teachers and administrators, college and university
333 teachers and administrators, elementary and secondary school

335 Religious workers (expanded)

13 clergymen
53 religious workers

336 Artists (expanded)

7 artists and art teachers
24 designers
49 photographers
133 decorators and window dressers; interior decorators

337 Writers (expanded)

10 authors and writers
27 editors and reporters, journalists

338 Musical workers

42 musicians and music teachers
175 piano and organ tuners and repairmen

339 Entertainers (expanded)

3 actors, radio announcers, TV announcers
8 athletes
35 entertainers NEC
42 musicians and music teachers

340 Athletes (expanded)

8 athletes
52 recreation workers
58 sports instructors and officials

341 Financial workers

1 accountants and auditors
55 economists, business consultants, analysts
70 assessors
71 treasurers, financial managers, bank officers
75 credit men
119 stock and bond salesmen, counsellors, etc.

342 Funeral workers

39 embalmers
76 funeral directors

343 Postal workers (all)

86 postmasters
104 mail carriers
107 postal clerks
318 postal workers NEC

344 Carpenters (expanded)

127 boatbuilders; carpenters, shipyard
128 cabinet makers
129 carpenters

345 Electricians (expanded)

134 electricians
135 electricians, shipyard

346 Painters (expanded)

169 painters, construction and maintenance
170 painters, sigh
171 painters, auto
172 painters, shipyard

347 Plumbers (expanded)

178 steamfitters
179 plumbers and pipefitters
180 plumbers, shipyard

348 Mechanics and repairmen, vehicle

157 mechanics and repairmen, airplane
158 mechanics and repairmen, automobile
159 mechanics and repairmen, automobile body
161 mechanics and repairmen, railroad and car shop

349 Mechanics and repairmen (all)

150 linemen, servicemen, and installers - telegraph, telephone, power (utility and gas)
156 mechanics and repairmen, air conditioning, heating, refrigeration applicances
160 mechanics and repairmen, radio, television
162 loom fixers
163 mechanics and repairmen NEC
175 piano and organ tuners and repairmen
348 mechanics and repairmen, vehicle

350 Machinists and related occupations

149 jobsetters and die setters, metal
153 precision machine operatives
154 machinists NEC
155 machinists, shipyard
165 millwrights
173 pattern and model makers, metal
192 tool and die makers, tool makers, etc.
224 filers,grinders and polishers, metal; metal cutters

351 Printing trades

131 compositors and typesetters
136 electrotypers and sterotypers
177 photoengravers,lithographers, and composers
181 pressmen and plate printers, printing
208 printing and publishing workers NEC

352 Crane operators (expanded)

132 cranemen, derrickmen, and hoistmen
184 riggers and steeplejacks

353 Stationary engineers (expanded)

182 power station operators
186 stationary engineers
253 stationary firemen

354 Railroad worker (on train)

74 conductors, railroad
151 locomotive engineers (railroad)
152 locomotive firemen

355 Railroad workers (off train)

112 railroad clerks
139 railroad foremen
146 inspectors, railroad
161 mechanics and repairmen, railroad and car shop
216 railroad brakemen
235 maintenance, railroad
316 railroad workers NEC

356 Railroad workers (all)

354 railroad workers (on train)
355 railroad workers (off train)

357 Assemblers (expanded)

123 boilermakers

212 assemblers NEC

358 Foundry workers (expanded)

166 molders, metal
228 foundry workers NEC

359 Welders (expanded)

123 boilermakers
261 welders and flame cutters
263 welders, shipyard

360 Heated metal workers

122 blacksmiths
142 forgemen and hammermen
145 heat treaters, annealers, temperers
229 furnacemen, smeltermen and pourers
358 foundry workers (expanded)
359 welders (expanded)

361 Metal workers

137 engravers, except photoengravers
188 structural metal craftmen
190 tinsmiths, coppersmiths, and sheet metal workers
204 fabricated metal product workers NEC
206 primary metal industry workers NEC
225 electroplaters
244 steelworkers, wire workers
350 machinists and related occupations
360 heated metal workers

362 Paper workers (expanded)

240 paper, pulp mill workers
241 paperboard container and box factory workers

363 Leather product workers

185 shoemakers and repairers
249 shoe factory workers
250 factory workers, other leather goods

364 Leather and leather product workers

251 leather workers, tanners
363 leather product workers

365 Textile workers (expanded)

162 loom fixers
223 dyers
252 rope makers

260 weavers, textile
266 textile workers NEC

366 Apparel workers (expanded)

189 tailors
193 upholsterers
207 apparel workers NEC
233 milliners
247 sewers and stitchers, manufacturing; cutters

367 Glass workers

144 glaziers, glass workers
168 opticians; lens grinders and polishers
236 optical workers NEC

368 Food workers

97 grocers and market managers
121 bakers
164 millers, grain
221 cannery and food processing workers
226 dairy workers, dairymen
308 grocery clerks
383 restaurant workers

369 Wood workers

264 woodworkers, mill workers, furniture workers
310 lumbermen
344 carpenters (expanded)

370 Armed forces

195 officers and enlisted men, Coast Guard
196 officers and enlisted men, Marine Corps
197 officers and enlisted men, Air force
198 officers and enlisted men, Navy
199 officers and enlisted men, Army
201 officers and enlisted men, Armed Forces NEC

371 Sailors

82 officers-pilots-pursers-engineers, ship
195 officers and enlisted men, Coast Guard
198 officers and enlisted men, Navy
200 merchant marines
246 sailors and deckhands, seamen NEC
303 fishermen and oystermen

372 Vehicle drivers

217 bus drivers

220 conductors, bus and street railway
222 deliverymen and routemen
254 taxicab drivers and chauffeurs
255 truck and tractor drivers
256 fuel oil truck drivers and laborers
257 drivers NEC
258 fork lift drivers
259 movers, moving truck drivers

373 Meat processing workers

231 meat cutters, except slaughter and packinghouse
232 slaughter house butchers

374 Gas station, garage workers

95 garage, gas station owners, foremen, managers
213 attendants, auto service, gas station
214 parking attendants

375 Oil exposure

94 fuel oil dealers, managers
209 oil and related industry workers NEC
237 oilers and greasers, except auto
256 fuel oil truck drivers and laborers

376 Oil and gasoline exposure

374 gas station, garage workers
375 oil exposure

377 Asbestos exposure

211 asbestos and insulation workers
347 plumbers (expanded)
395 shipyard workers

378 Chemical exposure (operatives)

202 chemical workers
223 dyers
239 pest control workers
240 paper, pulp mill workers
242 plastic workers
243 rubber workers
251 leatherworkers, tanners

379 Silica exposure

166 molders, metal
187 stonecutters and stonecarvers

380 Barbers (expanded)

270 barbers
285 hairdressers and cosmetologists

381 Hospital workers (expanded)

267 attendants, hospital
284 practical nurses

382 Bar workers

92 cocktail bar, tavern, owners, managers
271 bartenders

383 Restaurant workers (expanded)

91 restaurant and cafe owners, managers
273 cooks, chefs (except private household)
274 dishwashers
279 kitchen workers, restaurant employees NEC
290 waiters

384 Custodial, maintenance, cleaning workers

80 managers and superintendents, building
272 cleaners
276 housekeepers and stewards, except private households
277 window cleaners
278 janitors, sextons, maintenance workers
280 school custodians

385 Construction workers, management

29 engineers, civil and construction
126 building contractors, construction contractors

386 Construction workers (expanded)

140 construction foremen, etc. NEC
314 construction laborers NEC
315 road construction and maintenance workers

387 Construction trades (all)

125 brickmasons, stonemasons, tile setters
129 carpenters
130 cement and concrete finishers; cement workers
134 electricians
138 heavy equipment, construction equipment operators
169 painters, construction and maintenance
174 paperhangers
176 plasterers and lathers
179 plumbers and pipefitters
183 roofers and slaters
191 floor layers, installers, workers

385 construction workers, management
386 construction workers (expanded)

388 Material handlers (expanded)

259 movers, moving truck drivers
283 porters
306 longshoremen and stevedores
307 freight and material handlers
312 warehousemen NEC

389 Farmers

292 farm laborers
293 farm owners, managers, foremen
294 cranberry farmers, laborers
295 dairy farmers
296 egg and poultry farmers
297 nurserymen
298 orchardists

390 Plant and tree workers

38 foresters and conservationists
72 florists
292 farm laborers
293 farm owners, managers, foremen
294 cranberry farmers, laborers
297 nurserymen
298 orchardists
302 forestry workers; tree farmers, wardens, surgeons, workers, etc.
305 gardeners (except farm), groundskeepers, greenskeepers, landscapers

391 Animal workers

68 veterinarians
295 dairy farmers
296 egg and poultry farmers
299 ranchers, cattle, sheep, etc.
300 animal workers NEC

APPENDIX H

LARGE EMPLOYER CODES

CODE	TITLE
392	large employer A - electrical equipment; engines and turbines
393	large employer B - abrasives products
394	large employer C - electrical and electronic machinery, equipment, and supplies
395	shipyards*
396	large employer D - mass transit
397	large employer E - telephone company

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*includes: 1) 5 large shipyards
2) listings of navy yard, shipyard, shipbuilding, etc., in the "industry or business" entry on the death certificate.
3) all individuals with the following individual occupational codes:
127 boat builders; carpenters, shipyard
135 electricians, shipyard
155 machinists, shipyard
172 painters, shipyard
180 plumbers, shipyard
248 shipyard workers NEC
263 welders, shipyard

These overlap considerably with categories 1) and 2) above.

APPENDIX I

SOCIAL CLASS CLASSIFICATION

Social Class	Major Occupational Grouping	Socioeconomic* Index
1	+professional, technical, and kindred workers	> 50
	+managers, officials, proprietors, except farm	> 50
	clerical and kindred workers	> 60
	sales workers	> 60
2	professional, technical and kindred workers	≤ 50
	managers, officials, proprietors, except farm	≤ 50
	+clerical and kindred workers	31-60
	+sales workers	31-60
	craftsmen, foremen, and kindred workers	> 60
3	clerical and kindred workers	≤ 30
	+craftsmen, foremen, and kindred workers	21-60
	operatives	> 30
	service workers	> 30
4	craftsmen, foremen, and kindred workers	≤ 20
	+operatives	≤ 30
	+service workers	≤ 30
	+laborers	≤ 30

*Duncan's socioeconomic index of occupations (31).

+Indicates the main major occupational groupings which make up the social class.

APPENDIX J

COMPUTATION OF MORTALITY ODDS RATIO

	Occupation of interest	Non-exposed Comparison Group[1]
Cancer of interest	a	b
Auxiliary causes of death[2]	c	d
Population at risk	N_1=?	N_0=?

$$MOR = \frac{a}{c} / \frac{b}{d} = \frac{ad}{bc}$$

Relationship of MOR to SMR :

$$SMR = \frac{a}{N_1} / \frac{b}{N_0} = \frac{a\ N_0}{b\ N_1}$$

$$MOR = SMR \left(\frac{d}{N_0} / \frac{c}{N_1} \right)$$

$$If \ \frac{d}{N_0} = \frac{c}{N_1}, \ then \ MOR = SMR$$

Relationship of MOR to exposure odds ratio (EOR):

$$EOR = \frac{a}{b} / \frac{c}{d} = \frac{ad}{bc} = MOR$$

[1] In this study, we performed the analysis using two different comparison groups - all other individuals in the entire study population (standard or unadjusted analysis), and all other individuals within the same social class (social class adjusted analysis).

[2] Causes of death other than malignant neoplasms and cirrhosis of the liver.

APPENDIX K

ADJUSTMENT OF LUNG CANCER MORs FOR CONFOUNDING BY CIGARETTE SMOKING

	Major Occupational Group A	Comparison Group (All other individuals in the study group)
Lung cancer	a	b
Auxiliary causes of death	c	d

$$b_{adjusted} = \frac{I_A}{I_C} b$$

where I_A = cigarette smoking adjusted expected lung cancer mortality rate for major occupational group A.

I_C = cigarette smoking adjusted expected lung cancer mortality rate for the comparison group.

$b_{adjusted}$ is the number of lung cancer deaths one would have expected in the comparison group if it had the same cigarette smoking adjusted expected lung cancer mortality rate as major occupational group A. $b_{adjusted}$ was calculated for each five year age group (ages 20-64) and summed up over the age groups to obtain age-standardized summary odds ratios.

I_A and I_C were calculated as follows:

$$I_A = P_{ns,A}\, I_0 + 4.71 P_{ex,A}\, I_0 + 10.88 P_{sm,A} I_0$$

$$I_C = \frac{\sum_{i=1}^{10} N_i I_i - N_A I_A}{\sum_{i=1}^{10} N_i - N_A}$$

where

$P_{ns,A}$ = proportion of non-smokers in major occupational group A.

$P_{ex,A}$ = proportion of ex-smokers in major occupational group A.

$P_{sm,A}$ = proportion of smokers in major occupational group A.

I_0 = lung cancer mortality rate for never-smokers.

I_i = cigarette smoking adjusted expected lung cancer mortality rate for major occupational group i.

N_A = number of subjects in major occupational group A.

N_i = number of subjects in major occupational group i.

4.71 is the lung cancer risk ratio for ex-smokers compared with never-smokers.

10.88 is the lung cancer risk ratio for smokers compared with never-smokers.

The P's were obtained from an analysis of smoking characteristics by major occupational group using data from the 1970 Household Interview Survey (37)[2] Reliable age-specific P's were available for ages 20-64. However, most of the individuals who were older than 64 were classified as unemployed or retired. This is why the analysis was restricted to ages 20-64.

The risk ratios for ex-smokers and smokers were taken from the *Dorn Study of Smoking and Mortality Among U.S. Verterans* (38). There was insufficient information to obtain age-specific risk ratios.

[2] We obtained the complete age-specific tables of P's from Dr. Theodore Sterling, Department of Computing Science, Simon Fraser University, British Columbia, Canada.

APPENDIX L

sMORs FOR LUNG CANCER IN THE MAJOR OCCUPATIONAL GROUPINGS ADJUSTED FOR THE EFFECTS OF SMOKING, AGE 20-64

		Unadjusted		Adjusted	
Major Occupational Grouping	Observed	Expected	sMOR	Expected	sMOR
professional, technical, and kindred workers	150	225	67++[a]	185	81+
managers, officials, proprietors, except farm	204	254	80+[b]	234	87
clerical and kindred workers	122	114	107	110	111
sales workers	85	105	81	107	80
craftsmen, foremen, and kindred workers	565	439	129++	440	128++
operatives	469	391	120++	410	115+
service workers	242	245	99	282	86
laborers, except farm	133	138	96	142	94
farmers	10	16	61	14	72
unknown	68	98	69++	104	65++

[a] ++ indicates $p \leq .01$

[b] + indicates $p \leq .05$

INDEX OF OCCUPATIONAL TITLES

Occupation	Individual Code	Grouped Codes
A		
Abrasive workers	210	
Accountants	1	325,329,341
Actors	3	339
Actuaries	57	325,329
Adjustors	102	
Administrators NEC	93	
Advertising agents, salesmen, managers, executives	114	
Agricultural scientists	43	326,329
Air Force, officers and enlisted men	197	370
Air traffic controllers	4	328,329
Airplane pilots and navigators	5	328,329
Analysts NEC	2	
Animal workers		391
Animal workers NEC	300	391
Annealers	145	360,361
Apparel workers (expanded)		366
Apparel workers (NEC)	207	366
Architects	6	322,324,325,329
Architects and draftsmen		322
Architects, draftsmen, and engineers		324
Armed Forces		370
Armed Forces NEC, officers and enlisted men	201	370
Army, officers and enlisted men	199	370
Art teachers	7	336
Artists	7	336
Artists (expanded)		336
Asbestos exposure		377
Asbestos workers	211	377
Assemblers (expanded)		357
Assemblers NEC	212	357
Assessors	70	341
At home	282	
Athletes	8	339,340
Athletes (expanded)		340
Attorneys	40	
Auditors	1	325,329,341
Authors	10	337
Auto service attendants	213	374,376
B		
Bakers	121	368
Bank clerks, tellers, etc.	98	

Occupation	Individual Code	Grouped Codes
Bank officers	71	341
Bar workers		382
Barbers	270	380
Barbers (expanded)		380
Bartenders	271	382
Blacksmiths	122	360,361
Boatbuilders	127	344,369,377,395
Boilermakers	123	357,359,360,361
Bond salesmen, counsellors, etc.	119	341
Bookbinders	124	
Bookkeepers	99	
Box factory workers	241	362
Brewery workers	215	
Brickmasons	125	387
Brokers NEC	89	
Building contractors	126	385,387
Building managers and superintendents	80	384
Bus drivers	217	372
Business consultants and analysts	55	325,329,341
Butchers, slaughter house	232	373
Butlers	281	
Buyers	89	
Buyers, farm products	73	
C		
Cabinetmakers	128	344,369
Cafe owners and managers	91	368,383
Cannery workers	221	368
Car salesmen, dealers, managers	117	
Car washers	304	
Carpenters	129	344,369,387
Carpenters (expanded)		344
Carpenters, shipyard	127	344,369,377,395
Cashiers	100	
Cement finishers	130	387
Cement workers	130	387
Chauffers	254	372
Checkers, manufacturing	218	
Chefs (except private household)	273	368,383
Chemical exposure (operatives)		378
Chemical workers	202	378
Chemists	11	326,327,329
Chemists (expanded)		327
Chiropodists	9	330,331
Chiropractors	12	330,331
Cleaners	272	384

Occupation	Individual Code	Grouped Codes
Clergymen	13	335
Clerical and kindred workers NEC	113	
Clothing pressers	219	
Coast Guard, officers and enlisted men	195	370,371
Cocktail bar owners and managers	92	382
College presidents and administrators	14	332,334
Composers, printing	177	351
Compositors	131	351
Computer specialists	22	325,329
Concrete finishers	130	387
Conductors, bus and street railway	220	372
Conductors, railroad	74	354,356
Conservationists	38	390
Constables	288	
Construction contractors	126	385,387
Construction equipment operators	138	387
Construction foremen, etc. NEC	140	386,387
Construction laborers NEC	314	386,387
Construction trades (all)		387
Construction workers (expanded)		386
Construction workers, management		385
Consultants NEC	2	
Cooks (except private household)	273	368,383
Coppersmiths	190	361
Correction officers	287	
Cosmetologists	285	380
Counselors, vocational and educational	60	333,334
Court officers	288	
Craftsmen and kindred workers NEC	194	
Cranberry farmers, laborers	294	389,390
Crane operators (expanded)		352
Cranemen	132	352
Credit men	75	341
Crossing and bridge tenders	289	
Custodial, maintenance, cleaning workers		384
Cutters, cloth manufacturing	247	366
Cutters, metal	224	350,361
D		
Dairy farmers	295	389,391
Dairy workers, dairymen	226	368
Data processing specialists	22	325,329
Deans, college	14	332,334
Deck hands	246	371
Decorators	133	336

Occupation	Individual Code	Grouped Codes
Deliverymen	222	372
Dentists	23	330,331
Derrickmen	132	352
Designers	24	336
Detectives	288	
Die makers	192	350,361
Die setters, metal	149	350,361
Dieticians	25	330,331
Dishwashers	274	368,383
Dispatchers, vehicle	101	
Doorkeepers	287	
Draftsmen	26	322,324,325,329
Drivers NEC	257	372
Druggists	48	330,331
Drycleaning operatives, owners, managers	230	
Dyers	223	365,378
E		
Economists	55	325,329,341
Editors	27	337
Egg farmers	296	389,391
Electrical machinery, equipment, supplies workers NEC	205	
Electricians	134	345,387
Electricians (expanded)		345
Electricians, shipyard	135	345,377,395
Electronic machinery, equipment, supplies workers NEC	205	
Electroplaters	225	361
Electrotypers	136	351
Elevator operators	275	
Embalmers	39	328,329,342
Engineers		323
Engineers NEC	36	323,324,325,329
Engineers, chemical	28	323,324,325,327,329
Engineers, civil	29	323,324,325,329,385,387
Engineers, construction	29	323,324,325,329,385,387
Engineers, electrical	30	323,324,325,329
Engineers, industrial	31	323,324,325,329
Engineers, locomotive (railroad)	151	354,356
Engineers, marine	33	323,324,325,329
Engineers, mechanical	32	323,324,325,329
Engineers, metallurgical	34	323,324,325,327,329
Engineers, sales	35	323,324,325,329
Engineers, ship	82	371
Engravers, except photoengravers	137	361

Occupation	Individual Code	Grouped Codes
Entertainers (expanded)		339
Entertainers NEC	37	339
Estimators	102	
Examiners	102	
Examiners, manufacturing	218	
Expeditors	103	
Express agents	111	
F		
Farm laborers	292	389,390
Farm owners, managers, foremen	293	389,390
Farmers		389
Filers, metal	224	350,361
Financial managers	71	341
Financial workers		341
Firemen and fire protection	286	
Firemen, locomotive	152	354,356
Fishermen	303	371
Flame cutters	261	359,360,361
Floor layers, installers workers	191	387
Florists	72	390
Food processing workers	221	368
Food workers		368
Foremen NEC	141	
Foresters	38	390
Forestry workers	302	390
Forgemen	142	360,361
Fork lift drivers	258	372
Foundry workers (expanded)		358
Foundry workers NEC	228	358,360,361
Freight handlers	307	388
Fuel oil dealers, managers	94	375,376
Fuel oil truck drivers and laborers	256	372,375,376
Funeral directors	76	342
Funeral workers		342
Furnacemen	229	360,361
Furniture store owners, managers, dealers, salesmen	96	
Furniture workers	264	369
Furriers	143	
G		
Garage owners, foremen, managers	95	374,376
Garbage collectors	301	
Gardeners (except farm)	305	390
Gas station attendants	213	374,376
Gas station owners, foremen, managers	95	374,376
Gas station, garage workers		374
Glass workers	144	367
Glass workers		367

Occupation	Individual Code	Grouped Codes
Glaziers	144	367
Government workers NEC	317	
Greasers, except auto	237	375,376
Greenskeepers	305	390
Grinders, metal	224	350,361
Grocers	97	368
Grocery clerks	308	368
Groundskeepers	305	390
Guards	287	-
H		
Hairdressers	285	380
Hammermen	142	360,361
Healers NEC	67	330,331
Health administrators	77	
Heat treaters	145	360,361
Heated metal workers		360
Heavy equipment operators	138	387
Hoistmen	132	352
Hospital attendants	267	331,381
Hospital workers (expanded)		381
Hotel managers, owners, etc.	78	
Housekeepers, except private household	276	384
Housewives	282	
I		
Inspectors NEC	147	
Inspectors, manufacturing	218	
Inspectors, public administration	79	
Inspectors, railroad	146	355,356
Installers - telegraph, telephone, power (utility and gas)	150	349
Instructors, biological sciences	15	326,329,332,334
Instructors, chemistry sciences	16	326,327,329,332,334
Instructors, engineering	17	323,324,325,329,332,334
Instructors, mathematics	18	325,329,332,334
Instructors, non-scientific subjects	20	332,334
Instructors, physics	19	326,329,332,334
Instructors, subject not specified	21	332,334
Instrument workers NEC	203	
Insulation workers	211	377
Insurance agents, brokers, underwriters, executives, managers	116	
Interior decorators	133	336
Investigators	102	
Investigators, public administration	79	

Occupation	Individual Code	Grouped Codes
J		
Janitors	278	384
Jewelers	148	
Jobsetters, metal	149	350,361
Journalists	27	337
Judges	40	
Junk dealers, workers	309	
K		
Kitchen workers NEC	279	368,383
L		
Labor relations workers	85	
Laborers NEC	313	
Landscapers	305	390
Large employer A - electrical equipment; engines and turbines		392
Large employer C - electrical and electronic machinery, equipment, and supplies		394
Large employer B - abrasives products		393
Large employer D - mass transit		396
Large employer E - telephone company		397
Lathers	176	387
Laundry operatives, owners, managers	230	
Lawyers	40	
Leather and leather product workers		364
Leather goods - other, factory workers	250	363,364
Leather product workers		363
Leather workers	251	364,378
Lens grinders and polishers	168	367
Librarians	41	
Life and physical scientists		326
Linemen - telegraph, telephone, power (utility and gas)	150	349
Lithographers	177	351
Longshoremen	306	388
Loom fixers	162	349,365
Lumbermen	310	369
M		
Machine operatives, precision	153	350,361
Machine operators NEC	234	
Machinists and related occupations		350
Machinists NEC	154	350,361
Machinists, shipyard	155	350,361,377,395
Mail carriers	104	343

Occupation	Individual Code	Grouped Codes
Maintenance workers	278	384
Maintenance, railroad	235	355,356
Managers NEC	93	
Manufacturers representatives	115	
Marine Corps, officers and enlisted men	196	370
Market managers	97	368
Marshalls	288	
Material handlers	307	388
Material handlers (expanded)		388
Mathematical professions		325
Mathematical, scientific and technical professions		329
Meat cutters, except slaughter and packing house	231	373
Meat processing workers		373
Mechanics and repairmen (all)		349
Mechanics and repairmen NEC	163	349
Mechanics and repairmen, air conditioning	156	349
Mechanics and repairmen, airplane	157	348,349
Mechanics and repairmen, automobile	158	348,349
Mechanics and repairmen, automobile body	159	348,349
Mechanics and repairmen, heating	156	349
Mechanics and repairmen, radio	160	349
Mechanics and repairmen, railroad and car shop	161	348,349,355,356
Mechanics and repairmen, refrigeration appliances	156	349
Mechanics and repairmen, television	160	349
Mechanics and repairmen, vehicle		348
Medical workers		331
Merchant marine	200	371
Messengers	105	
Metal products workers, fabricated NEC	204	361
Metal workers		361
Millers, grain	164	368
Milliners	233	366
Millworkers	264	369
Millwrights	165	350,361
Model makers, metal	173	350,361
Molders, metal	166	358,360,361,379
Motel managers, owners, etc.	78	
Movers, moving truck drivers	259	372,388
Music teachers	42	338,339
Musical workers		338
Musicians	42	338,339

Occupation	Individual Code	Grouped Codes
N		
Natural scientists, miscellaneous	45	326,329
Navy, officers and enlisted men	198	370,371
Newspaper owners, publishers, managers, etc.	81	
None	321	
Not stated	321	
Nurserymen	297	389,390
Nurses, practical	284	331,381
Nurses, professional	46	330,331
Nutritionists	25	330,331
O		
Office boys	105	
Officers, ship	82	371
Officials NEC	93	
Officials, lodge	84	
Officials, society	84	
Officials, union	84	
Oil and gasoline exposure		376
Oil and related industry workers NEC	209	375,376
Oil exposure		375
Oilers, except auto	237	375,376
Operatives and kindred workers NEC	262	
Optical workers NEC	236	367
Opticians	168	367
Optometrists	47	330,331
Orchardists	298	389,390
Ordnance plant workers	265	
Organ tuners and repairmen	175	338,349
Oystermen	303	371
P		
Packers NEC	238	
Painters (expanded)		346
Painters, auto	171	346
Painters, construction and maintenance	169	346,387
Painters, shipyard	172	346,377,395
Painters, sign	170	346
Paper workers	240	362,378
Paper workers (expanded)		362
Paperboard container workers	241	362
Paperhangers	174	387
Parking attendants	214	374,376
Pattern makers, metal	173	350,361

Occupation	Individual Code	Grouped Codes
Payroll clerks	106	
Personnel workers	85	
Pest control workers	239	378
Pharmacists	48	330,331
Photoengravers	177	351
Photographers	49	336
Physicians	50	330,331
Physicians, dentists, and related practicioners		330
Physicists	44	326,329
Piano tuners and repairmen	175	338,349
Pilots, ship	82	371
Pipefitters	179	347,377,387
Plant and tree workers		390
Plasterers	176	387
Plastic workers	242	378
Plate printers, printing	181	351
Plumbers	179	347,377,387
Plumbers (expanded)		347
Plumbers, shipyard	180	347,377,395
Policemen	288	
Polishers, metal	224	350,361
Porters	283	388
Postal clerks	107	343
Postal workers (all)		343
Postal workers NEC	318	343
Postmasters	86	343
Poultry farmers	296	389,391
Pourers	229	360,361
Power station operators	182	353
Pressmen, printing	181	351
Primary metal industries workers NEC	206	361
Printing trades		351
Printing workers NEC	208	351
Private household workers	281	
Produce brokers	73	
Production control	103	
Professional and personal service attendants NEC	268	
Professors, biolgocial sciences	15	326,329,332,334
Professors, chemistry sciences	16	326,327,329,332,334
Professors, engineering	17	323,324,325,329,332,334
Professors, mathematics	18	325,329,332,334
Professors, nonscientific subjects	20	332,334
Professors, physics	19	326,329,332,334
Professors, subject not specified	21	332,334
Projectionists, motion picture	167	
Proprietors NEC	93	
Psychiatrists	56	330,331
Psychologists	56	330,331

Occupation	Individual Code	Grouped Codes
Public administration, officials and administrators NEC	83	
Public relations men	87	
Public utility supervisors, officials, managers, etc.	88	
Public utility workers NEC (gas, electric, telephone)	319	
Public works employees NEC	320	
Publishing workers NEC	208	351
Pulp mill workers	240	362,378
Purchasing agents	89	
Pursers, ship	82	371
R		
Radio announcers	3	339
Radio operators	51	328,329
Railroad brakemen	216	355,356
Railroad clerks	112	355,356
Railroad foremen	139	355,356
Railroad workers (all)		356
Railroad workers (off train)		355
Railroad workers (on train)		354
Railroad workers NEC	316	355,356
Ranchers, cattle, sheep, etc.	299	391
Real estate agents, brokers, developers, executives	118	
Receiving clerks	109	
Recreation and amusement (cardroom, poolhall, carnival) attendants	269	
Recreation workers	52	340
Religious workers	53	335
Religious workers (expanded)		335
Reporters	27	337
Researchers, miscellaneous	45	326,329
Restaurant employees NEC	279	368,383
Restaurant owners and managers	91	368,383
Restaurant workers (expanded)		383
Riggers	184	352
Road construction and maintenance workers	315	386,387
Roofers	183	387
Rope makers	252	365
Routemen	222	372
Rubber workers	243	378
S		
Sailors	246	371
Sailors		371

Occupation	Individual Code	Grouped Codes
Sales clerks NEC	120	
Sales managers	90	
Sales representatives	115	
Salesmen NEC	120	
Salvage dealers, workers	309	
School administrators, elementary and secondary school	61	333,334
School custodians	280	384
School professions		334
Scrap metal dealers, workers	309	
Seamen NEC	246	371
Secretaries	108	
Servants	281	
Service workers NEC	291	
Servicemen-telegraph, telephone, power (utility and gas)	150	349
Sewerage workers	301	
Sewers, manufacturing	247	366
Sextons	278	384
Sheet metal workers	190	361
Sheriffs	288	
Shippers, farm products	73	
Shipping clerks	109	
Shipyard workers NEC	248	377,395
Shipyards		377,395
Shoe factory workers	249	363,364
Shoe repairers	185	363,364
Shoemakers	185	363,364
Signmakers	245	
Silica exposure		379
Silversmiths	148	
Slaters	183	387
Smeltermen	229	360,361
Social workers, except group	54	
Sports instructors	58	340
Sports officials	58	340
Starters, vehicle	101	
Station agents	111	
Stationary engineers	186	353
Stationary engineers (expanded)		353
Stationary firemen	253	353
Statisticians	57	325,329
Steamfitters	178	347,377
Steelworkers	244	361
Steeplejacks	184	352
Sterotypers	136	351
Stevedores	306	388
Stewards, except private household	276	384
Stitchers, manufacturing	247	366
Stock clerks	110	

Occupation	Individual Code	Grouped Codes
Stock salesmen, counsellors, etc.	119	341
Stone carvers	187	379
Sonecutters	187	379
Stonemasons	125	387
Storekeepers	110	
Structural metal craftsmen	188	361
Students	69	334
Supervisors NEC	93	
Surgeons	50	330,331
Surveyors	59	325,329
T		
Tailors	189	366
Tanners	251	364,378
Tavern owners and managers	92	382
Taxicab drivers	254	372
Teachers and administrators, college and university		332
Teachers and administrators, elementary and secondary school		333
Teachers, elementary and secondary school	62	333,334
Teamsters	311	
Technicians		328
Technicians NEC	66	328,329
Technicians, dental	63	328,329,331
Technicians, electrical	64	328,329
Technicians, electronic	64	328,329
Technicians, medical	63	328,329,331
Technicians, other engineering and physical sciences	65	328,329
Temperers	145	360,361
Textile workers (expanded)		365
Textile workers NEC	266	365
Therapists NEC	67	330,331
Ticket agents	111	
Tile setters	125	387
Timekeeping clerks	106	
Tinsmiths	190	361
Toll collectors	289	
Tool makers	192	350,361
Tractor drivers	255	372
Treasurers	71	341
Tree farmers, wardens, surgeons workers, etc.	302	390
Truck drivers	255	372
TV announcers	3	339
Typesetters	131	351

Occupation	Individual Code	Grouped Codes
U		
Unknown	321	
Upholsterers	193	366
V		
Vehicle drivers		372
Veterinarians	68	330,331,391
W		
Waiters	290	368,383
Warehousemen NEC	312	388
Watchmakers	148	
Watchmen	287	
Watchmen, crossing and bridge	289	
Weavers, textile	260	365
Welders	261	359,360,361
Welders (expanded)		359
Welders, shipyard	263	359,360,361,377,395
Welfare workers, except group	54	
Winding operatives NEC	227	
Window cleaners	277	384
Window dressers	133	336
Wire workers	244	361
Wood workers		369
Woodworkers	264	369
Wrappers NEC	238	
Writers	10	337
Writers (expanded)		337

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